DREDGED MATERIAL MANAGEMENT PROGRAM

Puget Sound Dredged Disposal Analysis
Grays Harbor/Willapa Bay Evaluation Procedures
NW Regional Sediment Evaluation Framework (WA)

BIENNIAL REPORT

Dredging Years 2008/2009

PREPARED BY THE DMMP AGENCIES

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Grays Harbor/Willapa Bay Evaluation Procedures
Lower Columbia River Evaluation Framework (Washington)

BIENNIAL REPORT

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PRIMARY AUTHORS
David Kendall, Corps of Engineers
David Fox, Corps of Engineers
Stephanie Stirling, Corps of Engineers
Lauran Warner, Corps of Engineers

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LIST OF ACRONYMS

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
DMMP	Dredged Material Management Program
DMMU	Dredged Material Management Unit
DNR	Washington Department of Natural Resources
DY	Dredging Year
EPA	Environmental Protection Agency
EPTA	Evaluation Procedures Technical Appendix (PSDDA)
FC	Full Characterization
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
NWRSEF	Northwest Regional Sediment Evaluation Framework
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
QA/QC	Quality Assurance/Quality Control
SAP	Sampling and Analysis Plan
SDM	Suitability Determination Memorandum
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. INTRODUCTION & PROJECT OVERVIEW

1.1 Introduction

The Dredged Material Management Program is an interagency approach to the management of dredged material in the State of Washington. The four cooperating agencies are: U.S. Army Corps of Engineers, Seattle District; U.S. Environmental Protection Agency, Region 10; Washington Department of Ecology; and Washington Department of Natural Resources. The DMMP applies dredged material evaluation guidelines to federal and permitted projects in Washington State. These guidelines were originally developed for the Puget Sound Dredged Disposal Analysis program in the 1980s, and expanded to cover Grays Harbor and Willapa Bay in 1995. The DMMP agencies modify the evaluation guidelines, as needed, through an annual review process. Updated guidelines for all areas are found in the DMMP Users Manual.

In 2002, the The Regional Sediment Evaluation Team (RSET) was initiated to derive dredged material evaluation guidelines beyond the scope of DMMP, throughout the states of Washington, Oregon and Idaho. RSET is a multi-agency effort that has been formed under the auspices of the Regional Dredging Team (RDT). The RDT works on facilitating communication, coordination, and resolution of dredging issues among the agencies with jurisdiction for dredged material management. The RSET is focused on consolidating the existing regional guidance manuals into one "umbrella" document, allowing consistent evaluation of dredging projects across the region. The resulting regional Sediment Evaluation Framework will be applicable throughout the Pacific Northwest for both freshwater and marine sediments.

Under the auspices of RSET, the Northwest Regional Sediment Evaluation Framework (SEF) was published in May 2009. Integration of guidance from RSET--the larger regional program, and DMMP—the locally specialized program--is an ongoing process. Projects in Puget Sound, on the Washington Coast, and on the north side of the Columbia River should use the DMMP Users Manual for SAP preparation and data review until coordination between the regional Sediment Evaluation Framework and DMMP are finalized. Please contact the DMMO if you have any questions about when to use DMMP vs. RSET guidance.

This report summarizes DMMP activities for Dredging Years 2008 and 2009. As defined by the DMMP agencies, DY08 covers the period from June 16, 2007 to June 15, 2008. DY09 covers the period from June 16, 2008 to June 15, 2009.

1.2 Project Overview

During DY08/09 there were 47 projects for which the DMMP agencies completed some kind of action or determination. These projects are summarized in Tables 1-1 and 1-2. Many were full characterizations (FC) of a project area, intended to assess the suitability of the proposed dredged material for open-water disposal. Full characterizations result in a suitability determination memorandum (SDM), signed by the DMMP agencies, that summarizes the results of the FC and provides an official determination regarding suitability for open-water disposal. Other DMMP actions include volume revisions, frequency/recency determinations, no-test determinations and post-dredged sediment surface evaluations.

As listed in Tables 1-1 and 1-2, 21 projects had DMMP suitability determinations or other actions completed by June 15, 2008 and are considered DY08 projects. Another 26 projects had DMMP suitability

determinations or other actions completed by June 15, 2009 and are considered DY09 projects. Puget Sound project locations for DY08 and DY09 are plotted in Figures 1-1 and 1-2. Projects in Grays Harbor and Willapa Bay for both years are shown in Figure 1-3. Projects on the Columbia River for the biennium are shown in Figure 1-4.

The DMMP agencies reviewed and approved sampling and analysis plans (SAPs) for another 8 projects during DY08/09. These projects were either not completed before the end of DY09 or the application was withdrawn. These projects are listed in Table 1-3 but are not discussed in the remainder of the report.

Chapter 2 includes tables related to project-specific ranking, sampling, testing and suitability determinations. Information regarding no-test determinations, recency extensions, frequency determinations, volume revisions and post-dredge surface sediment evaluations is also presented. Chapter 3 presents an overall assessment of sampling and testing activities, including a cost analysis and regulatory processing-time evaluation. Chapter 4 provides details of projects that were complex in nature or where the application of best professional judgment by the agencies was necessary. Chapter 5 reviews disposal-site monitoring activities during DY08/09.

Appendices A and B include the chemical and biological evaluation guidelines respectively. Appendix C tabulates exceedances of those guidelines.

Table 1-1. DMMP Evaluation Activities Completed in DY08.

PROJECT	DMMP Action	Disposal Jurisdiction	Project Volume (cy)	SAP DY	SDM DY
Barbee Mill Boathouse, Lake Washington	FC	BU	<1,000	2008	2008
City of Des Moines Marina	FC	PSDDA	10,580	2008	2008
Delta Marine Industries	FC	PSDDA	11,905	2008	2008
Georgia-Pacific Camas Slough	FC	CR	20,000/yr	2007	2008
Port of Grays Harbor, Terminals 1, 2 and 4	FC	GH/WB	114,000	2008	2008
Port of Tacoma, Blair-Hylebos Redevelopment Study Phase	FC	PSDDA	1,000,000	2007	2008
Semiahmoo Marina	FC	PSDDA	156,800	2007	2008
USACE, Grays Harbor O&M, Inner Harbor	FC	GH/WB	1,800,000/yr	2007	2008
Cap Sante Marina Recency Extension	SC/RE	PSDDA	40,900	2008	2008
South Lake Union Project: Phase 1	N&E ADD[1]	MTCA	NA	2006	Phase 1: 2008 (see Chapter 4)
USACE, Grays Harbor O&M, Outer Harbor	ED	GH/WB	455,000/yr	2008	2008
Willow Grove Beach Boat Launch	ED	CR	2,500	2008	2008
Weyerhaeuser Longview Docks	FE	CR	200,000	NA	NA
GRE Golden Tides	RE/VR	PSDDA	-667	NA	NA
Brightwater Marine Outfall Alignment Corridor	VR	PSDDA	+4,700	2004	2005
Ash Grove Cement – Duwamish River	NTD	Upland BU	600	NA	NA
Blake's Resort – North Fork Skagit River	NTD	Upland	50	NA	NA
Cape George Colony Club Marina Entrance Channel	NTD	Nearshore BU	600	NA	NA
City of Longview Regional Water Treatment Plant (RWTP)	NTD	CR	5,000/yr	NA	2008
Hat Island Marina	NTD	Upland	650	NA	NA
USACE Shoalwater Bay Shoreline Erosion Project (SBSEP)	NTD	BU	700,000	NA	2008

[1]The post-dredge evaluation has not yet been completed

DMMP Actions
ADD = Anti-Degradation Determination
FC = Full Characterization
FE = Frequency Extension
MTCA = Model Toxics Control Act (Cleanup)
N&E = Nature and Extent (MTCA)
NTD = No-Test Determination
RE = Recency Extension
SC = Supplemental Characterization
VR = Volume Revision

Disposal Jurisdictions
BU = Beneficial Use
CR = Columbia River
GH/WB = Grays Harbor/Willapa Bay
PSDDA = Puget Sound Dredged Disposal Analysis

NA = Not applicable

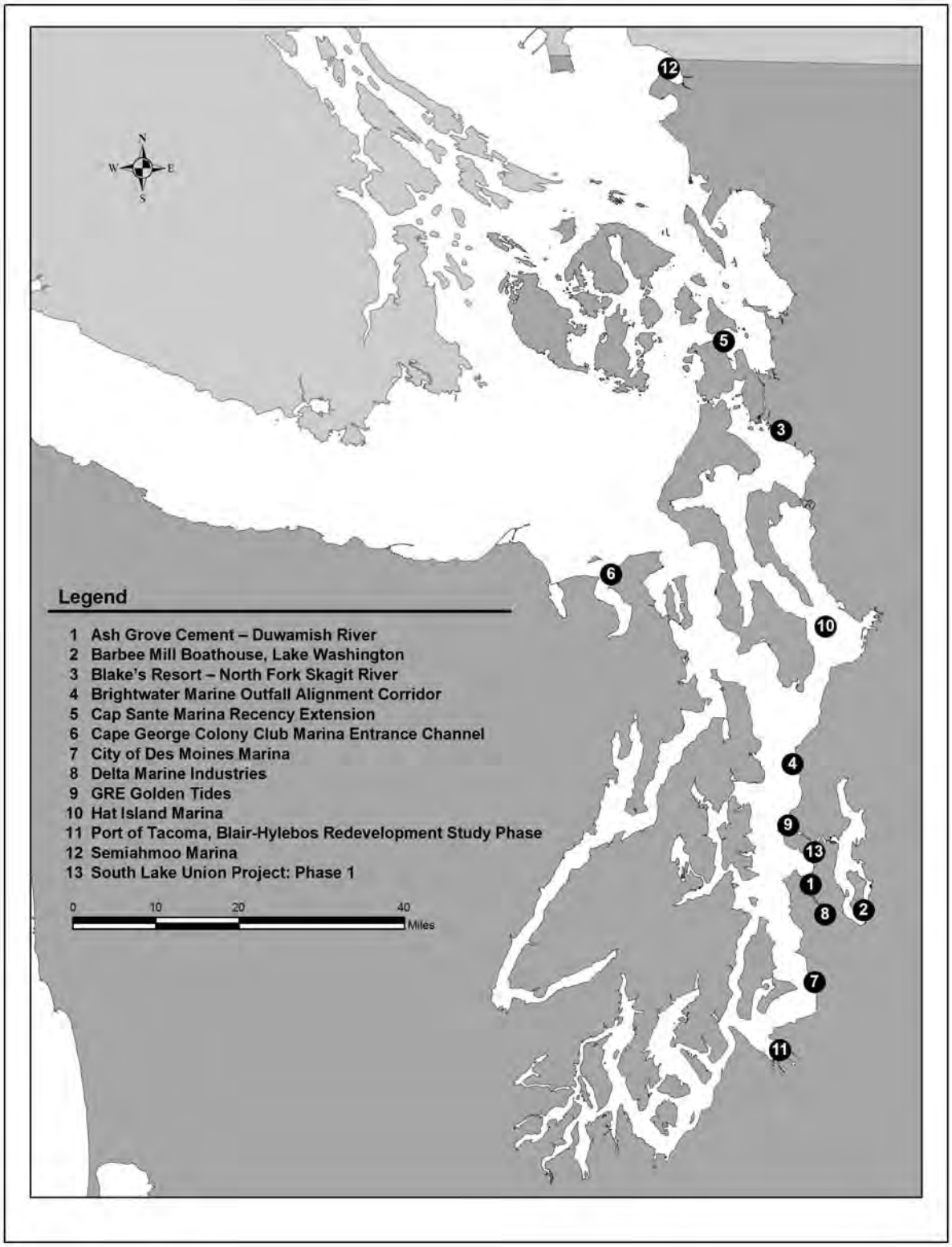


Figure 1-1. DY08 Puget Sound Project Locations

Table 1-2. DMMP Evaluation Activities Completed in DY09

PROJECT	DMMP Action	Disposal Jurisdiction	Project Volume (cy)	SAP DY	SDM DY
Grays Harbor PDA – Satsop Barge Terminal	FC/ADD	Upland	7,000	2009	2009
Lagoon Point Marina	FC	PSDDA	24,000	2008	2009
MJB Properties South Dock Barge Channel (SD), South Dock Boat Ramp (SDBR)	FC	PSDDA	17,100 (SD) 2,000 (SDBR)	2009	2009
Monroe Street Dam, Spokane River	FC	BU	10,000	2009	2009
Murphys Landing Marina	FC	PSDDA	1,500	2009	2009
Newport Yacht Club – Coal Creek Delta	FC	PSDDA	32,800	2008	2009
Port of Grays Harbor, Terminal 1 Expansion	FC	GH/WB	66,000	2009	2009
Port of Grays Harbor, Terminal 3	FC	GH/WB	40,000	2008	2009
Port of Seattle – Terminal 5	FC	PSDDA	6,900	2009	2009
Port of Seattle – Terminal 18	FC/ADD[1]	PSDDA	6,800	2008	2009
Port of Seattle – Terminal 115	FC/ADD	PSDDA	3,000	2008	2009
Port of Tacoma, Blair-Hylebos Redevelopment Project Phase	FC	PSDDA	600,000[2]	2009	2009
Port of Tacoma – Washington United Terminal – Wharf, Bank Cutback	FC	PSDDA, BU	234,000	2009	2009
Puyallup Tribal Terminal, Blair Waterway	FC	PSDDA	1,750,000	2009	2009
USACE, Grays Harbor Inner Harbor O&M	FC	GH/WB	1,800,000/yr	2009	2009
USACE Port Townsend	FC	PSDDA	1,250	2009	2009
Weyerhaeuser Bay City Log Terminal, Aberdeen	FC	GH/WB	20,000	2008	2009
Weyerhaeuser Longview – Access Channel and Chip Barge Slip	FC/ADD	CR	110,000	2009	2009
Zittel's Marina	FC	PSDDA	32,000	2008	2009
Port of Seattle – Terminal 91	ADD	PSDDA	NA	2008	2009
Mariners Cove Entrance Channel	ED	Nearshore BU	400/yr	2008	2009
USACE Toke Point Entrance Channel and Tokeland Marina	VR	GH/WB	+2,154	NA	NA
USACE Quillayute Boat Basin O&M	RE	Beach BU	NA	NA	NA
Hemlock Dam	NTD	Upland	75,000	NA	NA
Newhalem Dam Ogee Repair	NTD	Inwater BU	200-400	NA	NA
Nichols Brothers Boat Builders (a.k.a. Ice Floe)	NTD	Upland	150	NA	NA
Tukwila Public Works – Stormwater Outfall	NTD	Upland	40	NA	NA
Port of Olympia – Berths 2 & 3 Interim Action Cleanup	NTD	MTCA /Upland	9,515	NA	NA

[1]The post-dredge evaluation has not yet been completed
[2]This volume is in addition to the 1,000,000 cy characterized during the study phase in DY08

DMMP Actions
ED = Exclusionary Determination
FC = Full Characterization
NTD = No-Test Determination
ADD = Anti-Degradation Determination
RE = Recency Extension
VR = Volume Revision

Disposal Jurisdictions
BU = Beneficial Use
CR = Columbia River basin
GH/WB = Grays Harbor/Willapa Bay
PSDDA = Puget Sound Dredged Disposal Analysis

NA = Not applicable

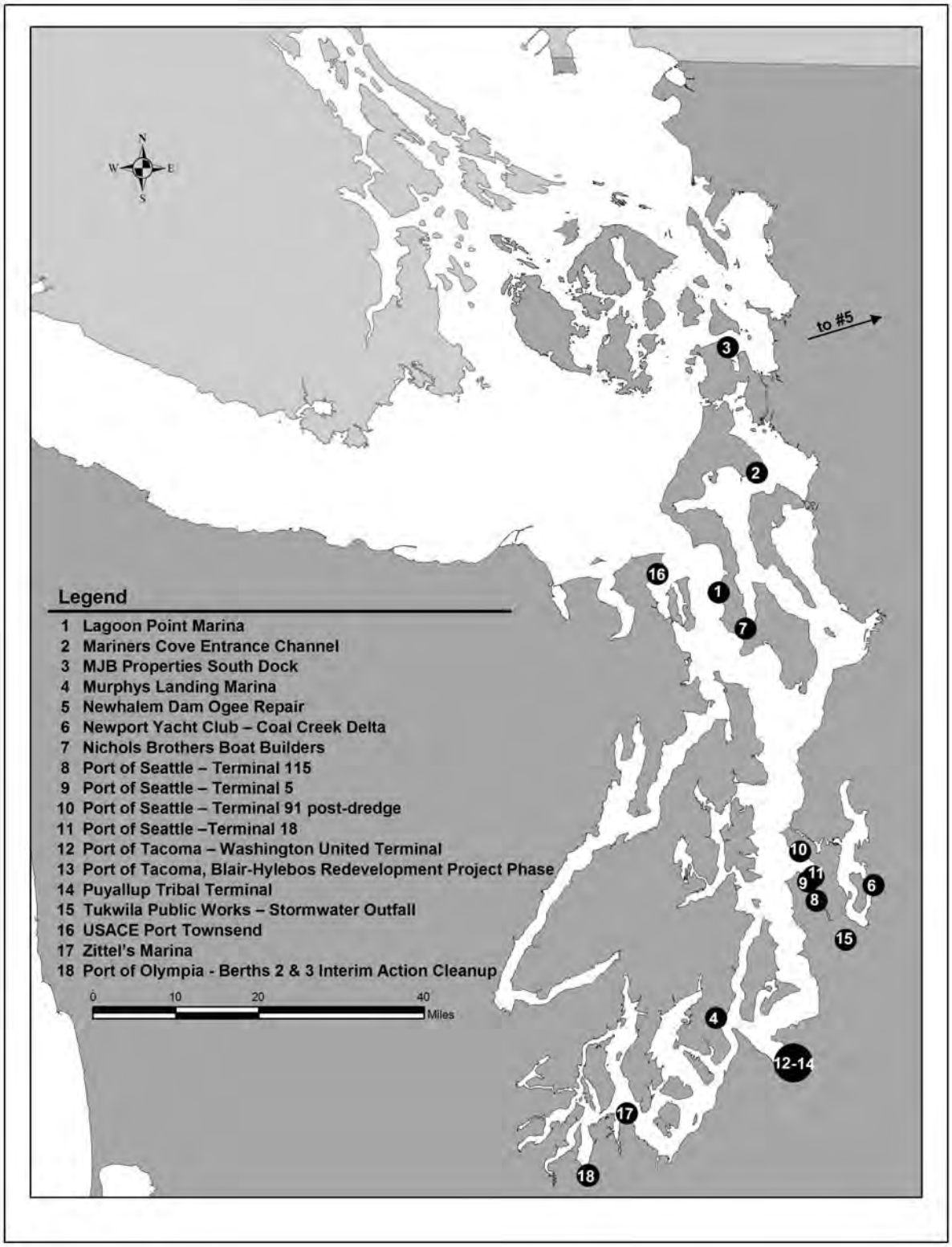


Figure 1-2. DY09 Puget Sound Project Locations

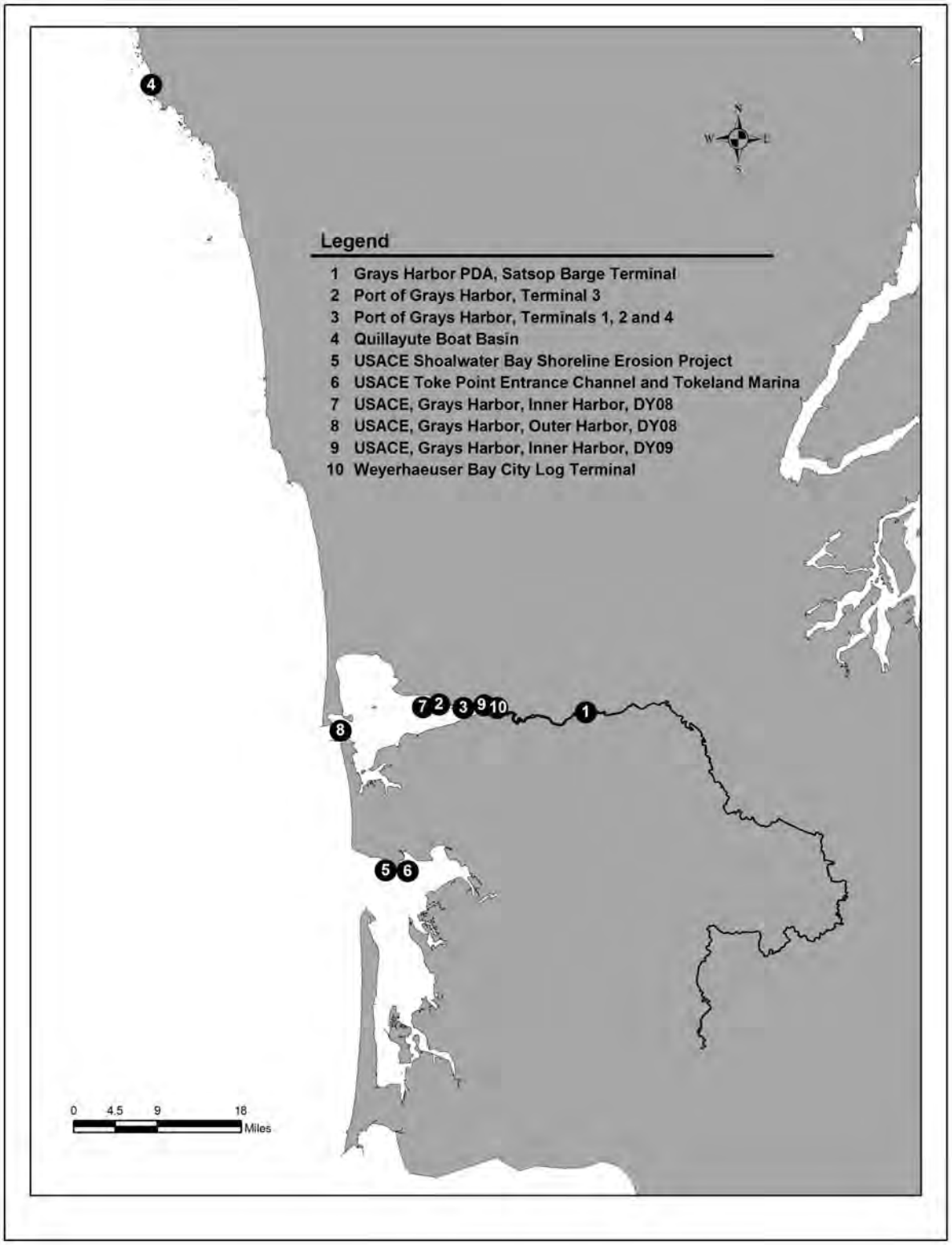


Figure 1-3. DY08/09 Coastal Project Locations

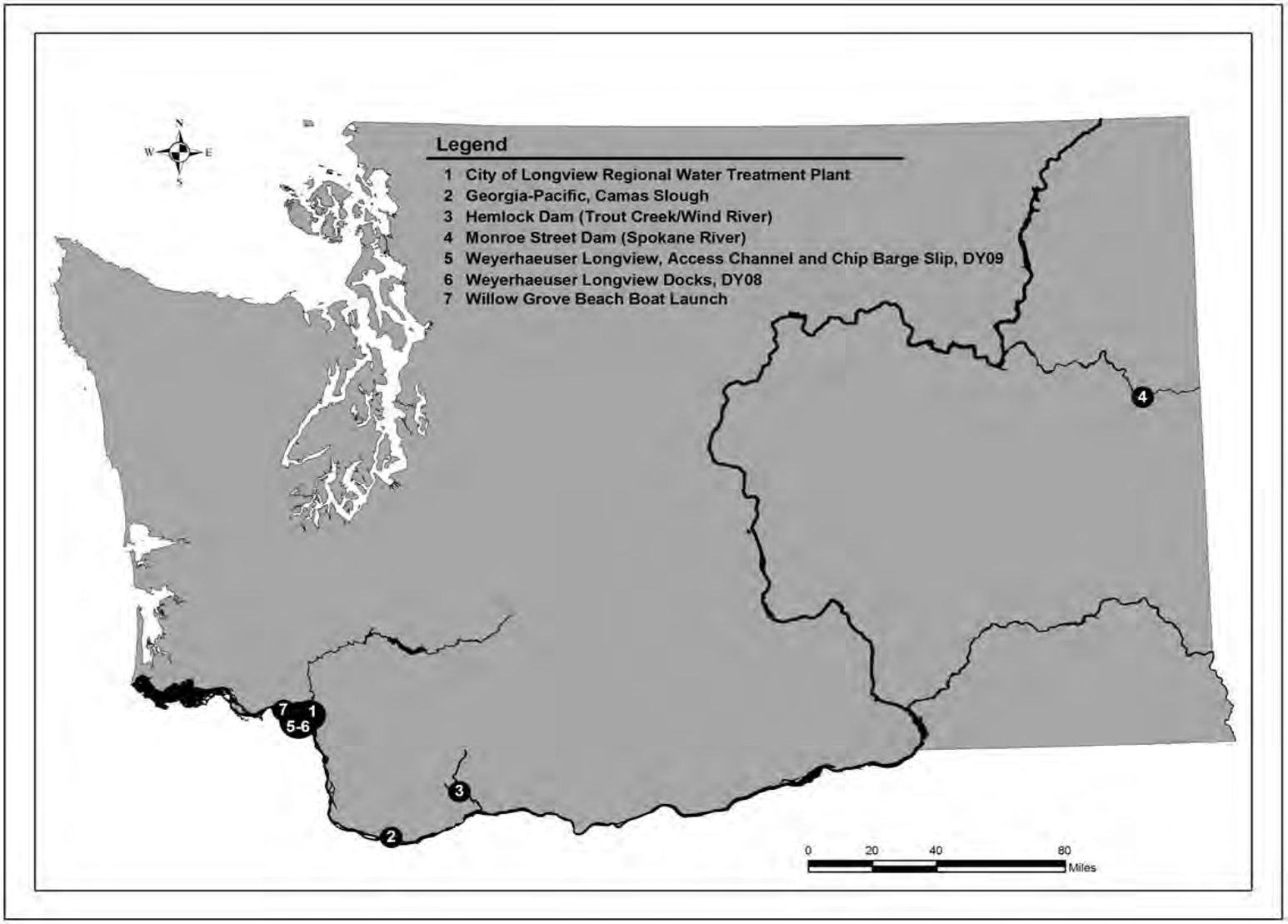


Figure 1-4. DY08/09 Columbia River Project Locations

Table 1-3. DMMP Evaluation Activities Initiated, But Not Completed, in DY08/09

PROJECT	DMMP Action	Disposal Jurisdiction	Project Volume (cy)	SAP Review DY	Status
Former Scott Paper Mill Site, Anacortes	FC	PSDDA	25,640	2009	SD Completed DY10
Skyline Marina, Anacortes	FC	PSDDA	105,700	2009	SD completed DY10
Thatcher Bay Restoration	FC	PSDDA	12,900	2009	SD completed DY10
USACE Duwamish O&M	FC	PSDDA	109,535	2009	SD completed DY10
Port of Everett 10th Street Marina	PC	PSDDA	130,000	2009	Rerank completed DY10
Asotin Marina	ADD	CR	10,000	2009	Not yet sampled
Hell's Canyon Marina	ADD	CR	15,000	2009	Not yet sampled
South Lake Union Project: Phase 2	ADD	MTCA	NA	2009	Phase II SAP approved.

DMMP Actions
FC = Full Characterization
PC = Partial Characterization
ADD = Anti-Degradation Determination

Disposal Jurisdictions
CR = Columbia River basin
PSDDA = Puget Sound Dredged Disposal Analysis
MTCA = Model Toxics Control Act

SD = Suitability Determination
NA = Not Applicable

CHAPTER 2. DY08/09 PROJECTS

This chapter presents project-specific information related to the evaluation of DY08/09 projects. Sections 2.1 through 2.7 pertain only to those projects that underwent full, supplemental or exclusionary characterization. Sections 2.8 through 2.11 address those projects for which no-test determinations, recency extensions, frequency determinations or post-dredge surface sediment evaluations were completed.

2.1 Ranking

Project ranking is based on a "reason to believe" that sediments in a project area may have elevated concentrations of chemicals of concern. Sampling and analysis requirements are determined, to a large extent, by the project ranking. The DMMP agencies have established ranks for geographic areas (e.g., Elliott Bay) and activities (e.g., marinas) based on historical data or the presence of active sources of contamination. Ranking guidance for Puget Sound, Grays Harbor and Willapa Bay can be found in the DMMP Users Manual. Ranking guidance for projects on the Columbia River can be found in the Northwest Regional Sediment Evaluation Framework document.

Adjustment of the initial ranking is possible if the historical data at the site are adequate, if the applicant conducts a partial characterization (PC), or in special cases where additional information is available. If the PC chemistry data support a lower ranking, sampling and analysis requirements may be reduced during the full characterization (FC), commensurate with the revised ranking. Chemicals of concern may also be eliminated for analysis during the FC, based on the PC data. There were no partial characterizations completed in DY08/09, although one was begun during DY09 and completed in DY10. For two projects, grain size information was obtained to change the Tier 1 evaluation from a ranked, sampled project to an "exclusionary" project. Dredged material that may be excluded from testing, and circumstances when this may be allowed, are described in the regulations for both the Marine Protection, Research, and Sanctuaries Act (MPRSA) (40 CFR 227.13) and the Clean Water Act (40 CFR 230.60). Generally, relatively coarser grained material (e.g., sand and gravel) from high energy environments that are geographically removed from contaminant sources meet the exclusionary criteria. The DMMP agencies apply the exclusionary criteria on a case-by-case basis. Projects can also sometimes be excluded from testing based on site-specific information available during the Tier 1 evaluation. In other cases, based on new data, a ranking may be raised to a higher level of concern. There were no cases of raised rankings during the 08/09 biennium.

Tables 2-1 and 2-2 contain the initial and final ranking for all DY08/09 projects that underwent sediment sampling and testing. The "initial rank" was taken from the guidance documents that were in effect at the time of project initiation. The "final rank" reflects any adjustment made by the DMMP agencies prior to, or based on, the characterization.

Table 2-1. DY08 Project Rankings

PROJECT	Disposal Jurisdiction	Location	Waterbody	Initial Rank	Final Rank
Barbee Mill Boathouse Renovation	PSDDA	Renton	Lake Washington	M	M
Cap Sante Marina	PSDDA	Anacortes	Fidalgo Bay	M	M
City of Des Moines Marina	PSDDA	Des Moines	Puget Sound	M	M
Delta Marine Industries	PSDDA	Seattle	Duwamish River	H	H
Georgia-Pacific Camas Slough	CR	Camas	Camas Slough	M	M
Port of Grays Harbor Terminals 1, 2 and 4	GH/WB	Aberdeen	Grays Harbor	L/LM	L/LM
Port of Tacoma, Blair-Hylebos Redevelopment Study Phase	PSDDA	Tacoma	Commencement Bay	LM/M/N	LM/M/N
Semiahmoo Marina	PSDDA	Blaine	Drayton Harbor	M	M
South Lake Union - Phase 1	PSDDA / MTCA	Seattle	Lake Union	H	H
USACE, Grays Harbor Inner Harbor O&M	GH/WB	Grays Harbor	Grays Harbor	L	L
USACE, Grays Harbor Outer Harbor O&M	GH/WB	Grays Harbor	Grays Harbor	E	E
Willow Grove Beach Boat Launch	CR	Near Longview	Columbia River	L	E

Ranking:
E = Exclusionary
L = Low
LM = Low-moderate
M = Moderate
H = High
N = Deep Native

Disposal Jurisdictions:
CR = Columbia River basin
GH/WB = Grays Harbor/Willapa Bay
PSDDA = Puget Sound Dredged Disposal Analysis
MTCA = Model Toxic Control Act (Cleanup)

Table 2-2. DY09 Project Rankings

PROJECT	Disposal Jurisdiction	Location	Waterbody	Initial Rank	Final Rank
Grays Harbor PDA – Satsop Barge Slip	Upland	Montesano	Chehalis River	LM	LM
Lagoon Point Marina	PSDDA	Whidbey Island	Admiralty Inlet	M	M
Mariners Cove Entrance Channel	PSDDA	Whidbey Island	Saratoga Passage	LM	E
MJB Properties South Dock	PSDDA	Fidalgo Bay	Fidalgo Bay	M	M
Monroe Street Dam	CR	Spokane River	Spokane River	LM	LM
Murphy's Landing	PSDDA	Gig Harbor	Gig Harbor	M	M
Newport Yacht Club	PSDDA	Newport Shores	Lake Washington	M	M
Port of Grays Harbor, Terminal 1 Exp.	GH/WB	Aberdeen	Grays Harbor	L	L
Port of Grays Harbor, Terminal 3	GH/WB	Hoquiam	Grays Harbor	LM	LM
Port of Seattle Terminal 5	PSDDA	Seattle	West Waterway	H	H
Port of Seattle –Terminal 18	PSDDA	Seattle	East Waterway	H	H
Port of Seattle – Terminal 91 post-dredge	PSDDA	Seattle	Elliott Bay	H	H
Port of Seattle Terminal 115	PSDDA	Seattle	Duwamish River	H	H
Port of Tacoma Blair-Hylebos Redevelopment – Project Phase	PSDDA	Tacoma	Commencement Bay	LM/M/N	LM/M/N
Port of Tacoma Washington United Terminal – Wharf & Bank Cutback Dredging	PSDDA	Tacoma	Commencement Bay	LM	LM
Puyallup Tribal Terminal	PSDDA	Tacoma	Commencement Bay	M/N	M/N
USACE, Grays Harbor Inner Harbor O&M	GH/WB	Grays Harbor	Grays Harbor	L	L
USACE Port Townsend	PSDDA	Port Townsend	Port Townsend	M	M
Weyerhaeuser Bay City Log Terminal	GH/WB	Aberdeen	Grays Harbor	LM	LM
Weyerhaeuser Longview	CR	Longview	Columbia River	LM	LM
Zittel's Marina	PSDDA	Olympia	Nisqually Reach	M	M

Ranking:
E = Exclusionary
LM = Low-moderate
M = Moderate
H = High
N = Native

Disposal Jurisdictions
CR = Columbia River basin
GH/WB = Grays Harbor/Willapa Bay
PSDDA = Puget Sound Dredged Disposal Analysis program

2.2 Sampling and Analysis Plans

A sampling and analysis plan (SAP) must be prepared by the applicant and approved by the DMMP agencies before sediment samples are collected. The sampling and analysis requirements are determined by the volume of surface and subsurface dredged material and the final rank. The minimum number of field samples and dredged material management units for a full characterization are calculated as follows:

Table 2-3. DMMP Sampling requirements

Project Rank	Maximum Volume Represented by a Field Sample (CY)	Heterogeneous Sediment		Homogeneous Sediment DMMUs (CY)
		Surface[1] DMMUs (CY)	Subsurface[1] DMMUs (CY)	
Low	8,000	48,000	72,000	60,000
Low-Moderate	8,000	32,000	48,000	40,000
Moderate	4,000	16,000	24,000	20,000
High	4,000	4,000	12,000	8,000

[1]"Surface" is defined as the top 4 feet of the dredge prism. "Subsurface" is defined as portions of the dredge prism beneath the 4 ft surface layer.

The applicant defines a conceptual dredging plan in the SAP, with the dredging area divided into the requisite number of DMMUs. The number of DMMUs may need to be increased beyond the minimum to address site-specific considerations. Sampling locations are identified and a compositing plan is presented. Protocols for station positioning, decontamination, field sampling, sample compositing, chemical analysis, biological testing, QA/QC and data submittal requirements are also included. Once completed, the DMMO coordinates review and approval of the plan with the DMMP agencies. Tables 2-4 and 2-5 contain data for sampling plans approved for DY08/09 projects. Descriptions of those projects for which best professional judgment was applied are provided in Chapter 4.

Table 2-4. DY08 Projects – Approved Sampling Plans

PROJECT	Rank	Total Volume (cy)	Surface Volume (cy)	Number of Surface Samples	Number of Surface DMMUs	Subsurface Volume (cy)	Number of Sub-surface Samples	Number of Sub-surface DMMUs
Barbee Mill Boathouse	M	<1,000	<1,000	5	1	0	0	0
Cap Sante Marina Recency Extension	M	40,900	40,900	16	4	0	0	0
City of Des Moines Marina	M	10,580	10,580	6	3	0	0	0
Delta Marine Industries	H	12,760	10,131	6	3[1]	2,629	2	1
Georgia-Pacific Camas Slough	M	20,000	20,000	10	4	0	0	0
Port of Grays Harbor Terminals 1, 2, 4	L/LM	114,000	114,000	15	4	0	0	0
Port of Tacoma Blair-Hylebos Redevelopment – Study Phase	LM/M/N	317,017[2]	38,828	12	3	278,189	59	8[1]
Semiahmoo Marina	M	156,800	156,800	41	11	0	0	0
USACE Grays Harbor Inner Harbor	L	490,196[3]	490,196	72	9	0	0	0
USACE Grays Harbor Outer Harbor	E	455,000	455,000	15	15	0	0	0
Willow Grove Beach Boat Launch	E	2,500	2,500	2	2	0	0	0

[1]At the time of sampling, one of these DMMUs was dropped due to a lack of material.

[2] SAP volume does not include deep native sediments that were exempt from testing. Total proposed dredging volume is reflected in Table 1-1.

[3] Per the Grays Harbor Dredged Material Evaluation Procedures, only a portion of the entire dredging prism is sampled during each characterization. The total annual project dredging volume is reflected in Table 1-1.

Table 2-5. DY09 Projects – Approved Sampling Plans

PROJECT	Rank	Total Volume (cy)	Surface Volume (cy)	Number of Surface Samples	Number of Surface DMMUs	Subsurface Volume (cy)	Number of Sub-surface Samples	Number of Sub-surface DMMUs
Grays Harbor PDA – Satsop Barge Slip	LM	7,000	7,000	3	1	0	0	0
Lagoon Point Marina	M	24,000	24,000	4	2	0	0	0
Mariners Cove Entrance Channel	E	400	400	4	2	0	0	0
MJB Properties SDBC:	M	17,100	17,100	5	2	0	0	0
SDBR:	M	2,000	2,000	2	1	0	0	0
Monroe Street Dam	LM	10,000	10,000	2	2	0	0	0
Murphy's Landing	M	4,000	4,000	2	1	0	0	0
Newport Yacht Club	M	32,800	10,665	5	1	22,150	5	1
Port of Grays Harbor Terminal 1 Expansion	L	66,000	66,000	8	2	0	0	0
Port of Grays Harbor Terminal 3	LM	40,000	40,000	5	1	0	0	0
Port of Seattle – Terminal 5	H	6,900	6,900	7	3	0	0	0
Port of Seattle –Terminal 18	H	6,800	6,800	4	1	0	0	0
Port of Seattle – Terminal 91 post-dredge	H	NA	NA	3	0	0	0	0
Port of Seattle – Terminal 115[1]	H	3,000	3,000	4	2	0	0	0
Port of Tacoma Blair-Hylebos Redevelopment – Project Phase	LM/M/N	600,000	12,400	4	4	68,200 + 519,400 Native	12	3
Port of Tacoma WUT Wharf High Spot Dredging	LM	5,600	5,600	2	1	0	0	0
Port of Tacoma WUT, Wharf and Bank Cutback	LM-M	228,400	40,700	7	2	49,400 + 138,300 Native	6	2
Puyallup Tribal Terminal	M/N	1,750,000	61,083	16	4	315,440 + 1,474,317 Native	84	21
USACE, Grays Harbor Inner Harbor O&M	L	1,200,000[2]	1,200,000	72	9	0	0	0
USACE Port Townsend	M	1,250	1,250	6	2	0	0	0
Weyerhaeuser Bay City	LM	20,000	20,000	4	1	0	0	0
Weyerhaeuser Longview	LM	110,000	110,000	15	4	0	0	0
Zittel's Marina	M	32,000	32,000	8	2	0	0	0

[1] Z-samples were collected at each Core location, and analyses conducted on Z+1 foot to Z+3 foot samples for DMMP COCs, including PCDD/Fs.

[2] Per the Grays Harbor Dredged Material Evaluation Procedures, only a portion of the entire dredging prism is sampled during each characterization. The total annual project dredging volume is reflected in Table 1-2.

2.3 Sampling

Tables 2-6 and 2-7 contain data related to sampling efforts during DY08/09. Two general requirements exist with respect to core sampling: 1) samples must be taken to the depth of dredging (including overdepth and Z-samples) and 2) positioning data must be collected with a minimum precision of one-tenth of a second, latitude and longitude. In areas with high shoaling rates or that meet Section 404 or Section 103 exclusionary criteria, core samples are unnecessary. In these cases sampling of the surface sediment with a van Veen grab sampler is generally allowed.

For projects utilizing coring devices, the maximum sample depth in the tables corresponds to the maximum thickness of the dredging prism, including overdepth. Exceptions include projects in which sampling problems were encountered, such as core refusal due to compact native sediment, gravel or woody debris. There is an additional requirement to collect an archived sample from the one foot of sediment beyond the dredging prism ("Z" sample). This additional depth is not reflected in the table.

Table 2-6. DY08 Project Sampling

PROJECT	GRAIN SIZE PERCENTAGES				SAMPLING EQUIPMENT	MAX. SAMPLE DEPTH (FT)	MEAN SAMPLE DEPTH (FT)
	GRAVEL > 2 mm	SAND .063 – 2 mm	SILT .004 – .063 mm	CLAY < .004 mm			
Barbee Mill Boathouse	3.5	81.6	14.9[1]	---	Van Veen	0.35	0.35
Cap Sante Marina	NA	NA	NA	NA	Van Veen	0.35	0.35
City of Des Moines Marina	12-37	55-83	4-36	3-4	Vibracorer	9.0	6.7
Delta Marine Industries	0-1	27-42	45-59	13-17	Vibracorer	7.5	5.2
Georgia-Pacific Camas Slough	1-4	44-83	9-44	3-26	Geoprobe/Vibracore	8	5
Port of Grays Harbor, Terminals 1, 2 and 4	0-1	14-25	53-63	21-24	Power grab	0.5	0.5
Port of Tacoma Blair-Hylebos Redevelopment, Study Phase	0-25	55-84	8-34	2-11	Hollow-stem Auger Drilling Rig	32.0[2]	25.5
Semiahmoo Marina	9-55	27-70	4-25	3-13	Vibracorer/ Impact corer	6.5	3.3
USACE Grays Harbor Inner Harbor O&M	0-2	7-53	33-66	11-25	Van Veen	0.5	0.5
USACE Grays Harbor Outer Harbor O&M	0-21	78-99	< 9	< 9	Van Veen	0.5	0.5
Willow Grove Beach Boat Launch	0	98-99	0-1	0-1	Shovel	2.0	1.5

[1]Did not differentiate clays and silts and used #200 rather than #230 sieve for % fines; the percentage shown is for total fines.

[2] Sampling depth does not include deep native sediments. Total dredging depth is to approximately -55 ft MLLW.

Table 2-7. DY09 Project Sampling

PROJECT	GRAIN SIZE PERCENTAGES				SAMPLING EQUIPMENT	MAX. SAMPLE DEPTH (FT)	MEAN SAMPLE DEPTH (FT)
	GRAVEL > 2 mm	SAND .063 – 2 mm	SILT .004 – .063 mm	CLAY < .004 mm			
Grays Harbor PDA – Satsop Barge Slip	0	11	60	15	Telescoping auger	11	11
Lagoon Point Marina	3-16	43-78	7-18[1]	---	Vibracorer	7.4	5.2
Mariners Cove Entrance Channel	74-88	12-26	0	0	Hand auger	3	2.5
MJB Properties – SDBC:	1-2.3	12.2-15.5	54.6-57	25.1-32.2	Pneumatic Corer (MudMole™)	4.1	2.9
SDBR:	42.9	48.5	4	4.6		10.3	6.7
Monroe Street Dam	91.2- 91.3	8.5 – 8.6	0.2	0	Dredge Bucket	1	1
Murphy's Landing	55	12	6	28	Vibracorer	6.7	6.7
Newport Yacht Club	6.9 – 9.9	44.1 – 76.6	13.8 – 40.1	2.9 – 5.9	Acker Drill, Hollow-stem auger	15	9.35
Port of Grays Harbor, Terminal 1 Expansion	0	31-42	42-49	15-20	Vibracorer	11.9	6.9
Port of Grays Harbor, Terminal 3	0	31	50	18	Power grab	0.5	0.5
Port of Seattle – T5	2.6-11.8	63.9-84.6	8.6-18.3	4.2-6	Vibracorer	7	6.3
Port of Seattle –T18	5	68	18	9	Diver-operated push core	3	3
Port of Seattle – T91 post-dredge	14-68	26-55	3-23	2-9	Power grab	0.5	0.5
Port of Seattle – T115	10.6-28.6	22.7-25	36.6-48.6	12-15.8	Vibracorer	6.5	5.1
Port of Tacoma, Blair-Hylebos Redevelopment, Project phase	0-25	55-84	8-34	2-11	Hollow-stem Auger Drilling Rig	32.0[2]	23.9
Port of Tacoma, WUT – High Spot Dredging	3.6	89.2	4.9	2.4	Vibracorer	9.4	6.95
Port of Tacoma, WUT – Wharf and Bank Cutback	1.4 – 31.1	47.2 -83.3	10.3 – 36.3	4.9 – 14.4	Vibracorer Truck Mounted Drill Rig – Split-spoon sampler	8	5.4
Puyallup Tribal Terminal	0-29	10-93	6-71	1-28	Direct-Push Geoprobe	6	4
USACE, Grays Harbor Inner Harbor O&M	0-17	16-89	8-69	3-40	Van Veen	0.5	0.5
USACE Port Townsend	0	94-95	3-4	1-3	Vibracorer	4.0	4.0
Weyerhaeuser Bay City Log Terminal, Aberdeen	0.03	8.5	58.5	23.2	Petite Ponar grab	0.33	0.33
Weyerhaeuser Longview	0-2	44-100	0-54	0	Van Veen	0.5	0.5
Zittel's Marina	26-47	27-43	3-8	2-3	MudMole™	9.6	5.8

[1]Did not differentiate clays and silts; the percentage shown is for total fines.
[2] Sampling depth does not include deep native sediments. Total dredging depth is to approximately -55 ft MLLW.

2.4 Chemical Testing

Chemical testing was conducted for nine (9) full or supplemental characterizations in DY08 and nineteen (19) in DY09.

A complete listing of DMMP chemical guideline exceedances for DY08/09 is included in Appendix C. Only those projects with guideline exceedances are included. But for those projects that *are* included, all DMMUs are listed whether or not they had guideline exceedances. Appendix D includes all dioxin testing results.

2.5 Biological Testing

Five projects required bioassay testing (Table 2-8) during DY08/09. Tiered testing was employed for all five projects, meaning that biological tests were conducted only on those DMMUs that had one or more exceedances of DMMP screening levels. Only one of the tested DMMUs failed bioassay interpretive guidelines.

Table 2-8. DY08/09 Biological Testing Summary

PROJECT	Number of biological analyses		Number of analyses failing bioassays	Bioassay tests conducted			Control sediment location	Reference sediment location
	tiered testing	concurrent testing		Amphipod	Sediment Larval	*Neanthes* 20-day Growth		
City of Des Moines Marina	1	0	0	*Ee*	*De*	*Na*	Yaquina Bay, OR	Carr Inlet, WA
Port of Seattle Terminal 5	1	0	1	*Ee*	*Mg*	*Na*	Yaquina Bay, OR	Carr Inlet, WA
USACE Grays Harbor O&M (DY08)	2[1]	0	0	*Ee*	*Mg*	*Na*	Yaquina Bay, OR	Grays Harbor GS7
USACE Grays Harbor O&M (DY09)	2[1]	0	0	*Ee*	*De/Mg*	*Na*	Yaquina Bay, OR	Grays Harbor GS7
Zittel's Marina	1	0	0	*Ee*	*Mg*	*Na*	Yaquina Bay, OR	Sequim Bay, WA

[1]Safety-net testing

De = *Dendraster excentricus*
Ee = *Eohaustorius estuarius*
Mg = *Mytilus galloprovincialis*
Na = *Neanthes arenaceodentata*

2.6 Bioaccumulation Testing

Four of the DY08/09 projects had chemical concentrations that exceeded one or more bioaccumulation triggers (BT). Chemicals for which BTs were exceeded included fluoranthene, pyrene, total PCBs and TBT. Several of the exceedances were noted in the exposed surface (Z-sample) analysis results, which were subsequently evaluated relative to the overlying sediments for compliance with the Washington State antidegradation compliance. Z-samples with BT exceedances were not subject to bioaccumulation testing if the project proponents did not leave the contaminated layer exposed, either by dredging deeper/shallower than initially planned, or by capping the exposed surface subsequent to dredging. The remaining BT exceedances in DMMUs did not undergo bioaccumulation testing and were therefore determined to be unsuitable for unconfined-open-water disposal.

2.7 Suitability Determinations

A suitability determination summarizes the evaluation procedures used in the characterization of project sediments, evaluates 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 representatives from the DMMP agencies. It documents the suitability of proposed dredged sediments for open-water disposal. The suitability determination 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 2-9 and 2-10 contain information taken from the suitability determinations for each of the projects that completed their DMMP review during DY08 and DY09, respectively. For the projects receiving suitability determinations in DY08 and DY09, ten projects included material that was found unsuitable for unconfined open-water disposal. Of the 7,749,935 cubic yards covered by 31 suitability determinations (the DY08 Blair-Hylebos Redevelopment study phase was excluded because all study-phase DMMUs and volume were also included in the DY09 project-phase suitability determination), 428,327 cubic yards (5.5%) were found unsuitable for open-water disposal at a non-dispersive site.

Table 2-9. DY08 Suitability Determinations

PROJECT	Rank	Total Volume (cy)	DMMUs, chemical analyses	DMMUs, bioassay analyses	DMMUs, bioaccum analyses	DMMUs Failing	Volume Failing (cy)	DMMUs Passing	Volume Passing (cy)	Proposed DMMP Disposal Site
Barbee Mill Boathouse	M	1,000	1	0	0	0	0	1	1,000	BU
Cap Sante Marina	M	40,900	4	0	0	4[D] 3ND	40,900[D] 25,700[ND]	0[D] 1ND	0[D] 15,200[ND]	BB or PG
City of Des Moines Marina	M	10,580	3	1	0	0	0	3	10,580	EB
Delta Marine Industries	H	11,905	3	0	0	0	0	3	11,905	EB
Georgia-Pacific Camas Slough	M	20,000/yr	4	0	0	1[2]	5,000	3	15,000	upland
Port of Grays Harbor, Terminals 1, 2 and 4	L/LM	114,000	4	0	0	0	0	4	114,000	SJ/PC
Port of Tacoma Blair-Hylebos Redevelopment	LM/M/N	1,000,000	10	0	0	3	38,828	7	961,172	CB/BU
Semiahmoo Marina	M	156,800	11	0	0	0	0	11	156,800	RS
USACE Grays Harbor Outer Harbor	E	455,000	15[1]	0	0	0	0	15	455,000	BU
USACE Grays Harbor Inner Harbor	L	1,770,000	9	2	0	0	0	9	1,770,000	SJ/PC/BU
Willow Grove	E	2,500	2[1]	0	0	0	0	2	2,500	upland
Totals:		3,582,685	66	3	0	8[D] 7ND	84,728[D] 69,528[ND]	58[D] 59ND	3,497,957[D] 3,513,157[ND]	

[1]Exclusionary testing included grain-size and total organic carbon only
[2]The underlying sediment for this DMMU failed to meet the State of Washington antidegradation standard

Disposal Sites
EB = Elliott Bay (ND)
CB = Commencement Bay (ND)
PG = Port Gardner (ND)
AK = Anderson/Ketron (ND)
BB = Bellingham Bay (ND)
RS = Rosario Strait (D)
PT = Port Townsend (D)
PA = Port Angeles (D)
PC = Point Chehalis (D)
SJ = South Jetty (D)
BU = Beneficial Use

Disposal Site Type
D = Dispersive
ND = Non-dispersive

Table 2-10. DY09 Suitability Determinations

PROJECT	Rank	Total Volume (cy)	DMMUs, chemical analyses	DMMUs, bioassay analyses	DMMUs, bioaccum analyses	DMMUs Failing	Volume Failing (cy)	DMMUs Passing	Volume Passing (cy)	Proposed DMMP Disposal Site
Grays Harbor PDA	LM	7,000	1	0	0	0	0	1	7,000	upland
Lagoon Point Marina	M	24,000	2	0	0	0	0	2	24,000	PT
Mariners Cove	E	400	2[1]	0	0	0	0	2	400	BU
MJB Properties SDBC: SDBR:	 M M	 17,100 2,000	 2 1	 0 0	 0 0	 2 0	 13,700 0	 0 1	 3,400[2] 2,000	 RS BB
Monroe St Dam	LM	10,000	2	0	0	0	0	2	10,000	BU
Murphy's Landing	M	4,000	1	0	0	0	0	1	4,000	CB
Newport Yacht Club	M	32,800	2	0	0	0	0	2	32,800	EB
Port of Grays Harbor Terminal 1 Exp.	L	66,000	2	0	0	0	0	2	66,000	SJ/PC
Port of Grays Harbor Terminal 3	LM	40,000	1	0	0	0	0	1	40,000	SJ/PC
Port of Seattle Terminal 5	H	6,900	3	1	0	2	4,500	1	2,400	EB
Port of Seattle Terminal 18	H	6,800	1	0	0	1	6,800	0	0	upland
Port of Seattle Terminal 115	H	3,000	2	0	0	2	3,000	0	0	EB
POT, Blair-Hylebos Redevelopment	LM/M/N	1,600,000[3]	17[3]	0	0	7	71,582	10	1,528,418	CB, BU
POT WUT – High Spot	LM	5,600	1	0	0	0	0	1	5,600	CB
POT WUT, Wharf & Bank Cutback	LM/M	228,400	4	0	0	0	0	4	228,400	CB, BU[4]
Puyallup Tribal Terminal, Blair Waterway	M/N	1,750,000	25	0	0	6	297,645	19	1,452,355	CB, BU
USACE, Grays Harbor Inner Harbor O&M	L	1,200,000	9	2	0	0	0	9	1,200,000	SJ/PC
USACE Port Townsend	M	1,250	2	0	0	1	400	1	850	PT
Weyerhaeuser Bay City	LM	20,000	1	0	0	0	0	1	20,000	SJ/PC
Weyerhaeuser Longview	LM	110,000	4	0	0	0	0	4	110,000	CR
Zittel's Marina	M	32,000	2	1	0	0	0	2	32,000	AK
Totals:		5,167,250	87	4	0	21	397,627	66	4,769,623	

[1]Exclusionary testing included grain-size and total organic carbon only.
[2]This native material underlies the unsuitable material. The unsuitable material included a 0.5-1 ft protective buffer of 1,600 cy.
[3]Includes the 10 DMMUs and 1,000,000 cy from the DY08 study phase, and subunit sampling in the project phase.
[4]Project re-evaluated for BU and 163,000 cy were determined suitable for BU placement. The remaining 65,400 cy (excluding the 5,600 cy from the wharf high-spot area) are suitable for open-water disposal, based on the interim dioxin framework in place during project review.

2.8 No-Test Determinations

Projects can be exempted from sediment testing under three different scenarios: 1) the small-project guidelines are met; 2) the proposed dredged material meets the Section 404 or Section 103 exclusionary criteria; or 3) upland disposal is planned and there are no issues with the sediment surface to be exposed by dredging.

The *small-project* guidelines are as follows:

Project Rank	Maximum No-Test Volume (CY)
L	8,000
LM or M	1,000

The *exclusionary criteria* are described in the regulations for the Marine Protection, Research, and Sanctuaries Act (MPRSA) (40 CFR 227.13) and Clean Water Act (40 CFR 230.60). Generally, relatively larger grained material (e.g., sand and gravel) from high-energy environments that are geographically removed from contaminant sources meet the exclusion criteria. The DMMP agencies apply the exclusion criteria on a case-by-case basis.

A total of ten projects received no-test determinations, six (6) in DY08 and four (4) in DY09 (Table 2-11).

Table 2-11. DY08/09 No-Test Determinations

PROJECT	DY	Total Volume (cy)	Rank	Reason for No-Test Determination	Proposed Disposal Site
Ash Grove Cement	2008	600	H	Removal of spilled aggregate - BPJ	Upland reuse
Blake's Resort	2008	50	LM	Small project	Upland
Cape George Colony Club Marina	2008	600	E	Exclusionary	Beach Nourishment
City of Longview RWTP	2008	5,000	E	Exclusionary	Cowlitz River
Hat Island Marina	2008	650	M	Small Project	Upland
USACE SBSEP	2008	700,000	E	Exclusionary	Willapa Bay
Hemlock Dam	2009	75,000	L	Upland Disposal/BPJ	Upland
Newhalem Dam Ogee Repair	2009	200-400	E	Small Project/Exclusionary	In-water Beneficial Use
Nichols Brothers Boat Builders	2009	150	LM	Small Project	Upland
Tukwila Public Works – Stormwater Outfall	2009	40	LM	Small Project	Upland

Ranking:
E = Exclusionary
L = Low
LM = Low-moderate
M = Moderate
H = High

2.9 Recency/Frequency Determinations

Recency guidelines apply to material that has been sampled and tested for open-water disposal but not yet dredged. Key considerations in determining whether the existing data are still representative is the recency of the information and sources of contamination in the vicinity of the project. For high-ranked projects, the recency guidelines allow characterization data to be valid for a period of 2 years. The PSDDA guidelines specify a recency period of 5 to 7 years for moderate, low-moderate and low-ranked projects. For Grays Harbor and Willapa Bay, more definitive guidance is provided, with recency periods of 5, 6 and 7 years for moderate, low-moderate and low-ranked projects respectively.

When other permitting requirements prevent a project from being dredged during the recency period, extension of the recency period is considered on a case-by-case basis. When considering whether existing data continue to adequately characterize sediment from a specific project, the agencies review previous characterization data, any new data from the dredge site or vicinity, and site use and character. Based on this review, the agencies may extend the recency determination, typically for one to two years. This extension may be allowed with no additional testing, or may require some level of confirmatory testing.

Frequency guidelines refer to the extent of time a given dredging project can be maintained with repeated dredging without further testing. Once the sampled and tested material has been dredged, frequency guidelines apply. Time durations for the frequency guidelines are the same as for the recency guidelines. Sediment dredged within the frequency guidelines generally does not require testing. Table 2-12 presents information for the three recency extensions and the single frequency determination.

Table 2-12. DY08/09 Recency/Frequency Determinations

PROJECT	DY	Rank	Determination Type	Sampling Date	Original Recency/ Frequency Time Limit	Recency/ Frequency Extension
Cap Sante Marina[1]	2008	M	Recency Extension	1999	2006	2012
GRE Golden Tides	2008	H	Recency Extension	2006	2008	2010
Weyerhaeuser Longview Docks[2]	2008	M	Frequency Extension	1999	2006	2008
USACE Quillayute Boat Basin O&M	2009	M	Recency Extension	2005	2010	2011

[1]Supplemental characterization was required, including semivolatile organics, TBT and dioxins (see Chapter 4 for details).
[2]A two-year extension was granted, based on additional characterization data provided by Weyerhaeuser.

2.10 Project Volume Revisions

Dredging projects are dynamic by nature and shoaling continues to occur between the time of sediment characterization and the time of dredging. When the project volume changes - subsequent to full characterization - a dredging applicant may request a revision of the volume found in the suitability determination. The DMMP agencies review such requests on a case-by-case basis. Table 2-13 has the pertinent information for volume revisions approved by the DMMP agencies in DY08/09.

Table 2-13. DY08/09 Volume Revisions

PROJECT	DY	Rank	Original Volume (CY)	Revised Volume (CY)	Reason for Volume Revision
Brightwater Marine Outfall Alignment Corridor	2008	M	5,300	10,000	Volume revised during preconstruction design
GRE Golden Tides	2008	H	1,336	700	Scaled-down project
USACE Toke Point Entrance Channel and Tokeland Marina	2009	L/LM	62,846	65,000	Preconstruction bathymetry survey revised volume

2.11 Antidegradation Evaluations

Dredging operations expose new sediment to direct contact with biota and the water column. The exposed sediment must meet the State of Washington Sediment Quality Standards (SQS) or the antidegradation policy contained in the Sediment Management Standards. A "Z sample" is a sample from the first foot (additional Z-layers are sometimes collected) below the dredging overdepth and typically is collected during sampling of heterogeneous sediments. Depending on the results from characterization of the dredged material prism, it may be necessary to analyze the Z-samples to determine whether dredging the project will result in degradation of the surface sediment conditions. In some cases collection of Z-samples is not possible (e.g. refusal during vibracore sampling). In other cases, where DMMUs with elevated concentrations of chemicals of concern have been removed, there may be concern that residuals from the dredging operation may leave a contaminated surface. In either case, sampling and testing of the new surface sediment may be necessary. In DY08/09, the DMMP agencies required analysis of Z-samples or post-dredge sampling and testing for seven projects, the details of which are included in Table 2-14.

Table 2-14. DY08/09 Antidegradation Evaluations

PROJECT	DY	Rank	Type	Reason for Z-Sample Analysis or Post-Dredge Evaluation	Did the New Surface Meet SMS?
Georgia-Pacific Camas Slough	2008	M	Z-Samples	Evaluate compliance with anti-degradation standard	Yes for 3 DMMUs No for 1 DMMU
South Lake Union Project: Phase 1	2008	H	Z-Samples	MTCA Cleanup	Evaluation underway, not completed
Delta Marine Industries	2009	H	Z-Sample	Proximity to station with elevated dioxin	Yes
Grays Harbor PDA – Satsop Barge Slip	2009	LM	Z-Sample	EIM data from Ecology	Yes
Port of Seattle – Terminal 91 post-dredge	2009	H	Post-Dredge	Overdredged by contractor	Yes
Weyerhaeuser Longview	2009	LM	Z-Samples	Proximity to upland sources of dioxin	Yes
Port of Seattle – T-115	2009	H	Z-Samples	Evaluate compliance with anti-degradation standard	No

CHAPTER 3. SUMMARY AND ASSESSMENT OF DY08/09 DATA

3.1 Summary of Chemical Testing Results.

Table 3-1 and Appendix C summarize the chemical testing results from DY 2008/2009 for projects with chemical-of-concern guideline exceedances. A total of 21 of the 58 standard DMMP COCs had screening levels exceeded for at least one project. These included both detected exceedances (20 COCs) and detection limit exceedances (1 COC). Four COCs had detected concentrations above the BT; no COCs were undetected above the BT. Four chemicals were detected above the ML; and none were undetected above the ML. Projects excluded from this analysis included exclusionary projects without chemical testing, where only grain-size, and total organic carbon analyses were performed. The number of DMMUs included post-dredge surface analyses (Z-samples), but excluded exclusionary testing, which did not include chemical testing.

There were relatively few chemicals noted with elevated concentrations for the DY08/09 projects, although there was a slight increase compared to the DY06/07 biennial report, where there were very few projects with chemical exceedances. In earlier biennial reports (http://www.nws.usace.army.mil/PublicMenu/Doc_List.cfm?sitename=DMMO&pagename=Biennial_Reporting) prior to DY06/07 there were many more chemicals and projects that exceeded DMMP guidelines. In DY08/09, detection limit problems were relatively rare, limited to SL exceedances for DDT and chlordane in one project each. None of the detection limit exceedances of screening levels alone triggered bioassays, as there were other chemicals detected above the screening level with exceedances within these DMMUs.

Dioxin Evaluation. For the evaluation of dioxins and furans for projects in Puget Sound, Grays Harbor, and the Lower Columbia River in DY08/09, the DMMP agencies utilized the interim guidelines depicted in Table 3-2. All projects under DMMP purview were subject to a rigorous reason-to-believe analysis to determine whether dioxin testing would be necessary. Appendix D includes all the dioxin testing data for the biennium and Table 3-3 summarizes the dioxin testing outcomes for all projects subject to dioxin testing. Of the total 130 DMMUs evaluated with chemical testing during this 2-year period, 66 DMMUs were subject to testing for dioxin/furans, including 16 analyses for new surface/anti-degradation evaluation, which included testing for 19 of the 30 total projects from the three geographical areas (Puget Sound, Grays Harbor, Lower Columbia River). The DMMP agencies utilized best professional judgment on a case-by-case basis in determining the suitability of dioxin-containing dredged material for open-water disposal.

Table 3-1. DY08/09 Chemical Testing Exceedance Summary

CHEMICAL OF CONCERN	# of DMMU / AE D > SL	# of Projects D > SL	# of DMMU / AE D > BT	# of Projects D > BT	# of DMMU / AE D > ML	# of Projects D > ML	# of DMMU / AE U > SL	# of Projects U > SL	# of DMMU / AE U > BT	# of Projects U > BT	# of DMMU / AE U > ML	# of Projects U > ML
METALS												
Cadmium	2	1										
Mercury	1	1										
Zinc	2	1										
LPAH												
Anthracene[1]	2	2										
Phenanthrene[1]	1	1										
HPAH												
Benzo(a)anthracene[1]	1	1			1	1						
Benzo(a)pyrene[1]	1	1										
Benzofluoranthenes[1]	1	1			1	1						
Chrysene[1]	5	2										
Dibenzo(a,h)anthracene[1]	1	1										
Fluoranthene	6	3	1	2								
Indeno(1,2,3-c,d)pyrene[1]	1	1										
Pyrene	6	1	1	1	1	1						
Total HPAH[1]	3	1			1	1						
PHTHALATES												
Bis(2-ethylhexyl)phthalate[1]	2	2										
Butylbenzylphthalate[1]	1	1										
Dimethylphthalate[1]	3	3										
PESTICIDES and OTHER CHEMICALS												
Total Chlordane							1	1				
Total DDT	2	2					6	1				
Total PCBs	11	4	1	1								
Tributyltin[2]	4	4	4	4								

D = Detected, U = Undetected, SL = Screening Level, BT = Bioaccumulation Trigger, ML = Maximum Level; AE = new surface/anti-degradation evaluation

[1] = No BT exists, [2] = No ML exists

The DMMP agencies are currently revising the Puget Sound interim framework for interpreting dioxin data for open-water disposal, and expect to update the existing guidance in 2010 (http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=DMMO&pagename=Dioxin_Guidelines). The existing interim guidelines for Puget Sound specific non-dispersive sites are briefly described below. For dredged material considered for open-water disposal, the interim framework directs a project-specific comparison of dioxin/furan concentrations in project dredged material to the disposal site background, outside the boundary of the disposal site. The site-specific guidelines for the five Puget Sound non-dispersive disposal sites are depicted in Table 3-2 (a), and specify the following:

- Comparison of dioxin in test sediments to disposal-site background
- Background is defined using disposal site-specific monitoring data, which include an offsite maximum concentration, and an offsite average concentration
- Dioxin concentrations in any given DMMU may not exceed the site specific maximum
- Average dioxin concentrations (weighted to the volume of each DMMU) cannot exceed the site-specific mean offsite concentration

Table 3-2. Interim Dioxin Guidelines* utilized to evaluate DY08/09 Projects within DMMP

(a) Puget Sound Nondispersive Site Offsite Interim Guidelines				
Disposal Site	Mean	Maximum	Range	n = # of stations
Anderson/Ketron Island	3.6	6.8	1.7 – 6.8	n = 7
Commencement Bay	2.4	5.2	0.86 – 5.2	n = 10
Elliott Bay	8.7	12.2	4.0 – 12.2	n = 11
Port Gardner	4.1	5.2	3.1 – 5.2	n = 9
Bellingham Bay	6.9	10.5	4.3 – 10.5[1]	n = 9
(b) Puget Sound Dispersive Site Interim Guidelines				
Samish Bay Reference: 2.44				
(c) Grays Harbor Guidelines				
1991 Risk Assessment: 15				
(d) Lower Columbia River Background Dioxin Concentrations				
0.65 – 2.387				

* dioxin concentrations expressed in pptr-dry weight-TEQ

The results depicted in Table 3-3 illustrate that most of the material evaluated from the nineteen projects, and sixty-six DMMUs was found to be suitable for open-water disposal at either a non-dispersive or dispersive site. Sixteen dioxin analyses were also performed on four projects to evaluate whether dredging would expose sediments which would violate Washington State's anti-degradation policy, and half of those analyses concluded that the exposed sediments did not meet the anti-degradation policy.

[1] Mean excludes Benchmark station BBB01 located near the Georgia Pacific Outfall with 22 pptr-dry- weight-TEQ

Table 3-3. Dioxin Testing Summary for DY08/09 Projects with Dioxin Testing

	Dredged Material Evaluation						Anti-Degradation Evaluation		
Project ID	**Disposal Site**	**# DMMUs**	**# Suitable ND**	**# Unsuitable ND**	**# Suitable D**	**# Unsuitable D**	**# Z-samples**	**Pass-AE**	**Fail-AE**
POT-Blair-Hylebos Redevelopment	CB, Upland	5	4	1	--	--	0	--	--
POT-WUT-high spot	CB	1	1	0	--	--	0	--	--
POT-WUT-Wharf & Bank Cutback	CB	4	4	0	--	--	0	--	--
Puyallup Tribal Terminal	CB, Upland	8	6	2	--	--	0	--	--
POS-T18	EB, Upland	1	0	1	--	--	0	--	--
POS-T115	EB, Upland	2	0	2	--	--	9	2	7
POS-T5	EB, Upland	3	2	1	--	--	0	--	--
Delta Marina	EB	2	2	0	--	--	1	1	0
USACE-Port Townsend	PT	2	--	--	1	1	0	--	--
Port of Anacortes - Cap Sante Marina	PG, RS	4	1	3	0	4	0	--	--
MJB Properties	BB	3	1	2	0	--	0	--	--
Weyerhaeuser, Bay Center, Aberdeen	GH	1	--	--	1	0	0	--	--
USACE Grays Harbor O&M DY08	GH	9	--	--	9	0	0	--	--
USACE Grays Harbor O&M DY09	GH	9	--	--	9	0	0	--	--
Port of Grays Harbor Terminal's 1, 2, 4	GH	4	--	--	4	0	0	--	--
Port of Grays Harbor Terminal 1	GH	2	--	--	2	0	0	--	--
Port of Grays Harbor Terminal 3	GH	1	--	--	1	0	0	--	--
Georgia-Pacific Camas Slough	CR (Upland BU)	4	--	--	3	1	4	3	1
Weyerhaeuser, Longview	CR (FLD,BU)	1	--	--	1	0	2	2	0
Totals:		**66**	**21**	**12**	**31**	**6**	**16**	**8**	**8**

Legend: POT = Port of Tacoma; WUT = Washington United Terminal; POS = Port of Seattle; ND = Nondispersive; D = Dispersive; -- = This evaluation not performed; AE = New Surface/Antidegradation evaluation; CB = Commencement Bay; EB = Elliott Bay; PT = Port Townsend; PG = Port Gardner; RS = Rosario Strait; BB = Bellingham Bay; GH = Grays Harbor (South Jetty/Point Chehalis); CR = Columbia River; FLD = Flowlane Disposal; BU = Beneficial Uses

3.2 Biological Testing

Biological testing was conducted on 7 DMMUs from 5 of the 28 projects undergoing chemical testing during DY08/09, which excluded exclusionary projects limited to grain-size and organic carbon only analyses. Table 3-4 shows that three of the seven were evaluated for nondispersive disposal and four were evaluated for dispersive disposal (see Appendix A for bioassay interpretation guidelines in place during this 2-year testing evaluation summary). A single 2-hit response was noted for the *Neanthes* growth bioassay. One 1-hit response and one 2-hit response were noted for the *Mytilus galloprovincialis* sediment larval bioassay. Based on these bioassay testing results, one of the seven DMMUs tested was found to be unsuitable for non-dispersive disposal. There were no hits recorded for the four DMMUs utilizing the dispersive site guidelines for the three bioassays.

Table 3-4. DY 08/09 Bioassay "Hit" Summary

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	ND	D	
Amphipod	2	4	0	0	0	0	0
Sediment Larval	2	4	1	0	1	0	2
Neanthes Growth	2	4	1	0	0	0	1

ND = non-dispersive site interpretation guidelines

D = dispersive site interpretation guidelines

3.3 Bioaccumulation Testing

During the two-year period covered by this report, there were four bioaccumulation trigger (BT) exceedances, with 2 DMMUs exceeding Fluoranthene BTs, and one DMMUs exceeding BTs for Pyrene and Total PCBs, and four DMMUs exceeding the SL/BT for TBT. However, no bioaccumulation testing was accomplished, and all DMMUs with BT exceedances were unsuitable for open-water disposal without that testing.

3.4 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 3-1 shows the relationship of average total cost per cubic yard to the total volume tested for all DMMP projects submitting data from DY90 to DY09. The regression of these two variables resulted in a significant ($p<0.001$) correlation, with the regression equation noted in Figure 3-1. However, it should be noted that costs have not been adjusted for inflation over time, so this figure should not be used to estimate actual testing costs, but may be useful as a relative yardstick to estimate costs.

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 period DY90 to DY09 are depicted in Figure 3-2 as a function of the number of analyses for 1) the standard suite of chemicals and 2) 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 $1,200 to $1,500 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 3-3. 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.

Please note that the costs shown in Figures 3-2 and 3-3 have not been adjusted for inflation.

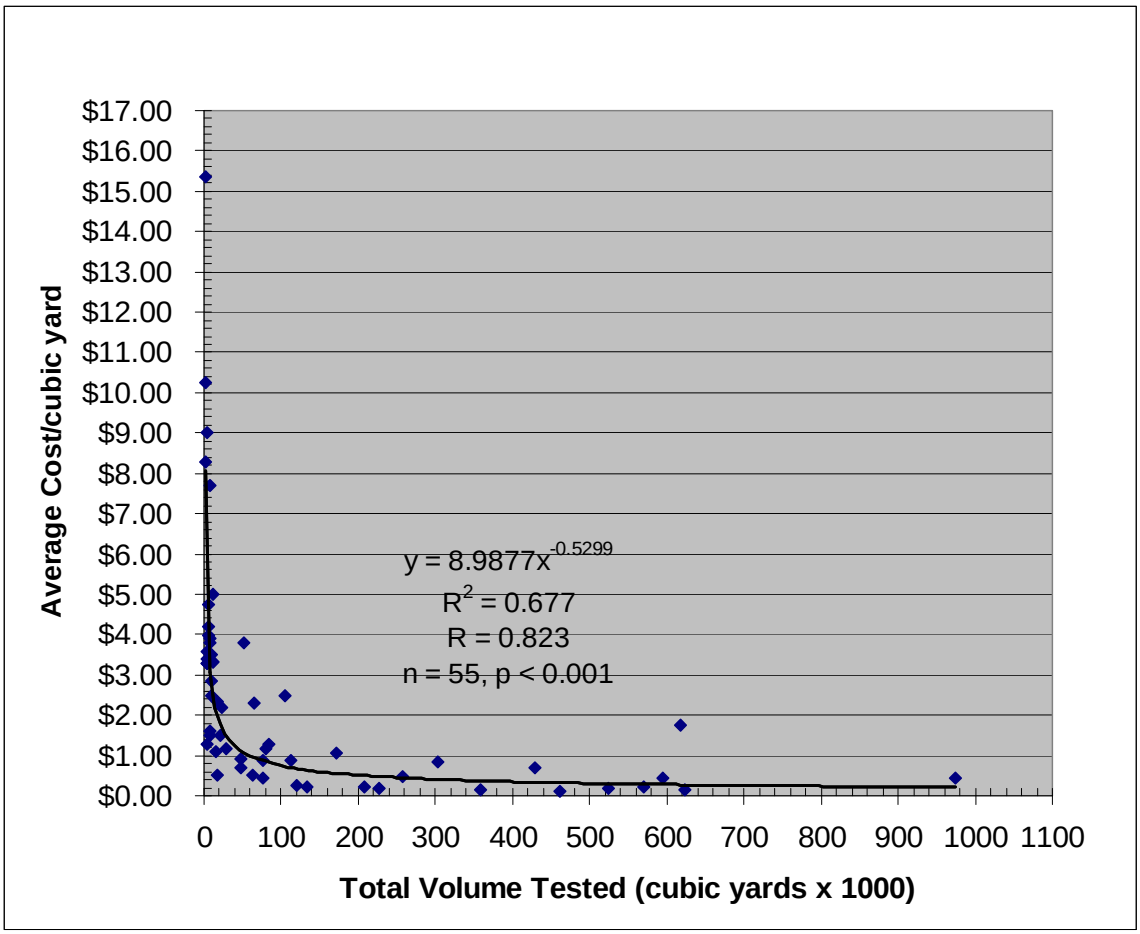


Figure 3-1. Project Size versus Unit Testing Cost

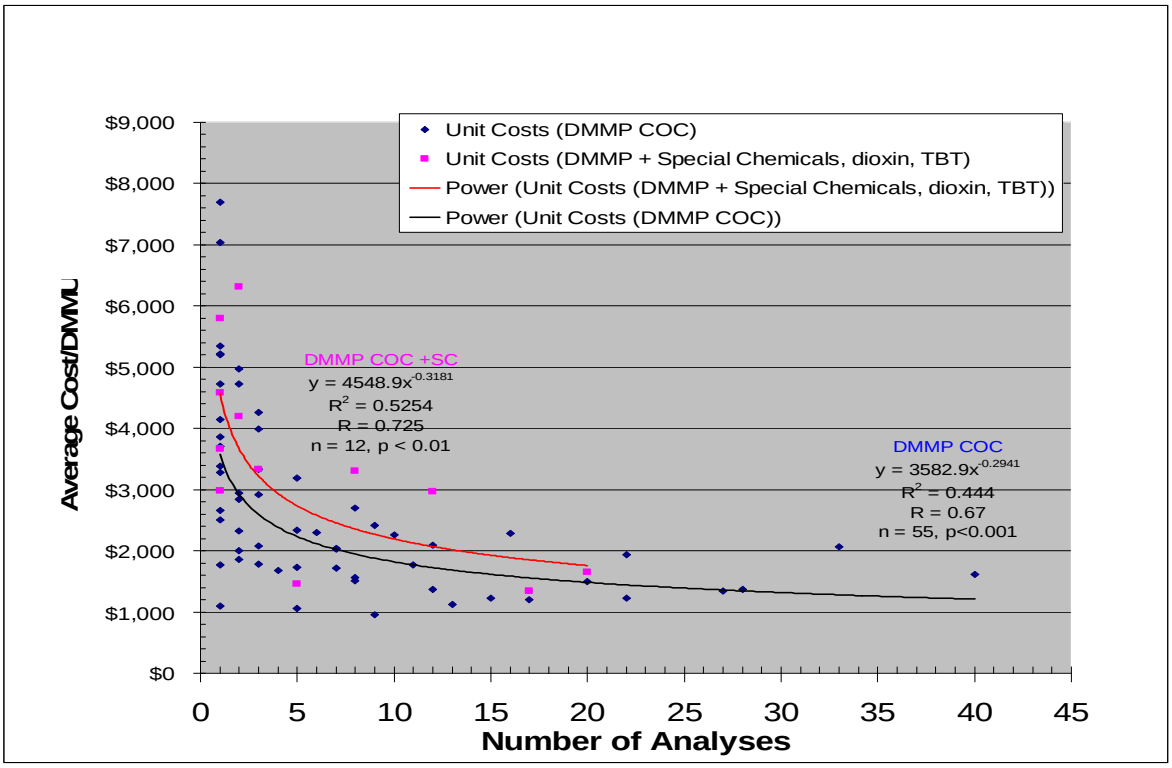


Figure 3-2. Chemistry Unit Cost

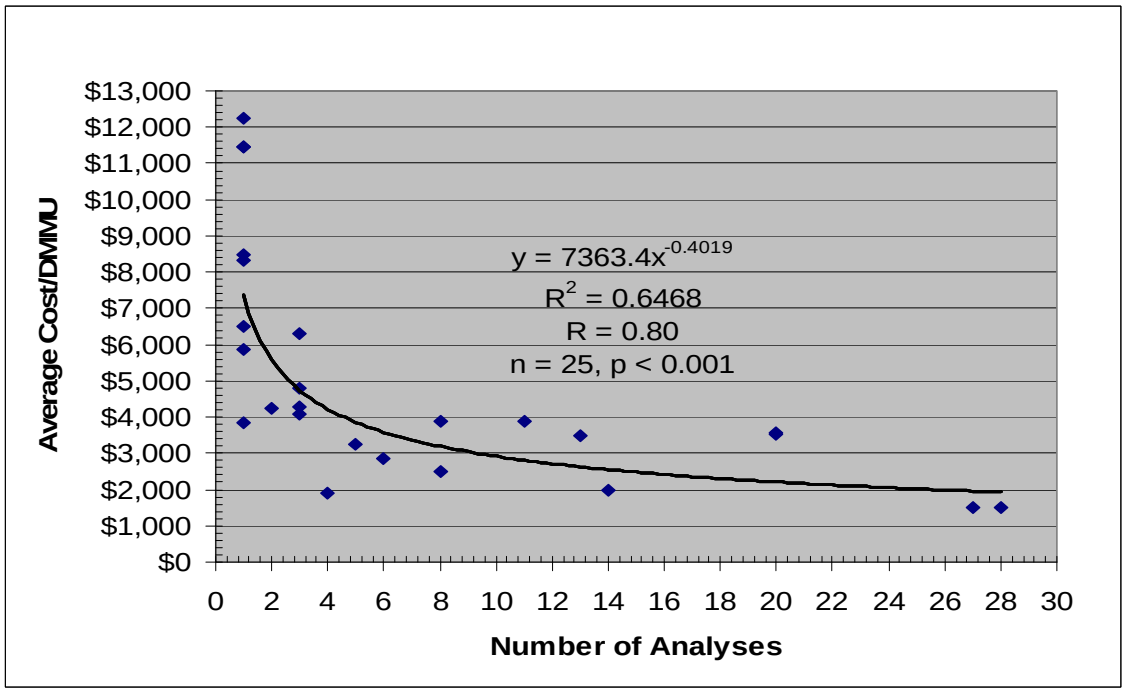


Figure 3-3. Bioassay Suite Unit Cost Analysis

3.5 Regulatory Processing

Regulatory Framework. 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 that must be taken before obtaining a permit. The majority of permit actions involve 404 jurisdiction but the steps are similar for 103 actions. These steps are typically sequenced as follows:

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

(2) Receive approval of SAP from DMMP agencies.

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

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

(5) Complete application details required for issuance of public notice.

(6) Corps prepares and issues public notice.

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

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

(9) Corps completes public interest review, 404(b)(1) evaluation, NEPA documentation, ESA consultation, and HPA coordination - as necessary - and issues permit decision.

The DMMP dredged material evaluation process consists of Steps 1 through 4, which are elaborated on in the following sections.

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.

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 the applicant, via telephone, letter or e-mail, has accepted these comments and modifications, sampling and analysis may proceed. It is the goal of the DMMO to complete the review of SAPs within three weeks. During DY08/09 the average and median time from the submittal of the final SAP for a project to SAP approval was 21 and 20 days, respectively, and ranged from a low of 2 days to a high of 82 days. Larger, more complex projects influence the DMMP review time, and have extended the review timelines for those projects.

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 dredged material characterization report. Sampling, testing and reporting consume a substantial portion of the DMMP process time budget, averaging 148 days during DY 08/09. This is one of the project phases with the highest degrees of variability, with sampling, analysis and reporting taking anywhere from 51 to 365 days during this 2 year time period. Factors influencing the time required for this phase include 1) weather 2) sampling difficulties 3) laboratory capacity and turn-around 4) QA problems arising during chemical and biological testing and 5) report compilation time. Those projects that include bioassay or bioaccumulation testing usually are those with the longer turn-around

times, although no bioaccumulation testing was accomplished during this 2 year review period, and only 5 of 28 projects required toxicity testing.

Data Review and Suitability Determination. Once a full set of chemical/biological testing data is submitted, 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 for unconfined open-water disposal at one or more DMMP open-water disposal sites, or beneficial use sites. The goal of the DMMO is to complete this review within three weeks of data submittal. In DY08/09, the average time required was 29 days, with review times ranging from 3 to 103 days[2]. The longest reviews usually involve complications such as a change in dredge volume or especially large or complex data sets.

Total DMMP Process Time. The entire DMMP dredged material evaluation process, as depicted in Figure 3-4, includes final sampling and analysis plan review and approval, field sampling and analysis, data review and completion of the suitability determination. The average and median time required for the DMMP dredged material evaluation process was 207 and 159 days respectively (ranging from 83 to 454 days) in DY08/09, with the majority of that time taken up by sampling, testing, and data report preparation by the applicant. Note that Figure 3-4 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.

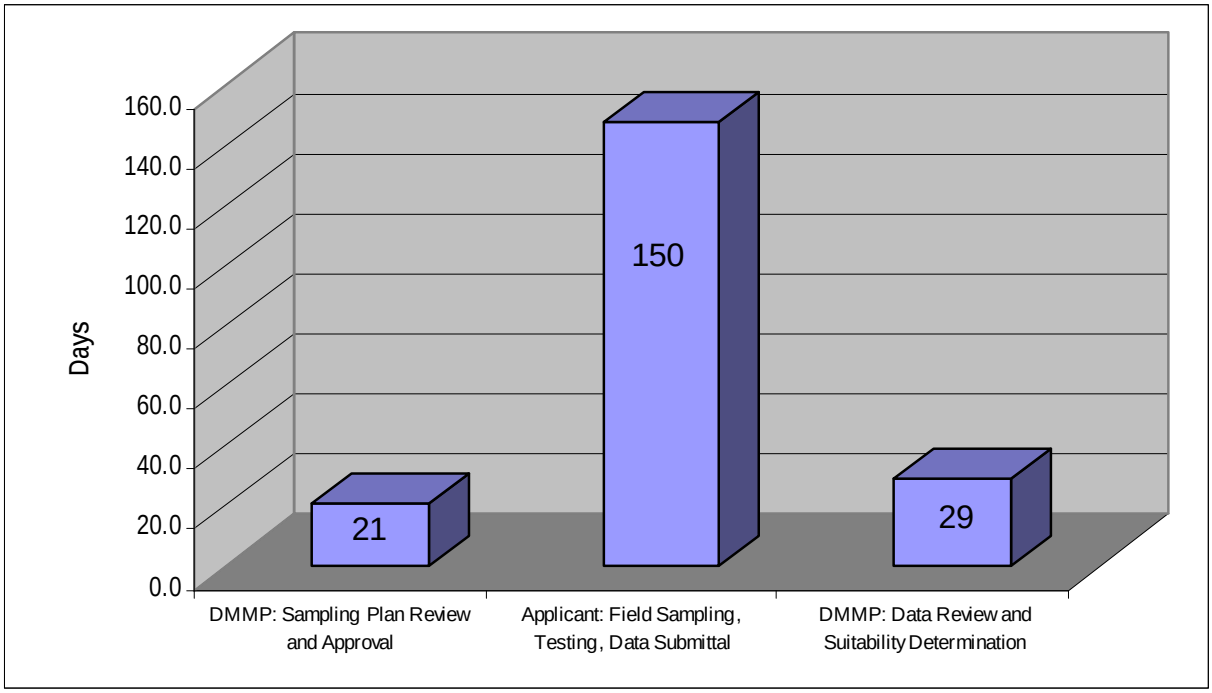


Figure 3-4. DMMP Processing Time (means for DY 08/09 projects in days)

[2] Considered to be an outlier project during this review, the Port of Seattle Terminal 115 DMMP characterization took 200 days to reach resolution on issues with EPA Superfund and the City of Seattle on the appropriate remedies for addressing side slope stability and the exposed surface after dredging to bring the sediment quality back into compliance with the Washington State antidegradation policy (http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/POS-T115-SDM-Dy09.pdf).

CHAPTER 4. UNUSUAL AND/OR COMPLEX PROJECTS

The following discussion includes unusual or complex projects requiring explanation beyond the summaries provided in Chapters 1 and 2. Projects with special considerations for ranking, sampling plan development, sampling, chemical testing, biological testing, or those for which the DMMP agencies used best professional judgment (BPJ) are further described in this chapter.

4.1 Dredging Year 2008

Ash Grove Cement

Ash Grove Cement received a 10-year permit in 2003 from the Corps of Engineers (permit 2001-1-00155) to maintenance dredge 600 cubic yards of spilled sand, gravel and limestone material every two years from its barge-unloading berth. The salvaged material is to be reused in Ash Grove's cement manufacturing facility. The permit calls for leaving a 1-foot buffer of spilled material in place in order to prevent resuspension of river sediment. Because of the coarse nature of the spilled material and the best management practice in place for preventing resuspension, no testing was required for this project.

Cape George Colony Club Marina Entrance Channel

Cape George Colony Club was issued Corps of Engineers permit 2004-00887 in 2006. The permit authorizes up to 900 cubic yards of accumulated sand and cobble to be dredged from the marina entrance channel on an annual basis and placed as beach nourishment along the seawall to the south of the entrance channel. The estimated dredging volume for the July 2007 dredging cycle was 600 cubic yards. The DMMP agencies reviewed the project, determined there were no changed conditions and allowed the project to proceed without testing.

Cap Sante Marina Recency Extension

The initial DMMP characterization was conducted in 1999/2000 and documented in a 12 April 2001 suitability determination (http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/Cap-Sante-Marina-sdm.pdf). The recency expired for the initial characterization in February 2006, and the applicant subsequently requested a recency extension. In response to this request, the DMMP agencies reviewed the previous testing conducted and responded that additional characterization of the 40,900 cy of material remaining to be dredged was necessary to evaluate the existing sediment quality (total project volume was 99,000 cy, of which approximately 58,100 cy were previously dredged). The DMMP agencies authorized the use of a grab sampler to evaluate the surface sediment quality within the 4 DMMUs remaining. Based on a review of previous testing results the DMMP agencies determined that the recency evaluation should focus on the analysis of semivolatile organic compounds (SVOCs, including polycyclic aromatic hydrocarbons), tributyltin, and dioxin/furans (dioxins had not been previously characterized). For this project evaluation, the DMMP agencies stipulated that dioxin/furan data would be compared directly with Samish Bay reference data (collected by the applicant) to evaluate suitability for unconfined open-water disposal at the Rosario Strait dispersive disposal site.

A complete summary of sediment testing results for the 4 characterized DMMUs is provided in the SDM (http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/Cap-Sante-Marina-Recency-SDM-08-rev.pdf).
Analysis results for the 4 DMMUs indicated that tributyltin and SVOCs were below both DMMP SLs and SMS SQS guidelines. Analysis of dioxin/furans within the 4 DMMUs indicated that the total TEQs ranged

from a low of 3.51 pptr-TEQ (DMMU-C2) to a high of 52.6 pptr-TEQ (DMMU-C8). The Samish Bay reference sample was quantitated at 2.44 pptr-TEQ, which was lower than all 4 DMMUs.

The agencies concluded that all four DMMUs, representing a total of 40,900 cy, are unsuitable for unconfined open-water disposal at the Rosario Strait dispersive disposal site, based on a comparison with the Samish Bay reference, utilizing the interim dioxin policy established in February 2007 (http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/dioxin.pdf).

However, DMMU-C2 - quantified at 3.51 pptr-TEQ - meets the interim non-dispersive site dioxin/furan guidelines for 4 of the non-dispersive sites, as this DMMU was quantitated below the off-site mean concentrations for the Bellingham Bay, Port Gardner, Elliott Bay and Anderson/Ketron Island sites, but is above the Commencement Bay off-site mean. Dredging of these four DMMUs will trigger a requirement for analysis of the exposed post-dredge surface to evaluate the dioxin/furan concentrations relative to the Washington State antidegradation policy.

City of Longview Regional Water Treatment Plant (RWTP)

The RWTP is located on the west bank of the Cowlitz River at river mile (RM) 5.17. The Toutle River, which originates on the west and northwest flanks of Mount St. Helens, is a tributary to the Cowlitz. After the eruption of Mount St. Helens in 1980, a sediment retention structure (SRS) was constructed by the Corps of Engineers on the North Fork of the Toutle River to prevent large quantities of sediment and ash from being transported downstream. However, in recent years, the SRS has filled to the spillway crest and sediment is being passed through the SRS in greater quantities (USACE 2007a).

The additional sediment load has created problems along the Cowlitz River, including for the RWTP. To counteract the increased sedimentation rate, the City of Longview constructed an 8-foot tall sediment retention dam in front of the water intake structure in 2005. However, by 2006 sediment deposits had already exceeded the height of the dam and threatened to bury the lower section of the intake. In addition, during periods of low river flow, the accumulated sediment could impede the flow of water from the main channel of the river to the treatment plant intake, thereby threatening the water supply for 47,500 customers.

The City of Longview proposed maintenance dredging on an as-needed basis to 1) prevent build-up of sediment near the water intake and 2) provide an adequate flow of water from the main channel of the river during periods of low flow in summer and fall. An estimated 5,000 cubic yards of sediment are to be removed per year.

In January 2007 a sediment evaluation study was conducted by Portland District of the Army Corps of Engineers from the mouth of the Cowlitz to RM 10. Ten samples were taken, one from each river mile. All samples were analyzed for sediment conventionals and five of the samples were tested for the chemicals of concern (COCs) included in the Northwest Regional Sediment Evaluation Framework (SEF) (RSET 2006; USACE 2007b).

The grain-size analysis indicated that the Cowlitz River samples were predominantly sand, ranging from 90.7% to 98.9% in sand content. The chemical analysis showed that all COCs were below their respective SEF screening levels. All 4.5 million cubic yards proposed for dredging were found suitable for upland or in-water disposal (RSET 2007).

The Corps of Engineers study demonstrated that the sediment in the lower 10 miles of the Cowlitz River is clean sand and is suitable for in-water disposal. Based on the results of this study, the DMMP agencies concluded that the material adjacent to the water treatment plant was suitable for in-river disposal downstream of the treatment plant without additional testing.

Delta Marine Industries

Sampling took place July 17-18, 2007. Soundings taken during sampling indicated that field conditions had changed significantly since the time of the original bathymetry (March 2007). Sediment elevations were significantly lower, meaning that a portion of the proposed dredged material had eroded, possibly due to prop wash. Nearly all the material in one of the DMMUs was gone. Therefore, this DMMU was eliminated. The volumes of the remaining DMMUs were estimated.

For the original suitability determination, issued October 19, 2007, dioxin testing had not been required. However, subsequent to that determination, a report was published by the Lower Duwamish Workgroup that showed elevated concentrations of dioxin in close proximity to the Delta Marine facility. The DMMP agencies, in conjunction with EPA's Superfund Program, requested that Delta Marine conduct dioxin testing on a portion of the material (6,534 cubic yards in DMMUs 3 and 4) to determine whether it met the interim dioxin disposal guidelines for the Elliott Bay site. The dioxin testing results indicated that the dredged material met the interim guidelines and that the underlying material met Washington State's antidegradation standard.

Georgia-Pacific Camas Slough (Columbia River)

This project involves maintenance dredging of 20,000 cy of material from three areas of Camas Slough yearly for five years for a total of 100,000 cy. This material will be disposed in an upland disposal site, without return water to Camas Slough, on Lady Island owned by the applicant, Georgia-Pacific Consumer Products LLC. Following disposal, this material may be re-used in construction projects on the island. Because this project does not involve in-water disposal, only a permit issued pursuant to Section 10 of the Rivers and Harbors Act is required from the Corps of Engineers.

The Camas paper mill site, owned by Georgia-Pacific Consumer Products LLC, is located on Camas Slough, a side channel of the Columbia River that flows from the Washougal River on the east end, into the Columbia mainstem on the west end. The area in front of the mill accumulates sediment from both the Washougal and Columbia Rivers. Dredging is required to maintain these navigation channels for staging and transport of materials associated with mill operations. Dredging is also proposed to maintain the fresh water intake structure that is operated seasonally.

The project was ranked Moderate based on its location in Camas Slough and the proximity to the paper mill. The sampling and analysis plan called for dredging of no more than 20,000 cy of sediment per year for each of five years. Based on input from the resource agencies (U.S. Fish and Wildlife Service, Washington Department of Ecology) as well as the applicant, it was agreed that four dredged material management units (DMMUs), each a composite of 1 to 4 field samples from the dredging prism, would be tested. Additionally, it was agreed that each of the ten cores collected during characterization, would be drilled an additional foot below the dredging depth in order to collect Z-samples to evaluate the sediment surface that would be exposed by dredging.

Analysis of the dredging prism focused on an analysis of the RSET Sediment Evaluation Framework contaminants of concern and an analysis of potential water quality impacts due to the dredging process

were required to assess potential impacts to species listed under the Endangered Species Act and to provide information needed for the consultation process with the U.S. Fish and Wildlife Service. Dioxin was added to the list of contaminants of concern due to the proximity of the paper mill to Camas Slough. To evaluate potential water quality impacts of dredging, a Dredging Elutriate Test (DRET) was conducted on sediment from the dredge prism. It was also agreed that one of the Z-samples would be analyzed initially with the provision that analysis of additional Z-samples might be required, and all Z-samples were subsequently analyzed.

The approved sampling and analysis plane was followed, and quality control guidelines specified by the RSET and DMMP programs were met, with few minor exceptions. The data were considered sufficient and acceptable for regulatory decision-making under the DMMP program, and the DMMP analysis is reflected in the suitability determination (http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/Camas_Slough_SDM07.pdf).

The chemical results indicated that there were no exceedances of RSET freshwater screening level 1 (SL-1) values in DMMUs 1, 2, and 3. The concentration of Zinc in sediments from DMMU 4 were quantitated at 144 mg/kg (dry weight), which exceeded the RSET SL1 value of 130 mg/kg (dw). However, bioassay testing of this material is not required for the dredge prism to be disposed upland. There are no agreed upon RSET or DMMP freshwater values for dioxin. However, the MTCA Level C value for 2,3,7,8-TCDD was used as a way of determining environmental impact of these sediments in an upland environment. The dioxin data measured in the Camas Slough DMMUs ranged from 0.3 to 4.7 pptr-TEQ. The DRET test focused on the analysis results for organics only, because the preparation of the elutriate alters the solubility of some metals. Test results indicated that during dredging, neither EPA or Ecology acute water quality standards would be exceeded for chemicals with available standards.

Sediments exposed by dredging must meet either the State of Washington Sediment Quality Standards (SQS) or the State's anti-degradation standard. Because there are no SQS values for freshwater sediments, the RSET freshwater SL-1 values were used as a first tier indicator for this analysis. Analysis of Z-samples indicated there were no detected exceedances of SL1 chemicals within DMMU's 1,2, and 4. Therefore, these 3 DMMUs may be dredged without concern that unsuitable material will be exposed during dredging. However, analysis of Z-sample for DMMU-3, indicated that cadmium, zinc, and PCBs exceeded SL1 values, and dioxin values measured in the Z-sample (12.4 pptr-TEQ) exceeded dioxin concentrations in the overlying DMMU-3 (4.7 pptr-TEQ), and therefore, violate Ecology's antidegradation policy. The applicant subsequently after deliberation with the DMMP agencies, elected not to dredge DMMU-3 during their 5-year maintenance dredging permit.

The material in DMMU 1, 2, and 4 was subsequently evaluated for upland beneficial use, by comparing the chemical testing results to the MTCA guidelines, and all chemicals of concern were below MTCA Method A and C Screening Levels for industrial land-use. This analysis however, indicated that both Ecology and the local health district should be consulted if beneficial use is contemplated.

If upland disposal of DMMU-3 is contemplated, additional DMMP review and consultation would be required, including consultation with Ecology and the local health district.

Port of Grays Harbor, Terminals 1, 2 and 4

The Port of Grays Harbor owns four terminals in the vicinity of Aberdeen, Washington, three of which were included in this sediment characterization. Terminal 1 is a barge-loading facility, currently used for loading

wood chips and vegetable oil products. Terminal 2 is a bulk-loading facility used for agricultural and vegetable oil products. Terminal 4 is the Port's main general cargo facility.

Terminal 2 requires annual maintenance dredging to -41 ft MLLW. Dredging is not currently required at Terminal 1, but characterization was performed in anticipation of future needs. Terminal 4 is equipped with an anti-siltation system to maintain a berthing depth of -41 ft MLLW, but characterization was performed in case additional sediment removal is required or the anti-siltation system experiences a mechanical breakdown.

The Port of Grays Harbor terminals are located in an area where sediment can accumulate rapidly and is therefore considered to be relatively homogeneous. In areas subject to rapid shoaling, not all sediment to be dredged will be in place at the time of sampling. Therefore, the volume estimated for each terminal was based on historical dredging records and best professional judgment as required in the DMMP Users Manual (DMMP, 2007). The estimated volumes were 30k, 60k and 24k for Terminals 1, 2 and 4 respectively. Terminal 1 is ranked "low", while Terminals 2 and 4 are ranked "low-moderate".

Port of Tacoma, East Blair Waterway Study Phase (Blair-Hylebos Redevelopment)

This project was a study phase characterization, intended to provide information to the Port for project design. No specific project had yet been proposed when the characterization occurred. The applicability of the information gathered under this characterization was reviewed and amended as necessary after a specific project was proposed, and a final SDM was issued in DY 2009 that included both study-phase and project-phase characterizations.

Sampling took place on approximately 317,000 cy of the total proposed one million cy study area. As in previous cutback projects along the Blair waterway, only the top eight feet of native sediments were sampled, except for one discreet sample at the bottom of the dredge prism. The remaining 683,000 cy in the study area are deep native sediments that the DMMP determined, as part of its Tier 1 evaluation, were not necessary to characterize.

Because of proximity to an ongoing Superfund cleanup site (Occidental Chemical Company on the Hylebos Waterway), some additional analyses were required to rule out migration of these contaminants to the study area. The DMMP required analyses for dioxins and furans (PCDD/F) and PCB congeners on material composites representing different sediment depths and potential paths of exposure. PCDD/F, as well as dioxin-like PCB congeners that were not detected with typical Aroclor analysis, have been found on the nearby Superfund site and there was no information with which to rule out the potential for contamination migrating from this site to study area sediments. Five analyses for PCDD/Fs and PCB congeners were performed.

The characterization results indicated that the upper 4 feet of the entire dredge prism (DMMUs 1, 2 and 3) were unsuitable for open-water disposal and beneficial use due to various exceedances of DMMP guidelines for mercury, PCBs and PCDD/F. Concentrations of PCDD/F were evaluated under Interim Guidelines (Feb. 2007). All other sediments were suitable for open water disposal and/or in water beneficial use.

Semiahmoo Marina

Sampling took place August 20-24, 2007. A vibracore sampler was used throughout. During field sampling activities, difficulties in achieving target core penetration and sediment recovery were encountered. The

primary cause of the sampling difficulties was a layer of gravel and cobble that was present over much of the proposed dredging footprint, with consolidated low-moisture clayey or silty sand below. The gravel/cobble layer and underlying material were assumed to be undisturbed native sediment.

Core collection was planned at 43 target locations. Where refusal was encountered, an additional core was attempted 20 to 25 feet from the target. In some cases 3 or 4 attempts were made, for a total of 65 coring attempts. Refusal was encountered during 57 of these attempts. The sampling crew tried several approaches to improve penetration and recovery, including use of both vibratory and rotary impact power heads, two types of core barrels and attempts with and without a core catcher.

The DMMP agencies deemed that the contractor's attempts to achieve target penetration and recovery were adequate and that the acquired samples represented the material to be dredged. Further, the agencies believed that there was no reason to believe that the native material, consisting of the gravel/cobble layer and underlying sediments, contained concentrations of chemicals of concern greater than those found in the overlying sediment. This was borne out by DMMU SMB-5, which contained the largest portion of material from below the gravel/cobble layer. All organic chemicals in this DMMU were undetected and metals were well below screening levels.

South Lake Union Project

This is a MTCA cleanup project that was first initiated in 2005, and is being conducted in two phases, the first being shoreline stabilization, the second being in-water excavation, which required sediment testing prior to in-water work in DY09, which is discussed below.

USACE Grays Harbor – Outer Harbor O&M

The federal navigation channel is comprised of ten reaches. The "outer harbor" reaches are located in the high-energy area near the mouth of Grays Harbor and contain predominantly coarse-grained material. The "inner-harbor" reaches have a much higher silt content. The outer harbor is excluded from testing based on the nature of its coarse-grained sediment, high-energy environment and distance from sources of contamination. However, this exclusionary status must be confirmed periodically through grain-size testing. In DY08, the following reaches were subjected to confirmatory testing: Bar Channel, Entrance Channel, Pt. Chehalis Channel, South Reach and Cross Over Reach. All but Cross Over Reach met the exclusionary criteria. The tables in Chapters 1 and 2 include data only for those reaches that met the criteria. Cross Over Reach will continue to be tested for the full suite of DMMP chemicals of concern.

USACE Shoalwater Bay Shoreline Erosion Project

The Shoalwater Bay Shoreline Erosion Project was authorized by Section 545 of the Water Resources Development Act of 2000. A study to determine the most appropriate long-term solution to reduce shoreline erosion and flood damage due to coastal storms affecting the Shoalwater Bay Indian Reservation was conducted by the Corps of Engineers (USACE, 2007c). The preferred alternative was to restore the severely eroded barrier sand dune located on Graveyard Spit, extend an existing riprap flood berm along the shoreline, and restore the entrance channel to North Cove to the location it occupied in 1994. Material for dune restoration was proposed to be taken from two borrow sites located adjacent to the Willapa Bay North Channel.

The entire project area, including the borrow sites, is located within three miles of the baseline for territorial seas. Therefore, Section 404 of the Clean Water Act (CWA) applied. The CWA Section 404(b)1 Guidelines for Specification of Disposal Sites for Dredged or Fill Material (CFR 40 Section 230.60,

subparagraphs a and b) include exclusionary criteria with regard to testing. The Guidelines state that (1) dredged or fill material is most likely to be free from chemical, biological, or other pollutants where it is composed primarily of sand, gravel, or other naturally occurring inert material. Dredged material so composed is generally found in areas of high current or wave energy such as streams with large bed loads or coastal areas with shifting bars and channels; and (2) the extraction site shall be examined in order to assess whether it is sufficiently removed from sources of pollution to provide reasonable assurance that the proposed discharge material is not a carrier of contaminants (EPA, 1980). Dredged material that meets these two guidelines may be excluded from further testing.

The project was in a highly dynamic coastal area with high-energy waves and currents. The USGS verified the physical characteristics of the sediment in a 2004 erosion study for the U.S. Army Corps of Engineers (USGS, 2004). Seven sediment samples were taken from five locations near the entrance to Willapa Bay. Three of the sampling locations were in the general vicinity of the borrow sites and proposed North Cove channel alignment. Surface samples were collected with a Van Veen grab sampler and analyzed for grain size. All samples were predominantly fine sand, with very low fines content (< 2%). The proposed dredged material is also far from any known sources of contamination. The DMMP Users Manual indicates that the Willapa Bar is ranked "low", meaning that there are few or no sources of chemicals of concern (DMMP, 2007).

Based on this information, the DMMP agencies determined that the material did not require further testing under Section 404 of the CWA. All 700,000 cubic yards of dredged material were found suitable for beneficial use or as fill material.

Weyerhaeuser Longview Docks

This project was sampled in late 1998 or early 1999, with a suitability determination issued in April 1999. All material was found suitable for in-water disposal. Sampling and testing were conducted again in 2005/2006 per the DMMP frequency guidelines. However, a sampling and analysis plan was not submitted for agency review. A characterization report was submitted in 2006. Because the DMMP agencies had not had the opportunity to review the SAP, a number of procedural errors took place during sampling and testing. There were no indications of any guideline exceedances, but due to the procedural errors the agencies did not issue a suitability determination, but instead approved a frequency extension and allowed the then-upcoming dredging to occur. However, the DMMP agencies required that sampling and testing occur again before the next dredging cycle (expected in 2009/2010), this time with agency review of the SAP prior to sampling and testing.

Subsequent to the frequency extension, Tidewater Barge Lines requested that Weyerhaeuser make a minor modification to the proposed dredging footprint to facilitate access to the chip-barge slip. The expanded dredging area was in close proximity to one of the sampling stations from the 2005/2006 sediment characterization and there was no reason to believe this material differed in any way from the characterized material. Therefore, the DMMP agencies approved the expanded dredging without additional testing.

4.2 Dredging Year 2009

Hemlock Dam, Wind River, Skamania County

The US Forest Service proposed to remove Hemlock Dam on Trout Creek, a tributary of the Wind River in Southwest Washington. The Forest Service proposed removing 75,000 cubic yards of sediment from

behind the dam prior to removing the dam itself. The material was to be removed in the dry, and trucked to a nearby upland location for potential reuse. Sediment data were collected in 2001, and the sediment is predominantly sand (91 percent to 97 percent). The DMMP agencies reviewed the proposed action and determined there was no need for further sediment testing.

Monroe Street Dam, Spokane River (BU)

The DMMP evaluated the suitability of material accumulated behind the Monroe Street Hydroelectric Development Dam for dredging with subsequent placement on the dam apron on the downstream side of the dam. The sampling and analysis was conducted by the applicant (Avista Utilities) after the Corps of Engineers received a letter from the Sierra Club, dated August 8, 2008, requesting testing to confirm the sediment quality of the material being dredged under an existing permit (1997-4-00098).

The dredging of approximately 3,000 – 10,000 cy of accumulated sediments (predominantly gravel and cobble) from the Monroe Street Dam forebay was required to prevent failure of the turbine trash racks and to restore full generating capacity of the hydroelectric plant. The dredged material is placed on the dam apron as required by the 1997 U.S. Army Corps permit in response to the Washington Department of Fish and Wildlife in their 1997, 2002, and 2007 Hydraulic Project Approvals, so that the cobbles and gravels would continue to serve as potential source material for spawning habitat in the Spokane River system. Prior to the 1997 permit, the dredged material was removed from the river and placed upland.

The chemical analysis results were compared to the draft 2006 Sediment Evaluation Framework (SEF) freshwater guidelines, or to SEF marine guidelines for chemicals with no existing freshwater guidelines. This comparison for the two < 16 mm fraction subsamples indicated that all chemicals were quantitated below the freshwater screening level (SL1) guidelines. Analysis results for the < 2 mm sieved samples indicated that all chemicals were below the freshwater screening level guidelines except zinc, which was quantitated at 420 ppm and 400 ppm (SL1 =130 ppm) for the two samples. The sample with the highest zinc concentration also exceeded the SL2 Guideline of 400 ppm.

The DMMP agencies further evaluated the potential for dredging to result in exceedances of water quality criteria for zinc using conservative assumptions about river flow (assumed low), sediment distribution in the water column (assumed all material <2mm size fraction remains suspended) and dredging rates (assumed high). The maximum concentrations of zinc that would be expected in any given 24 hour period of time was determined to be 24 ug/L. This value is below Ecology's total dissolved zinc chronic freshwater standard of 33.4 ug Zn/L, based on a conservative value for water hardness. Therefore, based on this evaluation, the DMMP agencies concluded that it is unlikely that dredging of this material would have unacceptable adverse effects on water quality downstream of the dam (http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/Monroe_Street__Dam_Evaluation.pdf).

Port of Seattle – Terminal 5

This project is located in a Superfund site, within the Harbor Island Operable Unit. Portions of this project were previously characterized under DMMP guidelines in 1992 and 1997, and all material was previously found suitable for open-water disposal at the Elliott Bay disposal site. The proposed dredging at Terminal 5 involves maintenance dredging along 2,900 linear feet of container cargo pier margin. The estimated dredging prism thickness is 3-7 ft within the berthing area, which has authorized depths of 45 ft MLLW + 2 ft of allowable overdredge depth at the south end of the berthing area, and 50 ft MLLW + 2 feet allowable overdredge depth at the north end of berthing area.

DMMUs S1 and S2 had no detected or undetected exceedances of the DMMP marine guidelines for any of the standard chemicals of concern. However, DMMU S3 had a TBT pore water concentration of 1 ppb, which exceeded the SL/BT. The fluoranthene and phenanthrene SLs were also exceeded for S3. DMMU S3 was subjected to toxicity testing for the later two SL exceedances, prior to conducting bioaccumulation testing for TBT. S3 failed toxicity testing interpretation guidelines and was found unsuitable for open-water disposal. Therefore, bioaccumulation testing for TBT was unnecessary.

The dioxin testing results for the three DMMUs are summarized as follows: DMMU S1 = 12.1 pptr-TEQ, S2 = 6.31 pptr-TEQ, and S3 = 4.33 pptr-TEQ (U = ½ detection limit). The DMMP agencies are currently using an interim process for interpreting dioxin data (http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=DMMO&pagename=Dioxin_Guidelines) pending the development of a programmatic regulatory framework, expected in 2010. The interim guidelines provide a project-specific comparison of dioxin/furan concentrations in project dredged material to the disposal site background outside the disposal site. The guidelines applicable to the Elliott Bay non-dispersive disposal site specify the following:

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

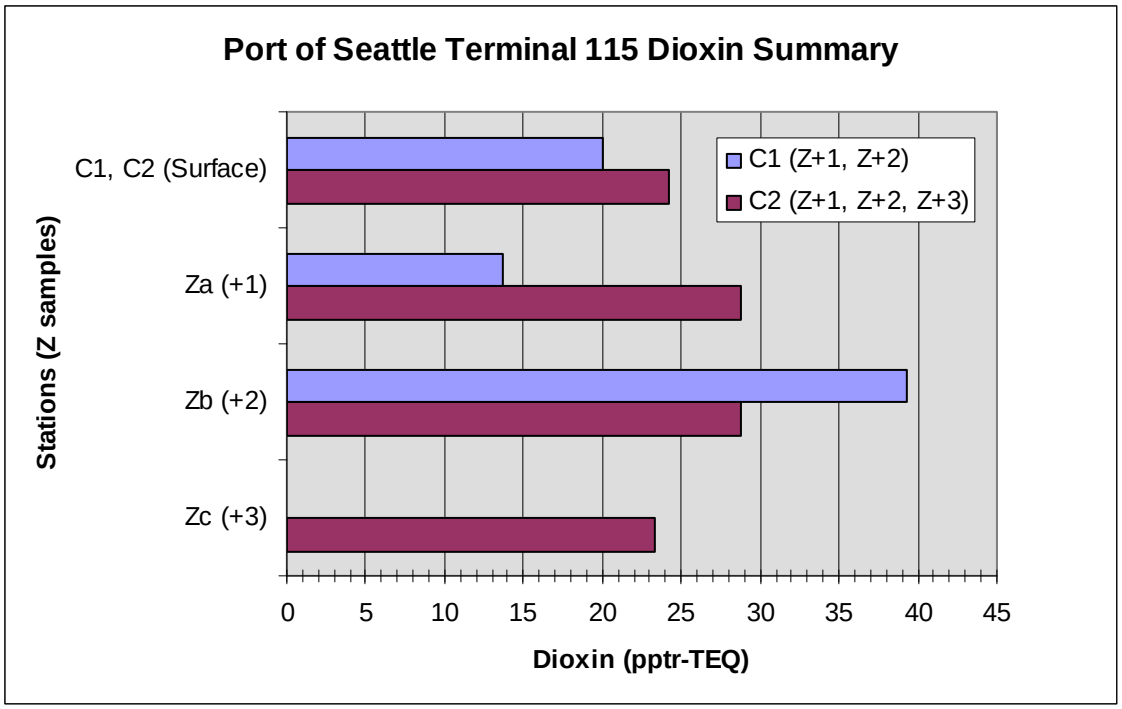
All three DMMUs were quantitated below the site maximum of 12.2 pptr-TEQ. DMMU S3 dropped out of the volume-weighted average due to its failure in toxicity testing. The volume-weighted average concentration for DMMUs S1 and S2 was 9.03 pptr-TEQ, which is above the interim Elliott Bay offsite average of 8.7 pptr-TEQ. However, DMMU S2, taken by itself, was below the offsite average at 6.31 pptr-TEQ.

Based on the chemical and toxicity testing results, DMMUs S1 and S3 were found unsuitable for unconfined open-water disposal. The 2,400 cy of material represented by DMMU S2 were found suitable for disposal at the Elliott Bay site.

Port of Seattle – Terminal 115

The Port of Seattle proposed dredging 3,000 cy of maintenance material from the Terminal 115 berthing area (dredging to -15 ft MLLW + 2 feet of allowable overdredge depth) with disposal at the Elliott Bay nondispersive site. The DMMP evaluation included testing for dioxin/furans in both the dredged material and Z-samples (Z+1 = 0-1 ft; Z+2 = 1–2 ft; and Z+3 = 2–3 ft below overdepth).

The dioxin testing results summarized in the figure below show that dioxin concentrations were elevated in surface DMMUs C1 and C2 (20.1 and 24.1 pptr-TEQ, respectively), as well as in the Z-samples (concentrations ranging from 12.9 to 39.3 pptr-TEQ).



The DMMP agencies used the interim framework for interpreting dioxin data for open-water disposal pending the development of a programmatic regulatory framework, expected in 2010 (http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=DMMO&pagename=Dioxin_Guidelines). For open-water consideration, the interim framework involves a project-specific comparison of dioxin/furan concentrations in project dredged material to the disposal site background outside the disposal site. The guidelines applicable to the Elliott Bay non-dispersive disposal site specify the following:

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

As summarized above, both DMMUs were quantitated above the site maximum of 12.2 pptr-TEQ and, therefore, would not be suitable for unconfined-open-water disposal. Furthermore, the underlying Z-samples all exceeded the site maximum of 12.2 pptr-TEQ, and were further analyzed relative to the surface DMMUs for compliance with the Washington State antidegradation policy. The data indicated that dredging to an elevation of -17 ft (e.g. -15 ft + 2 ft of allowable overdredge depth) would expose a sediment surface that would not be in compliance with the antidegradation policy for dioxin (and also for PCBs) for DMMU-C2.

The DMMP agencies deliberated with the Port of Seattle about how to remedy the exposed surfaces following dredging, to bring the sediment surface back into compliance with the Washington State antidegradation policy. The Port agreed to place a nominal 1-foot clean sand cover of approximately 1,250

cy over the exposed sediment surface, and it is anticipated that the actual average thickness of the sand layer would be approximately 1.5 ft. This cover would provide an effective temporary cover to reduce the dioxin concentrations expressed after dredging at Terminal 115. However, the effectiveness of this cover will be re-evaluated as part of the Superfund Feasibility Study currently underway for the Lower Duwamish Waterway Superfund site. Because of the 1 to 1.5 ft cover, the Port now proposes increasing the dredging depth an additional 1.5 feet to -16.5 ft + 2 feet of allowable overdredge depth, which would make the effective maintenance dredge depth -18.5 ft, rather than the -17 foot depth initially proposed, to insure an adequate navigation depth between -17 to -17.5 feet MLLW.

The DMMP agencies and the City of Seattle expressed concerns about side-slope stability of the under-pier sediments immediately adjacent to the dredging area and especially the potential for sloughing of these sediments (presumed to be contaminated) back into the dredged berthing area. The Port of Seattle has agreed to address these concerns by installing a sheet pile retaining wall at the pierhead line. The sheet pile wall would extend approximately 430 linear ft, and would be located at approximately the -10 ft MLLW contour, and would extend vertically from -10 MLLW to the USACE-approved berth depth at -15 ft MLLW. The top of the wall would extend above the sediment surface approximately 2 feet in order to ensure slope stability and limit the movement of any sediment due to sloughing during and after maintenance dredging.

Port of Tacoma, Blair-Hylebos Redevelopment Project (E. Blair) Final

The study phase of this project was completed in DY08. Further characterization took place when the final project design was proposed, and portions of uncharacterized material were included in the final design. The characterization was complicated by the discovery of historical underground storage tanks (USTs) that required additional sampling and testing. The following table summarizes sampling and testing of all phases of the project:

Characterization Phase	Sediment Horizon (Rank)	DMMU	Volume (cy)
Study Phase 1	Surface Fill (M)	DMMU 1	15,216
		DMMU 2	10,116
		DMMU 3	13,496
	Subsurface Fill (LM)	DMMU 4	52,260
		DMMU 5	43,198
		DMMU 6	42,279
		DMMU 7	25,056
	Subsurface Native (LM)	DMMU 9[1]	40,440
		DMMU 10	37,584
		DMMU 11	37,372
Phase 2 (Final DMMP project) and Phase 3 (UST investigations)	Surface Fill (M)	DMMU 12	12,400
	Subsurface Fill (LM)	DMMU 13	27,900
		DMMU 14	15,500
	Subsurface Native (LM)	DMMU 15	24,800
Project Totals	Total Tested		397,617
	Deep Native - no test		1,202,383
	Project Total		1,600,000

[1] There is no DMMU 8 due to field conditions (less material in fill layer than expected.)

Dioxins. The surface fill portion of the additional project area (DMMU 12) was considered unsuitable for open water disposal prior to Phase 2 due to concentrations of dioxin detected in surface sediments during Phase 1. No additional dioxin analysis was performed during Phases 2 & 3.

PAHs/USTs. Phase 2 of this characterization, in the additional project portion of the proposed dredge prism, found high PAHs in DMMU 14. This finding led to discovery of historical UST locations. Follow-up sampling was then performed to evaluate potential impacts of former USTs located in, adjacent to, and upgradient from the dredge prism. Borings were completed in some locations to evaluate the lateral limits of potential petroleum hydrocarbon-related impacts, where observed, and are included in the total number of borings (35). Samples were collected continuously from each boring at 2-foot intervals (starting at 4 feet bgs) and two samples from each boring were submitted for analysis of gasoline-, diesel- and heavy oil-range petroleum hydrocarbons and VOCs (including benzene, toluene, ethylbenzene and total xylenes).

MTCA criteria were used to evaluate the results of the UST analysis because there are no DMMP or SMS criteria for total petroleum hydrocarbons and most of the DMMP-listed VOCs in soils. It is known that petroleum mixtures can be toxic to marine organisms at concentrations below those used for evaluation of upland material (e.g. MTCA criteria) so the DMMP consulted the Ecology Toxic Cleanup program (Joyce Mercuri) for assistance with interpreting these results. Using their collective best professional judgment, the DMMP compared the results not only to MTCA Method A Cleanup Level (CUL) for unrestricted and industrial land use but also to the SMS/DMMP criteria for total PAHs (total of both LPAH & HPAH DMMP analytes).

Suitability. The following table summarizes the determination of suitability for all phases of this project.

DMMU	Volume (cy)	Approx. Depth (ft. MLLW)	Suitable	Unsuitable[2]	Comments/Qualifiers
1	15,216	+17 to +13 Surface fill		15,126	Dioxins
2	10,116	+17 to +13 Surface fill		10,116	Dioxins, mercury
3	13,496	+17 to +13 Surface fill		13,496	Dioxins
4	52,260	+13 to +5 Subsurface fill	52,260		
5	43,198	+13 to +5 Subsurface fill	30,245	12,944	Southern 200 ft. of subunits S7B and S7C, all of subunits S8B and S8C, and northern half of subunits S9B and S9C are unsuitable; remainder is suitable
6	42,279	+5 to -3 Subsurface fill	42,279		
7	25,056	+5 to -3 Subsurface fill	25,056		
9[1]	40,440	-3 to -11 Upper native	40,440		
10	37,584	-3 to -11 Upper native	37,584		
11	37,372	+5 to -3 Upper native	34,968	2,404	Upper 1 ft of subunit S8D, and upper 1 ft of northern half of subunit S9D are unsuitable; remainder is suitable (PAHs)
12	12,400	+17 to +13		12,400	Dioxins, PCBs, dimethyl phthalate, PAHs
13	27,900	+13 to +3 Subsurface fill	27,900		
14	15,500	+13 to +1 Subsurface fill	10,404	5,096	Northern 800 feet of subunit S15 B (from -4 to 12 ft) are unsuitable; remainder is suitable (PAHs)
15	24,800	+ 5 to -15 Upper native	24,800		
5, 11 & 14	96,070			20,444	Total of unsuitable areas as specified above (PAHs)
Deep Native	1,193,083		1,202,482		
TOTALS	1,600,000		1,528,418	71,582	

[1] There is no DMMU 8 due to field conditions (less material in fill layer than expected.)
[2] Unsuitable volumes may vary depending on cleanup results.

The determination of suitability for all sediments was qualified by the following:

1. Cleanup of upland UST-impacted areas associated with the dredge prism must be completed prior to dredging. This includes impacted soils in the vicinity of USTs designated U-4, U-6 and U-7. Cleanup must be conducted under oversight of Ecology's Toxics Cleanup Program. All post-cleanup soils bordering dredging areas must be characterized and found to be either a) suitable for open water disposal (if part of the proposed dredge prism) or b) conforming to State of Washington non-degradation standards (if part of the exposed surface) prior to dredging. The cleanup, particularly the post clean-up monitoring and the timing of clean up relative to dredging, must be coordinated with the DMMP.
2. The volume of material suitable for open water disposal in DMMUs 5, 11 and 14 are qualified, and may vary depending on results of the cleanup performed under #1. Volumes given in this SDM should be construed as approximate and secondary to the vertical and horizontal descriptions of the suitable/unsuitable areas, as well as to any changes due to pre-dredging cleanup.

South Lake Union Project, Phase I Construction (Corps permit 2005-00969)

The DMMP agencies completed a coordinated review through Ecology's Toxics Cleanup Program (TCP) of sediment quality data collected prior to initiating Phase 2 excavation/cleanup on Waterways 3 and 4 in South Lake Union. The Phase I SAP was approved by DMMP/TCP on September 2, 2005, and sampling commenced on November 2, 2007 at 5 stations on Waterway 3, and November 8 and 12, 2007 at 2 stations on Waterway 4. The results were compared to the Sediment Evaluation Framework (SEF) freshwater guidelines (Screening Level 1 (SL1) and Screening Level 2 (SL2)). For chemicals without freshwater guidelines, the SMS marine Sediment Quality Standards (SQS) and Cleanup Standard Levels (CSL) were used.

The testing results for Waterway 3 and Waterway 4 showed guideline exceedances (detected and/or undetected) at every tested location in both waterways. The DMMP reanalyzed the initial data provided using the appropriate regulatory guidelines, and data showed that detected chemicals exceeding guidelines were Hg, Zn, TBT and bis(2-ethylhexyl)phthalate in Waterway 3, and Cu, Hg, Zn, Ag, TBT, benzo(b,k)fluoranthenes, total LPAHs, bis(2,ethyl,hexyl)phthalate and PCBs in Waterway 4 (note: all detected SL2/CSL exceedances are bolded). Based on this review, Ecology/DMMP will require the following actions before the Phase 2 project dredging/excavation begins, and will require follow-up sampling and testing of the exposed sediment surface after cleanup excavation/dredging is completed, as follows:

Before dredging/excavation begins, surface grab samples will be collected at each of the five previous sampling stations in Waterway 3 and two previous sampling stations in Waterway 4 to evaluate Washington State antidegradation compliance. These samples will be archived for up to one year for potential dioxin/furans analysis, pending toxicity testing results of the exposed sediment surface in both waterways. Phase 2 inwater excavation and debris removal can then commence.

After dredging/excavation, grab samples of the top 10-cm of the exposed sediment surface will be collected at all five previous sediment stations in Waterway 3 and two in Waterway 4 for freshwater toxicity testing. Each station will be evaluated using 10-day *Hyalella* mortality and 20-day *Chironomous* mortality/growth tests. Additionally, sediment conventional analyses (including grain size analysis) will be required on subsamples from all the exposed sediment surface stations to evaluate reference sediment collection requirements prior to toxicity testing. The DMMP agencies and Ecology's TCP will coordinate the reference

site collection location with the applicant's consultant prior to initiating testing. Additional details on freshwater toxicity testing and the interpretation framework can be found in Chapter 8 (pages 8-1 to 8-12) of the interim final Sediment Evaluation Framework manual at:
http://www.nws.usace.army.mil/publicmenu/DOCUMENTS/DMMO/RSET_Interim_Final.pdf.

After dredging/excavation, grab samples of the top 10-cm of the exposed sediment surface will be collected at all five stations in Waterway 3 and 2 stations in Waterway 4. Subsamples will be archived from for potential future analysis of dioxin/furans. Additional subsamples will be archived from Waterway 3, Station W3-4 for TBT, and Waterway 4, Station W4-1 for PCBs and TBT.

If the bioassay testing results show toxicity being expressed, at some or all of stations, those stations showing toxicity will be subject to placement of a cap under the direction of TCP.

If the results show no toxicity being expressed, the archived sediments will be analyzed for dioxin/furans (comparison of pre-excavation and post-excavation dioxin values), and selected stations will be analyzed for TBT and PCB (e.g., Station W3-4 for TBT; W4-1 for TBT and PCBs).

If the results of the post-excavation chemistry show that the sediment surface is degraded relative to the removed sediment, those stations where antidegradation compliance has not been met will be subject to placement of a cap under the direction of TCP.

All testing results will be submitted to the Corp's Dredged Material Management Office, DMMP agencies and Ecology TCP. At this point in time, the post-Phase 2 testing results of the pre-excavation/post-excavation surface have not yet been submitted.

<u>USACE Grays Harbor – Inner Harbor O&M</u>
Problems were encountered in running safety-net bioassays. In the larval test, both DMMUs subjected to testing scored hits under the 1-hit rule, which would normally make the dredged material unsuitable for open-water disposal. However, the July 2008 DMMP Users Manual (Section 4.9, page 4-13) provides guidance in this situation:

> "If all chemicals-of-concern are below the screening level, yet the safety-net biological testing indicates a potential for adverse biological effects, best professional judgment will need to be applied in resolving the apparent conflict between the chemical and biological testing data. Additional chemical or biological testing may be needed to determine the nature of the problem."

Based on this guidance, and the fact that there had never been a bioassay failure in the history of safety-net testing in Grays Harbor, the DMMP agencies decided that the larval test should be run a second time with side-by-side testing using *Dendraster excentricus* and *Mytilus galloprovincialis*.
The DMMUs were resampled and the larval test rerun. However, at the time of testing, the bioassay lab's local source of *Dendraster excentricus* was spawned out and their California supplier wouldn't have *Dendraster* available for several months. So the agencies agreed to test with *Mytilus galloprovincialis* only. The retest was aerated (whereas the original test had not been aerated). Both DMMUs performed well, with mean normal survival greater than 80% of control. There were no hits in this bioassay. Based on these results, the DMMP agencies agreed that both DMMUs passed biological testing.

There were also minor problems with the *Neanthes* growth test. The test sediments performed well, but the reference sediment failed to meet its performance standard for growth. The DMMP agencies decided to set aside the *Neanthes* results and base their decision on the amphipod test and the retest results for the larval bioassay.

Weyerhaeuser Longview Docks

The sampling and analysis plan included sampling in the Mount Coffin Ship Access Channel, as well as at the various Weyerhaeuser facilities. These facilities included the salt dock, cargo dock and turning basin, export dock and chip barge slip. However, during field sampling it was determined that little or no sediment accumulation had occurred above the maintenance depth for the salt dock, cargo dock, turning basin or export dock. Only the chip barge slip and the Mount Coffin access channel required dredging.

For this project, the DMMP agencies agreed to use the SEF freshwater guidelines (RSET, 2006), supplemented by the DMMP marine guidelines (DMMP, 2008) for those chemicals of concern for which freshwater guidelines do not exist. The chemical results indicated that there were no exceedances of SEF freshwater or DMMP marine screening levels.

In addition to routine DMMP chemicals of concern, analysis of resin acids and guaiacols was required at the chip barge slip due to the probable presence of woody debris associated with unloading operations at that facility. All resin acids and guaiacols were either undetected or detected at very low concentrations. The detected concentrations were compared to those found in projects in Grays Harbor for which bioassays were conducted. The Weyerhaeuser concentrations were far below concentrations associated with bioassays that passed open-water dispersive suitability guidelines in Grays Harbor.

Z-samples were collected to represent the sediment surface to be exposed by dredging. Due to agency concern for potential contamination of deeper sediments, Weyerhaeuser agreed to collect z-samples in two layers: 0-1' and 1-2' below the proposed dredging depth. The analysis of dioxins/furans was required for DMMU 8 and its corresponding z-samples, due to its proximity to potential upland sources of dioxin, including a Kraft batch digestor and a Kaymr continuous Kraft digestor. The dioxin/furan toxic equivalence (TEQ) concentrations were very low for the three samples tested and were well below the range of concentrations (0.65 to 2.387 pptr) compiled by the Department of Ecology for freshwater samples taken downstream of Puget Island. This range of values can be considered background for the lower Columbia River. Therefore, the Weyerhaeuser dioxin/furan concentrations were below background and suitable for flow-lane disposal.

Port of Olympia, Berths 2 and 3 Interim Action Cleanup (MTCA)

This project was permited as a Nationwide # 38 under Ecology/MTCA oversight as an Interim Action Pilot Study. The Corps permit authorized the Port of Olympia to dredge up to a maximum volume of 22,300 cy of sediments containing elevated levels of dioxin/furan within a portion of Berths 2 and 3 to an elevation of -39 feet MLLW (plus 2 feet of allowable overdepth). The DMMP agencies reviewed and provided input to the Interim Action Plan, and Berth 2 and 3 SAP, as part of the Corps permit. Dredging of approximately 9,515 cy was initiated on January 19, 2009 and completed on February 24, 2009, and was subsequently followed by the placement of approximately 2,170 cy of clean sand between February 27 and March 3, 2009 to achieve a 6-inch clean cover over the surface sediments expressed following dredging within the berthing area. All dredged material was offloaded from toploaded barges by excavator, which transferred sediment directly into lined 100-ton open-top rail gondolas. A front-end loader was used to push dredged material on

the barge into a central area of the barge for excavator access. A spill apron was constructed on the wharf to catch any material dropping from the excavator.

During project review, DMMP agencies expressed concerns about underpier slumping of material back into the dredged berthing area, and requested additional underpier sampling to further elucidate the dioxin concentrations upslope from the dredging area. Earlier Nature and Extent sampling under the pier had noted highly dioxin contaminated sediments located upslope and underneath the piers adjacent to the berths. Post-dredge monitoring results collected 3-months following dredging were summarized in monitoring report prepared on September 15, 2009, and demonstrated that there was some recontamination of the thin clean cover in the berthing area, which appear to be attributable to upslope sediments sloughing into the berthing area.

4.3 References Cited in Chapter 4

DMMP, 2007. *Dredged Material Evaluation and Disposal Procedures (Users Manual)*, prepared by the U.S. Army Corps of Engineers – Seattle District for the Dredged Material Management Program agencies, May 2007.

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EPA, 1980. *Guidelines for Specification of Disposal Sites for Dredged or Fill Material, 40 CFR Part 230*, Environmental Protection Agency (published in the Federal Register), December 24, 1980.

USACE, 2007c. *Shoalwater Bay Shoreline Erosion, Washington – Flood and Coastal Storm Damage Reduction, Shoalwater Bay Indian Reservation. Appendix 1 – Engineering Analysis and Design*, U.S. Army Corps of Engineers – Seattle District, July 2007.

USGS, 2004. *Shoalwater Bay Tribe Erosion Study Report*, U.S. Geological Survey, December 6, 2004 Draft Report.

RSET 2006. *Northwest Regional Sediment Evaluation Framework - Interim Final*. Regional Sediment Evaluation Team. September 2006.

RSET 2007. *Memorandum for File: RSET Review of Corps of Engineers, Portland District, Sediment Characterization Report for the Lower Cowlitz River.* Stephanie Stirling, U.S. Army Corps of Engineers, Northwestern Division. May 2007.

USACE 2007a. *Mount St. Helens Project – Lower Cowlitz River Interim Dredging – Environmental Assessment*. U.S. Army Corps of Engineers, Portland District. June 2007 Draft.

USACE 2007b. *Cowlitz River Federal Project – Sediment Quality Evaluation Report*. U.S. Army Corps of Engineers, Portland District. March 2007.

CHAPTER 5. DISPOSAL SITE USE AND MONITORING

5.1 Disposal Activity and Site Use

The Washington State Department of Natural Resources (DNR) issues site-use authorizations to project proponents electing to dispose of suitable dredged material at PSDDA and Grays Harbor/Willapa Bay (GH/WB) designated disposal sites[3]. 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/WB disposal activity for Dredging Years 2008 and 2009. This information is discussed by dredging year and individual disposal site.

Dredging Year 2008 (June 16, 2007 through June 15, 2008). In DY08, a total of 502,560 cubic yards (cy) of dredged material were deposited at three Puget Sound sites. Of the three PSDDA sites utilized in DY08, Commencement Bay received the bulk of the material with 214,858 cy from the Port of Tacoma Blair Waterway project, followed by Elliott Bay with disposal of 172,999 cy from four projects. The Anderson/Ketron Island site received 97,310 cy from one project, the federal navigation project in Olympia Harbor.

In Grays Harbor, a total of 927,396 cy were disposed at the Point Chehalis estuarine disposal site. An additional 171,353 cy were placed at the Half Moon Bay beneficial use site. No disposal occurred in Willapa Bay during DY08. Further north on the Pacific coast, 54,284 cy were placed at the Rialto Beach beneficial use site from the Quillayute project by portable hydraulic pipeline dredge. The volumes disposed at the Puget Sound and Grays Harbor sites in DY08 are graphically presented in Figures 5-1a and 5-1b, and are summarized in Tables 5-1 and 5-2.

Dredging Year 2009 (June 16, 2008 through June 15, 2009). In DY09, a total of 244,822 cy of dredged material were deposited at five Puget Sound sites. The bulk of the material was disposed of at the Rosario Strait dispersive site with 188,580 cy from two projects, the Port of Anacortes – Dakota Creek Project and the Corps Swinomish Channel operations and maintenance dredging project. Three small projects disposed a total volume of 18,803 cy at the Commencement Bay site, and one project (Port of Seattle Terminal 30) disposed 20,133 cy at the Elliott Bay site. The Port Gardner disposal site received a total volume of 10,450 cy from two small projects. The Port Townsend dispersive site received a total of 6,856 cy from two small dredging projects. Additionally, the Corps placed 27,690 cy at the Jetty Island beneficial use site, and 52,302 cy was placed at the upland disposal site "O" in the upper Snohomish River, from routine Snohomish River maintenance dredging.

In Grays Harbor 952,262 cy were disposed at the two estuarine disposal sites – Pt. Chehalis and South Jetty – from Corps maintenance dredging. A total of 144,975 cy were placed at the Half Moon Bay beneficial use site, and 214,502 cy were placed at the South Beach beneficial use site. No disposal took place at the Willapa Bay disposal sites. The DY09 volumes disposed at Puget Sound and Grays Harbor sites are graphically presented in Figures 5-2a and 5-2b, and are summarized in Tables 5-3 and 5-4.

[3] There are no designated disposal sites on the Lower Columbia River, and Flow-Lane Disposal is the principal means of open-water disposal, and therefore DNR does not issue Site Use Authorizations here.

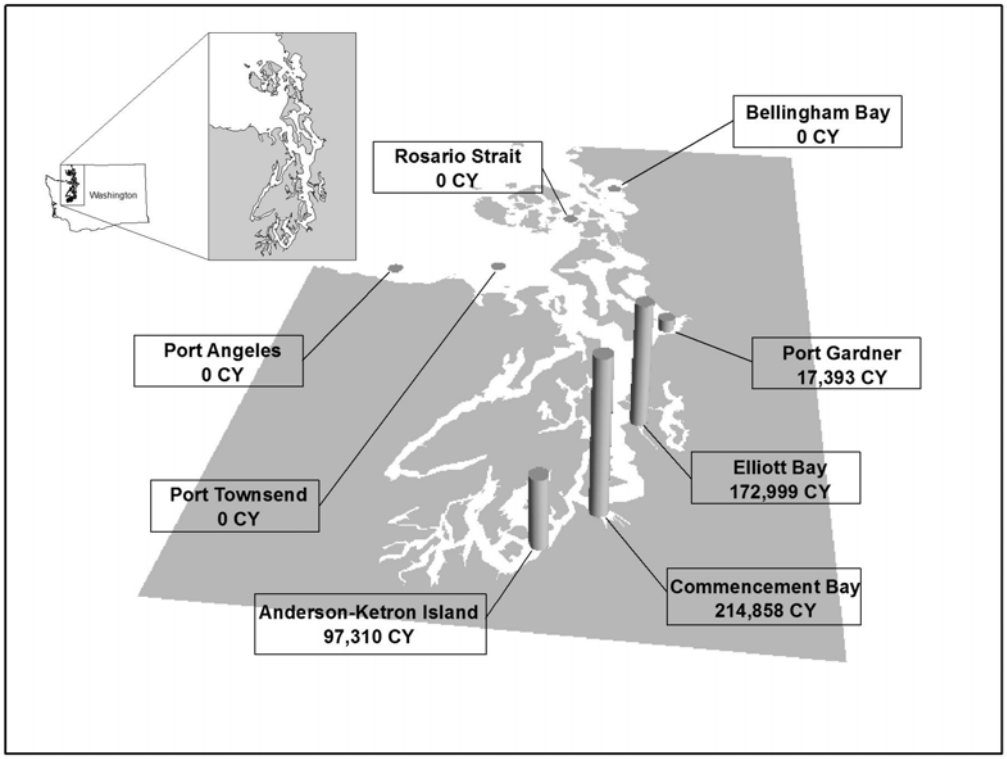

Figure 5-1. DY08 disposal volumes in Puget Sound

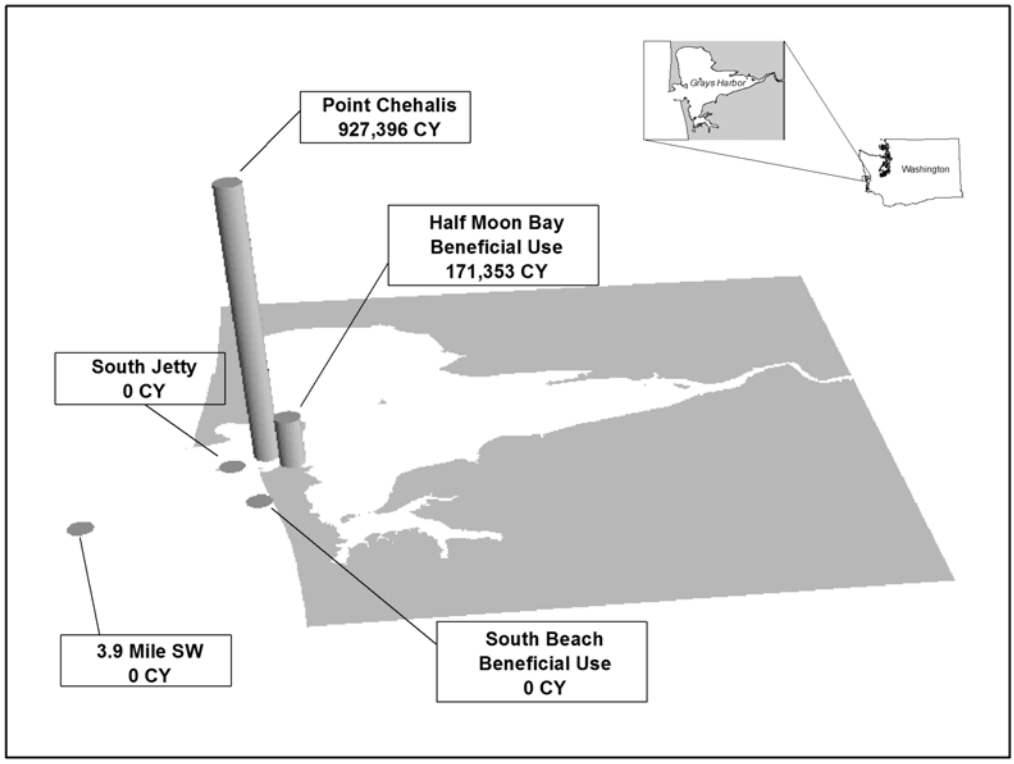

Figure 5-2. DY08 disposal volumes in Grays Harbor

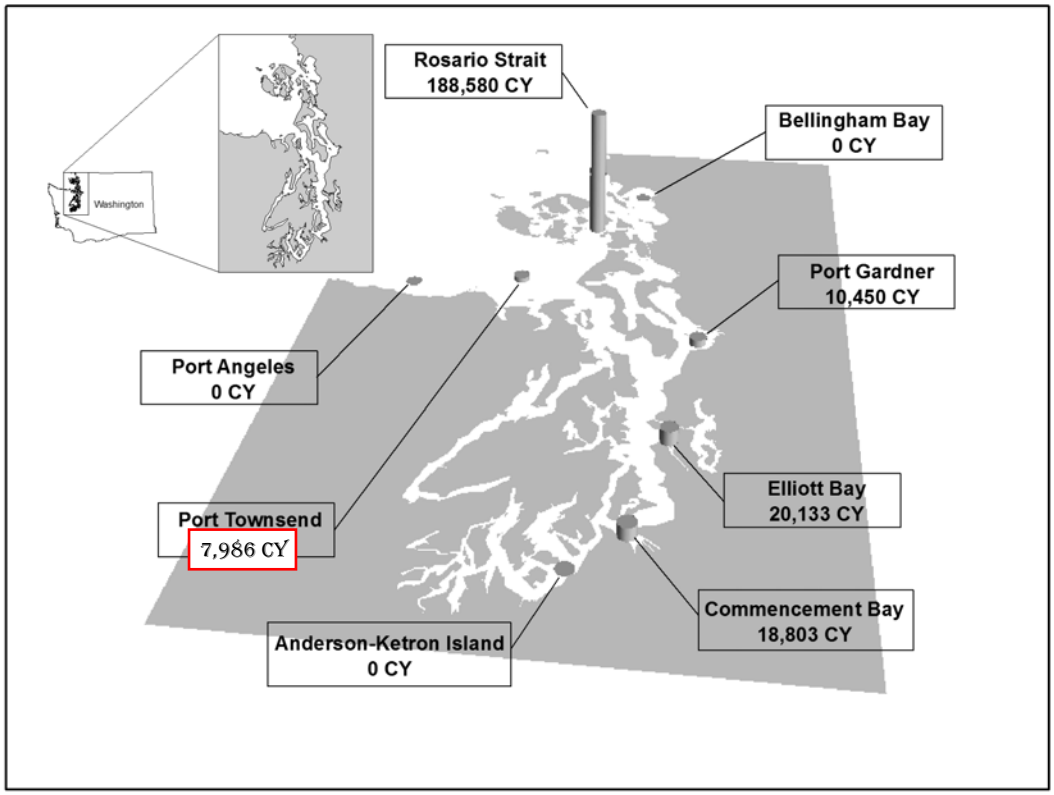

Figure 5-3. DY09 disposal volumes in Puget Sound

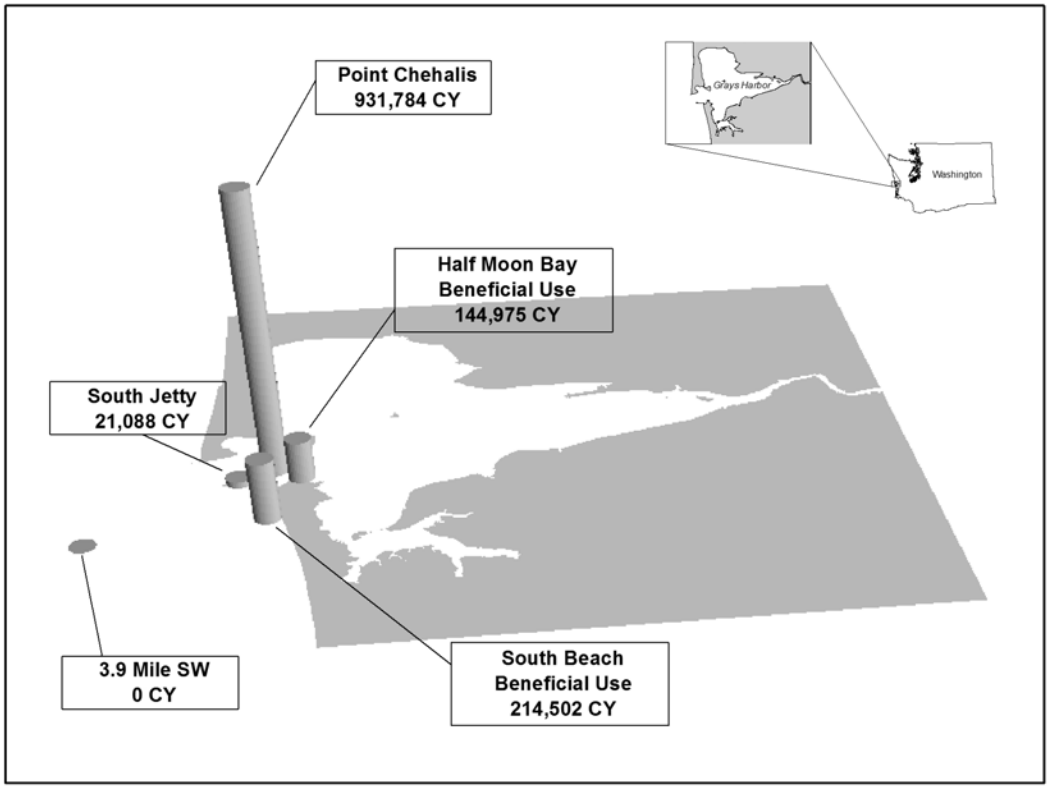

Figure 5-4. DY09 disposal volumes in Grays Harbor

Table 5-1. Disposal Site Activity Summary, DY08

Disposal Site	Jurisdiction	Number of Projects	Total Volume (cy)
Anderson/Ketron Island	PSDDA	1	97,310
Commencement Bay	PSDDA	1	214,858
Elliott Bay	PSDDA	4	172,999
Port Gardner	PSDDA	1	17,393
Point Chehalis	Grays Harbor	2	927,396
Half Moon Bay-BU	Grays Harbor	1	171,353
Quillayute (Rialto Beach)-BU	Coastal Washington (CW)	1	54,284
All Sites within Puget Sound Jurisdiction	PSDDA sites Puget Sound	7	502,560
All Sites within GH/WB/CW Jurisdiction	Grays Harbor Estuarine sites Grays Harbor BU Willapa Bay sites Quillayute-Rialto Beach BU	2 1 0 1	927,396 171,353 0 54,284

Table 5-2. Summary of Disposal Activity by Jurisdiction and Site, DY08

Site	Proponent/Project	Dredger	Dredge Type	Disposal Volume (cy)	# Barge Loads	Off Site	Disposal Dates
AK	USACE/Port of Olympia, Olympia Harbor Navigation	Manson Construction	CD	97,310	44	Yes[4]	10/30/07 – 11/10/07
CB	Port of Tacoma, Blair Waterway	Manson Construction	CD	214,858	71	No	7/25/07 – 10/17/07
EB	USACE Duwamish O&M	Manson Construction	CD	136,085	98	No	12/09/07 – 1/26/08
EB	Delta Marine	Manson Construction	CD	6,924	7	No	1/23/08 – 1/25/08
EB	Port of Seattle – Terminal 30	General Construction	CD	19,222	15	No	2/05/08 – 2/15/08
EB	Port of Seattle – Terminal 91	General Construction	CD	10,768	11	No	1/18/08 – 2/04/08
PG	Driftwood Key Club	Caicos Corporation	CD	17,393	11	No	11/26/07 – 2/08/08
JI-BU	USACE Everett Harbor O&M	Roy D. Garren	PD	87,835	N/A	N/A	1/24/08 – 2/14/08
PC	Port of Grays Harbor	American Construction	CD	32,936	14	No	2/11/08 – 2/14/08
PC	USACE, Grays Harbor O&M	American Construction	CD	257,872	92	No	1/17/08 – 2/18/08
PC	USACE, Grays Harbor O&M	USACE (Yaquina)	HD	135,609	N/A	No	4/18/08 – 5/20/08
PC	USACE, Grays Harbor O&M	GLD&D (Terrapin Island)	HD	500,979	N/A	No	4/08
HMB-BU	USACE, Grays Harbor O&M	Corps (Yaquina)	HD	171,353	N/A	No	4/18/08 – 5/20/08
RB-BU	USACE Quillayute O&M	Portable Hydraulic Dredging Company	PD	54,284	N/A	No	10/15/07 - 11/30/07

Legend: AK = Anderson/Ketron Island; CB = Commencement Bay; EB = Elliott Bay; HMB-BU Half Moon Bay beneficial use (Grays Harbor); JI-BU = Jetty Island Beneficial Use; PC = Point Chehalis (Grays Harbor); PG = Port Gardner; RB-BU = Rialto Beach Beneficial Use; RS = Rosario Strait; GLD&D = Great Lakes Dredge and Dock; CD = Clamshell Dredge; HD = Hopper Dredge; PD = Pipeline Dredge; N/A = Not Applicable

[4] One barge load of dredged material was disposed outside the disposal site boundary, approximately 500 feet northeast of perimeter station P-01.

Table 5-3. Disposal Site Activity Summary, DY09

Disposal Site	Jurisdiction	Number of Projects	Total Volume (cy)
Commencement Bay	PSDDA	3	18,803
Elliott Bay	PSDDA	1	20,133
Port Gardner	PSDDA	2	10,450
Everett – Jetty Island BU	PSDDA	1	27,690
Everett – Upland Site "O"	PSDDA	1	52,302
Rosario Straight	PSDDA	2	188,580
Port Townsend	PSDDA	3	7,986
Point Chehalis	Grays Harbor	2	931,784
South Jetty	Grays Harbor	1	21,088
Half Moon Bay BU	Grays Harbor	1	144,975
South Beach BU	Grays Harbor	1	214,502
All Sites within Puget Sound Jurisdiction	PSDDA sites Puget Sounds Jetty Island (Everett) BU Upland Site "O" (Everett)	11 1 1	245,952 27,690 52,302
All Sites within Grays Harbor and Willapa Bay Jurisdiction	Grays Harbor Estuarine sites Grays Harbor BU Willapa Bay sites	2 2 0	952,262 359,477 0

Table 5-4. Summary of Disposal Activity by Jurisdiction and Site, DY09

Site	Proponent/Project	Dredger	Dredge Type	Disposal Volume (cy)	# Barge Loads	Off Site	Disposal Dates
CB	Port of Tacoma, Blair Waterway WUT High Spot	American Construction	CD	2,813	3	No	1/11/09 – 2/13/09
CB	Day Island Yacht Harbor	General Construction	CD	7,740	8	No	7/13/08 – 9/5/08
CB	Des Moines Marina	Pacific Pile and Marine	CD	8,250	17	No	1/19/09 – 2/3/09
EB	Port of Seattle, Terminal 30	General Construction	CD	20,133	22	No	12/2/08 – 2/3/09
PG	Port of Everett –South Marina Dock	American Construction	CD	3,300	3	No	12/22/08 – 1/30/09
PG	King County Wastewater Treatment Division	American Construction	CD	7,150	6	No	6/21/08 – 9/8/08
JI BU	USACE – Everett Harbor O&M	Roy D. Garren – Pipeline	PD	27,690	N/A	N/A	1/16/09 – 2/21/09
Upland Site "O"	USACE – Everett Harbor O&M	Roy D. Garren – Pipeline	PD	52,302	N/A	N/A	1/16/09 – 2/21/09
RS	USACE – Swinomish O&M	American Construction	CD	82,420	74	No	10/23/08 – 12/18/08
RS	Port of Anacortes – Dakota Creek	Pacific Pile and Marine	CD	106,160	107	No	10/17/08 – 3/14/09
PT	Driftwood Keys	Caicos	CD	4,403	8	No	12/4/08 – 1/23/09
PT	Port of Port Townsend Hudson Marina	Caicos	CD	2,453	4	NA	1/30/09 – 2/12/09
PT	USACE – Port Townsend Mar. O&M	American Construction	CD	1,130	4	No	10/10/09-10/13/09
PC	Port of Grays Harbor – Terminal 2	American Construction	CD	30,099	13	No	1/28/09 – 1/30/09
PC	USACE Grays Harbor O&M	American Construction	CD	351,270	92	No	1/17/09 – 2/18/09
PC	USACE Grays Harbor O&M	USACE (Yaquina)	HD	166,910	N/A	No	4/29/09 – 5/26/09
PC	USACE Grays Harbor O&M	USACE (Essayons)	HD	214,502	N/A	No	4/2/09 – 4/18/09
SJ	USACE Grays Harbor O&M	USACE (Essayons)	HD	21,088	N/A	No	4/2/09 – 4/18/09
HMB-BU	USACE Grays Harbor O&M	USACE (Yaquina)	HD	144,975	N/A	No	4/29/09 – 5/26/09
SB-BU	USACE Grays Harbor O&M	USACE (Essayons)	HD	214,502	N/A	No	4/2/09 – 4/18/09

Legend: CB = Commencement Bay; EB = Elliott Bay; JI-BU = Jetty Island Beneficial Use; PC = Point Chehalis (Grays Harbor); HMB-BU Half Moon Bay beneficial use (Grays Harbor); PG = Port Gardner; PT = Port Townsend; RB-BU = Rialto Beach Beneficial Use; RS = Rosario Strait; SB-BU = South Beach Beneficial Use; SJ = South Jetty; CD = Clamshell Dredge; HD = Hopper Dredge; PD = Pipeline Dredge; N/A = Not Applicable

5.2 Post-Disposal Site Monitoring (2008 – 2009)

During the two year period covered by this biennial report the cumulative volume disposed at each of the non-dispersive sites was relatively low and cumulative volumes were below the nominal soft-triggers for initiating routine environmental monitoring as summarized in Table 5-5. However, three post-disposal monitoring events were either conducted or reviewed during 2008 – 2009 and are discussed briefly below. Two relate to special studies conducted at the Anderson/Ketron site and at the Elliott Bay site relative to dioxin/furan concentrations. The third monitoring event evaluated bathymetric survey data collected at the Rosario Strait dispersive site to confirm the dispersive characteristics at this site and assess potential mounding of dredged material.

Table 5-5. Monitoring History[5] relative to Soft Triggers[6] and Site-Use Disposal

Site: (Monitoring Soft Triggers)	A/K (300 kcy)	CB (500 kcy)	EB (500 kcy)	PG (500 kcy)	BB (300 kcy)
Last Monitoring date(s)	Partial 2005 SS 2007[7]/2008 (dioxin)	Full 2007 SS 2007 (dioxin)	Partial 2002 SS 2005 SS 2007 (dioxin)	Tiered-Full 2006 SS 2006 (dioxin)	Partial 1993 SS 2007 (dioxin)
Cumulative volume since last monitoring event	107,717	233,661	314,623	32,243	46,000
Cumulative volume since SS (dioxin)	0	233,661	197,977	32,243	0

Legend: A/K = Anderson/Ketron; CB = Commencement Bay; EB = Elliott Bay; PG = Port Gardner; BB = Bellingham Bay; SS = Special Study

Anderson/Ketron Island Dioxin/Furan Special Study (2008)

During August 2008, a limited special study was conducted by the DMMP agencies at the Anderson/Ketron Island site to assess the impact from the 2007 disposal of 97,310 cy of material dredged from the Olympia Harbor Federal/Port of Olympia Navigation Project. This assessment was conducted as part of the EPA Ocean Survey Vessel (OSV) Bold's Puget Sound dioxin/furan survey. .

While only dioxins/furans were analyzed in the Anderson-Ketron samples, the Bold report also includes PCBs (congeners and Aroclors) and other chemicals of concern in non-urban areas of Puget Sound, including reference areas. The special monitoring at the Anderson/Ketron site was precipitated in part to evaluate the site after DNR was notified by the Corps contractor for the Olympia Harbor Navigation project that one barge load of material had been inadvertently disposed outside the disposal site boundary near perimeter station P01 (Figure 5-5). The dioxin/furan concentrations at the accidental dump coordinates and previous monitoring stations were assessed as an additional unplanned part of the OSV Bold cruise,

[5] See Table 5-8 for full chronology of monitoring history over the life of the DMMP.
[6] Clarification Paper 2002 SMARM: http://www.nws.usace.army.mil/publicmenu/DOCUMENTS/dmmo/volume_trigger1.pdf
[7] Cooperative effort with PSAMP to collect Dungeness crab and English sole tissue samples to supplement the 2005 dioxin analyses for sediments and benthos tissue.

and the results of those analyses were reported separately and not part of the OSV Bold Data Report. Samples were also collected and analyzed for dioxin/furans at the 2005 partial monitoring stations at Anderson/Ketron. The comparative dioxin concentrations from 2005 and 2008 demonstrated that disposal of the 97,310 cy of maintenance material from the Olympia Harbor navigation project resulted in a net reduction in dioxin concentrations on-site, and no increase of dioxin concentrations outside the disposal site (Figure 5-5).

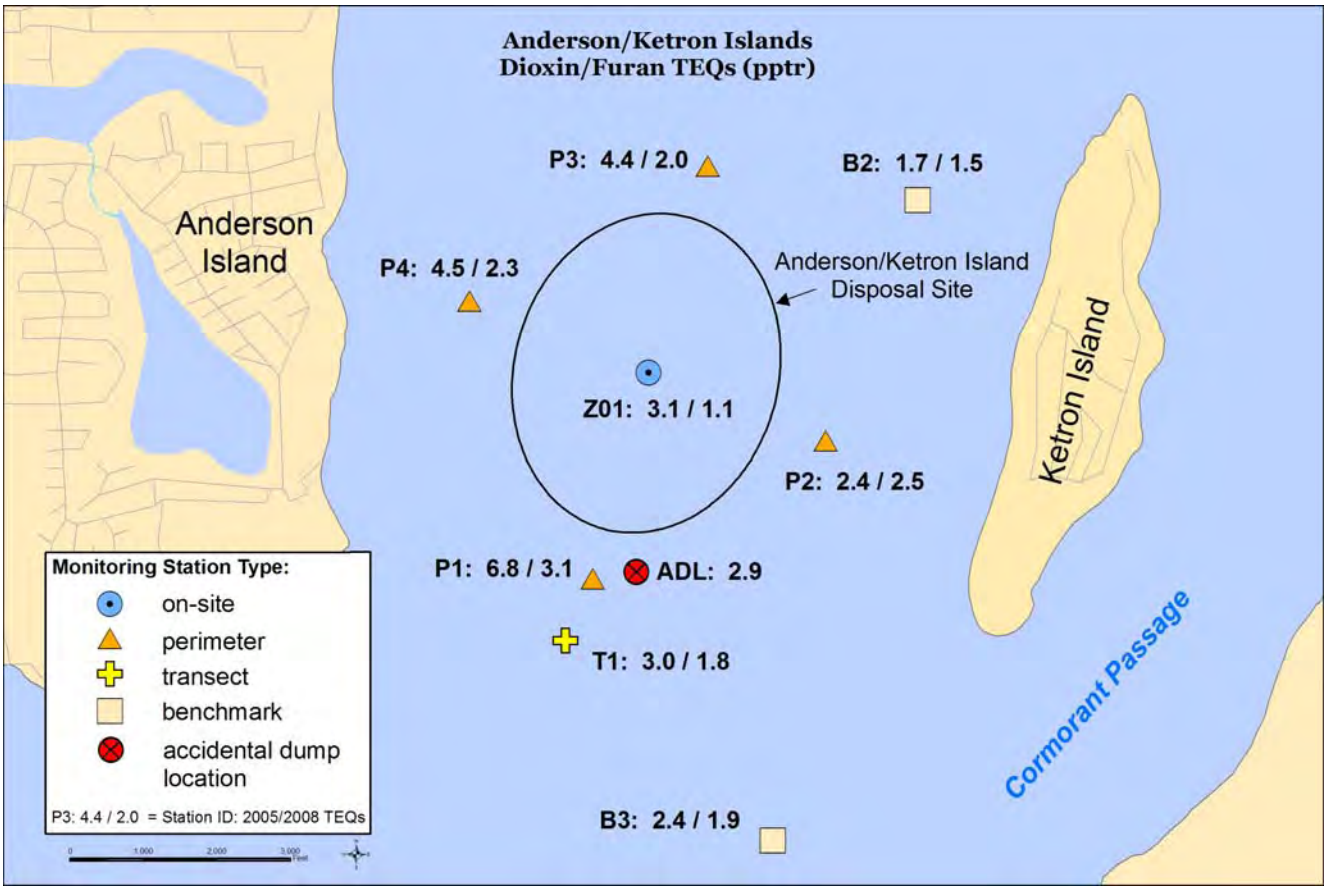

Figure 5-5. Anderson/Ketron disposal site with accidental dump location (ADL) and observed post-disposal dioxin concentrations from the 2007 Olympia Harbor navigation project. Dioxin/furan total toxic equivalent (TEQ) concentrations (in ng/kg dry-weight) observed at the site are depicted at each monitoring station as 2005 TEQ / 2008 TEQ.

Comparative Onsite Elliott Bay Disposal Site Dioxin/Furan Concentrations (2005 and 2007)

The DMMP agencies conducted a limited special study at onsite stations in 2005, which included dioxin/furan, and the results of that evaluation were previously summarized in the biennial report for Dredging Years 2004 and 2005 (http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/BR_06_1106.pdf). In 2007, a second special study was conducted at the Elliott Bay site for dioxins/furans, which also included offsite perimeter and benchmark stations. The dioxin/furan concentrations were higher at the three onsite stations in 2007 compared to the 2005 data. The onsite 2005/2007 dioxin concentrations, as well as the 2007 offsite concentrations are depicted in Figure 5-6. The elevated onsite 2007 dioxin concentrations at Stations S2 and S4 were evaluated by the DMMP agencies, which concluded that the source was likely attributable to disposal of 24,250 cy from the Port of Seattle's Fisherman's Terminal Project, the only project to dispose material at the Elliott Bay site in 2006. This project was not tested for dioxin when characterized in 2004, which predated the more recent heightened concern for this family of chemicals. The DMMP agencies now know that across from Fisherman's Terminal, elevated dioxin concentrations of 63 and 187 pptr-TEQ have been documented near a storm water outfall along the Lake Washington Ship Canal. Under the current reason-to-believe guidelines, Fisherman's Terminal would require dioxin testing.

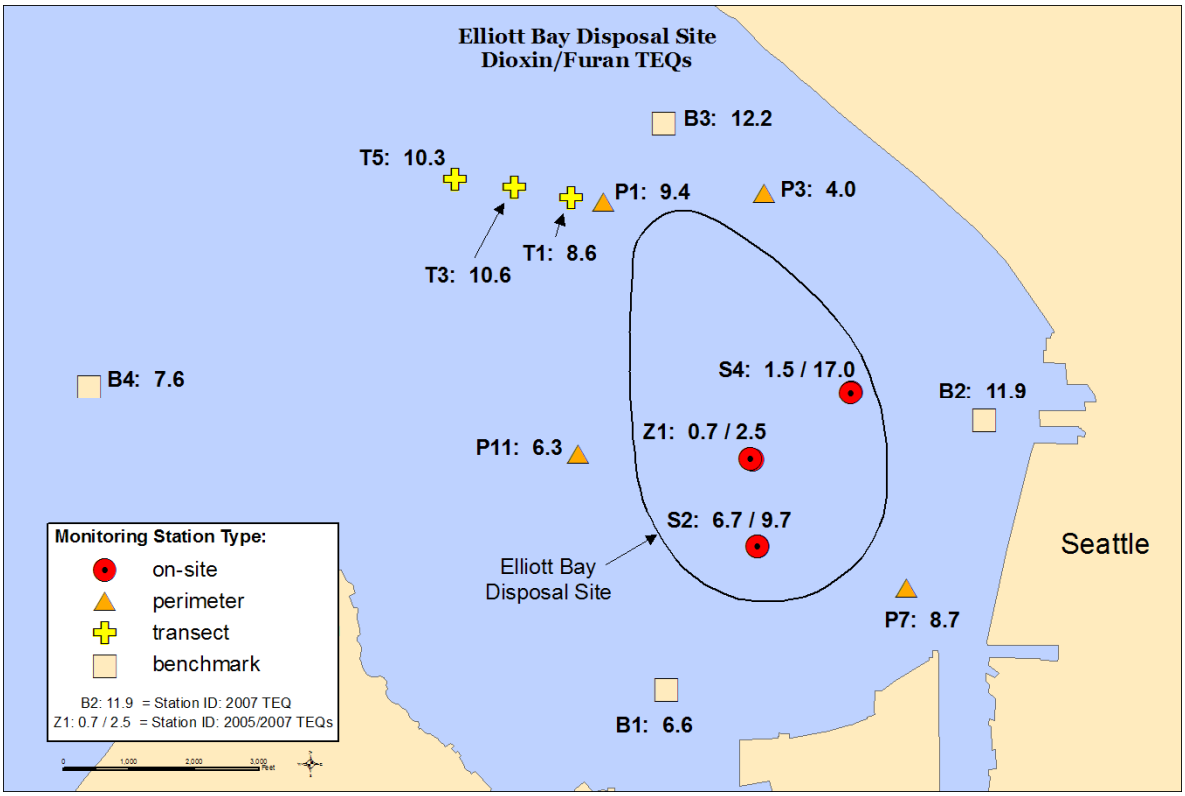

Figure 5-6, Elliott Bay disposal site comparative 2005 and 2007 onsite dioxin concentrations. Offsite concentrations based on 2007 survey results.

Bathymetric Survey at the Rosario Strait Dispersive Site (2009).

The Corps of Engineers Survey Vessel (SV) "Shoalhunter" conducted a multibeam bathymetric survey (MBS) of the Rosario Strait disposal site on May 18, 2009. The survey lanes from the initial 1989 predisposal baseline survey and the 1991, 1994 and 1999 post-disposal surveys were re-occupied to provide comparable data. The results from the 2009 MBS are depicted in oblique view in Figure 5-7. Figure 5-8 depicts a cross-sectional transect view from north to south through the site center, which can be compared to the predisposal and post-disposal surveys through 1999 shown in Figure 5-9. A software format change occurred after the 1999 survey, which prevents overlaying the 2009 survey on the previous survey results. The comparative cross-sectional analysis however, does confirm that all the dredged material disposed at this site has been dispersed, and there has been no accumulation of dredged material observed along the transect lines, as illustrated by the comparative North-South Transects through the Site Center (Figures 5-8 and 5-9). The results indicate that there has been no net change in bathymetry at the site since the 1989 baseline survey. The 2009 MBS survey results will be the new baseline for future post-disposal bathymetry monitoring results to verify compliance with the site management objective.

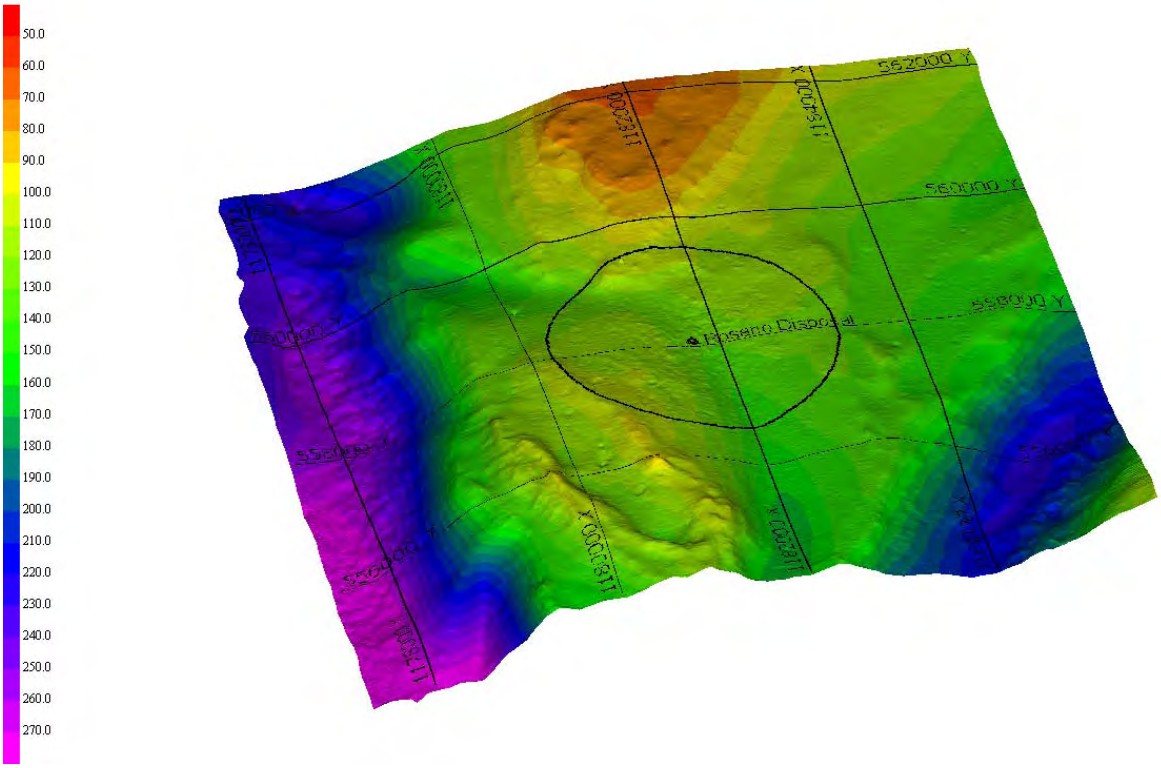

Figure 5-7. Multibeam Bathymetric Survey (May 2009) of Rosario Strait disposal site with disposal site boundary depicted.

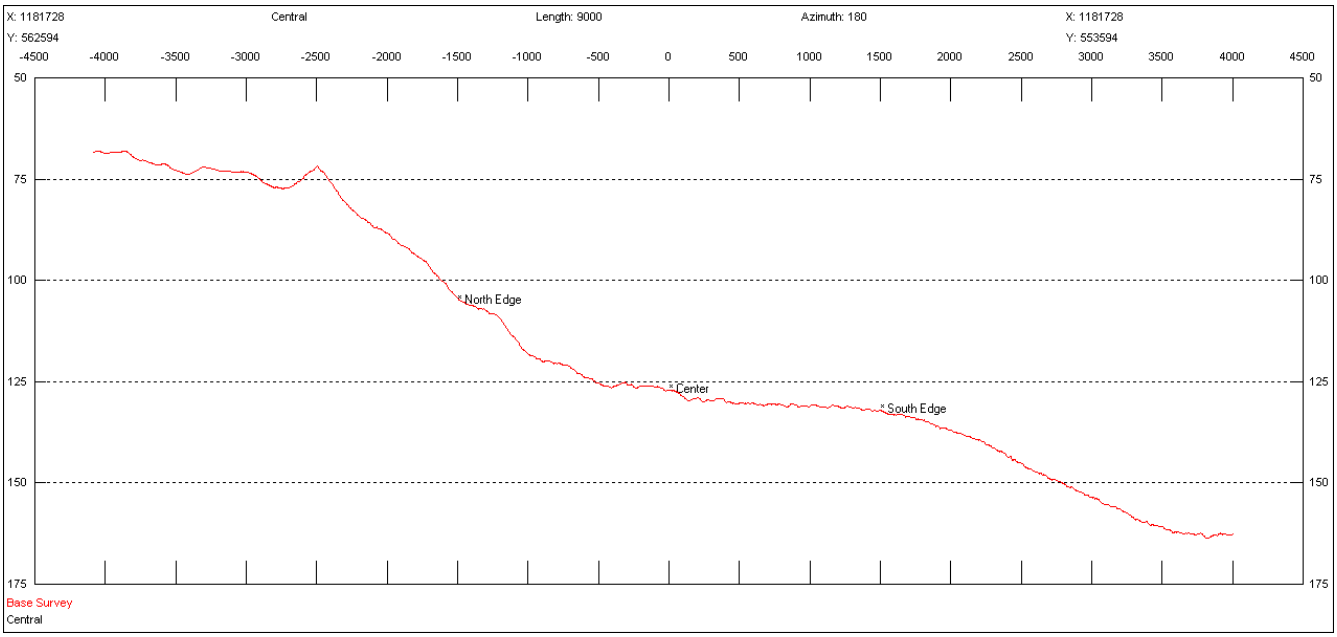

Figure 5-8. Multibeam Bathymetric Survey (May 2009) of Rosario Strait disposal site depicting North-South Transect cross-section through the disposal site center.

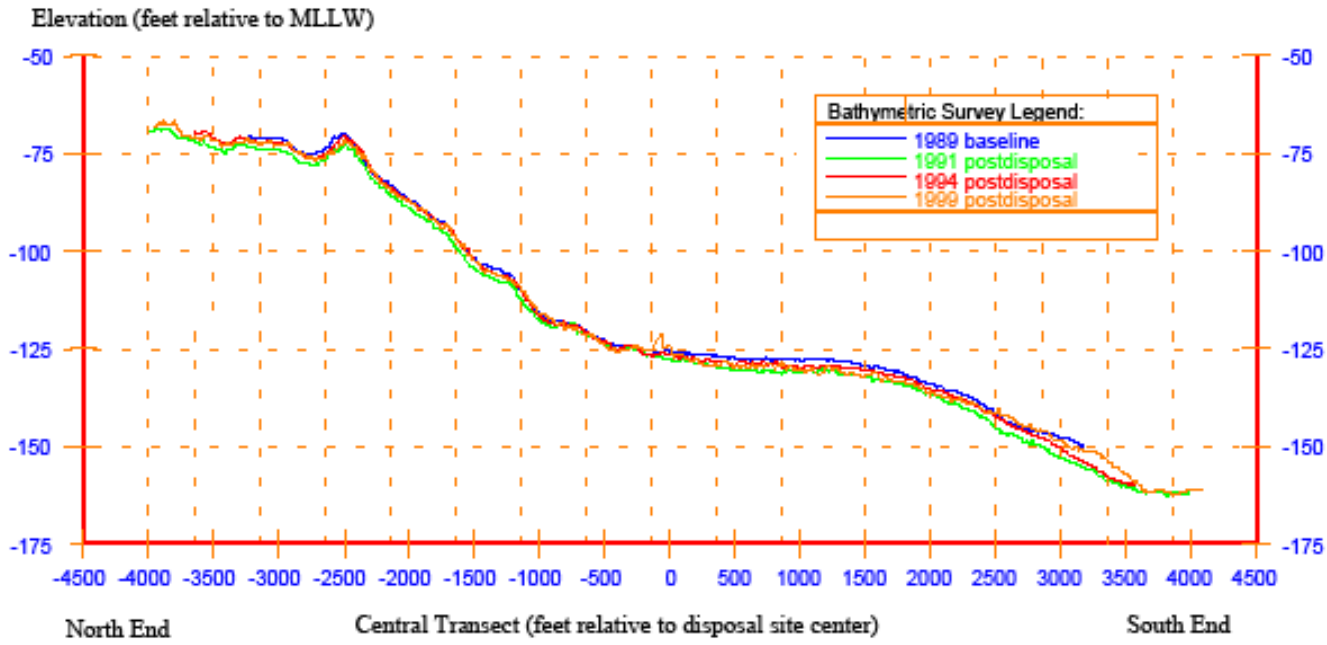

Figure 5-9. Comparative bathymetric surveys from the 1989 predisposal baseline survey and the 1991, 1994 and 1999 post-disposal surveys relative to the disposal site center.

5.3 Summary: DMMP Disposal Site Use, Activities, and Monitoring Frequency

The cumulative dredged material volumes disposed at each Puget Sound and Grays Harbor/Willapa Bay site since program implementation are depicted in Figures 5-10 and 5-11 and listed in Table 5-6. Twenty-one-year summaries of site use for the Puget Sound sites show that site capacities[8] used in the FEIS appear to be sufficient to last at least 40 years, except the Commencement Bay site, which is expected to reach its 9 million cubic yard site capacity threshold within the next 2 years (Table 5-7).

The PSDDA Management Plan Reports (MPR, 1998, 1989) recognized 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. None of the monitoring events to date have detected adverse impacts at any of the non-dispersive sites. 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. The DMMP agencies increased the disposal volume soft trigger from 150,000 cy to 300,000 cy in 1996, and subsequently raised it from 300,000 cy to 500,000 cy at the Commencement Bay site, Elliott Bay site, and the Port Gardner site following the 2002 SMARM, but left the volume trigger at 300,000 cy for the two less frequently used non-dispersive sites (Bellingham Bay and Ketron/Anderson Island). The monitoring triggers are soft triggers, and may be relaxed at the discretion of the DMMP agencies based on best-professional-judgment.

Table 5-8 summarizes the completed DMMP disposal site monitoring surveys at the Puget Sound non-dispersive and dispersive sites. To date, the DMMP agencies have conducted multiple post-disposal monitoring surveys at non-dispersive sites, four post-disposal bathymetric surveys at the Rosario Strait dispersive site, and four bathymetric surveys at the Commencement Bay site. Monitoring has also involved side-scan surveys at the Bellingham Bay and Elliott Bay sites to evaluate debris disposal concerns onsite. Additionally, multiple special studies have been conducted, including the 2006-2007 dioxin sediment and tissue evaluation at the Puget Sound non-dispersive sites, and the 2008 dioxin special study at the Anderson/Ketron Island site to reassess dioxin sediment concentrations following the offsite disposal of one barge load of material discussed earlier.

Based on Puget Sound site monitoring conducted to date (including physical mapping, on and offsite sediment chemistry, sediment toxicity, offsite infaunal bioaccumulation, and offsite benthic community structure analysis), dredged material disposal has not caused adverse impacts at or adjacent to any of the non-dispersive sites. DMMP evaluation procedures have consistently met the site management objectives, and appear to be adequately protecting the disposal site environments and surrounding areas.

The overall goals of the DMMP site monitoring program are to ensure that the DMMP prescribed disposal site conditions are maintained and to verify that DMMP dredged material evaluation procedures adequately protect the aquatic environment. Monitoring surveys provide positive feedback to verify the adequacy of the DMMP dredged material management process. The Sediment Management Annual Review Meetings

[8] Site capacity, as used in the FEIS, did not mean that once reached the site had no additional capacity, but implies that additional NEPA/SEPA review would be required before a shoreline permit would be granted by the shoreline permitting agency. In the case of the Commencement Bay site, that NEPA/SEPA review has just been completed by the DMMP agencies with the finalization of the 2009 Supplemental Environmental Impact Statement (SEIS), a supplement to the original 1988 EIS, which supports a revised site capacity limit of 23 mcy for this site.

provide a forum to report on these post-disposal survey findings conducted during any given dredging year, and any management plan adjustments if needed.

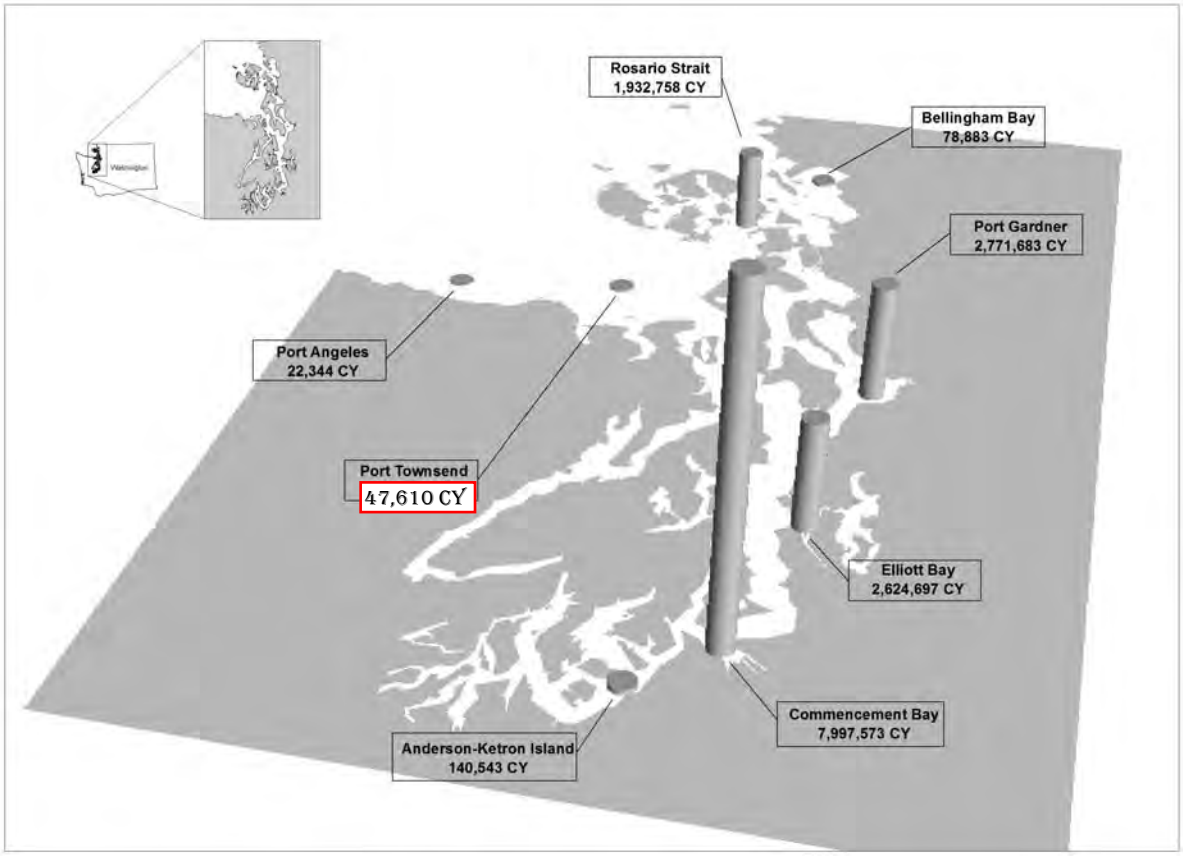

Figure 5-10. DMMP cumulative disposal volumes in Puget Sound 1989 – 2009

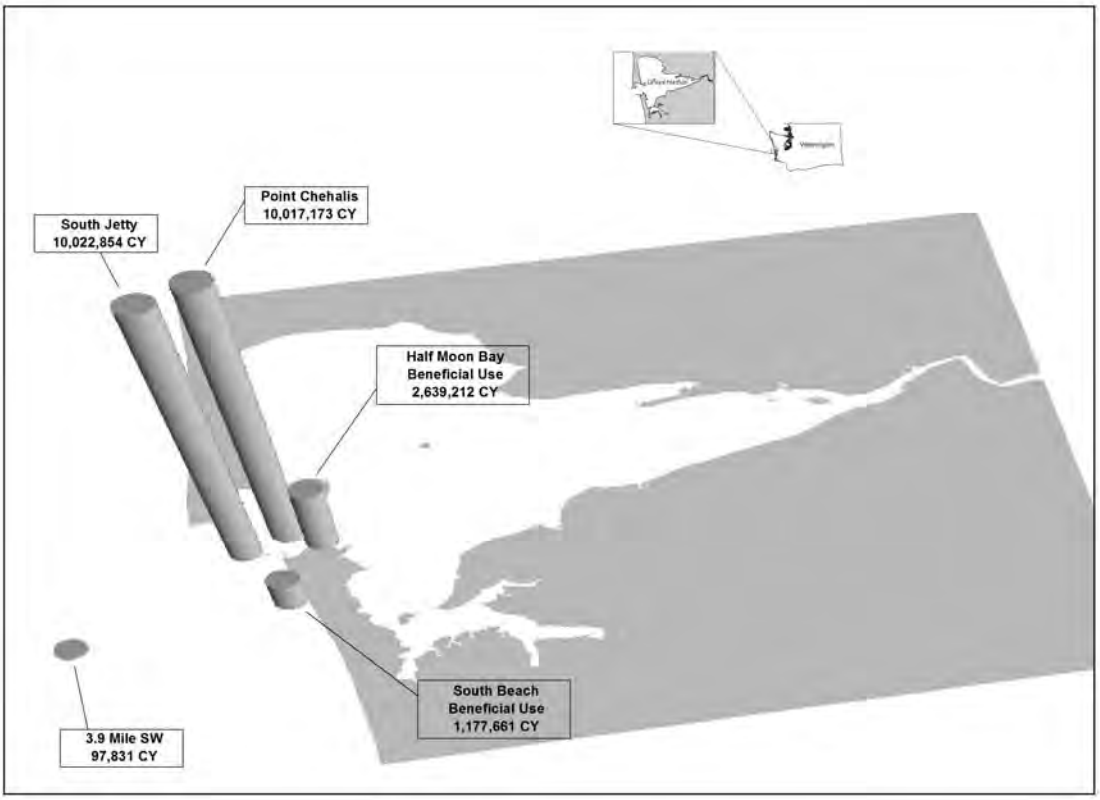

Figure 5-11. DMMP cumulative disposal volumes in Grays Harbor 1996 – 2009

Table 5-6. Cumulative Site-Use Frequency Summary

Disposal Site	Dredging Years Used	Cumulative Volumes Disposed (cy)	Average Annual Disposal Volume (cy)
PSDDA (Central)	(1989 - 2009)		
Port Gardner (ND)	90, 91, 93, 94, 95, 96, 97, 02, 06, 07, 08, 09	2,771,683	138,584
Elliott Bay (ND)	90, 91, 92, 93, 94, 95, 96, 97,98, 99, 00, 01, 02, 04, 05, 06, 07, 08, 09	2,624,697	131,235
Commencement Bay (ND)	89, 91, 95, 96, 98, 99, 00, 01, 03, 04, 05, 06, 07, 08, 09	7,997,573	399,879
PSDDA (North / South)	(1990 – 2009)		
Bellingham Bay (ND)	93, 96, 98	78,883	3,944
Anderson/Ketron (ND)	93, 95, 04, 05, 07, 08	140,543	7,397
Rosario Strait (D)	91, 92, 93, 94, 95, 96, 98, 99, 02, 03, 04, 05, 06, 07, 09	1,932,758	101,724
Port Townsend (D)	93, 98, 99, 07, 09	47,610	2,381
Port Angeles (D)	96	22,344	1,176
Total cumulative volume		15,616,091	786,320
GRAYS HARBOR	(1996 – 2009)		
Point Chehalis (D)	96, 97, 98, 99, 00, 01, 02, 03, 04, 05, 06, 07,08, 09	10,017,173	715,512
South Jetty (D)	96, 97, 98, 99, 00, 01, 02, 03, 04, 05, 06, 07, 09	10,022,854	715,918
Half Moon Bay (beneficial uses site)	96, 97, 98, 99, 02, 03, 04, 05, 06, 07, 08, 09	2,639,212	188,515
Southwest beach nourishment site	01, 02, 04, 05, 06, 09	1,177,661	130,851 (AVG: 01-09)
3.9 Mile Ocean (D)[9]	03, 04	97,831	6,988
Total cumulative volume		24,384,156	1,741,725
WILLAPA BAY	(1996 – 2009)		
Cape Shoalwater (D)	00, 03	251,095	17,935
Goose Point (D)	99, 03, 06	205,977	14,713
Total cumulative volume		457,073	32,648
Totals (all sites)		40,456,190	2,523,231

Legend: ND = nondispersive; D = dispersive

[9] Site is currently deactivated

Table 5-7. Puget Sound Site-Use Summary 1989 – 2009

Non-dispersive Disposal Site	Cumulative Volumes (CY)	Average Volume per Year (CY/YR)	15-Year Predictions MPR[10] Phase I/II (CY)	Percent of 15-Year Prediction	Estimated Time to Exceed Site Capacity[11] (Years)
Port Gardner (1989-2009)	2,771,683	138,584	8,243,000	33.6	47.2
Elliott Bay (1989-2009)	2,624,697	131,235	10,525,000	24.9	48.6
Bellingham Bay (1990-2009)	78,883	4,152	1,181,500	6.7	2,149
Commencement Bay (1989-2009)	7,997,573	399,879	3,929,000	203.6	2.5[12]
Anderson/Ketron Island (1990-2009)	140,543	7,397	785,000	17.9	1,198
SUBTOTALS:	13,613,379	681,017	24,763,500	55.0	N/A
Dispersive Disposal Site	**Cumulative Volumes (CY)**	**Average Volume per Year (CY/YR)**	**15-Year[13] Predictions MPR Phase I/II (CY)**	**Percent of 15-Year Prediction**	**Estimated Time to Exceed Site Capacity[14] (Years)**
Rosario Strait (1990-2009)	1,932,758	101,724	1,801,000	107.3	N/A
Port Townsend (1990-2009)	47,610	2,381	687,000	6.8	N/A
Port Angeles (1990-2009)	22,344	1,176	285,000	7.8	N/A
SUBTOTALS:	2,002,712	105,281	2,773,000	72.2	N/A
GRAND TOTALS:	15,616,091	786,298	27,536,500	56.7	N/A

[10] MPR = Management Plan Reports, Phase I (Central Puget Sound), Phase II (North and South Puget sound)
[11] Site capacity estimated in Phase I and II Disposal Site Selection Technical Appendices for non-dispersive sites is approximately 9,000,000 cubic yards, therefore (Site Capacity – Cumulative Volume)/average annual disposal volume = Estimated Time to Exceed Site Capacity.
[12] Based on the recent site use, the theoretical site capacity soft trigger of 9,000,000 cy will be exceeded in two years or less. The DMMP agencies have finalized a Supplemental EIS to the initial 1988 EIS, completing the NEPA/SEPA evaluation to reauthorize this site for a cumulative volume of 23 million cubic yards
[13] 1990-2004
[14] Actual site capacity for dispersive sites is not limited, assuming complete dispersal of dredged material off site.

Table 5-8. Puget Sound Disposal Site Monitoring Survey History[15]

Year	Disposal Site	Type of Survey
1988	Port Gardner, Elliott Bay, Commencement Bay	Initial Baseline Surveys: Full
1989	Bellingham Bay, Anderson/Ketron Island	Initial Baseline surveys: Full
1990	Bellingham Bay	Dungeness Crab Density Study
1990	Port Gardner	Full
1990	Elliott Bay	Partial
1991	Rosario Strait	Bathymetric Survey
1991	Port Gardner, Bellingham Bay	Special Study: new PG benchmark station Special Study: tissue chemistry protocol PG/BB
1992	Elliott Bay	Full
1993	Bellingham Bay	Partial, Side Scan Sonar Survey
1994	Port Gardner	Tiered-Full
1994	Rosario Strait	Bathymetric Survey
1995	Elliott Bay	Side Scan Sonar Survey (debris evaluation)
1995	Commencement Bay	Tiered-Full (new baseline)
1996	Commencement Bay	Tiered-Partial
1998	Commencement Bay	SPI Survey
1999	Rosario Strait	Bathymetric Survey
2000	Elliott Bay	Full, special PCB Congener Study, 45-day bioaccumulation.
2001	Commencement Bay	Full + Bathymetric Survey
2002	Elliott Bay	Tiered-Full, BCOC special study
2003	Commencement Bay	Tiered-Full
2004	Commencement Bay	Tiered-Partial + Bathymetric Survey
2005	Commencement Bay	SPI Survey + Special Phenol Study
2005	Anderson/Ketron Island	Full (new baseline) + Dioxin (sediment + tissue)
2005	Elliott Bay	Special Onsite Chemistry Study
2006	Port Gardner	Full, dioxin baseline (S + T)[16]
2006	Commencement Bay	Multibeam bathymetric Survey (MBS)
2007	Commencement Bay, Bellingham Bay, Elliott Bay,	Tiered Full @ CB site + MBS + Resource Trawls; dioxin baseline (S + T) at all 3 sites
2008	Anderson/Ketron Island	Dioxin/furan post-disposal special survey (offsite disposal evaluation): OSV Bold Survey
2009	Rosario Strait	Multibeam Bathymetric Survey

Legend. SPI = Sediment Profile Imagery Survey; PG = Port Gardner; BB = Bellingham Bay; BCOC = bioaccumulative chemicals of concern; Partial = Answers 1st 2 Monitoring Questions (hypothesis 1-4); Full = Answers all 3 Monitoring Questions (Hypothesis 1-6); S = Sediment;
T = Tissue

[15] The DMMP agencies elected to forego monitoring between 1997 and 2000 due to funding requirements for a DNR R&D contract to evaluate the potential development of *Leptocheirus* sp. as a potential chronic/sublethal bioassay.
[16] Includes tissue dioxin for English Sole and Dungeness Crab and 2 species of polychaetes (*Travisia*, *Nephtys* at Port Gardner), and various polychaete and bivalve species tissues at Commencement Bay, Elliott Bay, and Bellingham Bay sites.

5.4 Endangered Species act (ESA) Consultation

The Corps, in coordination with the DMMP agencies, will need to re-initiate the 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) in 2012. The DMMP agencies may need to prepare a "White Paper" on Rockfish, as three species of rockfish (e.g., Canary Rockfish, Greenstriped Rockfish, Redstripe Rockfish) are proposed for listing as Threatened in the April 23, 2009 Federal Register (Volume 74, Number 77). Previous ESA coordination in 2005 and 2007 were summarized in the 2006/2007 Biennial Report (http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/BR_06_07.pdf).

In 1996, the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) was reauthorized and amended to establish procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a federal fisheries management plan (i.e. only for commercially harvested species). MSFCMA requires all federal agencies to consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agency that may adversely affect EFH (MSFCMA 305(b)(2)). The Corps, in consultation with the DMMP agencies, will need to update the existing 2005 Essential Fish Habitat Assessment for the eight PSDDA disposal sites in Puget Sound as part of the Programmatic Biological Evaluation for the Section 7 ESA Consultation. The existing EFH consultation is in effect until June 2010. The DMMP agencies will reinitiate Section 7 ESA and EFH consultation during early 2010.

5.5 Commencement Bay Disposal Site NEPA/SEPA Review

The DMMP agencies were required to complete a NEPA/SEPA evaluation to reauthorize the disposal site up to a volume ceiling up 23 million cub yards to accommodate regional disposal needs in Commencement Bay site as part of the Pierce County Shoreline Permit process. The DMMP agencies recently completed a NEPA/SEPA Supplemental Environmental Impact Statement (SEIS) (http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=DMMO&pagename=CB_SEIS) – a supplement to the 1988 EIS– which re-evaluated the purpose and need for this site, and evaluated the existing site relative to site capacity and site management. The draft NEPA SEIS went out for a 45-day public interest review in April 2009. The Final NEPA SEIS with minor revisions went out for a 30-day "Wait Period" in August 2009. The SEPA compliance review was completed on October 23, 2009. A Record of Decision Amendment was completed and signed by the Corps on February 12, 2010, and by EPA on February 17, 2010. A joint Corps/EPA Public Notice (40 CFR 230.80) reauthorizing this disposal site was signed by the Corps and EPA and mailed out on February 19, 2010. All documents are posted on the DMMO website (http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=DMMO&pagename=CB_SEIS).

The SEIS evaluated two action alternatives and a no-action alternative. The preferred alternative included an adaptive management mound dampening strategy that expands the volume ceiling up to 23 million cubic yards. The predicted mound dampening effects of periodic shifting of the disposal coordinates within the existing target area (i.e., a 1,200 ft diameter circle around the site center) are depicted in Figure 5-12. In June 2007, the DMMP agencies implemented a provisional coordinate shift 565 feet southeast of the site center, and the selected Alternative 2 (preferred alternative) would implement two additional coordinate shifts at 13 million cubic yards (mcy) to the southwest, and one additional coordinate shift at 18 mcy to the northeast corner of the target zone. Table 5-9 depicts the past, present, and future coordinates for disposal at this site as described above. Figure 5-12 depicts the effect of coordinate shifts on mound height for the

two action alternatives, and Figure 5-13 depicts the existing and predicted[17] mound configurations, as a result of adaptive management coordinate shifts for the two action alternatives evaluated in the SEIS, and the predicted effects on mound height growth without additional coordinate shifts. It illustrates that active management can significantly reduce mound height growth for the preferred alternative.

Appendix A to the SEIS provides (http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/AppendixA_Attachments_A-E.pdf) a comprehensive summary of DMMP adaptive management, and 20 years of post-disposal monitoring at the Commencement Bay site relative to the pre-disposal monitoring, and demonstrates compliance with the DMMP site management objectives. The site has generally received clean sediments from Blair Waterway, with approximately 97% of the sediments coming from Blair Waterway dredging projects.

Table 5-9. Commencement Bay Disposal Site Coordinates (past, present and future) for Preferred Alternative Evaluated in SEIS

DMMP Coordinates	Disposal Site Volume (cy)	Latitude (N)	Longitude (W)
Site Center (1988-2007)	0 – 7.8 mcy	47 degrees 18.21 minutes N	122 degrees 27.91 minutes W
SE corner of Target Zone (2007-present)	7.8 – 13 mcy	47 degrees 18.145 minutes N	122 degrees 27.815 minutes W
SW corner of Target Zone	13 – 18 mcy	47 degrees 18.143 minutes N	122 degrees 28.004 minutes W
NE corner of Target Zone	18 – 23 mcy	47 degrees 18.277 minutes N	122 degrees 27.816 minutes W

[17] The DMMP agencies evaluated the likely future disposal site mound configuration and mound height for two potential alternatives in the SEIS with MDFATE. Data used in MDFATE to predict SEIS alternatives was repeatedly field validated with two bathymetric (2001 and 2003) and two Multibeam bathymetric (2006 and 2007) surveys (see Appendix D to 2009 SEIS).

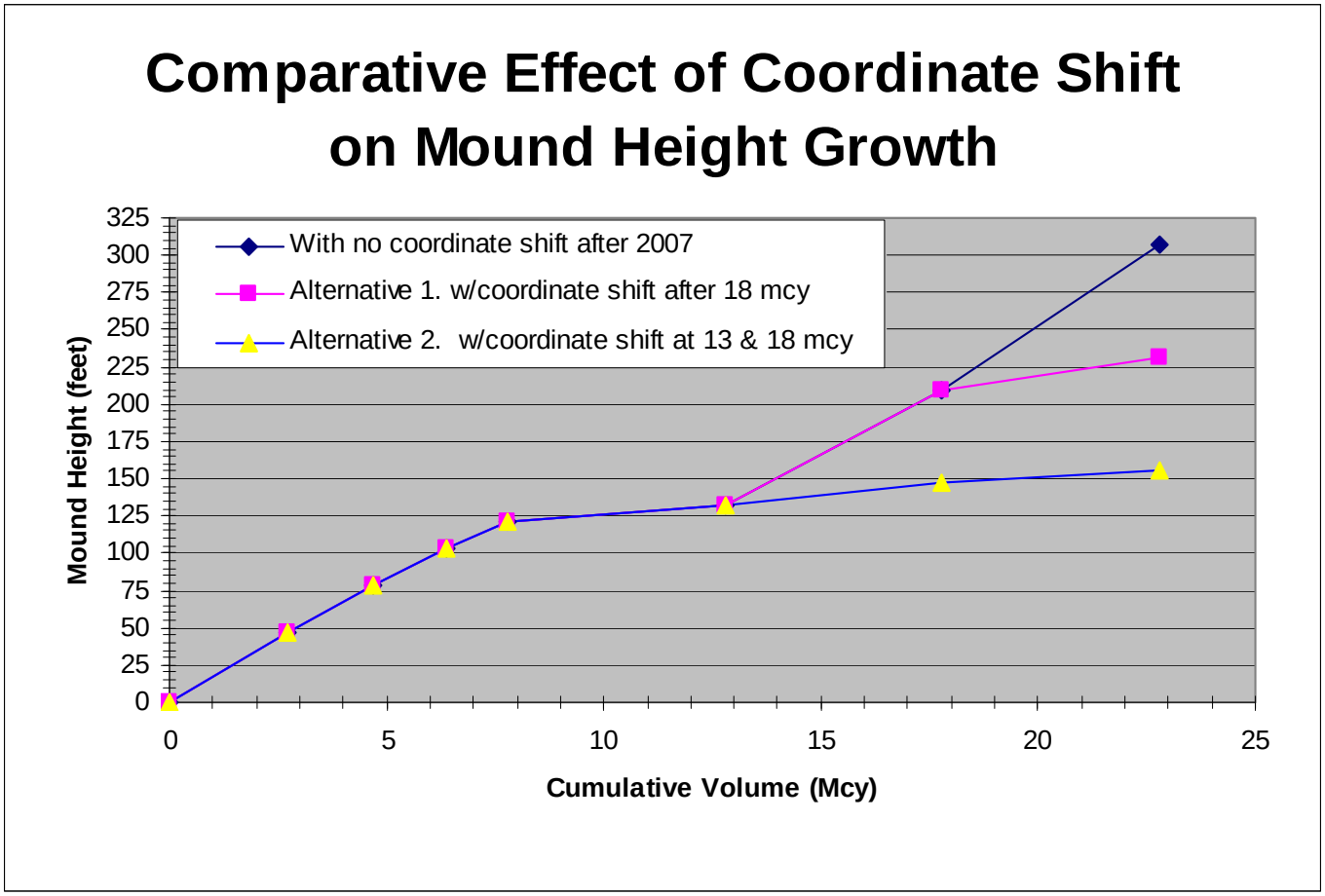

Figure 5-12. Comparative Effect of Coordinate Shift on Mound Height Growth for two Alternatives

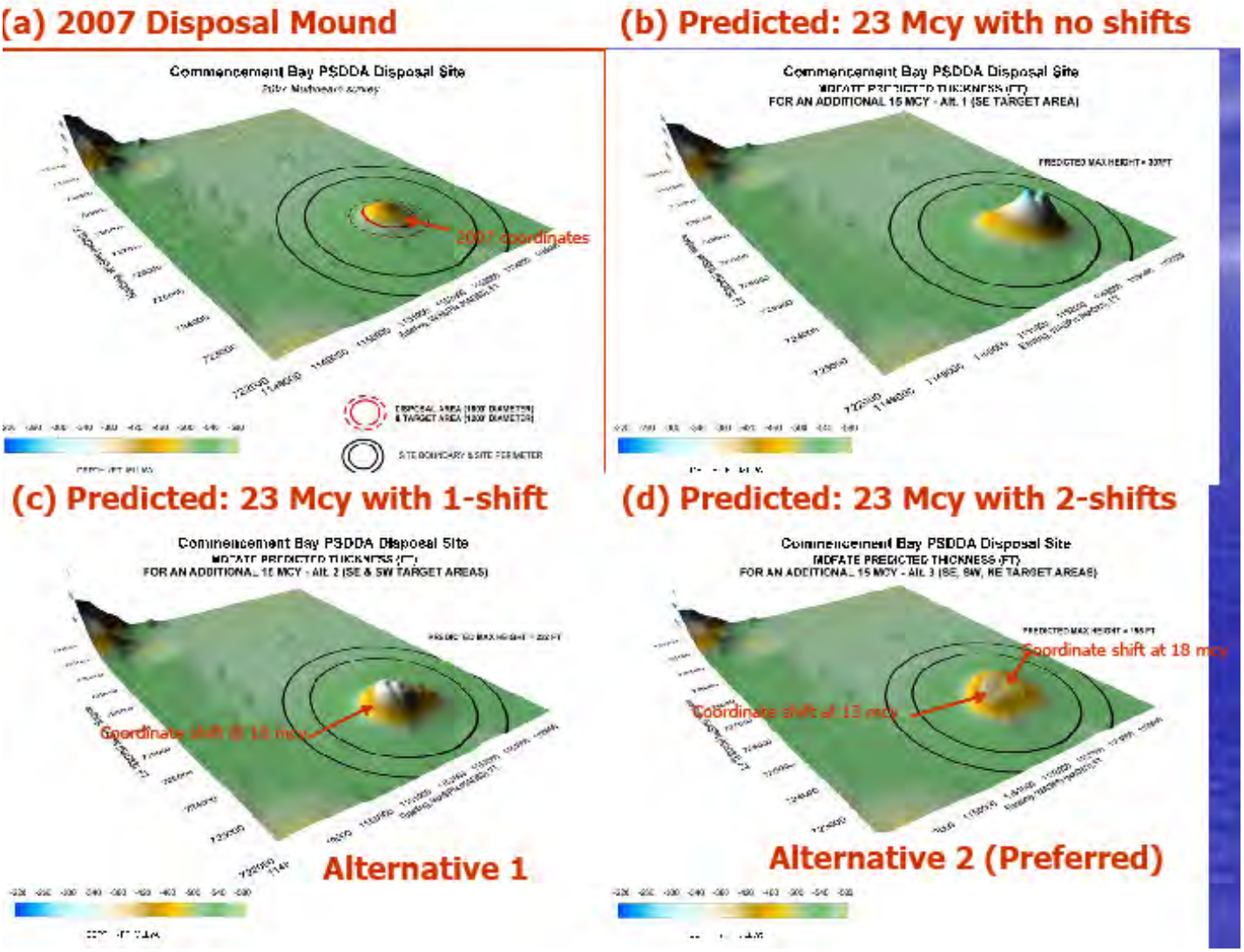

Figure 5-13. (a) Comparative analysis of the existing site, (b) site with 23 mcy with no additional coordinate shifts beyond 2007, (c) Alternative 1: site with 1 additional coordinate shift at 18 mcy, (d) Alternative 2 (Preferred): site with 2 additional coordinate shifts at13 mcy and 18 mcy after a cumulative disposal volume of 23 mcy.

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APPENDICES

Dredging Years 2008/2009

APPENDICES

Dredging Years 2008/2009

APPENDIX A - DY08/09 GUIDELINE VALUES

		Marine				Freshwater	
CHEMICAL NAME	**Units**	**SL**	**BT**	**ML**	**(SL+ ML)/2**	**SL1**	**SL2**
METALS							
Antimony	mg/kg	150	---	200	175	---	---
Arsenic	mg/kg	57	507.1	700	378.5	20	51
Cadmium	mg/kg	5.1	11.3	14	9.55	1.1	1.5
Chromium	mg/kg	---	267	---	---	95	100
Copper	mg/kg	390	1,027	1,300	845	80	830
Lead	mg/kg	450	975	1,200	825	340	430
Mercury	mg/kg	0.41	1.5	2.3	1.355	0.28	0.75
Nickel	mg/kg	140	370	370	255	60	70
Selenium	mg/kg	---	3	---	---	---	---
Silver	mg/kg	6.1	6.1	8.4	7.25	2	2.5
Zinc	mg/kg	410	2,783	3,800	2,105	130	400
ORGANOMETALLICS							
TBT ion (porewater)	ug/L	0.15	0.15	---	---	---	---
LPAH							
Naphthalene	ug/kg	2,100	---	2,400	2,250	500	1,300
Acenaphthene	ug/kg	500	---	2,000	1,250	1,100	1,300
Acenaphthylene	ug/kg	560	---	1,300	930	470	640
Fluorene	ug/kg	540	---	3,600	2,070	1,000	3,000
Phenanthrene	ug/kg	1,500	---	21,000	11,250	6,100	7,600
Anthracene	ug/kg	960	---	13,000	6,980	1,200	1,600
2-Methylnaphthalene[1]	ug/kg	670	---	1,900	1,285	470	560
Total LPAHs	ug/kg	5,200	---	29,000	17,100	6,600	9,200
HPAH							
Fluoranthene	ug/kg	1,700	4,600	30,000	15,850	11,000	15,000
Pyrene	ug/kg	2,600	11,980	16,000	9,300	8,800	16,000
Benzo(a)anthracene	ug/kg	1,300	---	5,100	3,200	4,300	5,800
Benzofluoranthenes (sum of b,j,k)	ug/kg	3,200	---	9,900	6,550	600	4,000
Chrysene	ug/kg	1,400	---	21,000	11,200	5,900	6,400
Benzo(a)pyrene	ug/kg	1,600	---	3,600	2,600	3,300	4,800
Indeno(1,2,3-c,d)pyrene	ug/kg	600	---	4,400	2,500	4,100	5,300
Dibenzo(a,h)anthracene	ug/kg	230	---	1,900	1,065	800	840
Benzo(g,h,i)perylene	ug/kg	670	---	3,200	1,935	4,000	5,200
Total HPAHs	ug/kg	12,000	---	69,000	40,500	31,000	55,000
CHLORINATED HYDROCARBONS							
1,2,4-Trichlorobenzene	ug/kg	31	---	64	47.5	---	---
1,2-Dichlorobenzene	ug/kg	35	---	110	72.5	---	---
1,3-Dichlorobenzene	ug/kg	170	---	---		---	---
1,4-Dichlorobenzene	ug/kg	110	---	120	115	---	---
Hexachlorobenzene (HCB)	ug/kg	22	168	230	126	---	---

CHEMICAL NAME	Units	SL	BT	ML	(SL+ ML)/2	SL1	SL2
PHTHALATES							
Bis(2-ethylhexyl) phthalate	ug/kg	1,300	---	8300	4,800	220	320
Butylbenzyl phthalate	ug/kg	63	---	970	517	260	370
Di-n-butyl phthalate	ug/kg	1,400	---	5100	3,250	---	---
Di-n-octyl phthalate	ug/kg	6,200	---	6200	6,200	26	45
Diethyl phthalate	ug/kg	200	---	1200	700	---	---
Dimethyl phthalate	ug/kg	71	---	1400	736	46	440
PHENOLS							
2-Methylphenol	ug/kg	63	---	77	70	---	---
4-Methylphenol	ug/kg	670	---	3,600	2,135	---	---
2,4-Dimethylphenol	ug/kg	29	---	210	120	---	---
Pentachlorophenol	ug/kg	400	504	690	545	---	---
Phenol	ug/kg	420	---	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	400	440
Hexachlorobutadiene	ug/kg	29	---	270	149.5	---	---
Hexachloroethane	ug/kg	1,400	---	14,000	7,700	---	---
N-Nitrosodiphenylamine	ug/kg	28	---	130	79	---	---
VOLATILE ORGANICS							
Ethylbenzene	ug/kg	10	---	50	30	---	---
Tetrachloroethene	ug/kg	57	---	210	133.5	---	---
Total Xylene (sum of o,m,p)	ug/kg	40	---	160	100	---	---
Trichloroethane	ug/kg	160	---	1,600	880	---	---
PESTICIDES AND PCBs							
Total DDT[2]	ug/kg	6.9	50	69	37.95	---	---
Aldrin	ug/kg	10	---	---		---	---
Total Chlordane[3]	ug/kg	10	37	---	---		---
Dieldrin	ug/kg	10	---	---		---	---
Heptachlor	ug/kg	10	---	---		---	---
Gamma-BHC (Lindane)	ug/kg	10	---	---		---	---
Total PCBs	ug/kg	130	38[4]	3,100	1,615	60	120

[1]2-Methylnaphthalene is not included in the summation for total LPAH.

[2]Total DDT is the sum of 4,4'-DDD, 4,4'-DDE and 4,4'-DDT.

[3]Total Chlordane is the sum of cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlor, oxychlordane.

[4]This value is normalized to total organic carbon and is expressed in mg/kg carbon.

APPENDIX B - 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 SS (p=.05) and		$M_T - M_C > 20\%$ and M_T vs. M_R SS (p=.05) and	
			$M_T - M_R > 10\%$	NOCN	$M_T - M_R > 30\%$	NOCN
Larval	$N_C \div I \geq 0.70$ N	$_R \div N_C \geq 0.65$	$N_T \div N_C < 0.80$ and N_T/N_C vs. N_R/N_C SS (p=.10) and		$N_T \div N_C < 0.80$ and N_T/N_C vs. N_R/N_C SS (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 $MIG_C \geq 0.38$	$M_R \leq 20\%$ and $MIG_R \div MIG_C \geq 0.80$	$MIG_T \div MIG_C < 0.80$ and MIG_T vs. MIG_R SS (p=.05) and		$MIG_T \div MIG_C < 0.80$ and MIG_T vs. MIG_R SS (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 larvae, I = initial count, MIG = mean individual growth rate (mg/individual/day)
SS = statistically significant, NOCN = no other conditions necessary, N/A = not applicable
Subscripts: R = reference sediment, C = negative control, T = test sediment

APPENDIX C – GUIDELINES EXCEEDANCES

LEGEND

S	=	reported concentration exceeds the marine screening level
S^{FW1}	=	reported concentration exceeds the freshwater screening level 1
S^{FW2}	=	reported concentration exceeds the freshwater screening level 2
B	=	reported concentration exceeds the bioaccumulation trigger (and SL, if it exists for that COC)
M	=	reported concentration exceeds maximum level
BM	=	reported concentration exceeds bioaccumulation trigger and maximum level
D	=	reported dioxin concentration exceeds the interim dioxin maximum guideline for proposed disposal site
D^{VWA}	=	reported dioxin concentration drives the volume-weighted average beyond the interim dioxin guideline for proposed disposal site
U	=	detection limit exceeds either screening level, bioaccumulation trigger, or maximum level
J	=	estimate
NA	=	not applicable
NH	=	no hit
2H	=	a hit under the two-hit interpretation guideline
1H	=	a hit under the one-hit interpretation guideline
PASS	=	test sediment passes DMMP guidelines for open-water unconfined disposal
$PASS^{AD}$	=	test sediment meets the antidegradation guideline
$PASS^{1}$	=	test sediment passes DMMP guidelines except for material surrounding underground storage tanks identified by MTCA
FAIL	=	test sediment fails DMMP guidelines for open-water unconfined disposal
$FAIL^{1}$	=	DMMUs 1, 2 and 3 were composited for dioxin analysis; the composite failed for dioxin
$FAIL^{2}$	=	DMMUs 1, 2, 3 and 4 were composited for dioxin analysis; the composite failed for dioxin (see data for H1)
$FAIL^{3}$	=	DMMUs 17B, 17C & 20 were composited for dioxin analysis; composite failed for dioxin. (see data for H6) DMMU 20 was then analyzed separately and passed for dioxin.
$FAIL^{AD}$	=	test sediment fails to meet the antidegradation guideline
$FAIL^{C}$	=	DMMU found unsuitable for open-water disposal in the absence of bioassay testing data
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^{B}	=	the sediment rank is based on biological testing results
H^{D}	=	the sediment rank is based on dioxin results

PROJECT:	Port of Tacoma Blair-Hylebos Redevelopment - Study and Project Phases											
DMMU ID:	DMMU 1	DMMU 2	DMMU 3	DMMU 4	DMMU 5	DMMU 6	DMMU 7	DMMU 9	DMMU 10	DMMU 11	DMMU 12	DMMU 13
Assessment Rank:	M	M	M	LM	LM	LM	LM	LM	LM	LM	M	LM
METALS (mg/kg)												
Antimony												
Arsenic												
Cadmium												
Chromium												
Copper												
Lead												
Mercury		0.45										
Nickel												
Selenium												
Silver												
Zinc												
LPAH (ug/kg)												
2-Methylnaphthalene												
Acenaphthene												
Acenaphthylene												
Anthracene												
Fluorene												
Naphthalene												
Phenanthrene												
Total LPAH												
HPAH (ug/kg)												
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(g,h,i)perylene												
Benzofluoranthenes												
Chrysene												
Dibenzo(a,h)anthracene												
Fluoranthene												
Indeno(1,2,3-c,d)pyrene												
Pyrene												
Total HPAH												
CHLORINATED HYDROCARBONS (ug/kg)												
1,2,4-Trichlorobenzene												
1,2-Dichlorobenzene												
1,3-Dichlorobenzene												
1,4-Dichlorobenzene												
Hexachlorobenzene												
PHTHALATES (ug/kg)												
Bis(2-ethylhexyl)phthalate												
Butyl benzyl phthalate												
Di-n-butyl phthalate												
Di-n-octyl phthalate												
Diethyl phthalate												
Dimethyl phthalate											150	
PHENOLS (ug/kg)												
2 Methylphenol												
2,4-Dimethylphenol												
4 Methylphenol												
Pentachlorophenol												
Phenol												
MISCELLANEOUS EXTRACTABLES (ug/kg)												
Benzoic acid												
Benzyl alcohol												
Dibenzofuran												
Hexachlorobutadiene												
Hexachloroethane												
N-Nitrosodiphenylamine												
VOLATILE ORGANICS (ug/kg)												
Ethylbenzene												
Tetrachloroethene												
Total Xylene												
Trichloroethene												
PESTICIDES AND PCBs (ug/kg)												
Aldrin												
Chlordane												
Dieldrin												
Heptachlor												
Lindane												
Total DDT												
Total PCBs											200	
Total PCBs (carbon-normalized)												
OTHER CHEMICALS OF CONCERN												
Tributyltin (ug/l porewater)	-	-	-	-	-	-	-	-	-	-	-	-
Dioxins/Furans (pptr TEQ; u=1/2 DL)	-	-	-	-	-	-	-	-	-	-	-	-
BIOASSAYS												
Amphipod	-	-	-	-	-	-	-	-	-	-	-	-
Larval	-	-	-	-	-	-	-	-	-	-	-	-
Neanthes Growth Rate	-	-	-	-	-	-	-	-	-	-	-	-
Bioassay Result:	-	-	-	-	-	-	-	-	-	-	-	-
OVERALL PASS/FAIL:	FAIL[1]	FAIL[1]	FAIL[1]	PASS	PASS[1]	PASS	PASS	PASS	PASS	PASS[1]	FAIL[C]	PASS
VOLUME (CY):	15,216	10,116	13,496	52,260	43,198	42,279	25,056	40,440	37,584	37,372	12,400	27,900
HIGHEST RANKING (based on testing):	H	H	H	L	L	L	L	L	L	L	LM	L

PROJECT:	Port of Tacoma Blair-Hylebos Redevelopment (continued)							Des Moines Marina			POS-T18
DMMU ID:	Below Exceedances.		C1	C2	C3	C4	S4	C1	C2	C3	DMMU 1
Assessment Rank:	LM	LM	M	LM	LM	LM	LM	M	M	M	H
METALS (mg/kg)											
Antimony											
Arsenic											
Cadmium											
Chromium											
Copper											
Lead											
Mercury											
Nickel											
Selenium											
Silver											
Zinc											
LPAH (ug/kg)											
2-Methylnaphthalene											
Acenaphthene											
Acenaphthylene											
Anthracene											
Fluorene											
Naphthalene											
Phenanthrene											
Total LPAH											
HPAH (ug/kg)											
Benzo(a)anthracene											
Benzo(a)pyrene											
Benzo(g,h,i)perylene											
Benzofluoranthenes											
Chrysene											
Dibenzo(a,h)anthracene											
Fluoranthene									2,000		
Indeno(1,2,3-c,d)pyrene											
Pyrene											
Total HPAH											
CHLORINATED HYDROCARBONS (ug/kg)											
1,2,4-Trichlorobenzene											
1,2-Dichlorobenzene											
1,3-Dichlorobenzene											
1,4-Dichlorobenzene											
Hexachlorobenzene											
PHTHALATES (ug/kg)											
Bis(2-ethylhexyl)phthalate									2,600		
Butyl benzyl phthalate									180		
Di-n-butyl phthalate											
Di-n-octyl phthalate											
Diethyl phthalate											
Dimethyl phthalate		220									
PHENOLS (ug/kg)											
2 Methylphenol											
2,4-Dimethylphenol											
4 Methylphenol											
Pentachlorophenol											
Phenol											
MISCELLANEOUS EXTRACTABLES (ug/kg)											
Benzoic acid											
Benzyl alcohol											
Dibenzofuran											
Hexachlorobutadiene											
Hexachloroethane											
N-Nitrosodiphenylamine											
VOLATILE ORGANICS (ug/kg)											
Ethylbenzene											
Tetrachloroethene											
Total Xylene											
Trichloroethene											
PESTICIDES AND PCBs (ug/kg)											
Aldrin											
Chlordane											
Dieldrin											
Heptachlor											
Lindane											
Total DDT									7.9		9.8
Total PCBs											900
Total PCBs (carbon-normalized)											84
OTHER CHEMICALS OF CONCERN											
Tributyltin (ug/l porewater)	-	-	-	-	-	-	-	-			1.2
Dioxins/Furans (pptr TEQ; u=1/2 DL)	-	-	7.33	1.04	0.33	0.32	0.41	-	-	-	21.7
BIOASSAYS											
Amphipod	-	-	-	-	-	-	-	-	NH	-	-
Larval	-	-	-	-	-	-	-	-	NH	-	-
Neanthes Growth Rate	-	-	-	-	-	-	-	-	2H	-	-
Bioassay Result:	-	-	-	-	-	-	-	-	PASS	-	-
OVERALL PASS/FAIL:	PASS[1]	PASS	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL
VOLUME (CY):	15,500	24,800	38,828	95,458	67,335	115,396	NA	7,000	3,040	540	6,800
HIGHEST RANKING (based on testing):	L	LM	H[D]	L	L	L	L	L	LM	L	H[D]

PROJECT:	Port of Seattle - T115										
DMMU ID:	delineation Exceedances.	C1-ZA1	C1-ZA2	C1-ZB2	C2	C2-ZA1	C2-ZB1	C2-ZC1	C2-ZA2	C2-ZB2	C2-ZC2
Assessment Rank:	H	H	H	H	H	H	H	H	H	H	H
METALS (mg/kg)											
Antimony											
Arsenic											
Cadmium											
Chromium											
Copper											
Lead											
Mercury											
Nickel											
Selenium											
Silver											
Zinc											
LPAH (ug/kg)											
2-Methylnaphthalene											
Acenaphthene											
Acenaphthylene											
Anthracene	1,200										
Fluorene											
Naphthalene											
Phenanthrene											
Total LPAH											
HPAH (ug/kg)											
Benzo(a)anthracene	6,800										
Benzo(a)pyrene	3,400										
Benzo(g,h,i)perylene											
Benzofluoranthenes	14,200										
Chrysene	16,000		2,600 J						1,600 J	1,500	
Dibenzo(a,h)anthracene	300										
Fluoranthene	47,000		7,400 J		2,400				2,000 J		
Indeno(1,2,3-c,d)pyrene	730										
Pyrene	34,000		5,500 J		2,900				3,300 J	4,600	8,500
Total HPAH	122,960		19,485 J								15,220
CHLORINATED HYDROCARBONS (ug/kg)											
1,2,4-Trichlorobenzene											
1,2-Dichlorobenzene											
1,3-Dichlorobenzene											
1,4-Dichlorobenzene											
Hexachlorobenzene											
PHTHALATES (ug/kg)											
Bis(2-ethylhexyl)phthalate					6700 J						
Butyl benzyl phthalate											
Di-n-butyl phthalate											
Di-n-octyl phthalate											
Diethyl phthalate											
Dimethyl phthalate									77 J		
PHENOLS (ug/kg)											
2 Methylphenol											
2,4-Dimethylphenol											
4 Methylphenol											
Pentachlorophenol											
Phenol											
MISCELLANEOUS EXTRACTABLES (ug/kg)											
Benzoic acid											
Benzyl alcohol											
Dibenzofuran											
Hexachlorobutadiene											
Hexachloroethane											
N-Nitrosodiphenylamine											
VOLATILE ORGANICS (ug/kg)											
Ethylbenzene											
Tetrachloroethene											
Total Xylene											
Trichloroethene											
PESTICIDES AND PCBs (ug/kg)											
Aldrin											
Chlordane									140 U		
Dieldrin											
Heptachlor											
Lindane											
Total DDT	9.9 U		9.9 U		9.9 U	9.9 U			9.9 U		7.0 U
Total PCBs	141				172	297	264	177	182	324	234
Total PCBs (carbon-normalized)											
OTHER CHEMICALS OF CONCERN											
Tributyltin (ug/l porewater)						0.19					
Dioxins/Furans (pptr TEQ; u=1/2 DL)	20.1	12.9	14.5	39.3	24.1	32.9	28.2	23.5	24.6	29.4	23.1
BIOASSAYS											
Amphipod	-	-	-	-	-	-	-	-	-	-	-
Larval	-	-	-	-	-	-	-	-	-	-	-
Neanthes Growth Rate	-	-	-	-	-	-	-	-	-	-	-
Bioassay Result:	-	-	-	-	-	-	-	-	-	-	-
OVERALL PASS/FAIL:	FAIL	PASS[AD]	PASS[AD]	FAIL[AD]	FAIL	FAIL[AD]	FAIL[AD]	FAIL[AD]	FAIL[AD]	FAIL[AD]	FAIL[AD]
VOLUME (CY):	1,380	NA	NA	NA	1,620	NA	NA	NA	NA	NA	NA
HIGHEST RANKING (based on testing):	H	H[D]	H[D]	H[D]	H[D]	H[D]	H[D]	H[D]	H[D]	H[D]	H[D]

PROJECT:	Port of Seattle - T5			USACE Pt Townsend		Port of Anacortes Cap Sante Marina				Zittel's Marina	
DMMU ID:	S1	S2	S3	CH1	CG2	C1	C2	C8	C9	DMMU 1	DMMU 2
Assessment Rank:	H	H	H	M	M	M	M	M	M	M	M
METALS (mg/kg)											
Antimony											
Arsenic											
Cadmium											
Chromium											
Copper											
Lead											
Mercury											
Nickel											
Selenium											
Silver											
Zinc											
LPAH (ug/kg)											
2-Methylnaphthalene											
Acenaphthene											
Acenaphthylene											
Anthracene										3,600	
Fluorene											
Naphthalene											
Phenanthrene			2,000								
Total LPAH											
HPAH (ug/kg)											
Benzo(a)anthracene											
Benzo(a)pyrene											
Benzo(g,h,i)perylene											
Benzofluoranthenes											
Chrysene										2,100	
Dibenzo(a,h)anthracene											
Fluoranthene			2,000 J							1,900	
Indeno(1,2,3-c,d)pyrene											
Pyrene											
Total HPAH											
CHLORINATED HYDROCARBONS (ug/kg)											
1,2,4-Trichlorobenzene											
1,2-Dichlorobenzene											
1,3-Dichlorobenzene											
1,4-Dichlorobenzene											
Hexachlorobenzene											
PHTHALATES (ug/kg)											
Bis(2-ethylhexyl)phthalate											
Butyl benzyl phthalate											
Di-n-butyl phthalate											
Di-n-octyl phthalate											
Diethyl phthalate											
Dimethyl phthalate											
PHENOLS (ug/kg)											
2 Methylphenol											
2,4-Dimethylphenol											
4 Methylphenol											
Pentachlorophenol											
Phenol											
MISCELLANEOUS EXTRACTABLES (ug/kg)											
Benzoic acid											
Benzyl alcohol											
Dibenzofuran											
Hexachlorobutadiene											
Hexachloroethane											
N-Nitrosodiphenylamine											
VOLATILE ORGANICS (ug/kg)											
Ethylbenzene											
Tetrachloroethene											
Total Xylene											
Trichloroethene											
PESTICIDES AND PCBs (ug/kg)											
Aldrin											
Chlordane											
Dieldrin											
Heptachlor											
Lindane											
Total DDT										7.0	
Total PCBs											
Total PCBs (carbon-normalized)											
OTHER CHEMICALS OF CONCERN											
Tributyltin (ug/l porewater)			1.0								
Dioxins/Furans (pptr TEQ; u=1/2 DL)	12.1[VWA]	6.31	4.33	4.71	1.36	34.3	3.5	52.6	44.4	-	-
BIOASSAYS											
Amphipod	-	-	NH	-	-	-	-	-	-	NH	-
Larval	-	-	1H	-	-	-	-	-	-	2H	-
Neanthes Growth Rate	-	-	NH	-	-	-	-	-	-	NH	-
Bioassay Result:	-	-	FAIL	-	-	-	-	-	-	PASS	-
OVERALL PASS/FAIL:	FAIL	PASS	FAIL	FAIL	PASS	FAIL	FAIL	FAIL	FAIL	PASS	PASS
VOLUME (CY):	2,700	2,400	1,800	400	850	3,000	15,200	14,500	8,200	16,000	16,000
HIGHEST RANKING (based on testing):	H[D]	L	H[B]	H[D]	L	H[D]	H[D]	H[D]	H[D]	LM	L

deline Exceedances.

PROJECT:	Georgia-Pacific Camas Slough									MJB Properties		
DMMU ID:	DMMU 1	DMMU 2	DMMU 3	DMMU 4	Z-B2b	Z-B5b	Z-B8b	Z-B10b	Z-B11b	SDBR-C1	SD-C1	SD-C2
Assessment Rank:	M	M	M	M	M	M	M	M	M	M	M	M
METALS (mg/kg)												
Antimony												
Arsenic												
Cadmium							2.1[FW2]	1.2[FW1]				
Chromium												
Copper												
Lead												
Mercury												
Nickel												
Selenium												
Silver												
Zinc				144[FW1]			207[FW1]					
LPAH (ug/kg)												
2-Methylnaphthalene												
Acenaphthene												
Acenaphthylene												
Anthracene												
Fluorene												
Naphthalene												
Phenanthrene												
Total LPAH												
HPAH (ug/kg)												
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(g,h,i)perylene												
Benzofluoranthenes												
Chrysene												
Dibenzo(a,h)anthracene												
Fluoranthene												
Indeno(1,2,3-c,d)pyrene												
Pyrene												
Total HPAH												
CHLORINATED HYDROCARBONS (ug/kg)												
1,2,4-Trichlorobenzene												
1,2-Dichlorobenzene												
1,3-Dichlorobenzene												
1,4-Dichlorobenzene												
Hexachlorobenzene												
PHTHALATES (ug/kg)												
Bis(2-ethylhexyl)phthalate												
Butyl benzyl phthalate												
Di-n-butyl phthalate												
Di-n-octyl phthalate												
Diethyl phthalate												
Dimethyl phthalate												
PHENOLS (ug/kg)												
2 Methylphenol												
2,4-Dimethylphenol												
4 Methylphenol												
Pentachlorophenol												
Phenol												
MISCELLANEOUS EXTRACTABLES (ug/kg)												
Benzoic acid												
Benzyl alcohol												
Dibenzofuran												
Hexachlorobutadiene												
Hexachloroethane												
N-Nitrosodiphenylamine												
VOLATILE ORGANICS (ug/kg)												
Ethylbenzene												
Tetrachloroethene												
Total Xylene												
Trichloroethene												
PESTICIDES AND PCBs (ug/kg)												
Aldrin												
Chlordane												
Dieldrin												
Heptachlor												
Lindane												
Total DDT												
Total PCBs							86[FW1]					
Total PCBs (carbon-normalized)												
OTHER CHEMICALS OF CONCERN												
Tributyltin (ug/l porewater)	-	-	-	-	-	-	-	-	-			1.0
Dioxins/Furans (pptr TEQ; u=1/2 DL)	0.3	1.8	4.7	1.1	0.4	0.7	12.4	1.4	0.5	4.7	14.0	9.87[VWA]
BIOASSAYS												
Amphipod	-	-	-	-	-	-	-	-	-	-	-	-
Larval	-	-	-	-	-	-	-	-	-	-	-	-
Neanthes Growth Rate	-	-	-	-	-	-	-	-	-	-	-	-
Bioassay Result:	-	-	-	-	-	-	-	-	-	-	-	-
OVERALL PASS/FAIL:	PASS	PASS	FAIL[AD]	PASS	PASS[AD]	PASS[AD]	FAIL[AD]	PASS[AD]	PASS[AD]	PASS	FAIL	FAIL
VOLUME (CY):	20,000	79,000	5,000	21,000	NA	NA	NA	NA	NA	2,000	8,791	8,309
HIGHEST RANKING (based on testing):	NA	NA	NA	NA	NA	NA	NA	NA	NA	L	H	H

Draft: For Review Purposes Only

PROJECT:	Puyallup Tribal Terminal											
DMMU ID:	DMMU 1	DMMU 2	DMMU 3	DMMU 4	DMMU 5	DMMU 6	DMMU 7	DMMU 8	DMMU 9	DMMU 10	DMMU 11	DMMU 12
Assessment Rank:	M	M	M	M	M	M	M	M	M	M	M	M
METALS (mg/kg)												
Antimony												
Arsenic												
Cadmium												
Chromium												
Copper												
Lead												
Mercury												
Nickel												
Selenium												
Silver												
Zinc												
LPAH (ug/kg)												
2-Methylnaphthalene												
Acenaphthene												
Acenaphthylene												
Anthracene												
Fluorene												
Naphthalene												
Phenanthrene												
Total LPAH												
HPAH (ug/kg)												
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(g,h,i)perylene												
Benzofluoranthenes												
Chrysene												
Dibenzo(a,h)anthracene												
Fluoranthene												
Indeno(1,2,3-c,d)pyrene												
Pyrene												
Total HPAH												
CHLORINATED HYDROCARBONS (ug/kg)												
1,2,4-Trichlorobenzene												
1,2-Dichlorobenzene												
1,3-Dichlorobenzene												
1,4-Dichlorobenzene												
Hexachlorobenzene												
PHTHALATES (ug/kg)												
Bis(2-ethylhexyl)phthalate												
Butyl benzyl phthalate												
Di-n-butyl phthalate												
Di-n-octyl phthalate												
Diethyl phthalate												
Dimethyl phthalate												
PHENOLS (ug/kg)												
2 Methylphenol												
2,4-Dimethylphenol												
4 Methylphenol												
Pentachlorophenol												
Phenol												
MISCELLANEOUS EXTRACTABLES (ug/kg)												
Benzoic acid												
Benzyl alcohol												
Dibenzofuran												
Hexachlorobutadiene												
Hexachloroethane												
N-Nitrosodiphenylamine												
VOLATILE ORGANICS (ug/kg)												
Ethylbenzene												
Tetrachloroethene												
Total Xylene												
Trichloroethene												
PESTICIDES AND PCBs (ug/kg)												
Aldrin												
Chlordane												
Dieldrin												
Heptachlor												
Lindane												
Total DDT												
Total PCBs												
Total PCBs (carbon-normalized)												
OTHER CHEMICALS OF CONCERN												
Tributyltin (ug/l porewater)	-	-	-	-	-	-	-	-	-	-	-	-
Dioxins/Furans (pptr TEQ; u=1/2 DL)	-	-	-	-	-	-	-	-	-	-	-	-
BIOASSAYS												
Amphipod	-	-	-	-	-	-	-	-	-	-	-	-
Larval	-	-	-	-	-	-	-	-	-	-	-	-
Neanthes Growth Rate	-	-	-	-	-	-	-	-	-	-	-	-
Bioassay Result:	-	-	-	-	-	-	-	-	-	-	-	-
OVERALL PASS/FAIL:	FAIL[2]	FAIL[2]	FAIL[2]	FAIL[2]	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
VOLUME (CY):	17,162	16,069	10,380	17,472	16,653	17,803	9,898	14,853	18,616	16,764	11,308	19,191
HIGHEST RANKING (based on testing):	H	H	H	H	L	L	L	L	L	L	L	L

PROJECT:	Puyallup Tribal Terminal (continued)										
DMMU ID:	DMMU 14	DMMU 15	DMMU 15	DMMU 16	DMMU 17	DMMU 17B	DMMU 17C	DMMU 17D	DMMU 18	DMMU 19	DMMU 20
Assessment Rank:	M	M	M	M	M	M	M	M	M	M	M
METALS (mg/kg)											
Antimony											
Arsenic											
Cadmium											
Chromium											
Copper											
Lead											
Mercury											
Nickel											
Selenium											
Silver											
Zinc											
LPAH (ug/kg)											
2-Methylnaphthalene											
Acenaphthene											
Acenaphthylene											
Anthracene											
Fluorene											
Naphthalene											
Phenanthrene											
Total LPAH											
HPAH (ug/kg)											
Benzo(a)anthracene											
Benzo(a)pyrene											
Benzo(g,h,i)perylene											
Benzofluoranthenes											
Chrysene											
Dibenzo(a,h)anthracene											
Fluoranthene											
Indeno(1,2,3-c,d)pyrene											
Pyrene											
Total HPAH											
CHLORINATED HYDROCARBONS (ug/kg)											
1,2,4-Trichlorobenzene											
1,2-Dichlorobenzene											
1,3-Dichlorobenzene											
1,4-Dichlorobenzene											
Hexachlorobenzene											
PHTHALATES (ug/kg)											
Bis(2-ethylhexyl)phthalate											
Butyl benzyl phthalate											
Di-n-butyl phthalate											
Di-n-octyl phthalate											
Diethyl phthalate											
Dimethyl phthalate											
PHENOLS (ug/kg)											
2 Methylphenol											
2,4-Dimethylphenol											
4 Methylphenol											
Pentachlorophenol											
Phenol											
MISCELLANEOUS EXTRACTABLES (ug/kg)											
Benzoic acid											
Benzyl alcohol											
Dibenzofuran											
Hexachlorobutadiene											
Hexachloroethane											
N-Nitrosodiphenylamine											
VOLATILE ORGANICS (ug/kg)											
Ethylbenzene											
Tetrachloroethene											
Total Xylene											
Trichloroethene											
PESTICIDES AND PCBs (ug/kg)											
Aldrin											
Chlordane											
Dieldrin											
Heptachlor											
Lindane											
Total DDT											
Total PCBs											
Total PCBs (carbon-normalized)											
OTHER CHEMICALS OF CONCERN											
Tributyltin (ug/l porewater)	-	-	-	-	-	-	-	-	-	-	-
Dioxins/Furans (pptr TEQ; u=1/2 DL)	-	-	-	-	-	-	-	-	-	-	-
BIOASSAYS											
Amphipod	-	-	-	-	-	-	-	-	-	-	-
Larval	-	-	-	-	-	-	-	-	-	-	-
Neanthes Growth Rate	-	-	-	-	-	-	-	-	-	-	-
Bioassay Result:	-	-	-	-	-	-	-	-	-	-	-
OVERALL PASS/FAIL:	PASS	PASS	PASS	PASS	PASS	FAIL[3]	FAIL[3]	PASS	PASS	PASS	PASS
VOLUME (CY):	16,462	14,677	11,843	14,853	10,496	10,496	11,466	10,398	17,157	11,777	14,853
HIGHEST RANKING (based on testing):	L	L	L	L	L	H	H	L	L	L	L

PROJECT:	Puyallup Tribal Terminal (continued)										
DMMU ID:	Delivery Exceedances.		H1	H2	H3	H4	H5	H6		H7	H8
Assessment Rank:	M	M	M	M	M	M	M	M		M	M
METALS (mg/kg)											
Antimony											
Arsenic											
Cadmium											
Chromium											
Copper											
Lead											
Mercury											
Nickel											
Selenium											
Silver											
Zinc											
LPAH (ug/kg)											
2-Methylnaphthalene											
Acenaphthene											
Acenaphthylene											
Anthracene											
Fluorene											
Naphthalene											
Phenanthrene											
Total LPAH											
HPAH (ug/kg)											
Benzo(a)anthracene											
Benzo(a)pyrene											
Benzo(g,h,i)perylene											
Benzofluoranthenes											
Chrysene											
Dibenzo(a,h)anthracene											
Fluoranthene											
Indeno(1,2,3-c,d)pyrene											
Pyrene											
Total HPAH											
CHLORINATED HYDROCARBONS (ug/kg)											
1,2,4-Trichlorobenzene											
1,2-Dichlorobenzene											
1,3-Dichlorobenzene											
1,4-Dichlorobenzene											
Hexachlorobenzene											
PHTHALATES (ug/kg)											
Bis(2-ethylhexyl)phthalate											
Butyl benzyl phthalate											
Di-n-butyl phthalate											
Di-n-octyl phthalate											
Diethyl phthalate											
Dimethyl phthalate											
PHENOLS (ug/kg)											
2 Methylphenol											
2,4-Dimethylphenol											
4 Methylphenol											
Pentachlorophenol											
Phenol											
MISCELLANEOUS EXTRACTABLES (ug/kg)											
Benzoic acid											
Benzyl alcohol											
Dibenzofuran											
Hexachlorobutadiene											
Hexachloroethane											
N-Nitrosodiphenylamine											
VOLATILE ORGANICS (ug/kg)											
Ethylbenzene											
Tetrachloroethene											
Total Xylene											
Trichloroethene											
PESTICIDES AND PCBs (ug/kg)											
Aldrin											
Chlordane											
Dieldrin											
Heptachlor											
Lindane											
Total DDT											
Total PCBs											
Total PCBs (carbon-normalized)											
OTHER CHEMICALS OF CONCERN											
Tributyltin (ug/l porewater)	-	-	-	-	-	-	-	-		-	-
Dioxins/Furans (pptr TEQ; u=1/2 DL)	-	-	8.16	1.90	1.23	0.4	2.55	7.22	0.16	0.45	0.16
BIOASSAYS											
Amphipod	-	-	-	-	-	-	-	-		-	-
Larval	-	-	-	-	-	-	-	-		-	-
Neanthes Growth Rate	-	-	-	-	-	-	-	-		-	-
Bioassay Result:	-	-	-	-	-	-	-	-		-	-
OVERALL PASS/FAIL:	PASS	PASS	FAIL	PASS	PASS	PASS	PASS	FAIL	PASS	PASS	PASS
VOLUME (CY):	21,519	24,357	61,083	59,207	65,879	43,158	35,669	21,962	14,853	43,694	24,357
HIGHEST RANKING (based on testing):	L	L	H	L	L	L	L	H	L	L	L

APPENDIX D – DY08/DY09 DIOXIN DATA

PROJECT	DMMU ID	VOLUME	TEQ	DETERMINATION
Port of Anacortes Cap Sante Marina	C1	3,000	34.3	FAIL
	C2	15,200	3.51	FAIL[D]
	C8	14,500	52.6	FAIL
	C9	8,200	44.4	FAIL
USACE Port Townsend	DMMU 1	400	4.71	FAIL[D]
	DMMU 2	850	1.36	PASS
Delta Marine Industries - Duwamish	DMMU 3	2,629	3.53	PASS
	DMMU 4	3,905	0.82	PASS
	DMMU 3-Z	NA	0.45	PASS[AD]
Port of Seattle T18	DMMU1	6,800	21.7	FAIL[1]
Port of Seattle T115	C1	2,035	20.1	FAIL
	C2	1,715	24.1	FAIL
	C1-ZA1 (Z+1)	NA	12.9	PASS[AD]
	C1-ZA2 (Z+1)	NA	14.5	PASS[AD]
	C1-ZB2 (Z+2)	NA	39.3	FAIL[AD]
	C2-ZA1 (Z+1)	NA	32.9	FAIL[AD]
	C2-ZB1 (Z+2)	NA	28.2	FAIL[AD]
	C2-ZC1 (Z+3)	NA	23.5	FAIL[AD]
	C2-ZA2 (Z+1)	NA	24.6	FAIL[AD]
	C2-ZB2 (Z+2)	NA	29.4	FAIL[AD]
	C2-ZC2 (Z+3)	NA	23.0	FAIL[AD]
Port of Tacoma - Washington United Terminals	WUT5 high spot	5,600	0.63	PASS
	WUT4 (maintenance dredge)	28,400	2.64	PASS
	WUT 03 (native)	24,700	0.86	PASS
	WUT 02 (cutback)	24,700	1.62	PASS
	WUT 1 (cutback)	12,300	2.96	PASS
Puyallup Tribal Terminal - Blair Waterway	H1, fill (DMMUs 1,2,3,4)	61,083	8.2	FAIL
	H2, native	59,207	1.9	PASS
	H3, native	65,879	1.23	PASS
	H4, native	43,158	0.4	PASS
	H5, native	42,330	2.55	PASS
	H6, native (DMMUs 17B,17C,20)	36,815	7.22	FAIL
	H7, native	43,694	0.45	PASS
	H8, native	24,357	0.156	PASS
Port of Seattle T5	T5-S1	2,700	12.05	FAIL[VWA]
	T5-S2	2,400	6.31	PASS
	T5-S3	1,800	4.33	FAIL[OT]
Port of Tacoma Blair-Hylebos Redevelopment	C1	38,828	7.33	FAIL
	C2	95,458	1.04	PASS
	C3	67,335	0.33	PASS
	C4	115,396	0.32	PASS
	S4	NA	0.41	PASS

PROJECT	DMMU ID	VOLUME	TEQ	DETERMINATION
MJB Properties - Anacortes	SD-BCC-1	8,791	14	FAIL
	SD-BCC-2	8,309	9.87	FAIL[VWA]
	SDBR-BRC-1	2,000	4.7	PASS
Weyerhaeuser, Bay Center	C1	20,000	4.23	PASS
USACE Grays Harbor Inner Harbor - DY08	CX1	56,201	2.88	PASS
	CX2	60,047	2.82	PASS
	CX3	57,718	3.71	PASS
	CX4	26,807	5.72	PASS
	NC5	58,073	6.64	PASS
	HQ6	58,021	11.21	PASS
	CP7	58,097	11.95	PASS
	CP8	58,310	11.23	PASS
	CP9	56,922	12.30	PASS
USACE Grays Harbor Inner Harbor - DY09	CP1	181,799	1.00	PASS
	CP2	168,480	0.97	PASS
	CP3	177,591	1.45	PASS
	CP4	184,506	0.83	PASS
	AB5	115,427	2.80	PASS
	AB6	119,428	1.25	PASS
	AB7	122,769	0.38	PASS
	SA8	63,833	0.31	PASS
	SA9	68,895	1.56	PASS
Port of Grays Harbor Terminal's 1, 2, 4	T1-DMMU 1	30,000	8.73	PASS
	T2-DMMU 2A	30,000	3.39	PASS
	T2-DMMU 2B	30,000	3.66	PASS
	T4-DMMU 3	24,000	7.7	PASS
Port of Grays Harbor Terminal 1	DMMU 1	33,000	1.09	PASS
	DMMU 2	33,000	1.12	PASS
Port of Grays Harbor Terminal 3	DMMU 4	40,000	7.05	PASS
Georgia-Pacific Camas Slough	DMMU 1	20,000	0.3	PASS
	DMMU 2	79,000	1.8	PASS
	DMMU 3	5,000	4.7	FAIL[AD]
	DMMU 4	21,000	1.1	PASS
	Z-Sample B2b (DMMU 2)	NA	0.4	PASS
	Z-Sample B5b (DMMU 1)	NA	0.7	PASS
	Z-Sample B8b (DMMU 3)	NA	12.4	FAIL[AD]
	Z-Sample B10b (DMMU 4)	NA	1.4	PASS
Weyerhaeuser, Longview	DMMU 8	33,333	0.12	PASS
	DMMU 8-Z (0-1 ft)	NA	0.06	PASS
	DMMU 8-Z (1-2 ft)	NA	0.07	PASS

Notes:

- Volumes are in cubic yards
- TEQ = toxic equivalents in parts per trillion dry-weight
- DMMU = dredged material management unit
- NA = not applicable
- FAIL[D] = failed dispersive guidelines
- FAIL[AD] = failed antidegradation guidelines
- FAIL[OT] = failed other testing
- FAIL[VWA] = failed volume-weighted averaging
- FAIL[1] = antidegradation evaluation will occur post-dredging
- PASS[AD] = passed antidegradation guidelines