DREDGED MATERIAL MANAGEMENT PROGRAM

State of Washington

including

Puget Sound
Grays Harbor, Willapa Bay and the Pacific Coast
Columbia River Basin

BIENNIAL REPORT

Dredging Years 2014/2015

PREPARED BY THE DMMP AGENCIES

US Army Corps of Engineers®

WASHINGTON STATE DEPARTMENT OF Natural Resources

EPA United States Environmental Protection Agency

DEPARTMENT OF ECOLOGY State of Washington

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LIST OF ACRONYMS

AD	Antidegradation
AET	Apparent Effects Threshold
AFDW	Ash-Free Dry Weight
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)
ESA	Endangered Species Act
FC	Full Characterization
HPA	Hydraulic Project Approval
HPAH	High-molecular-weight PAH
LPAH	Low-molecular-weight PAH
ML	Maximum Level
MPR	Management Plan Report
MPRSA	Marine Protection, Research and Sanctuaries Act
MTCA	Model Toxics Control Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
O&M	Operations and Maintenance
PAH	Polycyclic Aromatic Hydrocarbon
PC	Partial Characterization
PCBs	Polychlorinated Biphenyls
PPB	Parts per Billion
PPM	Parts per Million
PPTR	Parts per Trillion
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
SEF	Sediment Evaluation Framework
SMARM	Sediment Management Annual Review Meeting
SMS	Sediment Management Standards
SL	Screening Level
SQS	Sediment Quality Standard

TBT	Tributyltin
TOC	Total Organic Carbon
USACE	US Army Corps of Engineers
USFWS	US Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife

CHAPTER 1. INTRODUCTION & PROJECT OVERVIEW

1.1 Introduction

The Dredged Material Management Program (DMMP) 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 (USACE), Seattle District; U.S. Environmental Protection Agency, Region 10; Washington Department of Ecology; and Washington Department of Natural Resources. The DMMP agencies apply 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.

In 2002, the Regional Sediment Evaluation Team (RSET) was initiated to establish dredged material evaluation guidelines that would be applicable throughout the states of Washington, Oregon and Idaho. One goal of RSET was the consolidation of the existing regional guidance manuals into one "umbrella" document, allowing consistent evaluation of dredging projects across the region. This document, called the Northwest Regional Sediment Evaluation Framework (SEF), was last published in May 2009. It is currently out for public review following an extensive revision by the RSET agencies.

Integration of guidance from RSET (the larger regional program) and DMMP (the Washington-specific program) is an ongoing process. Projects in Washington State (with the exception of port projects on the north side of the Columbia River) use the DMMP User Manual for sampling and analysis plan preparation and data review. Elements from SEF, such as elutriate testing, are used for projects in Washington State on a case-by-case basis to augment the guidance found in the DMMP User Manual.

This report summarizes DMMP activities for Dredging Years (DY) 2014 and 2015. As defined by the DMMP agencies, DY14 covers the period from June 16, 2013 to June 15, 2014. DY15 covers the period from June 16, 2014 to June 15, 2015.

1.2 Project Overview

During DY14/15 there were 42 projects for which the DMMP agencies completed some kind of action or determination. Some of these projects, such as the terminals at the Port of Grays Harbor, had two or more actions/determinations. The DY14/15 projects are summarized in Tables 1-1 and 1-2. Many projects included full characterizations (FC), intended to assess the suitability of the proposed dredged material for open-water disposal and to evaluate the quality of the sediment to be exposed by dredging. 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, recency extensions, Tier 1 evaluations, and stand-alone anti-degradation evaluations.

As listed in Tables 1-1 and 1-2, 25 projects had DMMP suitability determinations or other actions completed by June 15, 2014 and are considered DY14 projects. Another 19 projects had DMMP suitability determinations or other actions completed by June 15, 2015 and are considered DY15 projects. Terminal 5 at the Port of Seattle and one or more of the terminals at the Port of Grays Harbor required DMMP

actions/determinations both years. Puget Sound project locations for DY14 and DY15 are plotted in Figures 1-1 and 1-2, respectively. Projects in Grays Harbor and Willapa Bay for both years are shown in Figure 1-3. Projects within the Columbia River basin for the biennium are shown in Figure 1-4.

Another 17 projects began the DMMP evaluation process in DY14/15 or before, but suitability determinations for these projects were not completed before the end of DY15. 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 anti-degradation evaluations is also presented.

Chapter 3 presents an overall assessment of sampling and testing activities, including an evaluation of regulatory processing time.

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 presents dredged material disposal information and reviews disposal-site monitoring activities during DY14/15. The status of coordination under the Endangered Species Act is also discussed.

Appendices A and B include the chemical and biological evaluation guidelines used during DY14/15.

Appendix C tabulates exceedances of those guidelines.

Table 1-1. DMMP Evaluation Activities Completed in DY14.

PROJECT	DMMP Action	Disposal Area/Type	Project Volume (cy)
Bridgehaven Marina, Hood Canal	T1	BU	1,750
Cape George Marina, Discovery Bay	T1	BU	5,000
City of Stevenson Wastewater Plant Outfall, Columbia R.	T1	CR	1,100
Coast Seafoods, South Bend	T1	UP	8,000
Duwamish Yacht Club	SD	PSDDA	20,250
Kittitas County Boat Ramp Recreational Improvement Project, Columbia River	SD	BU	12,280
Longview Fibre Paper and Packaging (KapStone Kraft Paper Corporation), Columbia River	SD	CR	316,348
MJB Travelift, Anacortes	SD	PSDDA	1,350
Olympia Yacht Club	RE	PSDDA/UP	16,241
Port of Anacortes, Pier 2	RE	PSDDA/UP	8,700
Port of Grays Harbor Terminals 2, 3 and 4	RE	GH	129,000
Port of Olympia Berths 1, 2, 3 and Swantown Boatworks	AD	PSDDA	39,000
Port of Seattle Terminal 5	SD	PSDDA	7,490
Puyallup Tribal Terminal/SSA Containers, Tacoma	RE	PSDDA	83,045
Seattle Public Utilities, Chester Morse Lake Pump Plant	SD	OI	4,200
Silver King Boat Basin Channel and Boat Ramp, Strait of Juan de Fuca	SD	PSDDA	7,300
Tahuya Basin Homeowners Assoc., Hood Canal	T1	UP	1,166
USACE Duwamish, Spokane Street Bridge	SD	PSDDA	2,237
USACE Grays Harbor Realignment	DR	GH	not applicable
USACE Hylebos Waterway	SD	none	47,437
USACE Olympia Harbor	T1	none	220,000
USACE Lower Snake/Clearwater Navigation Channel; Ports of Clarkston and Lewiston (for Walla Walla District)	SD	SR/BU	489,212
WDFW Bridgeport Boat Launch, Douglas County	T1	UP	600
Weyerhaeuser Longview Chip Barge Slip & Mt. Coffin Access Channel	RE	CR	110,000
WSDOT Mukilteo Multimodal Terminal	SD	PSDDA	18,200

DMMP Actions
AD = Anti-degradation Determination
DR = Design Revision
RE = Recency Extension
SD = Suitability Determination
T1 = Tier 1 Evaluation

Disposal Area/Type
BU = Beneficial Use
CR = Columbia River
GH = Grays Harbor
PSDDA = Puget Sound Dredged Disposal Analysis Site
UP = Upland
SR = Snake River (In-Water)
OI = Other In-Water Disposal Site

Table 1-2. DMMP Evaluation Activities Completed in DY15

PROJECT	DMMP Action	Disposal Area/Type	Project Volume (cy)
City of Renton, Lower Cedar River Flood Damage Reduction Dredging	SD	PSDDA	120,000
City of Tukwila Duwamish Gardens Habitat Restoration	T1	UP	26,256
Emerald Kalama Chemical, Water Intake and Outfall Line Maintenance Dredging, Columbia River	T1	UP	100
HME Construction Sand Mining Operation, Columbia River	T1	CR	100,000
La Conner Marina, Swinomish Channel	SD	PSDDA	136,500
Naval Air Station Whidbey Island Fuel Pier	RE	PSDDA	35,000
Naval Air Station Whidbey Island Fuel Pier	DR	PSDDA	+3,500
Northwest Grain Growers – Wallula Grain Elevator, Columbia	AD	UP	6,250
Port of Grays Harbor Terminal 2	RE	GH	41,000
Port of Grays Harbor Terminals 1, 2, 3 & 4	SD	GH	159,000
Port of Seattle Terminal 5 Berth Deepening	SD	PSDDA	51,000
Port of Tacoma Pier 4 Cleanup and Reconfiguration, Phase 1	SD	PSDDA	11,300
Scoular Company, Burbank Grain Facility, Snake River	SD	CR	9,700
Shelter Bay Marina, Swinomish Channel	SD	PSDDA	37,400
USACE Hiram Chittenden Locks Shell Hash Removal	T1	BU	50
USACE Kenmore	SD	none	30,000
USACE Tokeland Marina	RE	WB	~18,750
USACE Westhaven Cove	SD	GH	47,120
USACE Willapa Bay – Tokeland Marina and Entrance Channel; Bay Center Entrance Channel; Nahcotta Mooring Basin	SD	WB	351,380
USCG Cape Disappointment Emergency Shoal Removal	T1	UP	125
Wahkiakum County Ferry Terminal, Columbia River	T1	CR	2,750

DMMP Actions
AD = Anti-degradation Determination
DR = Design Revision
RE = Recency Extension
SD = Suitability Determination
T1 = Tier 1 Evaluation

Disposal Area/Type
BU = Beneficial Use
CR = Columbia River
GH = Grays Harbor
PSDDA = Puget Sound Dredged Disposal Analysis Site
UP = Upland
WB = Willapa Bay

Table 1-3. DMMP Evaluation Activities Initiated but not completed in DY14/15

PROJECT	Project Volume (cy)	SAP Review DY	Status at the end of DY15
Bellingham Cold Storage	13,000	16	Pre-SAP coordination
Dunlap Towing	4,814	12/15	Draft report/ waiting additional characterization
Emerald Kalama Chemical Dredging	1,600	16	Pre-SAP approval
Entiat Marina	24,400	16	Awaiting final SAP
Georgia-Pacific Gypsum	25,450	15	Draft report
Longview Regional Water Treatment Plant	5,000	15	SAP approved
Northwest Alloys	12,900	16	Pre-SAP coordination
Port Gamble Bay Clean-Up	22,000	14/15	Sampling completed; no further action under DMMP (MTCA oversight)
Port of Everett Former Weyerhaeuser Mill	40,000	15	Draft report
Port of Grays Harbor Westport Marina	245,000	15	Draft report/ awaiting additional
Port of Seattle Terminal 18	6,000	15	SAP approved
Port of Tacoma Pier 4, Phase 2	500,000	13	Waiting for Phase 1 completion to issue SD
Port Townsend Paper Company	7,250	15	SAP approved; on hold for further evaluation
Salmon Bay Marina Supplemental Physical Survey	11,888	NA	Draft report
Targa Sound Resources	7,500	15	SAP approved
USACE/Port of Seattle – Seattle Harbor Navigation Improvement Project	TBD	15	Awaiting final data report

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
JARPA = Joint Aquatic Resource Permit Application
MTCA = Model Toxic Cleanup Act
NA = Not Applicable
SAP = Sampling and Analysis Plan
SD = Suitability Determination

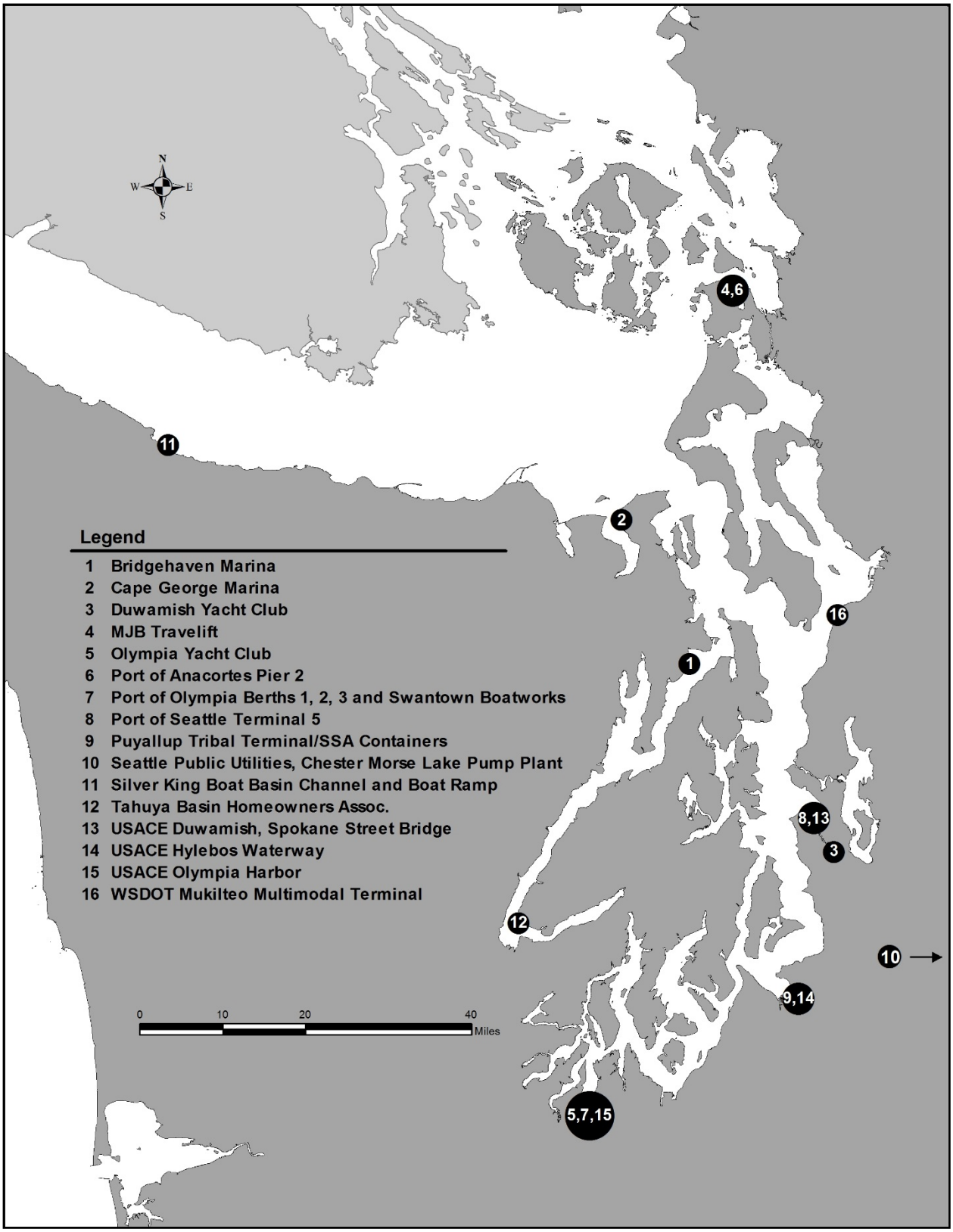

Figure 1-1. DY14 Puget Sound Project Locations

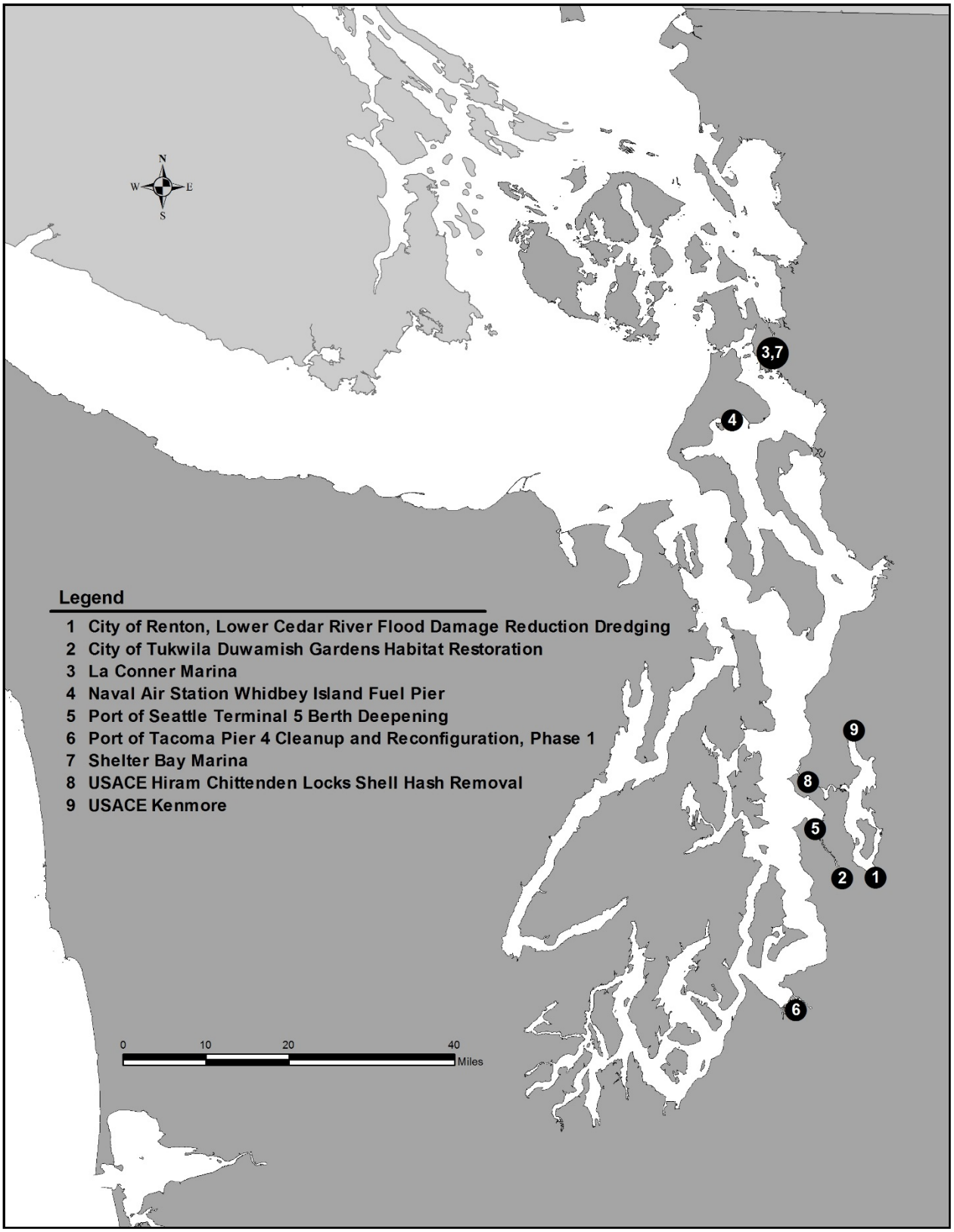

Figure 1-2. DY15 Puget Sound Project Locations

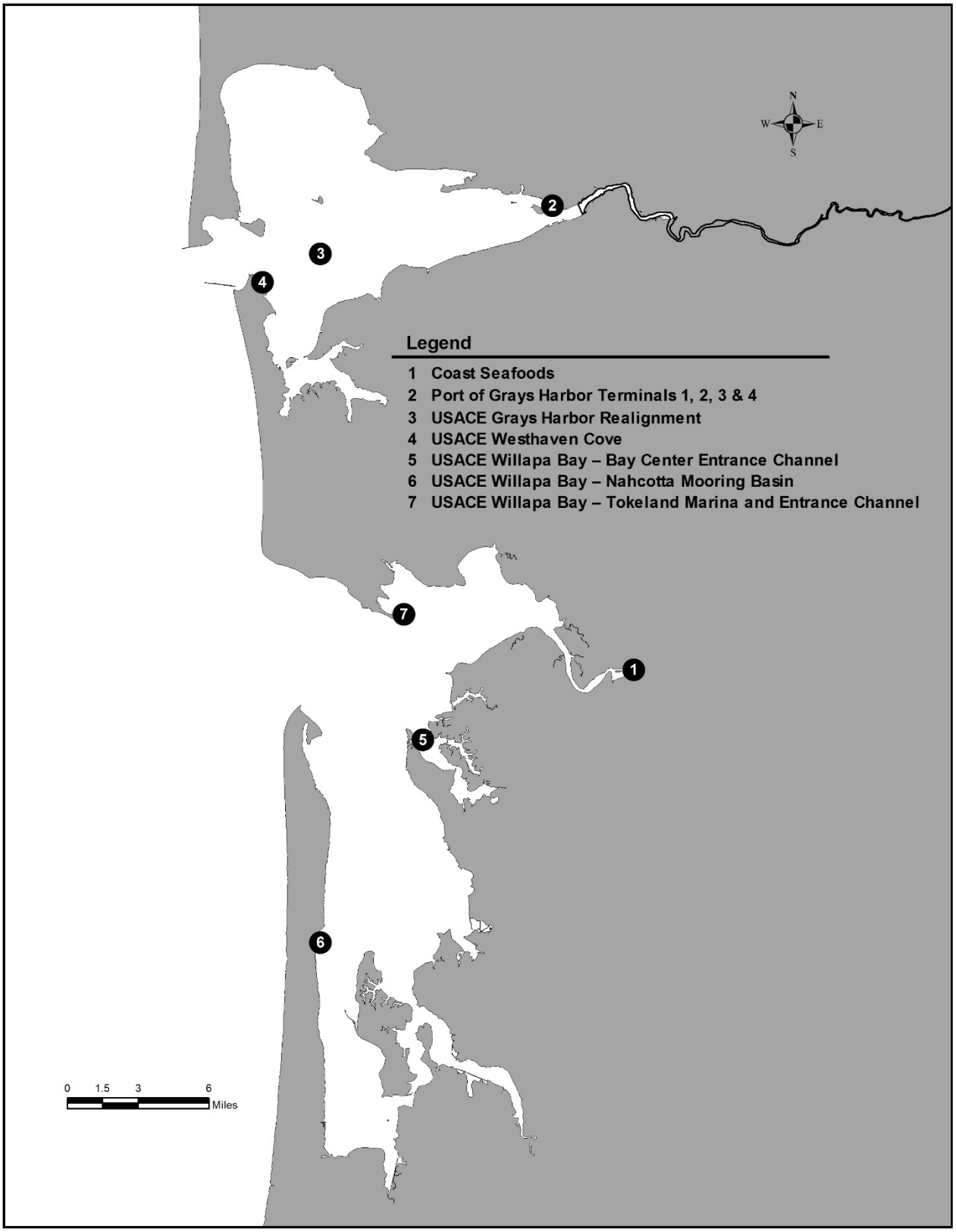

Figure 1-3. DY14/15 Coastal Project Locations

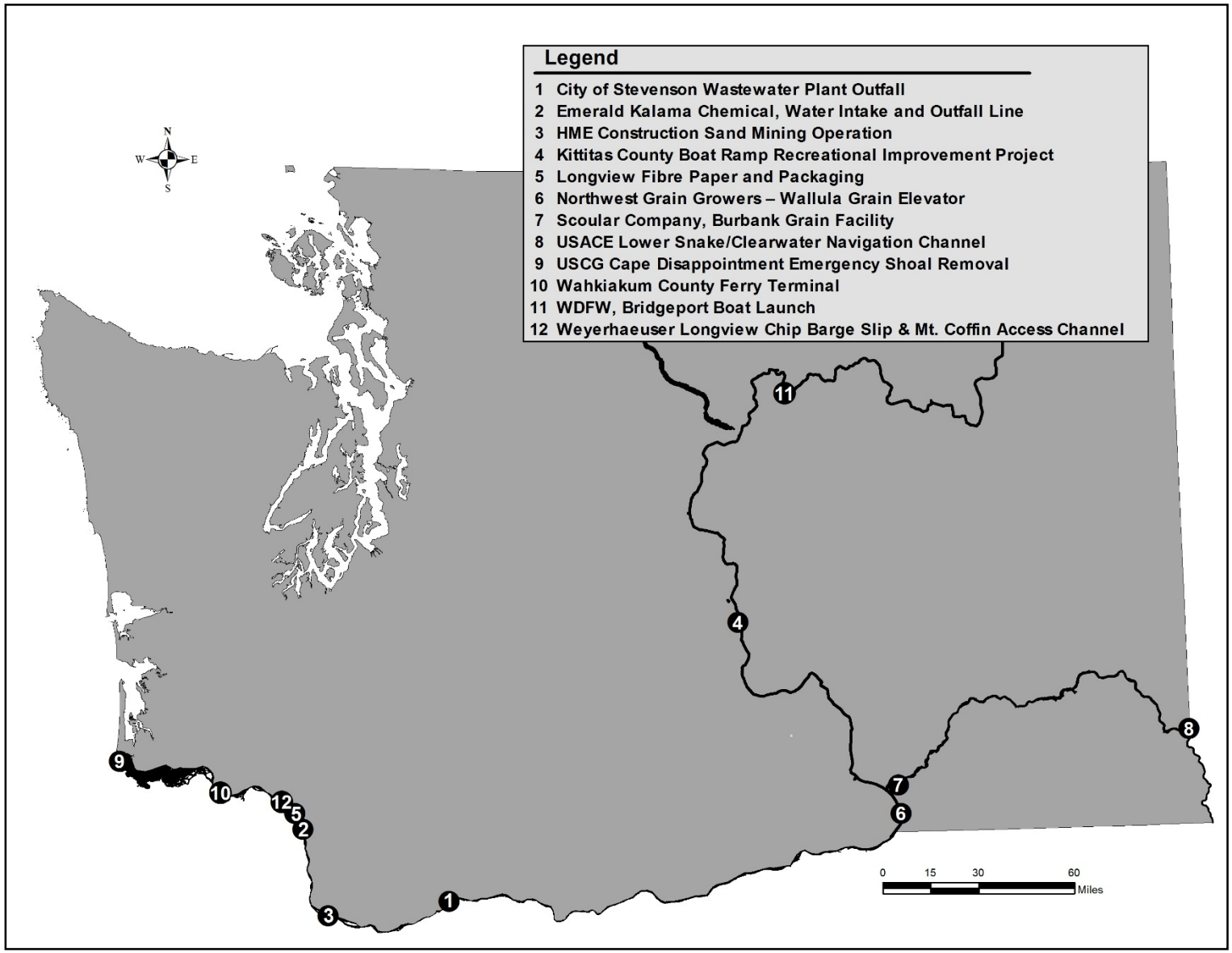

Figure 1-4. DY14/15 Columbia River Project Locations

CHAPTER 2. DY14/15 PROJECTS

This chapter presents project-specific information related to the evaluation of DY14/15 projects. Sections 2.1 through 2.8 pertain only to those projects that underwent sediment testing – including full characterizations and anti-degradation evaluations. Sections 2.9 through 2.11 address those projects for which Tier 1 determinations, recency extensions, or project revisions were completed.

2.1 Ranking

Project ranking is based on the likelihood of sediments in a project area having concentrations of chemicals of concern with the potential to cause adverse biological effects. 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, Columbia River, Grays Harbor and Willapa Bay can be found in the 2015 DMMP User Manual (DMMP, 2015a).

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 during DY14/15.

Projects that underwent DMMP sediment sampling and testing in DY14/15 and had an adjustment to their initial rank are shown in Table 2-1. The final rank reflects the adjustments made by the DMMP agencies prior to sediment characterization. Each project that was re-ranked is discussed briefly below.

Port of Tacoma, Pier 4 Reconfiguration. Initial characterization for this project was conducted under a moderate rank based on results from previous rounds of testing and its location within Blair Waterway in Commencement Bay. Results from the initial round of testing found elevated levels of porewater tributyltin (TBT) in surface grabs from one composited in-water DMMU. Individual sample archives were subsequently analyzed for bulk TBT and the results indicated that high levels of bulk TBT were present. Two additional characterizations to determine the horizontal and vertical extent of elevated TBT were conducted under the DMMP program. Very high concentrations of bulk TBT were found, up to 50,000 μg/kg, which resulted in the project being divided into two phases, with Phase One proceeding as a Time Critical Removal Action under USEPA's CERCLA process. Due to the level of TBT contamination found, and consistent with DMMP policy, the rank for this project area is now high.

USACE/Ports Snake/Clearwater O&M. Because this was the first time this project had undergone DMMP characterization, a Tier 1 analysis was used to determine the project rank. Physical descriptions (e.g. shoaling areas) and existing sediment data were used to delineate five discrete areas that could be considered separately for characterization. These five areas were:

1. Ice Harbor Lock (no further testing required, based on Tier 1 evaluation)
2. Clarkston West (including both the Federal Navigation Channel and the Port of Clarkston Grain Elevator)
3. Clarkston East (including the Federal Navigation Channel)
4. Port of Clarkston (Recreation Dock and Cruise Dock)

5. Clearwater River (including the Federal Navigation Channel) and the Port of Lewiston

Clarkston West, Clarkston East and the Clearwater/Lewiston reaches were all considered homogenous and ranked as low concern. Area 4 (Port of Clarkston) showed the greatest amount of core variability and fines content. It was given a low-moderate rank.

Port of Grays Harbor, Terminals 2, 3 & 4. DMMP guidelines allow consideration of project down-ranking after two testing cycles (DMMP, 2015a; PSDDA, 1988). Terminals 2 and 4 were characterized in November 2007 and had no screening level (SL) exceedances. Terminal 3 was characterized in August 2008. It too had no SL exceedances. Terminals 2, 3 and 4 were all characterized a second time in December 2014; again, there were no SL exceedances at any of the terminals. Based on the results of two cycles of testing, Terminals 2, 3 and 4 were down-ranked to low. Terminal 1 had previously been down-ranked to low.

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 rank. The minimum number of field samples and dredged material management units for full characterization are calculated as shown in Table 2-2.

The applicant presents 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 2-3 and 2-4 contain data for sampling plans approved for DY14/15 projects. Descriptions of projects for which best professional judgment was applied are provided in Chapter 4.

2.3 Sampling

Tables 2-5 and 2-6 contain data related to sampling efforts during DY14/15. Three general requirements exist with respect to core sampling: 1) samples must be taken to the depth of dredging (including overdepth) plus the Z-layer; 2) core recovery must be at least 75%; and 3) positioning must be accurate to within 3 meters. In areas with high shoaling rates and homogeneous material, or that meet Marine Protection, Research, and Sanctuaries Act (MPRSA) (40 CFR 227.13) or Clean Water Act (40 CFR 230.60) exclusionary criteria, core samples are unnecessary. In those cases sampling of the surface sediment with a grab sampler is generally allowed.

For projects utilizing coring devices, the maximum sample depth in Tables 2-5 and 2-6 corresponds to the maximum thickness of the dredge 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 two feet of sediment beyond the dredging prism (i.e. the Z-sample). This additional depth is not reflected in these tables.

2.4 Chemical Testing

Chemical testing was conducted for ten full characterizations in DY14 and ten in DY15. In addition, chemical testing was completed for two standalone antidegradation evaluations (NW Grain Growers and the Port of Olympia Berths/Swantown Boatworks). A complete listing of DMMP chemical guideline exceedances for DY14/15 is included in Appendix C. Appendix C also includes all dioxin testing results, regardless of whether or not the results exceeded DMMP guideline values.

2.5 Biological Testing

Three projects required bioassay testing (Table 2-7) during DY14/15. Tiered testing was employed for the Kittitas County Boat Ramp and USACE/Ports/ Snake/Clearwater River investigations. In tiered testing, bioassays are conducted only on those DMMUs having one or more exceedance of DMMP screening levels. No DMMUs failed the DMMP bioassay interpretive guidelines.

For the USACE Kenmore project, bioassays were conducted concurrently with chemical testing only for anti-degradation evaluation. All Z-sample bioassays passed the DMMP interpretive guidelines.

2.6 Bioaccumulation Testing

There were no projects with bioaccumulation testing in DY14/15.

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 data; and documents the interpretation of testing results. The suitability determination is a technical memorandum, drafted by the Corps' DMMO and then reviewed 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 2-8 and 2-9 contain information taken from the suitability determination for each of the projects that completed its DMMP review during DY14 and DY15, respectively. For the projects receiving suitability determinations in DY14 and DY15, six projects included material that was found unsuitable for unconfined open-water disposal. Dredged material in five of the six projects was found unsuitable due to chemical exceedances; the sixth project (Port of Tacoma Pier 4 Phase I) included 2,300 cubic yards of rip-rap not appropriate for open-water disposal. Of the 1,872,320 cubic yards covered by 20 suitability determinations, a total of 100,927 cubic yards (5.4%) were found unsuitable for open-water disposal at a DMMP disposal site.

2.8 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. All DMMP suitability determinations include a section in which antidegradation is evaluated, but not all projects require special testing to support that evaluation. Projects that received DMMP suitability determinations for open-water disposal but did not require additional testing to address antidegradation are not included in this section of the biennial report. The projects included in this section met one of the following criteria: a) upland disposal was planned, so the project did not have a DMMP suitability determination; the only DMMP action was to conduct an

antidegradation evaluation; b) additional testing was conducted to support the antidegradation evaluation, including analysis of surface sediment or Z-samples prior to dredging, or analysis of post-dredge samples.

A 'Z-sample' is a sample collected from the sediment layer just below the dredging overdepth and is typically collected during sampling of heterogeneous sediments. The Z-layer is defined as the two-foot interval beyond the overdepth. The Z-samples are typically archived. Depending on the results from characterization of the overlying dredged material prism, it is sometimes necessary to analyze the Z-samples to determine whether dredging the project will result in degradation of the surface sediment condition.

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 after dredging may be necessary.

In DY14/15, the DMMP agencies required analysis of Z-samples or post-dredge sampling and testing for six projects, the details of which are included in Table 2-10.

2.9 Tier 1 Determinations

All projects begin with a Tier 1 evaluation, which includes an analysis of existing information on the proposed dredging project, including the site history and all previously collected sediment data. Using the information collected in a Tier 1 evaluation, 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 exclusionary criteria. The DMMP agencies apply the exclusionary criteria on a case-by-case basis.

A total of 11 projects received no-test determinations in DY14/15 following Tier 1 review, with dredged material from these projects being found suitable for open-water disposal (Table 2-11). For a 12th project, USACE Olympia Harbor, existing data were evaluated to determine whether any of the shoaled sediment might pass testing for open-water disposal. Based on the Tier 1 review, Seattle District determined that this was unlikely and decided not to expend resources on further testing.

2.10 Recency Determinations and Extensions

Recency guidelines apply to material that has been sampled and tested for open-water disposal but not yet dredged, and to projects that may be dredged two or more times within the recency period. Key considerations in determining whether the existing data are still representative are 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 3 years. The DMMP guidelines specify a recency period of 5, 6 or 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 project, the agencies review previous characterization data, any new data from the dredge site or vicinity, site use, and sources of contamination. Based on this review, the agencies may confirm the applicability of the existing SDM (a recency determination) for a project that requires additional maintenance dredging within the current recency period, or extend the recency period (a recency extension) - typically for one to two years – for a project that has not yet dredged or will require additional dredging beyond the expiration of the current recency period. Recency extensions may be allowed with no additional testing, or may require some level of confirmatory testing.

Table 2-12 presents information for the eight recency extensions that were provided in DY14/15.

2.11 Project Revisions

Dredging projects are dynamic by nature and shoaling continues to occur between the time of sediment characterization and the time of dredging. There may also be design changes that alter the dredging volume or footprint. When the project volume or footprint changes subsequent to full characterization, a dredging applicant may request a revision of the volume/footprint found in the suitability determination. The DMMP agencies review such requests on a case-by-case basis. Table 2-13 includes the pertinent information for the three project revisions approved by the DMMP agencies during DY14/15.

Table 2-1. DY14/DY15 Project Rank Changes

PROJECT	DY	Location	Waterbody	Initial Rank	Final Rank
Port of Grays Harbor, Terminals 2, 3 & 4	15	Hoquiam, WA	Grays Harbor	LM	L
Port of Tacoma, Pier 4 Reconfiguration	14	Tacoma, WA	Blair Waterway	M	Cleanup/H/M
USACE/Ports Snake/Clearwater O&M	14	Clarkston, WA and Lewiston, ID	Snake and Clearwater Rivers	none	L/LM

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

Table 2-2. DMMP Sampling Requirements

Project Rank	Maximum Volume Represented by a Field Sample (CY)	Heterogeneous Sediment		Homogeneous Sediment DMMUs (CY)
		Surface[1] DMMUs (CY)	Subsurface[2] 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.
[2]"Subsurface" is defined as that portion of the dredge prism beneath the 4-ft surface layer.

Table 2-3. DY14 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 Subsurface Samples	Number of Subsurface DMMUs
Duwamish Yacht Club	H	20,250	15,150	10	4	5,100	5	2
Kittitas County Boat Ramp	M	12,280	8,340	3	1	3,940	0	1
Longview Fibre	LM	316,348	204,967	25	7	111,381	15	3
MJB Travelift	H	1,350	1,350	2	1	0	0	0
Port of Seattle Terminal 5	H	7,490	7,490	9	4	0	0	0
Port of Tacoma Pier 4	H	200,200	63,800	14	5	136,400	22	8
Silver King	LM	7,300	5,300	2	1	2,000	2	1
SPU Chester Morse Lake	LM	4,200	4,200	3	1	0	0	0
USACE Duwamish, Spokane Street Bridge	H	2,237	2,237	1	1	0	0	0
USACE Hylebos	H	47,437	47,437	59	15	0	0	0
USACE/Ports Snake/Clearwater River	L/LM	489,212	489,212	68	15	0	0	0
WSDOT Mukilteo Multimodal	M/H	18,200	7,800	3	1	10,400	6	2

Table 2-4. DY15 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 Subsurface Samples	Number of Subsurface DMMUs
Burbank Grain Facility	LM	9,700	9,700	3	1	0	0	0
City of Renton Cedar River	M	120,000	120,000	30	6	0	0	0
La Conner Marina	L	136,500	136,500	19	4	0	0	0
Port of Grays Harbor, Terminals 1, 2, 3, & 4	L, LM	159,000	159,000	21	6	0	0	0
Port of Seattle, T5 Berth Deepening	H	51,000	9,945	16	8	41,055	38	19
Shelter Bay Marina	M	37,400	37,400	10	4	0	0	0
USACE Kenmore	H	30	30	16	8	0	0	0
USACE Westhaven Cove	M	47,120	47,120	14	4	0	0	0
USACE Willapa	L to M	351,380	248,080	56	14	103,300	13	3

Table 2-5. DY14 Project Sampling

PROJECT	Grain Size Percentages				Sampling Equipment	Maximum Sample Depth (ft)	Mean Sample Depth (ft)
	Gravel	Sand	Silt	Clay			
	> 2 mm	.063 – 2 mm	.004 – .063 mm	< .004 mm			
Duwamish Yacht Club	0	49-72	9-34	12-26	Vibracore	4.6	3
Kittitas Co. Boat Ramp	16	39	39	7	Vibracore	3.0	1.4
Longview Fibre	0	4-85	7-83	1-10	Vibracore	14	7.6
MJB Travelift	35	26	23	16	Vibracore	1.9	1.7
Port of Seattle Terminal 5	1	74-83	11-17	5-8	Vibracore	3.7	2.1
Port of Tacoma Pier 4	0-87	11-93	1-40	0-9	Roto-Sonic and Direct Push Boring	20	11.2
Silver King	0	35-68	22-49	10-16	PVC Corer	8.0	7.5
SPU Chester Morse Lake	1	83	13	3	Ekman Grab	0.3	0.2
USACE Duwamish Spokane Street Bridge	37-42	57-60	0	0	Vibracore	6.9	6.4
USACE Hylebos	0-23	8-57	15-70	14-46	Vibracore	6.5	2.9
USACE/Ports Snake/Clearwater River	0	45-99	1-41	1-15	VanVeen Grab and Vibracore	Grabs: 0.3	Grabs: 0.3
						Cores: 6.5	Cores: 5.0
WSDOT Mukilteo Multimodal	16-43	54-62	<3-12	<3-10	Diver-operated Vibracore	9.9	8.2

Table 2-6. DY15 Project Sampling

PROJECT	Grain Size Percentages				Sampling Equipment	Maximum Sample Depth (ft)	Mean Sample Depth (ft)
	Gravel	Sand	Silt	Clay			
	> 2 mm	.063 – 2 mm	.004 – .063 mm	< .004 mm			
Burbank Grain Facility	0	41	47	11	Vibracore	4.6	3.5
City of Renton Cedar River	48-81	19-52	0-2	0	Power Grab/ Hand Tools	1.7	1.1
La Conner Marina	0	4-9	64-67	27-30	Vibracore	6.7	4.4
Port of Grays Harbor, Terminals 1, 2, 3, & 4	0-1	8-46	38-70	16-27	Power Grab	1.5	1.5
Port of Seattle, T5 Berth Deepening	0-1	15-80	14-83	0-19	Vibracore	14	14
Shelter Bay Marina	0-1	4-44	34-69	21-37	Vibracore	5.5	1.5
USACE Kenmore	0-10	26-43	43-58	11-16	Vibracore	5.1	1.4
USACE Westhaven Cove	0-4	27-64	31-56	5-16	Vibracore	5.6	3.5
USACE Willapa	0-3	6-84	9-58	7-35	Vibracore	9.5	2.6

Table 2-7. DY14/15 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 Mortality	Sediment Larval Development	Midge 20-day Mortality & Growth	*Neanthes* 20-day Mortality & Growth		
Kittitas Co. Boat Ramp	1	0	0	*Ha*	--	*Cd*	--	Commercial Silica Sand	Quilomene Bay
USACE Kenmore[1]	8	0	0	*Ha*	--	*Cd*	--	Beaver Creek, OR	none
USACE/Ports Snake/Clearwater River	6	0	0	*Ha*	--	*Cd*	--	Beaver Creek, OR	Hell's Canyon, Snake River

Ha = Hyalella azteca
Cd = Chironomus dilutus

[1]Bioassays were conducted only for anti-degradation evaluation.

Table 2-8. DY14 Suitability Determinations

PROJECT	Rank	Total Volume (cy)	DMMUs, Chemical Analyses	DMMUs, Bioassay Analyses	DMMUs, Bioaccumulation Analyses	DMMUs Failing	Volume Failing (cy)	DMMUs Passing	Volume Passing (cy)	Proposed Disposal Site/Type
Duwamish Yacht Club	H	20,250	6	0	0	4	12,350	2	7,900	EB/UP
Kittitas Co. Boat Ramp	M	12,280	1	1	0	0	0	2	12,280	BU
Longview Fibre	LM	316,264	10	0	0	0	0	10	316,264	CR/FL
MJB Travelift	H	1,350	1	0	0	1	1,350	0	0	UP
Mukilteo Multimodal	H/M	18,200	3	0	0	0	0	2.67*	18,200	PG
Port of Seattle T5	H	7,490	2	0	0	4	7,490	0	0	UP
Silver King	LM	7,300	2	0	0	0	0	2	7,300	BU
SPU, Chester Morse Lake	LM	4,200	1	0	0	0	0	1	4,200	BU
USACE Duwamish, Spokane St. Bridge	H	2,237	1	0	0	0	0	1	2,237	EB
USACE Hylebos	H	47,437	15	0	0	15	47,437	0	0	none
USACE/Ports Snake/Clearwater River	NT/L/LM	489,212	15	6	0	0	0	15	489,212	SR/BU
Totals:	---	926,220	57	7	0	24	68,627	35.67	857,593	---

*1/3 of DMMU 3 must be re-characterized; no data collected

Disposal Sites
CR = Columbia River (D)
EB = Elliott Bay (ND)
PG = Port Gardner (ND)
SR = Snake River (D)

Disposal Type
BU = Beneficial Use (includes both aquatic and upland)
D = Dispersive
FL = Flow Lane
ND = Non-Dispersive
UP = Upland Disposal

Table 2-9. DY15 Suitability Determinations

PROJECT	Rank	Total Volume (cy)	DMMUs, Chemical Analyses	DMMUs, Bioassay Analyses	DMMUs, Bioaccumulation Analyses	DMMUs Failing	Volume Failing (cy)	DMMUs Passing	Volume Passing (cy)	Proposed Disposal Site/Type
Burbank Grain Facility	LM	9,700	1	0	0	0	0	1	9,700	UP
City of Renton Cedar River	M	120,000	6	0	0	0	0	6	120,000	EB
La Conner Marina	L	136,500	4	0	0	0	0	4	136,500	PG
Port of Grays Harbor, Terminals 1, 2, 3, & 4	L, LM	159,000	6	0	0	0	0	6	159,000	PC/SJ
Port of Seattle, Terminal 5 Berth Deepening	H	51,000	27	0	0	0	0	27	51,000	EB
Port of Tacoma Pier 4 Phase 1	H	11,300	3	0	0	0	2,300[1]	3	9,000	CB
Shelter Bay Marina	M	37,400	4	0	0	0	0	4	37,400	RS
USACE Kenmore	H	30,000	8	0	0	8	30,000	0	0	EB
USACE Westhaven Cove	M	47,120	4	0	0	0	0	4	47,120	PC/SJ
USACE Willapa	L to M	351,380	17	0	0	0	0	17	351,380	WB
Totals:	---	953,400	80	0	0	8	32,300	64	921,100	---

[1]2,300 cy of rip-rap from the top two feet of the dredge prism is unsuitable for open-water disposal.

Disposal Sites
CB = Commencement Bay (ND)
EB = Elliott Bay (ND)
PC = Point Chehalis (D)
PG = Port Gardner (ND)
RS = Rosario Strait (D)
SJ = South Jetty (D)
WB=Willapa Bay (D)

Disposal Type
D = Dispersive
ND = Non-Dispersive
UP = Upland Disposal

Table 2-10. DY14/15 Anti-degradation Evaluations

PROJECT	DY	Rank	Type	Reason for Z-Sample Analysis, Post-Dredge Evaluation or Surface-Sediment Testing	Did the New Surface Meet SQS or Anti-degradation Policy?
Port of Olympia Berths 1,2,3[1]	14	H	Z-samples	Sediments known to be contaminated with dioxin	No, clean sand cover required
Port of Olympia Swantown Boatworks[1]	14	H	Z-samples	Dioxin contamination in the vicinity	Yes
Port of Seattle, T5	14	H	Z-samples	Previous anti-degradation failure	Partial failure, clean sand cover required over failed portion
USACE Hylebos	14	H	Z-samples	Subsurface sediments known to be contaminated	No, project will not be dredged
NW Grain Growers, Wallula[1]	15	LM	Z-samples	Dioxin in fish in region	Yes
Port of Seattle, T5 Berth Deepening	15	H	Z-samples	Previous Z-sample failures at shallower depths	Yes
USACE Kenmore	15	H	Z-samples	Dredged material failed due to dioxin	Yes

[1]Upland disposal was planned so there was no DMMP suitability determination for open-water disposal. The only DMMP action was to conduct an anti-degradation evaluation.

Table 2-11. DY14/15 Tier 1 No-Test Determinations

PROJECT	DY	Total Volume (cy)	Rank	Reason for No-Test Determination	Proposed Disposal Site
Bridgehaven Marina	14	1,750	L	Small project (<8,000 cy)	adjacent intertidal
Cape George Marina	14	5,000	E	Tested for grain size & TOC: grain-size exclusion; disposal area proximity	local beach nourishment
City of Stevenson Wastewater Plant Outfall	14	1,100	E	Grain-size exclusion (gravel from landslide); disposal area proximity	sidecast
Coast Seafoods South Bend	14	8,000	L	Small project (<8,000 cy)	upland
Tahuya Basin Homeowners Assoc.	14	1,166	L	Small project (<8,000 cy)	adjacent intertidal
USACE Olympia Harbor	14	220,000	H	Existing data showed material unsuitable for open-water disposal	none
WDFW Bridgeport Boat Launch	14	600	LM	Small project (<1,000 cy)	upland
City of Tukwila Duwamish Gardens	15	26,256	---	Contaminated soils to be removed in the dry; sediment to be exposed by dredging tested clean	upland
Emerald Kalama Chemical, Columbia River	15	100	L	Small project (<8,000 cy)	upland
HME Construction Sand Mining Operation	15	100,000	E	Sand to be removed had already been evaluated by Portland District	upland and in-water beneficial use
USACE Hiram Chittenden Locks	15	50	---	Shell hash; no reason to believe contaminated	adjacent intertidal
Wahkiakum County Ferry Terminal	15	2,750	---	Adjacent sediment tested	flow-lane

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

Table 2-12. DY14/15 Recency Extensions

PROJECT	DY	Rank	Sampling Date	Original Recency/ Time Limit	Recency Extension
Olympia Yacht Club	14	H	Dec. 2011	2 years	13 mos. (through Jan. 2014)
Port of Anacortes Pier 2	14	H	Nov. 2012	2 years	18 mos. (through Feb. 2016)
Port of Grays Harbor T2, T3, T4	14	LM	Sept. 2007	6 years	5 mos. (through Feb. 2014)
Puyallup Tribal Terminal/SSA	14	M	Aug. 2008	5 years	4 yrs. (through Aug. 2017)
Weyerhaeuser Longview Chip Barge Slip & Mt. Coffin Access Channel	14	LM	Sept. 2008	6 years	3 mos. (through Dec. 2014)
Port of Grays Harbor T2	15	LM	Sept. 2007	6 years	17 mos. (through Feb. 2015)
US Navy Whidbey Island Fuel Pier	15	M	Aug. 2010	5 years	18 mos. (through Feb. 2015)
USACE Tokeland Marina and Entrance Channel	15	L-LM	Aug. 2006	7 years	18 mos. (through Feb. 2015)

Table 2-13. DY14/15 Project Revisions

PROJECT	DY	Rank	Original Volume (CY)	Revised Volume (CY)	Reason for Volume Revision
SPU, Chester Morse Lake	14	LM	4,200	6,000	Design updates
Port of Grays Harbor T1	14	M	40,000	45,000	New bathymetry
USACE Grays Harbor Channel Realignment	14	L	---	---	Will decrease deepening and maintenance dredging volumes

CHAPTER 3. SUMMARY & ASSESSMENT OF DY14/15 DATA

3.1 Summary of Chemical Testing Results.

Table 3-1 and Appendix C summarize the chemical testing results from DY14/15. Only COCs with guideline exceedances are included in Appendix C, with the exception of dioxin, for which all testing results are included. There are 57 individual chemicals or groups of chemicals that have DMMP evaluation guidelines and are considered standard COCs for marine projects. For projects in freshwater, there are 33. Appendix A provides a list of these COCs. While TBT is not considered a standard chemical of concern for marine projects, it is often required on a case-by-case basis. Dioxins and furans are also required on a case-by-case basis in both marine and fresh water.

For marine projects in DY14/15, only 10 COCs were detected in dredged material at concentrations above DMMP screening levels (SLs) or bioaccumulation triggers (BTs) (Table 3-1). The COCs with detected concentrations above the marine BTs were TBT and dioxins/furans. One chemical, benzoic acid, was detected above the maximum level (ML) in a single project (USACE Kenmore). Only four chemicals had DMMP guideline exceedances in more than one project: benzyl alcohol, total PCBs, TBT and dioxins/furans. Dioxins/furans had the most guideline exceedances, with 34 DMMUs in 6 projects exceeding the SL in their respective geographic area. Of these, 22 DMMUs also exceeded the BT. Dioxin/furan concentrations were particularly high for the USACE Hylebos project, with concentrations in the DMMUs as high as 359 ng/kg toxic equivalents (TEQ). The second most frequently observed chemical to exceed the DMMP guidelines was benzyl alcohol – 13 DMMUs in 3 projects exceeded the marine SL. Total PCBs exceeded the marine SL in 9 DMMUs in two projects. The BT for TBT was exceeded in 8 DMMUs in two projects. Of special note were extremely high levels of TBT found at The Port of Tacoma Pier 4 Reconfiguration project, with the highest concentration being 50,000 ug/kg d/w (BT = 73 ug/kg d/w), resulting in a Time Critical Removal Action by EPA.

Freshwater projects had relatively few chemical guideline exceedances. Only three chemicals had SL1 exceedances (cadmium, phenol and 4-methylphenol) and none of these occurred in more than one project. The cadmium exceedance (Kittitas County boat ramp) was based on the interim SL1 of 1.1 mg/kg that existed in 2013. The SL1 for cadmium has since been raised to 2.1 mg/kg. The phenol and 4-methylphenol exceedances all occurred on the USACE and Ports of Clarkston and Lewiston maintenance dredging project on the Snake and Clearwater Rivers. The phenol SL1 was exceeded in a single DMMU, while the 4-methylphenol SL1 was exceeded in six DMMUs. One of these DMMUs also exceeded the SL2 for 4-methylphenol. Dioxin testing was only conducted on one freshwater project, with low concentrations reported.

Numerous SMS and DMMP guideline exceedances also occurred during antidegradation evaluations. The majority of these were SQS or SL exceedances; however the Port of Seattle (POS) Terminal 5 also had a cleanup screening level (CSL) exceedance of mercury in one Z-sample. Of more consequence was the discovery of highly elevated concentrations of dioxins/furans in several of the Z-samples for USACE Hylebos, with concentrations as high as 1,161 ng/kg TEQ. A similar pattern was found for PCBs in these same Z-samples, with PCB concentrations in the Z-samples exceeding those in the overlying DMMUS.

Chemicals detected above SQS or SL in Z-samples were largely the same as those in the overlying DMMUs, with a few exceptions. One exception was the mercury exceedance of CSL at POS Terminal 5; there were no SL/SQS exceedances for mercury in the overlying dredged material. Another exception was USACE Kenmore, in which nickel exceeded the freshwater SL1 in all Z-samples. Nickel is not a COC for marine projects, so was not reported for the overlying dredged material. USACE Hylebos also had several chemicals that exceeded SQS or SL in z-samples, without guideline exceedances in the corresponding DMMUs.

Similar reporting limit problems occurred in DY14/15 when compared to past biennia. COCs for which reporting limits exceeded SLs in DY14/15 included the chlorobenzenes; 2,4-dimethylphenol; pentachlorophenol; benzyl alcohol; benzoic acid; hexachlorobutadiene; the pesticides 4,4'-DDT, chlordane, heptachlor and dieldrin; PCBs, and TBT. In most cases reporting limit exceedances of SLs were resolved by verifying that method detection limits were below the SLs.

Dioxin Evaluation. For the evaluation of dioxins and furans for projects in DY14/15, the DMMP agencies utilized the guidelines found in Table 3-2. Testing outcomes for all projects subjected to dioxin testing can be found in Appendix C and are summarized in Table 3-3. Of the 20 projects receiving suitability determinations during the biennium, 15 included dioxin testing of dredged material in one or more DMMU. Fourteen of these were projects proposing dredged material disposal in marine waters and one in freshwater.

Five of the marine projects had dioxin concentrations at levels found unsuitable for open-water disposal (Duwamish Yacht Club, MJB Travelift, POS Terminal 5, USACE Hylebos and USACE Kenmore). Four of these five projects also had other DMMP chemical guideline exceedances. The fifth, MJB Travelift, had no other COCs detected above SL, although several COCs (pesticides and PCBs) had reporting limits that exceeded SL. Dioxins/furans are COCs for human health and biomagnification in higher tropic levels and would not be expected to have adverse effects in the toxicity tests used by DMMP. But because bioassays were not run for any of these projects, it is not possible to determine whether the other chemicals with SL exceedances would have caused DMMU failures in the absence of dioxin. However, given the many SL exceedances for other COCs, it is likely that at least some of the DMMUs that were found unsuitable due to elevated dioxin/furan levels would have failed toxicity testing. Additionally, two projects (POS T-5 and USACE Hylebos) had BT exceedances for TBT. The DMMUs exceeding the TBT BT would have needed to pass bioaccumulation testing in order to be found suitable for open-water disposal. Therefore, while all material found unsuitable for open-water disposal in DY14-15 was due to elevated concentrations of dioxins/furans, it cannot be said that dioxins/furans were the sole contributors to these failures.

3.2 Biological Testing

Freshwater toxicity testing was conducted on 7 DMMUs from two dredging projects in DY14/15 (Kittitas County Boat Ramp and the USACE/Ports Snake/Clearwater River). In-water beneficial use was proposed for both projects. Therefore, the more restrictive interpretive guidelines used for dispersive flow-lane disposal were used for these projects to ensure that there would be no adverse effects to benthic organisms at the beneficial-use sites. Under the dispersive guidelines, an exceedance of the SL1 biological response threshold in any of the bioassays would result in the tested DMMU being found unsuitable for beneficial use or flow-lane disposal. No SL1 biological response thresholds were exceeded for any of the DMMUs, as shown in Table 3-4.

Freshwater biological testing was also conducted on seven Z-samples from one project (USACE Kenmore) to evaluate the sediment that would become the new surface sediment if dredging were to occur. The freshwater bioassay interpretive guidelines in effect at the time were from the 2009 SEF. Under this guidance, the tested material could only be found unsuitable for unconfined exposure if the SL1 biological response threshold was exceeded in two or more of the bioassays, or the SL2 biological response threshold was exceeded in one or more bioassay. One SL1 exceedance (also known as a "hit") was recorded for one of the Z-samples in the *Chironomus dilutus* 20-day mortality test. However, there were no other exceedances, and the Z-samples were found to comply with the State of Washington's anti-degradation policy.

Appendix B includes the DMMP bioassay interpretative guidelines used in these evaluations.

There was no marine biological testing during the biennium.

3.3 Bioaccumulation Testing

During DY14/15, only two chemicals were reported at concentrations above BT in dredged material samples: TBT and dioxins/furans. The following projects had BT exceedances in one or more DMMU:

- Duwamish Yacht Club – dioxin/furans
- Port of Seattle Terminal 5 – TBT
- USACE Hylebos – TBT and dioxins/furans
- USACE Kenmore – dioxins/furans

In all of the above projects, the dredging proponent chose not to pursue bioaccumulation testing in the affected DMMU(s), and the material was determined unsuitable for open-water disposal.

There were also exceedances of the BT for TBT and dioxins/furans in Z-samples from these same projects.

No BTs currently exist for freshwater projects.

In summary, no bioaccumulation testing was conducted during the biennium.

3.4 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. For those dredging projects requiring sampling and testing under Section 404, the regulatory process consists of a sequence of steps that must be taken before obtaining a permit. These steps are typically sequenced as follows:

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

(2) DMMP agencies review SAP and provide comments to applicant; revised SAP approved by agencies once all agency comments have been addressed.

(3) Applicant conducts sampling and chemical/biological analysis and submits sediment characterization report to DMMO.

(4) DMMP agencies review report and provide comments to applicant; applicant submits revised report addressing agency comments.

(5) DMMO drafts suitability determination for open-water disposal; DMMP agencies review and sign.

(6) Applicant completes application details required for issuance of public notice.

(7) Corps Regulatory prepares and issues public notice.

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

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

(10) Corps Regulatory completes public interest review, Section 404(b)(1) evaluation, NEPA documentation, ESA consultation, NHPA Section 106 review, etc. (this list is not all-inclusive).

(11) Other agencies complete their permitting (e.g. Ecology issues a Section 401 Water Quality Certification (WQC) and the Washington Department of Fish and Wildlife issues a Hydraulic Project Approval). The WQC is needed before Corps Regulatory issues a permit.

(12) Corps Regulatory issues permit decision.

The DMMP dredged material evaluation process consists of Steps 1 through 4, which are detailed 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 SAP has been submitted, the DMMO coordinates review with the other DMMP agencies: EPA, DNR and Ecology. Agency comments are provided to the applicant, the applicant revises the SAP to address the comments, and the revised SAP is submitted to the agencies for approval. Occasionally, more than one round of revision is needed to adequately address all agency comments. Once the SAP is finalized, an approval letter or email message is sent to the applicant. At that point, sampling and analysis may proceed. It is the goal of the DMMO to complete the review of SAPs within three weeks. During DY14/15 the average time for SAP review was 13 days, and ranged from a low of 1 day (for a first draft) to a high of 41 days (also for a first draft). Two projects exceeded the goal of a three-week review turnaround time. For those projects with more than one review cycle, the average review time for all review cycles was used in compiling these statistics.

Sampling and Analysis. During this phase, field sampling and chemical/biological analysis are completed following the procedures documented 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 124 days during DY 14/15. This is the project phase with the highest degree of variability; with sampling, analysis and reporting taking anywhere from 28 to 301 days for projects completed within the biennium. Factors influencing the time required for this phase include 1) weather; 2) sampling difficulties; 3) laboratory capacity and turn-around time; 4) QA problems arising during chemical and biological testing; 5) data validation; and 6) 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 two-year review period, and only three of 20 projects receiving suitability determinations required toxicity testing.

Data Review and Suitability Determination. Once a full set of validated chemical/biological testing data is submitted, the DMMP agencies review the data report for completeness and accuracy. Agency comments are provided to the applicant, and the applicant revises the data report to address the comments. Once the report has been finalized, DMMO drafts a suitability determination for review and signature by the DMMP agency representatives. The suitability determination is a Memorandum for Record documenting the determination reached on the suitability/unsuitability of each of the dredged material management units for unconfined open-water disposal. The suitability determination also includes an evaluation of the sediment surface that will be exposed by dredging vis-à-vis the State of Washington's antidegradation standard. The goal of the DMMO is to complete the data review and finalize the suitability determination within three weeks of submittal of the final data report. In DY14/15, the average time required for review of the data report (and preparation of the suitability determination in the case of final reports) was 13 days, with review times for individual drafts ranging from 0 to 45 days. For most projects, the dredged material characterization report requires revision after agency review. In those cases, the average time required for review of draft and final data reports was used in compilation of these statistics.

Total DMMP Process Time. The entire DMMP dredged material evaluation process, as depicted in Figure 3-1, includes: 1) sampling and analysis plan review and approval; 2) field sampling, testing, validation and data report preparation; and 3) data review and completion of the suitability determination. The average time required for the

DMMP dredged material evaluation process in DY14/15 was 245 days (ranging from 70 to 647 days), with the majority of that time consumed by sampling, testing, and data report preparation by the applicant.

Table 3-1. DY14/15 Chemical Testing Summary

CHEMICAL OF CONCERN	Marine						Freshwater			
	# of DMMUs	# of Projects	# of DMMUs	# of Projects	# of DMMUs	# of Projects	# of DMMUs	# of Projects	# of DMMUs	# of Projects
	D > SL	D > SL	D > BT	D > BT	D > ML	D > ML	D > SL1	D > SL1	D > SL2	D > SL2
Cadmium	0	0	0	0	0	0	1	1	0	0
Dimethyl phthalate	1	1	NA	NA	0	0	NA	NA	NA	NA
Butyl benzyl phthalate	2	1	NA	NA	0	0	NA	NA	NA	NA
Phenol	0	0	NA	NA	0	0	1	1	0	0
4-Methylphenol	0	0	NA	NA	0	0	6	1	1	1
Benzyl Alcohol	13	3	NA	NA	0	0	NA	NA	NA	NA
Benzoic Acid	2	1	NA	NA	1	1	0	0	0	0
Hexachlorobutadiene	3	1	NA	NA	0	0	NA	NA	NA	NA
Total Chlordane	2	1	0	0	NA	NA	NA	NA	NA	NA
Dieldrin	1	1	NA	NA	0	0	0	0	0	0
Total PCBs	9	2	0	0	0	0	0	0	0	0
Tributyltin (porewater)	NA	NA	7	2	NA	NA	NA	NA	NA	NA
Tributyltin (bulk)	NA	NA	2	1	NA	NA	0	0	0	0
Dioxins/Furans	34	6	21	3	NA	NA	NA	NA	NA	NA

D = Detected, SL = Screening Level, BT = Bioaccumulation Trigger, ML = Maximum Level, NA = Not Applicable

Table 3-2. Dioxin Guidelines Utilized to Evaluate DY14/15 Projects

(a) Puget Sound Interim Guidelines for Non-dispersive Sites[1]		
Disposal Sites	Project Volume-Weighted Average	DMMU Maximum
Anderson-Ketron, Commencement Bay, Elliott Bay, Port Gardner, Bellingham Bay	4 pptr TEQ	10 pptr TEQ
(b) Puget Sound Interim Guidelines for Dispersive Sites		
Disposal Sites	DMMU Maximum	
Port Angeles, Port Townsend, Rosario Strait	4 pptr TEQ	
(c) Grays Harbor Guidelines (Derived from 1991 Risk Assessment)		
DMMU Maximum: 2,3,7,8-TCDD = 5 pptr; and TEQ = 15 pptr		
(d) Columbia River Basin		
Comparison to Columbia River background stations downstream of Puget Island: 0.65 to 2.89 pptr TEQ		

[1]Case-by-case determinations may be made for exceedances of these guidelines based on material placement sequencing, presence or absence of other bioaccumulatives, and frequency of disposal site use.

Table 3-3. Dioxin Testing Summary for DY14/15 Projects

Evaluation Guidelines	Project ID	Volume Tested for Dioxins	Total Unsuitable Volume	Volume Exceeding Dioxin Guidelines	Comments
Puget Sound Non-dispersive	City of Renton Lower Cedar River	40,000	0	0	2 DMMUs < 4 pptr TEQ; all other COCs < SL
	Duwamish Yacht Club	20,250	12,350	12,350	2 DMMUs > 10 pptr TEQ; 2 DMMUs between 4-10 pptr TEQ, but failed due to VWA > 4; other COCs (phthalates, chlordane) > SL
	MJB Travelift	1,350	1,350	1,350	1 DMMU between 4-10 pptr TEQ; VWA > 4; other COCs (pesticides, PCBs) nondetect > SL
	Mukilteo Multimodal	18,200	0	0	all DMMUs < 4 pptr TEQ
	Port of Seattle Terminal 5 maintenance (DY14)	7,125	7,125	7,125	2 DMMUs; VWA > 4 pptr TEQ; other COCs (PCBs, TBT) > SL/BT
	Port of Seattle, Terminal 5 deepening (DY15)	48,523	0	0	2 DMMUs between 4-10 pptr TEQ; VWA = 0.73 pptr TEQ
	Port of Tacoma Pier 4 Phase 1	9,000	0	0	All DMMUs < 4 pptr TEQ
	USACE Duwamish Spokane St. Bridge	2,237	0	0	All DMMUs < 4 pptr TEQ
	USACE Hylebos	47,437	47,437	47,437	All DMMUs > 10 pptr TEQ; other COCs (hexachlorobutadiene, dieldrin, PCBs, TBT) > SL/BT
	USACE Kenmore	30,000	30,000	30,000	4 DMMUs > 10 pptr TEQ; 4 DMMUs between 4-10 pptr TEQ, but failed due to VWA > 4; other COCs (benzyl alcohol, benzoic acid) > SL/ML
Puget Sound Dispersive	Shelter Bay Marina	10,800	0	0	All DMMUs < 4 pptr TEQ
Grays Harbor	Port of Grays Harbor, Terminals 1, 2, 3, 4	159,000	0	0	All DMMUs < 5 pptr 2,3,7,8-TCDD and < 15 pptr TEQ
	USACE Westhaven Cove	47,120	0	0	All DMMUs < 5 pptr 2,3,7,8-TCDD and < 15 pptr TEQ
Columbia River	Longview Fibre	63,381	0	0	2 DMMUs, both less than 1.4 pptr TEQ
Willapa Bay	USACE Willapa	351,410	0	0	All DMMUs < 5 pptr 2,3,7,8-TCDD and < 15 pptr TEQ
Total:		855,833	98,262	98,262	

Legend: BT = bioaccumulation trigger; SL = screening level
COCs = chemicals of concern; pptr = parts per trillion; TEQ = toxic equivalents; dba = doing business as; VWA = volume weighted average

Table 3-4. DY 14/15 Bioassay "Hit" Summary for DMMUs

BIOASSAY	Marine/ Freshwater	Number of DMMUs Tested		Number Rejected	Marine				Freshwater	
					Number of Hits Under the "Two-Hit Rule"		Number of Hits Under the "Single-Hit Rule"		Number of SL1 Hits	Number of SL2 Hits
		ND	D		ND	D	ND	D		
10-day Amphipod	Marine	0	0	NA	NA	NA	NA	NA	NA	NA
48-hr Sediment Larval Standard Protocol	Marine	0	0	NA	NA	NA	NA	NA	NA	NA
20-day *Neanthes* Growth Ash-Free Dry-Weight	Marine	0	0	NA	NA	NA	NA	NA	NA	NA
20-day *Chironomus dilutus* Growth	Freshwater	0	7	0	NA	NA	NA	NA	0	0
20-day *Chironomus dilutus* Mortality	Freshwater	0	7	0	NA	NA	NA	NA	0	0
10-day *Hyalella azteca* Mortality	Freshwater	0	7	0	NA	NA	NA	NA	0	0

NA = not applicable
ND = non-dispersive site interpretation guidelines
D = dispersive site interpretation guidelines

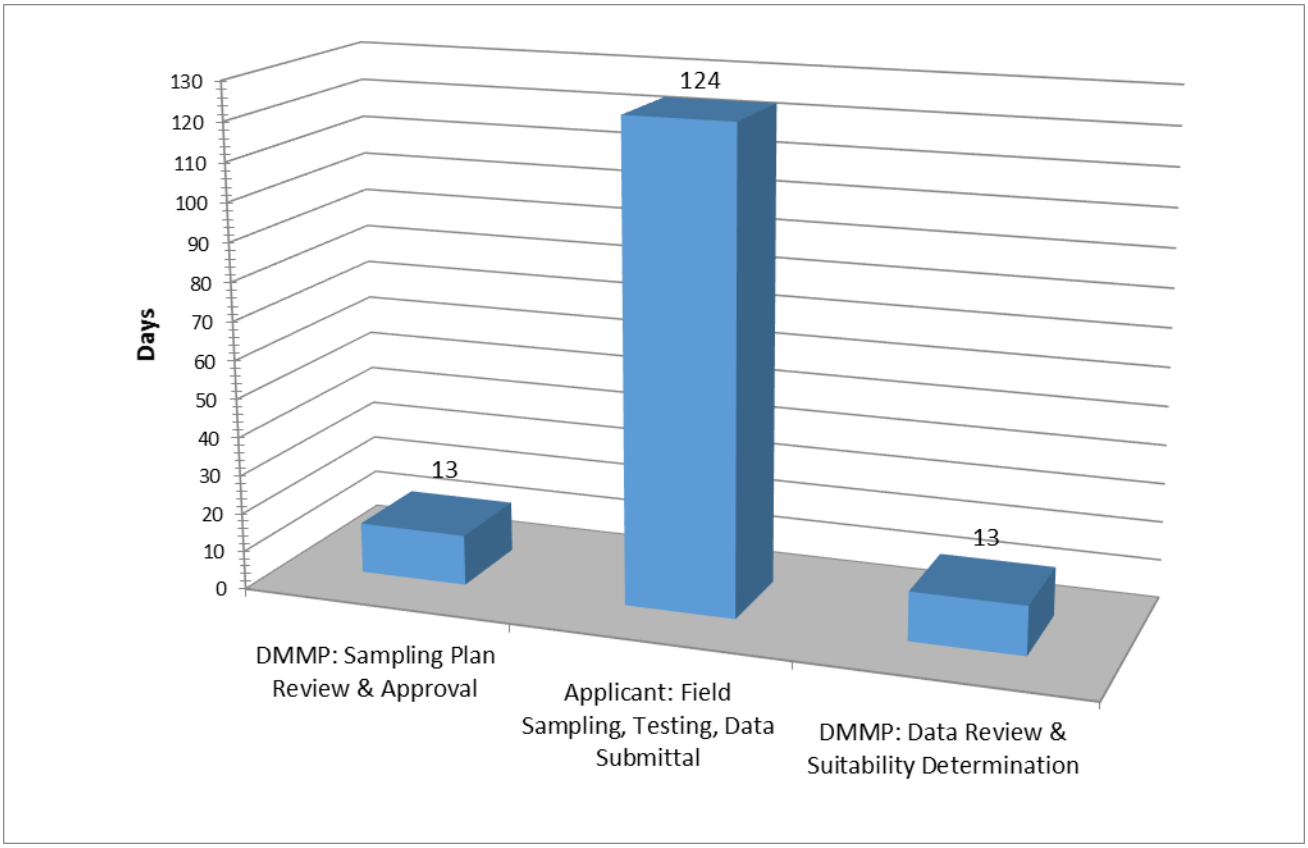

Figure 3-1. DMMP Processing Time (means for DY 14/15 projects in days)

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 2014

Duwamish Yacht Club (DMMP, 2013a) – Dioxin concentrations in the six DMMUs making up this project ranged from 4.16 to 20.9 ng/kg TEQ. Under the dioxin evaluation guidelines for non-dispersive disposal sites in Puget Sound, individual DMMUs may have dioxin concentrations up to 10 ng/kg TEQ as long as the volume-weighted average (VWA) for the project is 4 ng/kg TEQ or less. However, the dioxin evaluation guidelines also allow for case-by-case determinations for projects with minor exceedances of these levels. In the case of Duwamish Yacht Club, two of the DMMUs had concentrations just above 4 ng/kg TEQ (DMMU 2 = 4.16 ng/kg TEQ; DMMU 3 = 4.23 ng/kg TEQ). These concentrations were considered within the analytical uncertainty of the method being used. Therefore, the DMMP agencies made a case-by-case determination that these DMMUs were suitable for disposal at the Elliott Bay site. The other four DMMUs, with dioxin concentrations ranging from 6.43 to 20.9 ng/kg TEQ, could only be found suitable if they passed bioaccumulation testing. Bioaccumulation testing was not pursued by the dredging proponent. Therefore, in the absence of bioaccumulation testing, these four DMMUs were found unsuitable for open-water disposal.

Port of Seattle Terminal 5 (DMMP, 2013b) – Four dredged material management units were laid out to match previous dredged material characterization events. However, the majority of the dredged material was contained within DMMUs 3 and 4 (7,125 out of 7,490 cubic yards). Rather than sample and test the small amount of material in DMMUs 1 and 2, the Port of Seattle and the DMMP agencies agreed to use the results from DMMUs 3 and 4 to determine the suitability of DMMUs 1 and 2. DMMUs 3 and 4 were found unsuitable for open-water disposal, therefore DMMUs 1 and 2 were also found unsuitable.

USACE Hylebos (DMMP, 2014a) – Unexpectedly high concentrations of dioxin were found throughout the waterway, resulting in all proposed dredged material being found unsuitable for in-water disposal. Concentrations of dioxin in the dredged material ranged from 28 to 359 ng/kg TEQ. Dioxin concentrations were elevated in the Z-samples as well, ranging from 13 to 1,161 ng/kg TEQ. Due to the dioxin results, the Army Corps of Engineers determined that dredging of the Hylebos Waterway is not feasible under the Corps' maintenance dredging program.

USACE Snake/Clearwater River, Federal Navigation Channel and Ports of Lewiston and Clarkston (DMMP, 2014b) –The timing of this project characterization straddled implementation of Washington Department of Ecology changes to Chapter 173-204 WAC Sediment Management Standards (SMS), which became effective on September 1, 2013. As part of the SMS rule changes, Ecology promulgated new numeric chemical and biological cleanup objectives for freshwater sediment to protect the benthic community—essentially an update to the 2006 interim guidelines used by the DMMP from the Regional Sediment Evaluation Team's Sediment Evaluation Framework (SEF) for the Pacific Northwest. Though the DMMP in general uses only guidelines which have been adopted through a public notification and comment process, it also strives to use the most current relevant technical and project-specific information for sediment

evaluation. This is also consistent with Ecology's implementation of WAC 173-204-340, which allows use of the best available methods and guidelines.

In making these project-specific decisions, the DMMP strove to do two things: allow comparison to past data collection efforts and existing guideline values, while creating a bridge to future characterization for this project that will likely include the most up-to-date COCs and values for comparison (i.e. the 2013 SMS FW guidelines.) All decisions about analytes and regulatory guidelines were made prior to sampling and testing. The DMMP used the new SMS guidelines—then in draft form—as the basic list of COCs and regulatory guidelines to use in this project. The new SMS rule was considered to have the most current and supportable list of potential COCs and regulatory guidelines, at least for protection of benthic resources. This list was amended as appropriate on a site-specific basis based on previous testing and requests from other agencies. A summary of decisions and rationale behind the project-specific COCs are as follows:

a. Dioxin/furan analysis. Very low TEQs were found in most samples analyzed in 2011, and in all the samples in areas proposed for dredging. They indicated a low "reason-to-believe" that dioxins are of concern in the proposed dredge prism. Due to the presence of an upstream paper plant and associated outfall, however, this decision will be revisited for future characterizations.

b. No analysis for PAHs required. Levels of PAHs, when occasionally detected, have been found at orders of magnitude below levels of concern in either marine or freshwater guidelines. There are few sources in the area for this class of chemicals.

c. No analysis for other organics required (chlorinated hydrocarbons and some miscellaneous extractables). Again, previous data and lack of sources show low reason-to-believe for presence of omitted chemicals at levels of concern.

d. Analysis for the full suite of DMMP COCs for the Port of Clarkston Recreation Dock DMMU and for reference sediments required. Since no samples from previous characterizations had been taken at the recreation dock, the DMMP requested that chemical analysis be performed for all DMMP COCs, rather than the abbreviated list required for all other DMMUs. Reference sediments used during the bioassay round were also tested for the full list of COCs.

e. Toxaphene added to the list of COCs for all DMMUs. This request was made by fish biologists at the Washington Department of Ecology, due to previous detections of toxaphene in some parts of Eastern Washington. However, there were no regulatory sediment guidelines set for toxaphene in Washington State, including the existing DMMP marine guidelines, SEF guidelines and Ecology's 2013 SMS freshwater guidelines. Instead, a rough estimate was calculated for a sediment screening level based on the water quality standard for toxaphene and using a K_{oc} value of 5 L/kg-oc. The result of this calculation was a theoretical screening level of 0.2 ug/kg in sediments. The analytical method requested by Ecology, however, could not achieve a detection limit that low. Typical toxaphene sample quantitation limits (SQL) using Method 8081 are generally around 100 ppb. The chosen laboratory was requested to reduce the toxaphene SQL to the lowest possible value. Ecology accepted this approach.

f. Use the DMMP marine BT for selenium as the regulatory guideline, rather than the higher guideline found in the 2013 SMS freshwater guidelines. Selenium was the only element for which a marine guideline was used when a more current freshwater guideline was available. Selenium has been identified at concentrations above the DMMP bioaccumulation trigger in some areas of the watershed, most likely due to mining activities. The DMMP marine bioaccumulation

trigger guideline for selenium is 3 mg/kg dry wt.; the 2013 SMS guidelines use 11 mg/kg as the screening level. The marine value was simply used as a conservative option in a watershed that has some history of selenium detections.

WSDOT Mukilteo Multimodal Terminal (DMMP, 2014c) – Sampling was accomplished using a diver-operated vibracore sampler. The divers reported visible concrete, steel and timber debris at the sediment surface. The debris extended below the surface and complicated sampling activities, especially in a portion of one DMMU. In addition, a post-sampling bathymetric survey revealed a discrepancy between the target and actual sampling depths, resulting in a situation in which no Z-samples had been collected. Due to these sampling anomalies, the data collected were not sufficient to determine suitability for the entire project. The suitability determination covered only the dredged material that had been adequately characterized. Because there were no SQS exceedances in the DMMUs that had been adequately characterized and dioxin concentrations were below 4 ng/kg TEQ, there was no need to test the sediment that would be exposed by dredging. Therefore, the absence of Z-samples from this area turned out to be inconsequential. What was left then, after the suitability determination was signed, was the need for WSDOT to sample in the nearshore subunit of DMMU 3 and underlying Z-layer, to adequately characterize this material prior to dredging. Evaluation of that material took place in DY 2016 and will be summarized in the 2016-2017 Biennial Report.

WSDOT was required to develop a debris management plan to ensure debris is removed from the dredged material prior to disposal. This included use of a steel grid or grizzly to screen the material during dredging.

4.2 Dredging Year 2015

HME Construction Sand-Mining Operation (DMMP, 2015a) – HME has in the past performed maintenance dredging/mining of Columbia River sand and gravel between river miles 102-106 for use as upland fill or in-water environmental capping material in both Oregon and Washington. This work was accomplished under a Navigation Channel License issued by the Waterways Maintenance Section of the U.S. Army Corps of Engineers Portland District. Portland District no longer issues Navigation Channel Licenses. Therefore, HME applied for a permit from Seattle District to continue mining sand for use in upland and in-water projects.

Portland District is responsible for maintenance dredging of the Columbia River Navigation Channel and conducts periodic sediment sampling to ensure that material from the channel can continue to be dredged and disposed in-water without adverse environmental impacts. The Columbia River Mainstem Channel was last sampled and tested in August 2008.

On the basis of Portland District's sediment characterization report, the Portland District Dredging Project Review Group issued a suitability determination indicating that the navigation channel sediment is suitable for unconfined, aquatic placement. The DMMP agencies reviewed the existing documentation and agreed with the determination made by the Portland District Project Review Group (now known as the Portland Sediment Evaluation Team) that the material is suitable for unconfined aquatic placement. Therefore, no additional sampling and testing were required.

La Conner Marina (DMMP, 2014d) – Benzyl alcohol was the only COC exceeding the SL, with concentrations ranging from 130 to 180 ug/kg (SL = 57 ug/kg; ML = 870 ug/kg). In most cases, detected or undetected exceedances of even a single COC would result in a requirement to conduct bioassays. However, in a similar project in 2011 (downstream settling basin in the Snohomish River navigation

channel; DMMP, 2012), in which benzyl alcohol was the only COC exceeding SL, the DMMP agencies determined that bioassay testing was not necessary due to the presence of plant material and woody debris in the sediment samples and the lack of anthropogenic sources. Benzyl alcohol is produced naturally by the decay of plants and is often associated in marine sediments with plant material and woody deposits. Anthropogenic sources of benzyl alcohol include pharmaceuticals, soap, perfume and flavor products.

The core logs for La Conner Marina indicated that wood and root material were found in six of the cores, but the presence of plant material was not as visually evident as it was in samples taken from the Snohomish downstream settling basin. However, sulfides concentrations were much higher at La Conner Marina than in the Snohomish samples. Sulfide concentrations ranged from 1,950 to 3,640 mg/kg at La Conner, compared to a range of 503 to 609 mg/kg in the Snohomish samples that had benzyl alcohol exceedances of SL. Hydrogen sulfide is generated by the bacterial decomposition of organic material under anoxic conditions. The high sulfide concentrations at La Conner Marina provided indirect evidence of the possible presence of decomposed plant material in the sediment. TOC concentrations were similar in both projects, ranging from 0.8 to 1.1 percent at La Conner and from 0.9 to 1.2 percent in the Snohomish downstream settling basin.

The DMMP agencies used best professional judgment in determining that the benzyl alcohol found in La Conner Marina was most likely derived from natural sources and was unlikely to be anthropogenic in nature. On the basis of this judgment, the agencies determined that bioassays would not be required.

With regard to dioxins/furans, the DMMP agencies determined that there was no reason to believe that dioxins/furans would be present in the sediment at La Conner Marina at concentrations that would exceed the DMMP site management objective of 4 pptr TEQ. This determination was supported by the results from dioxin testing in the adjacent Swinomish Channel in 2009, where all concentrations were below 0.2 pptr TEQ. However, since adoption of the interim Puget Sound dioxin guidelines in 2010, the DMMP agencies have required limited dioxin testing for all projects proposing dispersive disposal, even when there is no reason to believe that dioxin may be present at elevated concentrations. There is no such requirement for non-dispersive sites. The Port of Skagit County was informed that use of the Rosario Strait dispersive site would require dioxin testing. The Port chose not to conduct this testing, but to instead transport the material to the non-dispersive site in Port Gardner.

Lower Cedar River Section 205 Flood Hazard Reduction Project (DMMP, 2014e) – Sampling took place in two phases. DMMUs 1-3, near the mouth of the Cedar River, were accessible by boat and were sampled July 8-9, 2014. DMMUs 4-6, located further upstream and inaccessible by boat, were sampled August 11-12, 2014 during a period of low summer flow.

For the downstream DMMUs, sampling attempts were first made with a vibracore sampler. However, recovery was poor and a decision was made in consultation with the DMMP agencies to switch to a power grab for these samples. The upstream sampling stations were located in very shallow water. Here, a stainless steel cylinder was used to isolate the sampling stations from the stream flow, with samples collected manually from within the cylinder with a hand trowel.

Sediment samples collected from five sampling stations within each DMMU were composited for analysis. Due to the high fraction of cobble and gravel in the sediment and the tendency of sediment contaminants to

be associated with the finer-grained fraction, anything larger than approximately ¼-inch was removed from the composited samples prior to placing in jars for laboratory analysis.

In addition to the composited samples, fine-grained sediment from one of the five individual sampling stations in each DMMU was collected for analysis of volatiles, the gasoline-fraction of petroleum hydrocarbons and sulfides in order to avoid the volatilization that would have occurred if these samples had been composited with samples from other stations. Bulk sediment, in which the gravel and cobble had not been removed, was collected from these individual stations as well and analyzed for grain size. This was done in order to characterize the in situ nature of the sediment.

Shelter Bay Marina (DMMP, 2014f) – This project was similar to the La Conner Marina project (see above), in that benzyl alcohol was the only COC exceeding the SL, with an estimated concentration of 81 ug/kg in DMMU 1. As with La Conner Marina, the DMMP agencies used best professional judgment in determining that the benzyl alcohol found in Shelter Bay Marina was most likely derived from natural sources and was unlikely to be anthropogenic in nature. On the basis of this judgment, the agencies determined that bioassays would not be required.

Due to a fire in 2014 that destroyed several boats and some docks at the marina, dioxin testing was required in the vicinity of the fire. The dioxin concentration in this area was 1.6 ng/kg TEQ, which is well below the DMMP site management objective of 4.0 ng/kg TEQ. Therefore, dioxin testing was not required elsewhere in the marina and all material was found suitable for open-water disposal at either a dispersive or non-dispersive site.

Port of Tacoma, Pier 4 Reconfiguration (DMMP, 2015b) – For the initial characterization this bank cutback project was divided into four areas, A-D. The two in-water areas, A and B, consisted of one surface DMMU in Area A and one surface and two subsurface DMMUS in Area B. The two upland bank-cutback areas, C and D, were divided into 8 DMMUs. There was a BT exceedance of TBT in one of the in-water DMMUs; all other DMMP COCs, including dioxin, were below DMMP screening levels. Due to the magnitude of the TBT exceedance, the individually archived cores were analyzed to try to isolate the location of the elevated TBT. Results from the analysis of the archived cores were even higher than in the original composite; the highest TBT concentration found was 7,000 μg/kg dry weight.

As a result of this highly elevated value, additional sampling was required by the DMMP agencies to get a better sense of the vertical and horizontal distribution of the TBT hotspot. Two additional rounds of testing were conducted, one in August 2013 and again in November 2013. The highest TBT concentration found during these additional rounds of testing was an order of magnitude higher than the previous result. The highest concentration of TBT found was 50,000 ug/kg at 6-8 feet below mudline at location A8 along the pier face.

Due to the unprecedented levels of TBT contamination found in the in-water portion of the project, the project was divided into two phases, with Phase 1 taken on by EPA CERCLA as a Time Critical Removal Action, and Phase 2 remaining as a standard regulatory/DMMP project. After additional testing, a portion of the Phase 1 material was determined to be suitable for open-water disposal and a suitability determination for this portion of the Phase 1 project was issued on January 8, 2015. A determination on the suitability of Phase 2 material and confirmation of the leave surface will be issued after Phase 1 dredging and post-dredging confirmational sampling has been completed.

USACE Kenmore (DMMP, 2015c) – Dioxin concentrations in the eight DMMUs from this project ranged from 7.4 to 23.2 ng/kg TEQ, making all the proposed dredged material unsuitable for open-water disposal without bioaccumulation testing. The dioxin results rendered any other analytical data inconsequential for decision-making. However, a testing anomaly for DDT and its breakdown products DDD and DDE required further investigation to determine the validity of the results. These chemicals were found at highly elevated levels in DMMU 2, with the sum of DDTs (4,4'-DDT; 4,4'-DDE; and 4,4'-DDD) detected at 5,960 ug/kg (BT = 50 ug/kg; ML = 69 ug/kg). However, the field duplicate of DMMU 2 did not corroborate these high levels, having a sum of DDTs of only 7 ug/kg. In an attempt to determine the validity and source of the elevated DDTs, the laboratory analyzed samples from the individual cores that had been composited for DMMU 2. The sum of DDTs was low for all cores, with concentrations ranging from 4.2 to 10.5 ug/kg. Additional analyses were done, both on the original composite and individual cores, including the use of an acid cleanup to improve the shape of peaks in the chromatograms. DDT concentrations were low in all cases. Laboratory contamination was evaluated as a possible source of the elevated DDT concentrations, but this possibility was eliminated based on a weight of evidence. The results from the original analysis remain an unexplained anomaly. Should the channel be dredged (with upland disposal) in the future, additional sampling and analytical work may be needed to determine management options for material from DMMU 2.

USACE Willapa Bay (DMMP, 2015d) – The Seattle District Navigation Section characterized three projects in Willapa Bay: Tokeland Marina and Entrance Channel; Bay Center Entrance Channel; and Nahcotta Mooring Basin. All three areas were characterized for open-water disposal in Willapa Bay and ultimately found suitable. However, there were some unusual issues with the analytical data.

First, based on results from the standard pesticide method, SW8081b, there were elevated reporting limits for several pesticides found throughout all three project areas. The Corps chose to do additional pesticide analysis using high resolution GS/MS/MS in order to lower detection limits and resolve interferences. These HRGC/MS/MS analyses were conducted on all 8 DMMUs with reporting limit exceedances and all pesticide results were subsequently reported as non-detects at levels well below DMMP SLs.

Second, one DMMU from Bay Center had an anomalously high level of diethyl phthalate detected at nearly five times the DMMP screening level. The sample was re-extracted and re-analyzed three times and all three results were non-detected at values well below the DMMP screening level. The DMMP agencies determined that since the replicate analyses were consistent between themselves and with the results throughout the rest of the project, and since diethyl phthalate is a known laboratory contaminant, that the weight of evidence suggested that diethyl phthalate was not a concern in the sediment of Bay Center DMMU 2 and that no additional testing was needed.

The Corps also elected to analyze a subset of samples for seven non-standard pesticides that are used or potentially used in Willapa Bay. These included: carbaryl (Sevin), 1-naphthol (a degradation product of carbaryl), imazamox, imazapyr, imidacloprid, glyphosate (Roundup, Rodeo) and aminomethylphosphonic acid (AMPA) – a degradation product of glyphosate. These analyses were done purely for informational purposes, as there are no established sediment screening levels for these compounds. All results were non-detects with the exception of glyphosate in Tokeland subsurface DMMU 4, which was detected at a concentration of 49 µg/kg.

Port Gamble Bay Cleanup and Restoration. Port Gamble, in Kitsap County, encompasses more than two square miles of subtidal and shallow intertidal habitat. The nearby Port Gamble S'Klallam Tribe uses the Bay for shellfish harvesting, fishing, and other resources. This project area, now managed by Pope Resources LP, is a MTCA cleanup site under consent decree with Ecology's Toxics Cleanup Program. Historical operations on this property released pollutants from wood waste, creosote pilings and other sources, including cadmium, mercury, PAHs, cPAHs and dioxins/furans. The cleanup plan included removal of creosote pilings and dredging and capping of contaminated sediment. The DMMP characterization was intended to determine whether a portion of the project sediments could be found suitable for open-water disposal. Previous sampling had identified areas that may pass DMMP guidelines, so DMMP sampling targeted those potentially suitable areas. Contaminants of concern for this round of sampling included PAHs, cPAHs, dioxins/furans and total volatile solids as an indication of wood waste. Proposed disposal was at the non-dispersive Port Gardner disposal site.

Twenty-one MudMole core samples were taken in July, 2014. Expedited analyses for the contaminants of concern were conducted in order to identify samples that could go on to bioassay analysis, required due to the extent of wood waste at the site. Some samples were eliminated after the chemical analysis due to dioxin exceedances, but approximately 12,000 cy of material were identified for Tier 3 bioassay analyses. However, bioassays were never done and project proponents decided not to pursue open-water disposal for any project sediments. No final report was prepared for this project, and no documentation was prepared.

The reasons for the decision to not pursue open-water disposal were complex. In general they were based on DMMP concerns about allowing open-water disposal of sediments that are being dredged because they exceed remedial action levels of a state or federal cleanup. The material in question from Port Gamble was being dredged, in part, because it exceeded site-specific human health-based cPAH values. The cPAH concentrations in these sediments also exceeded the newly-calculated Regional Background levels for cPAHs in Port Gardner Bay. The application of new Regional Background levels was part of the Washington Department of Ecology's 2013 revised Sediment Management Rule. Regional Background levels, calculated for major Puget Sound embayments, were designed in part to identify potential areas of sediment contamination that may require cleanup. The DMMP wanted to avoid any future liability for cleanup at DMMP disposal sites.

It should be noted that cPAH concerns in Port Gamble were largely based on human health risks from harvestable shellfish—particularly molluscs--in the shallow bay. Open-water disposal sites are located in deep areas of Puget Sound where there would be no completed pathway for exposure of cPAHs to humans. The DMMP wanted to investigate the liability issues of the new State requirements further before making a suitability determination for the Port Gamble sediments. However, the timeline for the Port Gamble cleanup was such that they were not able to wait for resolution of this issue.

4.3 References Cited in Chapter 4

DMMP, 2012. DMMP Suitability Determination for Proposed Maintenance Dredged Material from the Snohomish River, Everett, Snohomish County, for Unconfined Open-Water Disposal at the Port Gardner Non-Dispersive Site or at an Approved Beneficial Use or Upland Site. Prepared by the Seattle District Dredged Material Management Office for the Dredged Material Management Program, January 30, 2012.

DMMP, 2013a. Determination Regarding the Suitability of Proposed Dredged Material from the Duwamish Yacht Club, Seattle, Washington, Evaluated under Section 404 of the Clean Water Act for Unconfined Open-Water Disposal at the Elliott Bay Non-Dispersive Disposal Site. Prepared by the Seattle District DMMO for the DMMP, September 19, 2013.

DMMP, 2013b. Determination Regarding the Suitability of Proposed Maintenance Dredged Material from the Port of Seattle Terminal 5 (Corps Permit: NWS-2009-1559-WRD), Evaluated under Section 404 of the Clean Water Act, for Open-Water Disposal at the Elliott Bay Non-Dispersive Site. Prepared by the Seattle District DMMO for the DMMP, October 1, 2013.

DMMP, 2014a. Determination Regarding the Suitability of Federal Operation and Maintenance Dredged Material from the Hylebos Waterway, Tacoma, Pierce County, Washington, Evaluated under Section 404 of the Clean Water Act for Unconfined Open-Water Disposal at the Commencement Bay Nondispersive Site. Prepared by the Seattle District DMMO for the DMMP, June 4, 2014.

DMMP, 2014b. Determination on the Suitability of Proposed Dredged Material from Lower Snake/Clearwater River Maintenance Dredging for Open-Water Disposal in the Snake River or at an Approved Beneficial Use or Upland Site. Prepared by the Seattle District DMMO for the DMMP, February 18, 2014.

DMMP, 2014c. Determination Regarding the Suitability of a Portion of Proposed Dredged Material from the Mukilteo Multimodal Project, Mukilteo, Washington, Evaluated under Section 404 of the Clean Water Act for Unconfined Open-Water Disposal at the Port Gardner Non-Dispersive Disposal Site, or for In-Water Beneficial Use. Prepared by the Seattle District DMMO for the DMMP, June 5, 2014.

DMMP, 2014d. Determination Regarding the Suitability of Proposed Dredged Material from La Conner Marina for Unconfined Open-Water Disposal at the Port Gardner Non-Dispersive Site. Prepared by the Seattle District DMMO for the DMMP, October 20, 2014.

DMMP, 2014e. Determination Regarding the Suitability of Proposed Dredged Material from the City of Renton Lower Cedar River Section 205 Flood Hazard Reduction Project, Renton, Washington, for Unconfined Open-Water Placement at the Elliott Bay Disposal Site or In-Water Beneficial Use. Prepared by the Seattle District DMMO for the DMMP, December 4, 2014.

DMMP, 2014f. Determination Regarding the Suitability of Proposed Dredged Material from the Shelter Bay Marina, La Conner, Washington, Evaluated under Section 404 of the Clean Water Act for Unconfined Open-Water Disposal at the Rosario Strait Disposal Site. Prepared by the Seattle District DMMO for the DMMP, December 9, 2014.

DMMP, 2015a. Determination Regarding the Suitability of Proposed Dredged Material from the HME Construction, Inc. Columbia River Sand-Mining Project, Vancouver, Washington (Permit Application Number NWS-2014-00126), Evaluated under Section 404 of the Clean Water Act for In-Water Placement or Beneficial Use. Prepared by the Seattle District DMMO for the DMMP, February 26, 2015.

DMMP, 2015b. Determination Regarding the Suitability of Proposed Dredged Material from Phase 1 of the Port of Tacoma Pier 4 Cleanup and Reconfiguration Project Evaluated for Unconfined Open-Water

Disposal at the Commencement Bay Disposal Site or Beneficial Use. Prepared by the Seattle District DMMO for the DMMP, January 8, 2015.

DMMP, 2015c. Determination Regarding the Suitability of Proposed Dredged Material from Kenmore Navigation Channel, Evaluated under Section 404 of the Clean Water Act, for Unconfined Open-Water Disposal at the Elliott Bay Disposal Site or Beneficial Use. Prepared by the Seattle District DMMO for the DMMP, January 27, 2015.

DMMP, 2015d. Determination Regarding the Suitability of Proposed Dredged Material from the Willapa Bay Federal Navigation Projects at Tokeland Marina and Entrance Channel, Bay Center Entrance Channel and Nahcotta Mooring Basin for Unconfined Open-Water Disposal at the Goose Point or Cape Shoalwater Disposal Sites or for Flowlane Disposal and for Beneficial Use. Prepared by the Seattle District DMMO for the DMMP, April 7, 2015.

CHAPTER 5. DISPOSAL SITE USE AND MONITORING

5.1 Disposal Activity and Designated Disposal Site Use

The DMMP program manages designated open-water disposal sites in Puget Sound and coastal Washington (Grays Harbor and Willapa Bay). For those projects placing dredged material at these sites, the Washington State Department of Natural Resources (DNR) issues site-use authorizations prior to placement. These authorizations are issued for sediments that are:

- suitable for unconfined open-water disposal as determined by the DMMP evaluation process, and
- associated with dredging projects that have received all other required regulatory permits (e.g., Clean Water Act 401/404 permits).

Other disposal options for open-water disposal include flow-lane disposal (used primarily in the lower Columbia River and Willapa Bay) and beneficial use. Dredged material not suitable for open-water disposal is disposed upland.

During this biennium, annual disposal volumes at the designated Puget Sound sites were low compared to historical averages, with only four of the eight sites being used. The Bellingham Bay site remained closed during the biennium. Disposal volumes at the Grays Harbor sites were near historical averages. The designated multiuser dispersive sites in Willapa Bay were not used, although the Port of Willapa used flow-lane disposal for two projects.

5.1.1 **Dredging Year 2014 (June 16, 2013 through June 15, 2014).**

During DY14, two Puget Sound non-dispersive sites received material from four separate projects (Table 5-1 and Table 5-2). Elliott Bay was the most frequently used non-dispersive site in DY14, receiving over 100,000 cy of material from three projects. No dispersive sites in Puget Sound received any material. A total of 43,692 cy of material found unsuitable for open-water at the Puget Sound sites was dredged and disposed at upland sites.

The Point Chehalis dispersive site in Grays Harbor received a total of over 1.2 million cy from maintenance dredging of the federal navigation channel, the Port of Grays Harbor terminals and WSDOT's State Route 520 pontoon casting basin in Aberdeen. An additional 500,000 cy of federal maintenance material was placed at the South Beach beneficial use site. The multiuser dispersive sites in Willapa Bay were not used. However, the Port of Willapa placed 6,500 cy of hydraulically dredged material in the flow lane at Bay Center.

The DY14 disposal volumes in Puget Sound and Grays Harbor sites are graphically presented in Figures 5-1 and 5-2.

5.1.2 **Dredging Year 2015 (June 16, 2014 through June 15, 2015).**

During DY15, only two of the Puget Sound sites were used (Table 5-3 and Table 5-4). The Port Gardner non-dispersive site received approximately 11,000 cy of material from maintenance dredging at Kingston Marina. The Rosario Strait dispersive site received material from two projects, with a total of approximately 84,000 cy being placed. There was no dredging of material found unsuitable for open-water disposal. Therefore, no upland disposal was reported for projects in Puget Sound.

The Point Chehalis site received nearly 1.5 million cy of sediment from maintenance dredging of the Grays Harbor federal navigation channel, the Port of Grays Harbor terminals and WSDOT's pontoon casting basin. An additional 54,000 cy from the federal navigation channel were placed at South Beach. The multiuser dispersive sites in Willapa Bay were not used. However, the Port of Willapa placed 21,000 cy of hydraulically dredged material in the flow lane at Tokeland.

The DY15 volumes disposed at Puget Sound and Grays Harbor sites are graphically presented in Figures 5-3 and 5-4.

5.2 Post-Disposal Site Monitoring (2014 – 2015)

During this biennium, the following monitoring events and special studies occurred:

- partial monitoring at Elliott Bay
- SPI survey at Commencement Bay
- multibeam bathymetric surveys at Commencement Bay, Elliott Bay and Anderson/Ketron
- ROV inspection at Elliott Bay
- trawl study at Anderson/Ketron
- fate and transport modeling at Anderson/Ketron

Each monitoring event and special study is discussed in more detail below.

5.2.1 **Elliott Bay Partial Monitoring Characterization**

Monitoring at the Elliott Bay site was performed in response to surpassing the "soft trigger" of 500,000 cy of material at the end of DY13. The type of environmental monitoring conducted at a disposal site is determined by the volume of dredged material disposed at a site since the most recent monitoring survey and other site-specific considerations. Partial monitoring is conducted when an appreciable volume of dredged material has been disposed at a site, but the volume is not enough to trigger a full monitoring effort (PSDDA, 1988c). The DMMP agencies use best professional judgment in evaluating the disposal record since the last monitoring event and determining whether a partial monitoring survey is sufficient to characterize conditions at the site. At the Elliott Bay site, approximately 600,000 cy had been placed at the site since the last partial monitoring event in 2002, or about 55,000 cy/yr. It was anticipated that at that relatively low rate of disposal, the potential for adverse impacts was also low. In addition, two other surveys had been conducted at the site since 2002, a special on-site chemistry survey in 2005 and a dioxin survey in 2007. Based on these considerations, the DMMP agencies deemed a partial characterization sufficient.

The objective of partial monitoring is to answer the first two questions in the three-question DMMP monitoring framework: 1) Does the deposited dredged material stay on site?; 2) Are the biological effects conditions for site management (Site Condition II) exceeded at the site due to dredged material disposal? (DNR, 2007). A summary of the partial monitoring survey is provided below; more detailed information and results can be found in the monitoring report (Integral, 2014).

Monitoring Question 1: Does the deposited dredged material stay on site?

This monitoring question is answered using sediment profile imaging (SPI) to map the distribution of dredged material at the disposal site, and chemical analysis at perimeter stations – located 0.125 nautical mile outside the disposal site boundary – to determine whether chemical concentrations at off-site stations are increasing over time due to dredged material disposal.

SPI photographs were collected from 79 stations. Both recent and historic dredged material was found. The footprint of the more recent deposits was well within the disposal site boundary (Figure 5-5). The SPI results also indicated that the recent dredged material disposal did not result in widespread alterations of the benthic infauna community structure at the site. Overall, the Elliott Bay site benthic community appears to be in a climax situation with the highest order of succession (Stage III communities) present at 95% of the stations following the most recent dredged material disposal (NewFields, 2013).

Chemical analysis of surface samples collected at five perimeter stations found that most detected chemicals were well below the SQS, with the exception of mercury and PCBs. Mercury exceeded SQS at two perimeter stations and PCBs exceeded SQS at one station. However, the concentrations of mercury and PCBs found at these stations were greater than at the on-site station EBZ01, indicating that the elevated concentrations were likely not associated with recent dredged material disposal. In addition, a time-trend analysis using the Chemical Tracking System (CTS) indicated that neither mercury nor PCBs showed statistically significant increasing trends at the perimeter stations. The Elliott Bay disposal site vicinity has a history of elevated concentrations of mercury and PCBs, including those measured during the baseline survey in 1988 prior to any dredged material disposal under DMMP (Integral, 2014). This legacy contamination is likely the reason elevated concentrations of these chemicals are still found at the perimeter stations.

The results of the SPI survey and chemical analysis at perimeter stations were used to answer the first monitoring question. Taken together, these two lines of evidence demonstrated that deposited dredged material stayed on site.

Monitoring Question 2: Are the biological effects conditions for site management (Site Condition II) exceeded at the site due to dredged material disposal?

This monitoring question is answered by comparing on-site chemical concentrations to the DMMP MLs and conducting bioassays on an on-site sediment sample. The MLs are concentrations above which adverse biological effects are expected to occur; concentrations below ML meet Site Condition II for chemistry. The bioassays are used to measure adverse biological effects directly. Bioassay results which meet the non-dispersive suitability guidelines for disposal also meet Site Condition II for biological effects.

Chemical concentrations at the on-site station were very low for metals, PAHs, phthalates, phenols, miscellaneous extractable compounds, PCBs and pesticides. All concentrations were below the DMMP SLs and well below the MLs. PCB Aroclors were undetected and mercury had a concentration of only 0.06 mg/kg (SL = 0.41 mg/kg). No onsite chemical concentrations exceeded the DMMP MLs, which represent PSDDA Site Condition II chemical guidelines.

The standard suite of DMMP bioassays was conducted on sediment collected from on-site station EBZ01 and a reference sample from Carr Inlet. The on-site station passed the DMMP bioassay non-dispersive interpretive criteria for all toxicity tests, with no hits recorded under either the one-hit or two-hit rule.

The results of the chemical analysis and bioassays at the on-site station were used to answer the second monitoring question. Taken together, these two lines of evidence demonstrated that the biological effects conditions for site management (Site Condition II) were not exceeded at the site due to dredged material disposal.

Dioxins/Furans. The evaluation of dioxins/furans at the disposal sites was not part of the original monitoring framework. In 2010 the DMMP agencies implemented revised guidelines for these compounds and established a site management objective of 4.0 ng/kg TEQ. Analysis of dioxins/furans at ten on-site stations was added to the monitoring plan to verify that the site management objective was being met. The average dioxin concentration at ten on-site stations sampled in 2013 was 6.90 ng/kg TEQ, which exceeded the site management objective of 4.0 ng/kg TEQ. However, the DMMP agencies acknowledged when the site management objective was implemented that it would take time to reach this goal since dredged material disposal does not provide a uniform cover over the entire extent of the site. The presence of older dredged material was likely a contributing factor to the average on-site dioxin concentration in excess of the site management objective in 2013.

For the five sampling locations that fell within the dredged material footprint shown in Figure 5-7, the average dioxin concentration was 3.31 ng/kg TEQ (range = 1.25 to 5.25 ng/kg TEQ), which is below the site management objective. While not all individual locations met the objective, the surface sediment in the area covered by recently deposited material met the management objective when taken as a whole. These results provide evidence that the revised evaluation guidelines and best management practices for dioxin are working as intended.

The concentration of dioxin detected at station EBS04 (30 ng/kg TEQ), which lies outside the dredged material footprint, was clearly well above the site management objective. The dioxin concentration at this station in 2007 was 17 ng/kg TEQ. There is reason to believe the elevated dioxin at this station was associated with a dredging project that used the site prior to implementation of wide-scale dioxin testing for DMMP projects. USACE responded to this elevated concentration of dioxin in late 2013 by targeting EBS04 with disposal of clean sand from the Duwamish turning basin, effectively burying it in place (Figure 5-6).

5.2.2 Commencement Bay SPI Survey

The primary objective of the SPI survey in September of 2013 was to map the distribution of dredged material at the Commencement Bay disposal site to assess whether the shift in the target disposal coordinates in 2007 had affected the dredged material deposition pattern at the site. The shift in the target disposal coordinates was made in order to reduce the rate of growth in the height of the disposal mound, which had reached 121 feet after disposal of 8,000,000 cy of dredged material in the period 1988 to 2007. Subsequent to the shift in the target coordinates, approximately 450,000 cy of additional material was placed in the period 2007 to 2013. Evaluating the deposition pattern of this additional material was the objective of the survey.

SPI photographs were collected from 68 stations. Both recent and historic dredged material was found. The footprint of the more recent deposits showed that small amounts of dredged material had migrated off-site, with the most extensive migration occurring to the northwest (Figure 5-7). This is consistent with historical deposits that also show migration to the north, northwest, west and southeast (Figure 5-8). However, the amount of material extending beyond the disposal site boundary has been relatively small. The 2013 SPI survey showed that the depth of recent dredged material deposits at the perimeter line was less than 3 cm. Three centimeters of deposition at the perimeter line would trigger further assessment under the disposal site monitoring framework. Figure 5-7 includes an isopach line bounding the area with 3 cm or more of recent deposition. The 3-cm line is well inside the disposal site boundary. The isopach line clearly shows a shift in the deposition pattern to the southeast, which matches the shift of the disposal coordinates to the southeast boundary of the disposal zone. While the minor off-site migration to the southeast shown in Figure 5-7 appears to follow this same pattern, none of the material migrated as far as the perimeter line. Figure 5-8 shows that off-site migration to the southeast has also occurred historically. The SPI survey results demonstrated that a shift in the deposition pattern of dredged material resulted from a shift in the disposal coordinates, as expected. The effectiveness of this shift on the growth of the disposal mound will be examined in the next section.

5.2.3 Multibeam Bathymetric Surveys at the Elliott Bay and Commencement Bay Disposal Sites

Multibeam bathymetric surveys of the Elliott Bay and Commencement Bay disposal sites were conducted in the summer of 2013 by USACE personnel in advance of the SPI surveys at those sites. The Elliott Bay survey (Figure 5-9) shows a well-shaped mound with its apex at or near the disposal site coordinates (shown in this 3D rendering as a red dot). The Commencement Bay survey (Figure 5-10) also shows a well-shaped mound. There appears to have been some flattening of the top of the mound since 2007 and elongation of the mound to the southeast, both indications of the effectiveness of the shift in disposal coordinates. The shape of the mound in 2007 (Figure 5-11) was more conical than in 2013, with a more well-defined apex. Future bathymetric surveys will be needed to more definitively assess the effectiveness of the shift in disposal coordinates and compare the growth of mound height to that predicted in the supplemental environmental impact statement (DMMP, 2009).

5.2.4 Multibeam Bathymetric Survey, Fate and Transport Modeling, Benthic Trawl Survey, and Benthic ROV Survey at the Anderson/Ketron Disposal Site

In preparation for renewal of the shoreline permit for the continued use of the Anderson-Ketron site for dredged material disposal and to address stakeholder concerns regarding the site, the DMMP agencies completed several monitoring/modeling activities. These activities are briefly summarized in the following.

Multibeam bathymetric survey. A bathymetric survey of the Anderson/Ketron disposal site and environs was conducted to address stakeholder concerns about sand waves propagating in the Nisqually Delta and potentially causing resuspension and displacement of dredged material at the site. The survey showed the sand wave bedforms that have developed over time east of the Nisqually River mouth due to strong tidal currents (Figure 5-12). However, the sand waves dissipate at the 60 m depth contour and are restricted to the Nisqually Delta. The Anderson/Ketron site is located in a deep basin with depths exceeding 100 m, suggesting no active conduit for bedload sediment transport between the two areas (USACE, 2014b).

Fate and transport modeling. Fate and transport modeling was conducted at the Anderson/Ketron site to address stakeholder concerns about the potential for off-site transport of fine-grained dredged material from the disposal site toward the Nisqually Delta. Three numerical models were combined to simulate the disposal and fate of dredged material placed at the site. An existing hydrodynamic model of Puget Sound was used in conjunction with the results from a dredged material placement model to drive a particle tracking model.

Based on the model results approximately 95% of the material placed at the Anderson-Ketron disposal site settles to the bottom within the disposal site within two hours of placement (Figures 5-13 and 5-14). The other 5% of material remains in suspension in the water column after the initial mass of sediment encounters the bottom. There is the potential for a fraction of this material to be transported outside of the disposal site boundary. The particle tracking model results indicate that approximately one-half of the material in suspension eventually settles out within the disposal area boundary, leaving 2-3% of material placed in suspension with the potential to be transported outside of the site boundary. Although this fraction of material has the potential to move beyond the site boundaries, the site is situated such that the material remains confined by the bathymetric features into water depths greater than 100 meters where impacts to resources are expected to be minimal. These model results confirm that the assumptions used during the original siting of the disposal site were accurate and that the site is acting as described in PSDDA (1989) (USACE, 2014b).

Benthic trawl study. Since establishment of the Nisqually Reach Aquatic Reserve in 2011, concern has been expressed by some stakeholders that continued use of the Anderson/Ketron site threatens biological resources in the Nisqually Reach. It has also been contended that the biological resources at the site itself have changed significantly since the site was established, such that continued use of the site for dredged material disposal is adversely impacting those on-site resources. To address these concerns, the DMMP agencies replicated the epibenthic portion of the 1987 demersal resource evaluation that was conducted during the PSDDA siting study (PSDDA, 1989). The 1987 study showed that the biological resources in the deep trough between Anderson Island and Ketron Island were relatively sparse compared to more productive habitat in shallower water adjacent to the site and within the Nisqually Delta and Oro Bay. By replicating the 1987 study, the disposal site and vicinity could be evaluated for changes in biological resources.

The present study, conducted in 2014-2015, used a plumb-staff beam trawl comparable to the one used in the initial siting investigations. To maximize consistency between the two studies, seasonal trawling intervals occurred in July, October, February and May, consistent with the 1987 siting study intervals. Benthic crab, Pandalid shrimp, and other demersal resources in the vicinity of the Anderson/Ketron Island site were collected, identified, enumerated and measured. The study was designed to compare the existing epibenthic invertebrate community between off-site and on-site stations, and to determine whether any important changes had occurred in the existing benthic community relative to the 1987 study.

To remain consistent with the original 1987 siting study, the same 30 trawl stations investigated for the siting study were included in the 2014-15 study. To improve the understanding of the existing benthic community at the disposal site itself, the 2014-15 investigation added eight sampling stations (EW-1 through EW-5; S-2 through S-4) within the disposal site boundary, or in its immediate vicinity (Figure 5-15).

At the time of preparation of this biennial report, the study report for the 2014-15 benthic trawl survey was not yet complete. The 2016-17 biennial report will include a summary of the results and conclusions from that report.

WDFW ROV Survey. In summer 2014, WDFW conducted a survey of the Anderson/Ketron disposal site and vicinity using a remotely operated vehicle (ROV) to evaluate benthic indicators and habitat for comparison with results from the benthic trawl study. Results from the ROV survey are forthcoming.

5.2.5 Elliott Bay ROV Inspection

In February 2014, the Elliott Bay disposal site was inspected using an ROV in response to concerns about debris being improperly disposed from a nearby dredging project. The ROV was equipped with a high resolution camera and multi-beam imaging sonar instrumentation. During the inspection, positive identification of multiple anthropogenic debris items – previously photographed in the dump scow during dredging operations – was made (USACE, 2014a). In December 2015, USACE targeted disposal of clean sand dredged from the Duwamish turning basin to bury the debris. This incident, along with debris found during the benthic trawl study at the Anderson/Ketron site, prompted the DMMP agencies to implement revised guidelines for debris management (DMMP, 2015b).

5.3 Cumulative DMMP Disposal Site Use and Monitoring History

The cumulative dredged material volumes disposed at each Puget Sound and Grays Harbor/Willapa Bay site since program implementation are depicted in Figure 5-16 and Figure 5-17 and listed in Table 5-6. Twenty-seven-year summaries for the Puget Sound sites show that site capacities appear to be sufficient to last at least 40 more 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 to gather data on the adequacy of the evaluation procedures to meet the site management objectives. In accordance with the management plan, 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, Elliott Bay and Port Gardner sites following the 2002 SMARM. The volume trigger was left at 300,000 cy for the two less frequently used non-dispersive sites (Bellingham Bay and Ketron/Anderson Island). The monitoring triggers are considered soft triggers, and may be relaxed at the discretion of the DMMP agencies based on best professional judgment.

The DMMP agencies have conducted a variety of post-disposal physical and environmental monitoring surveys at the non-dispersive sites in Puget Sound and bathymetric surveys at the dispersive sites. Additional special studies have been conducted, including the 2014 fate and transport modeling and the 2014-15 benthic trawl study at the Anderson/Ketron non-dispersive site. Table 5-8 lists the DMMP disposal site monitoring surveys and special studies that have been completed since the Puget Sound sites were established in 1988/89.

Based on Puget Sound site monitoring conducted to date (including physical mapping, on- and off-site sediment chemistry, sediment toxicity, off-site infaunal bioaccumulation, and off-site benthic community structure analysis), dredged material disposal has not caused adverse impacts at or adjacent to any of the

non-dispersive sites. However, the recent discovery of debris at two of the non-dispersive sites has prompted the DMMP agencies to implement additional debris management procedures to ensure that the site management objectives continue to be met and to adequately protect and preserve the existing disposal sites for continued use (DMMP, 2015b).

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 feedback to verify the adequacy of the DMMP dredged material evaluation procedures and management plan. The Sediment Management Annual Review Meetings provide a forum to report on these post-disposal survey findings conducted during any given dredging year, and to make management plan adjustments if needed.

5.4 Endangered Species Act and Magnuson-Stevens Act Consultation

USACE, in coordination with the DMMP agencies, consults with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act (ESA) and with NMFS under Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) on a periodic basis. All DMMP disposal sites are covered under this consultation so that placement of dredged material in designated disposal sites does not need to be consulted individually for each project. The most recent consultation is summarized below.

5.4.1 **2015 Biological Evaluation and Consultation**

In June 2015, USACE submitted a biological evaluation (BE) to NMFS and USFWS for continued use of the ten multiuser dredged material disposal sites in Puget Sound and Grays Harbor (USACE, 2015). Effect determinations were made for 17 ESA-listed species, distinct population segments or evolutionary significant units and their designated critical habitat (Table 5-9). Effects of dredged material disposal on essential fish habitat (EFH) for Pacific coast groundfish, coastal pelagic species and Pacific salmon were assessed in accordance with the MSA.

ESA Consultation. In July 2015, USFWS responded to the BE with a concurrence letter for bull trout, bull trout critical habitat, and marbled murrelet. In December 2015, NMFS concurred with USACE's effect determination for all species and critical habitats with the exception of rockfish. NMFS determined that disposal under the DMMP program was "likely to adversely affect" canary rockfish (*Sebastes pinniger)*, yellow-eye rockfish (*S. ruberrimus*) and bocaccio (*S. paucispinis*). However, NMFS concluded in their biological opinion that "the proposed action is not likely to jeopardize the continued existence of yelloweye rockfish, canary rockfish or bocaccio of the Puget Sound/Georgia Basin or destroy or adversely modify their designated critical habitat."

The biological opinion included an incidental take statement for larval rockfish. NMFS stated that it was unlikely that adult ESA-listed rockfish would be harmed as a result of dredged material disposal, but concluded that incidental take of rockfish larvae would occur through exposure to elevated sediment levels of chemicals of concern and any bioaccumulative toxins attached to the sediment. Due to the difficulty in detecting and quantifying the take associated with actual disposal, NMFS estimated the number of larval fish that would be injured or killed by using habitat impacted by disposal as a surrogate. Habitat was defined as the full benthic footprint of the disposed dredged material after it settles on the bottom and the water column through which the sediment falls. The approximate benthic footprint resulting from disposal of

a typical barge of dredged material at a non-dispersive site was provided in the BE. Using this approximation, NMFS provided an annual larval take estimate for the DMMP non-dispersive sites.

The terms and conditions of the incidental take statement included a requirement for USACE to submit to NMFS the DMMP biennial reports; copies of clarification and issue papers adopted through the Sediment Management Annual Review Meeting process; and a periodic assessment by USACE as to whether programmatic coverage under the 2015 incidental take statement is still warranted. NMFS will review the provided material and notify USACE if programmatic coverage is to be continued or reinitiation required. The 2015 consultation provides coverage for the period 2015 to 2040 unless it is determined by NMFS that USACE must reinitiate consultation.

MSA Evaluation. NMFS evaluated the likely effects of dredged material disposal on EFH and made several conservation recommendations to USACE, including the following:

a. Continue to conduct or support comprehensive ichthyoplankton surveys near each of the DMMP program dispersive and non-dispersive sites within the Puget Sound/Georgia Basin.
b. Analyze dissolved and particulate PCB and PBDE in the open waters of Puget Sound. This may be accomplished through ongoing studies or new studies initiated under the DMMP.
c. Initiate systematic monitoring for PBDEs at candidate dredge sites, and manage dredged material disposal to reduce PBDE content within the receiving sites. Work towards inclusion of PBDEs on the list of potentially bioaccumulative substances that require testing under the DMMP.
d. Annually assess new scientific research for bioaccumulative compounds, including new and existing literature regarding effect thresholds (that include synergistic and sublethal effects) for aquatic species.
e. Assess and consider recommendations proposed by NMFS to improve sediment PAH values when evaluating dredging and disposal activities.

In its statutory response to these recommendations, USACE agreed to several actions (dependent on the availability of funding and staffing):

a. Fund the genetic identification of a limited number of rockfish larval specimens collected by NMFS at the DMMP disposal sites in Puget Sound.
b. Continue to analyze PBDEs during chemical monitoring surveys at non-dispersive sites and continue to do limited PBDE analysis at federal navigation projects in urban areas of Puget Sound. Undertake development of dredged material evaluation guidelines for PBDEs if warranted.
c. Continue to assess scientific research for bioaccumulative compounds as they relate to dredged material management. The chemicals targeted for this assessment will be prioritized by the DMMP agencies based on such factors as risk to human health and potential impacts on ESA-listed species.
d. Continue working with NMFS on the technical basis of the proposed PAH screening values for the protection of salmonids and consider adoption of a PAH screening level based on the recommendations from NMFS.

Table 5-1. Project-Specific Dredged Material Disposal and Beneficial Use Placement, DY14

Site	Proponent/Project	Dredger	Dredge Type	Disposal Volume (cy)	# Barge Loads	# Off Site	Disposal Dates
Federal							
EB	USACE Duwamish – Upper Channel and Turning Basin	American Construction	CS	68,165	59	0	12/27/2013 – 02/01/2014
EB	USACE Duwamish Spokane St. Bridge	American Construction	CS	1,687		0	
PC	USACE Grays Harbor	American Construction	CS	895,796	326	0	10/26/2013 – 01/28/2014
PC	USACE Grays Harbor	USACE Yaquina	HD	200,521	185	0	03/30/2014 – 04/20/2014
PC	USACE Grays Harbor	USACE Essayons	HD	13,199	111	0	04/25/2015 – 05/20/2014
SB	USACE Grays Harbor	USACE Essayons	HD	498,440		0	04/25/2015 – 05/20/2014
Non-Federal							
AK	Olympia Yacht Club	Pacific Pile & Marine	CS	6,093	19	0	01/06/2014 – 01/28/2014
BC	Port of Willapa Bay Center	Port of Willapa	HYD	6,500	-	-	12/01/2013 – 03/07/2014
EB	City of Renton – Municipal Airport Seaplane Base	American Construction	CS	15,711	14	0	12/06/2013 – 01/13/2014
EB	Newport Yacht Club	Pacific Pile & Marine	CS	32,030	69	0	11/23/2013 – 01/14/2014
PC	Port of Grays Harbor T-1	American Construction	CS	11,728	4	0	01/29/2014 – 01/30/2014
PC	Port of Grays Harbor T-2	American Construction	CS	39,411	14	0	11/06/2013 – 02/05/2014
PC	Port of Grays Harbor T-3	American Construction	CS	44,291	14	0	12/27/2013 – 12/30/2013
PC	Port of Grays Harbor T-4	American Construction	CS	11,572	4	0	01/30/2014 – 01/31/2014
PC	WSDOT – SR 520 Bridge Pontoons, Aberdeen	Kiewit-General	CS	17,490	11	0	03/17/2014 – 03/21/2014
WRL	Olympia Yacht Club	Pacific Pile & Marine	CS	6,892	-	-	12/09/2013 – 01/05/2014
WWL	Port of Seattle T-5	Kiewit	CS	7,250	-	-	12/01/2013 – 02/01/2014
WRL	Port of Olympia, Swantown Haulout and Berth Maintenance	Orion Marine Group	CS	29,550	-	-	11/18/2013 – 01/12/2014

Open-Water Disposal Sites
AK = Anderson/Ketron Island
BC = Bay Center (flow-lane disposal)
EB = Elliott Bay
PC = Point Chehalis

Beneficial Use Sites
SB = South Beach

Upland Disposal Sites
RRL = Roosevelt Regional Landfill (Klickitat County)
WRL = Weyerhaeuser Regional Landfill (Castle Rock)

Dredge Types
CS = Clamshell Dredge
HD = Hopper Dredge
HYD = Hydraulic Dredge

Table 5-2. DY14 Disposal/Placement Summary

Disposal/Placement Sites				
Dredging Location	Placement Site	Type	# of Projects	Total Volume (cy)
Puget Sound	Anderson/Ketron Island	OW-ND	1	6,093
	Elliott Bay	OW-ND	3	117,593
	Weyerhaeuser Regional Landfill	UD	2	36,442
	Roosevelt Regional Landfill	UD	1	7,250
Grays Harbor	Point Chehalis	OW-D	6	1,234,008
	South Beach	BU	1	498,440
Willapa Bay	Bay Center flow lane	OW-D	1	6,500
Disposal/Placement Types				
Puget Sound	Total open-water disposal		4	123,686
	Total upland disposal		3	43,692
Grays Harbor	Total open-water disposal		7	1,234,008
	Total beneficial use		1	498,440
Willapa Bay	Total open-water disposal		1	6,500
Disposal/Placement Types - Grand Totals				
All sites	Grand total open-water disposal		12	1,364,194
	Grand total beneficial use		4	498,440
	Grand total upland disposal		3	43,692
			Grand total all disposal/placement:	1,906,326

BU = Beneficial Use; D = Dispersive; ND = Non-dispersive; OW = Open-Water Disposal; UD = Upland Disposal

Table 5-3. Project-Specific Dredged Material Disposal and Beneficial Use Placement, DY15

Site	Proponent/Project	Dredger	Dredge Type	Disposal Volume (cy)	# Barge Loads	# Off Site	Disposal Dates
Federal							
PC	USACE Grays Harbor	American Construction	CS	1,172,392	352	0	11/10/2-14 – 03/24/2015
SB	USACE Grays Harbor	American Construction	CS	53,666		0	11/10/2014 – 03/24/2015
PC	USACE Grays Harbor	Manson Construction	HD	189,807	50	0	04/19/2015 – 04/23/2015
Site "O"	USACE Everett	Portable Hydraulic Dredging, Inc.	HYD	104,922	-	-	10/15/2014 – 12/21/2014
JI	USACE Everett	Portable Hydraulic Dredging, Inc.	HYD	47,585	-	-	10/15/2014 – 12/21/2014
RS	USACE Swinomish Channel	American Construction	CS	72,485	62	0	09/25/2014 – 10/29/2015
Sites 1 & 2A	USACE Quillayute	Marine Industrial Construction	HYD	14,000	-	-	11/30/2014 – 02/28/2015
Non-Federal							
PC	Port of Grays Harbor T-1	American Construction	CS	13,374	4	0	01/28/2015 – 01/29/2015
PC	Port of Grays Harbor T-2	American Construction	CS	55,441	15	0	11/29/2014 – 01/28/2015
PC	Port of Grays Harbor T-3	American Construction	CS	28,342	8	0	02/03/2015 – 02/09/2015
PC	Port of Grays Harbor T-4	American Construction	CS	6,544	2	0	01/29/2015 – 01/30/2015
PC	WSDOT – SR 520 Bridge Pontoons –Aberdeen	Kiewit-General	CS	10,960	6	0	02/21/2015 – 02/24/2015
PG	Port of Kingston Marina	American Construction	CS	11,480	11	0	11/25/2014 – 12/12/2014
RS	Skagit Fisheries Enhancement Group – Thatcher Bay Restoration – Blakely Island	Pacific Pile & Marine	CS	11,667	23	0	11/08/2014 – 11/24/2014
TK	Port of Willapa Tokeland	Port of Willapa	HYD	21,000	-	-	10/14/2014 – 02/27/2015

Open-Water Disposal Sites
PC = Point Chehalis
PG = Port Gardner
RS = Rosario Strait
TK = Tokeland (flow-lane disposal)

Beneficial Use Sites
JI = Jetty Island
SB = South Beach

Dredge Types
CS = Clamshell Dredge
HD = Hopper Dredge
HYD = Hydraulic Dredge

Table 5-4. DY15 Disposal/Placement Summary

Disposal/Placement Sites				
Dredging Location	Placement Site	Type	# of Projects	Total Volume (cy)
Puget Sound	Port Gardner	OW-ND	1	11,480
	Rosario Strait	OW-D	2	84,152
	Jetty Island - Everett	BU	1	47,585
	Site "O" - Everett	BU	1	104,922
Grays Harbor	Point Chehalis	OW-D	6	1,476,860
	South Beach	BU	1	53,666
Willapa Bay	Tokeland flow lane	OW-D	1	21,000
Quillayute	Sites 1 & 2A	BU	1	14,000
Disposal/Placement Types				
Puget Sound	Total open-water disposal		3	95,632
	Total beneficial use		2	152,507
Grays Harbor	Total open-water disposal		7	1,476,860
	Total beneficial use		1	53,666
Willapa Bay	Total open-water disposal		1	21,000
Quillayute	Total beneficial use		1	14,000
Disposal/Placement Types - Grand Totals				
All sites	Grand total open-water disposal		11	1,593,492
	Grand total beneficial use		4	220,173
Grand total all disposal/placement:				1,813,665

BU = Beneficial Use; D = Dispersive; ND = Non-dispersive; OW = Open-Water Disposal

Table 5-5. Cumulative Disposal Volumes at the End of DY15 and Projected DY16/17 Monitoring Events

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	Full 2007 SPI 2013	Partial 2013	Tiered-Full 2010	Partial 1993
Cumulative volume since last monitoring event	129,776	452,110	117,593	194,018	46,000
Projected DY16/17 Monitoring	--	Full	--	--	--

A/K = Anderson/Ketron

CB = Commencement Bay

EB = Elliott Bay

PG = Port Gardner

BB = Bellingham Bay

Table 5-6. Cumulative Site-Use Summary

Disposal Site	Dredging Years Used	Volume Disposed 2014 - 2015	Cumulative Volumes Disposed (cy)	Average Annual Disposal Volume (cy)
PUGET SOUND (Central)	1989 – 2015 (27 yrs)			
Commencement Bay (ND)	89, 91, 95, 96, 98, 99, 00, 01, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13	0	8,216,022[1]	304,297
Elliott Bay (ND)	90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 00, 01, 02, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14	117,593	3,030,788	112,251
Port Gardner (ND)	90, 91, 93, 94, 95, 96, 97, 02, 06, 07, 08, 09, 10, 11, 12, 13, 15	11,480	3,337,198	123,600
PUGET SOUND (North / South)	1990 – 2015 (26 yrs)			
Anderson/Ketron (ND)	93, 95, 04, 05, 07, 08, 12, 14	6,093	157,215	6,047
Bellingham Bay (ND)	93, 96, 98	0	78,883	3,034
Port Angeles (D)	96	0	22,344	859
Port Townsend (D)	93, 98, 99, 07, 09, 10	0	54,777	2,107
Rosario Strait (D)	91, 92, 93, 94, 95, 96, 98, 99, 02, 03, 04, 05, 06, 07, 09, 11, 12, 13, 15	84,152	2,207,161	84,891
PUGET SOUND (Total)		219,318	17,104,388	551,628
GRAYS HARBOR	1996 – 2015 (20 yrs)			
Point Chehalis (D)	96, 97, 98, 99, 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15	2,710,868	17,381,717	869,086
South Jetty (D)	96, 97, 98, 99, 00, 01, 02, 03, 04, 05, 06, 07, 09, 11, 12	0	11,217,129	560,856
Half Moon Bay (BU)	96, 97, 98, 99, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13	0	3,105,434	155,272
South Beach (BU) (2001-2015)	01, 02, 04, 05, 06, 09, 10, 11, 12, 13, 14, 15	552,106	2,878,667	143,933
3.9 Mile Ocean (D)	03, 04	0	97,831	4,892
GRAYS HARBOR (Total)		3,262,974	34,680,778	1,734,039
WILLAPA BAY	1996 – 2015 (20 yrs)			
Cape Shoalwater (D)	00, 03	0	251,095	12,555
Goose Point (D)	99, 03, 06	0	205,977	10,299
Tokeland (FLD) (2010-2015)	10, 11, 15	21,000	76,000	12,667
Bay Center (FLD) (2010-2015)	14	6,500	6,500	1,083
WILLAPA BAY (Total)		27,500	539,572	26,979
QUILLAYUTE	2008 – 2015 (8 yrs)			
Site A, Site 2A (BU)	08, 10, 15	14,000	133,184	16,648
QUILLAYUTE (Total)		14,000	133,184	16,648
Totals (all sites)		3,496,292	52,430,422	2,327,919

ND = non-dispersive; D = dispersive; BU = beneficial use; FLD = flow lane disposal

[1]The cumulative volume has been adjusted upwards by 19,324 cy. The DY2011 disposal volume in the DY2010/2011 biennial report was incorrectly reported as 179,160 cy. The correct amount is 198,484 cy (a difference of 19,324 cy).

Table 5-7. Puget Sound Non-dispersive Sites: Cumulative Disposal Volumes vs. Site Capacity

Disposal Site	Range of Years Open	# of Years Open	Cumulative Volume (cy)	Average Annual Volume (cy/yr)	Site Capacity[1] (cy)	Percent of Site Capacity	Estimated Time to Reach Site Capacity[2] (Years)
Port Gardner	1989-2015	27	3,337,198	123,600	9,000,000	37.1	46
Elliott Bay	1989-2015	27	3,030,788	112,251	9,000,000	33.7	53
Bellingham Bay[3]	1990-2015	26	78,883	3,034	9,000,000	0.9	>100
Commencement Bay[5]	1989-2015	27	8,216,022	304,297	23,000,000	35.7	49
Anderson/Ketron	1990-2015	26	157,215	6,047	9,000,000	1.7	>100

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

[2] Estimated Time to Reach Site Capacity = (Site Capacity – Cumulative Volume)/average annual disposal volume.

[3] The Bellingham Bay disposal site has not been used since 1998; it is currently not active pending renewal of the shoreline permit.

[4] The capacity of the Commencement Bay site was increased from 9 to 23 million cubic yards following finalization of a 2010 NEPA/SEPA Supplemental Environmental Impact Statement.

[5]The cumulative volume has been adjusted upwards by 19,324 cy. The reported volume in DY2011 of the DY2010/2011 incorrectly reported the volume of dredged material as 179,160 cy. The correct amount was 198,484 cy (a difference of 19,324 cy).

Table 5-8. Puget Sound Disposal Site Monitoring History

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)
2005	Elliott Bay	Special Onsite Chemistry Study
2006	Port Gardner	Full, Dioxin Baseline
2006	Commencement Bay	Mulitbeam bathymetric survey (MBS)
2007	Commencement Bay, Bellingham Bay, Elliott Bay,	Full + MBS @ CB site, dioxin baseline 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
2010	Port Gardner	Tiered-Full
2010	Puget Sound Dispersive Sites	Fate & Transport Study
2013	Commencement Bay	SPI Survey + Multibeam Bathymetric Survey
2013	Elliott Bay	Partial + Multibeam Bathymetric Survey
2014	Anderson/Ketron Island	Fate & Transport Study
2014	Anderson/Ketron Island	Multibeam Bathymetric Survey
2014	Elliott Bay	ROV Inspection
2014/15	Anderson/Ketron Island	Benthic Trawl Survey

SPI = Sediment Profile Imagery Survey
BCOC = bioaccumulative chemicals of concern
Partial = Answers 1st 2 Monitoring Questions (hypotheses 1-4)
Full = Answers all 3 Monitoring Questions (hypotheses 1-6)

PG = Port Gardner
BB = Bellingham Bay
S = Sediment
T = Tissue

Table 5-9. Effect Determination for ESA-Listed Species and Critical Habitat from 2015 Biological Evaluation

Species	Effect Determination	Designated Critical Habitat/Proposed Critical Habitat
Puget Sound Chinook Salmon *Oncorhynchus tshawytscha*	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Hood Canal Summer-Run Chum Salmon *Oncorhynchus keta*	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Puget Sound Steelhead *Oncorhynchus mykiss*	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Lower Columbia River Coho Salmon *Oncorhynchus kisutch*	May affect, not likely to adversely affect	No effect
Bocaccio Rockfish *Sebastes paucispinis*	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Canary Rockfish *S. pinniger*	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Yelloweye Rockfish *S. ruberrimus*	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Eulachon *Thaleichthys pacificus*	May affect, not likely to adversely affect	No effect
Coastal/Puget Sound Bull Trout *Salvelinus confluentus*	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Marbled Murrelet *Brachyramphus marmoratus*	May affect, not likely to adversely affect	No effect
Southern Resident Killer Whale *Orcinus orca*	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Humpback Whale *Megaptera novaeangliae*	May affect, not likely to adversely affect	NA
Leatherback Sea Turtle *Dermochelys coriacea*	No effect	No effect
North American Green Sturgeon *Acipenser medirostris*	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Lower Columbia River Chinook Salmon *Oncorhynchus tshawytscha*	May affect, not likely to adversely affect	No effect
Upper Willamette River Chinook Salmon *Oncorhynchus tshawytscha*	May affect, not likely to adversely affect	No effect
Columbia River Chum Salmon *Oncorhynchus keta*	May affect, not likely to adversely affect	No effect

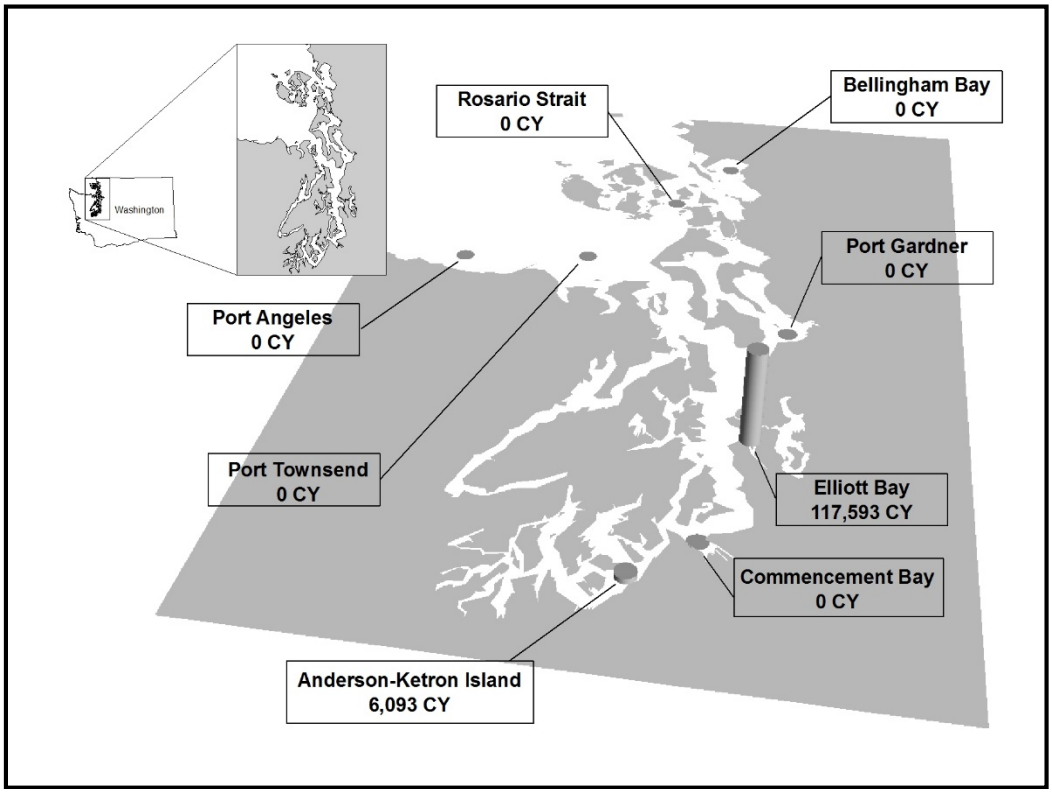

Figure 5-1. DY14 disposal volumes in Puget Sound

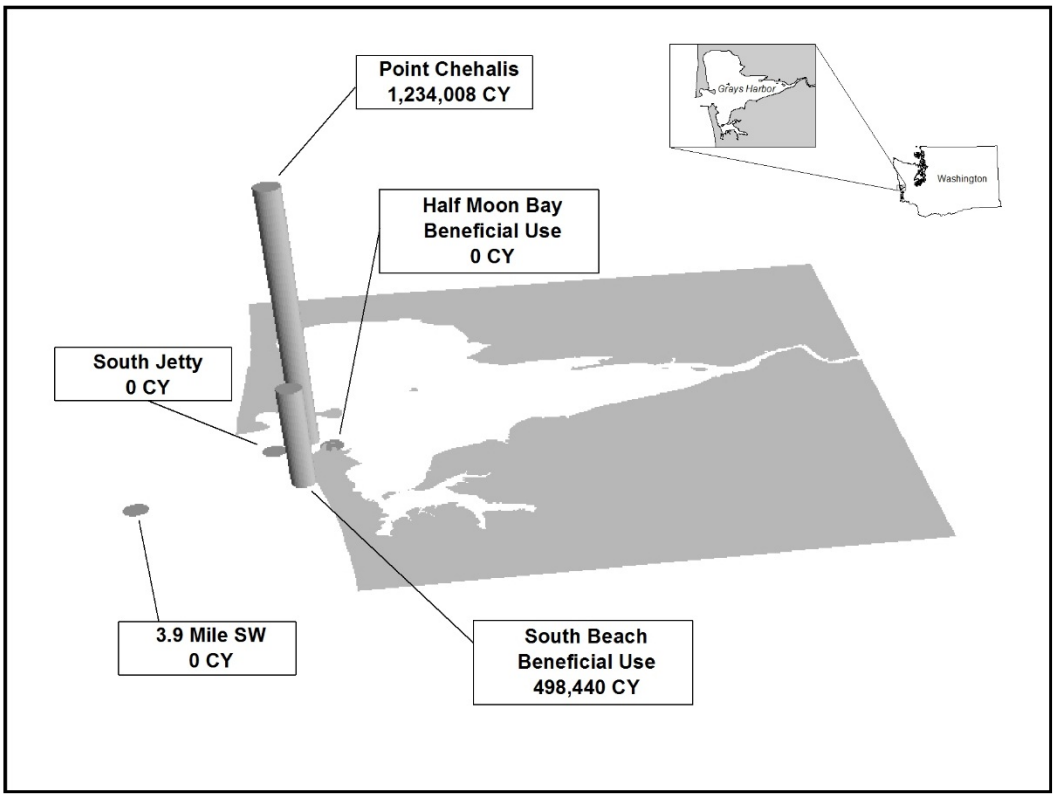

Figure 5-2. DY14 disposal volumes in Grays Harbor

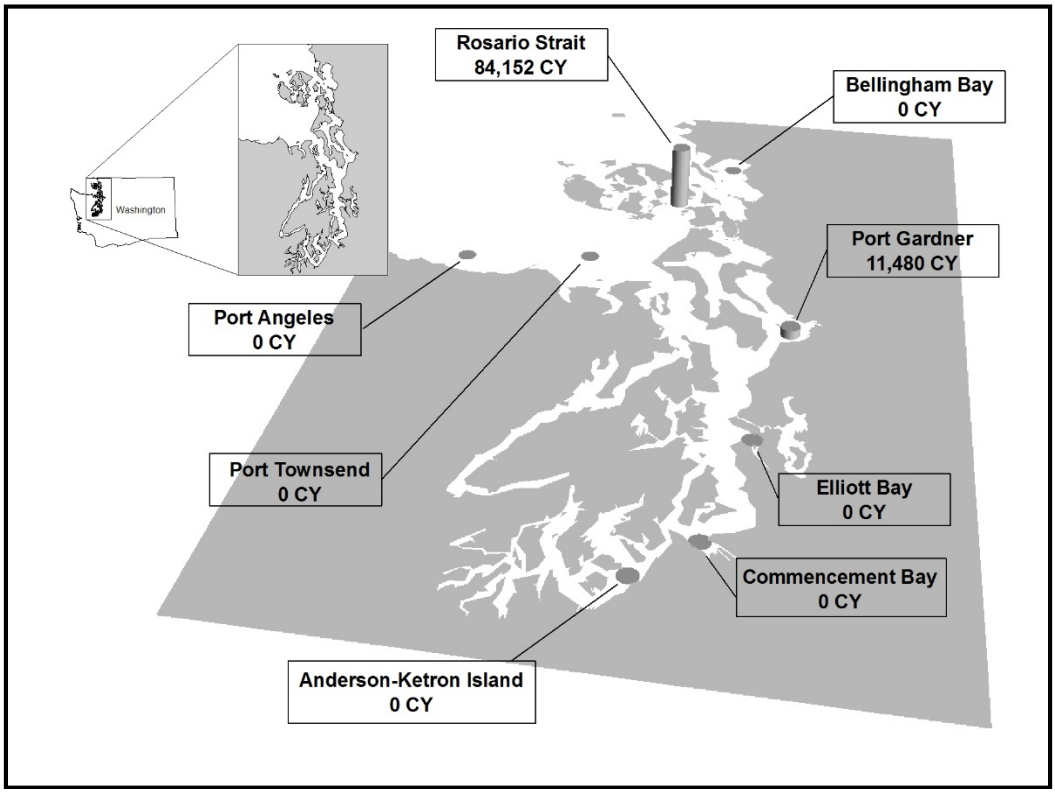

Figure 5-3. DY15 disposal volumes in Puget Sound

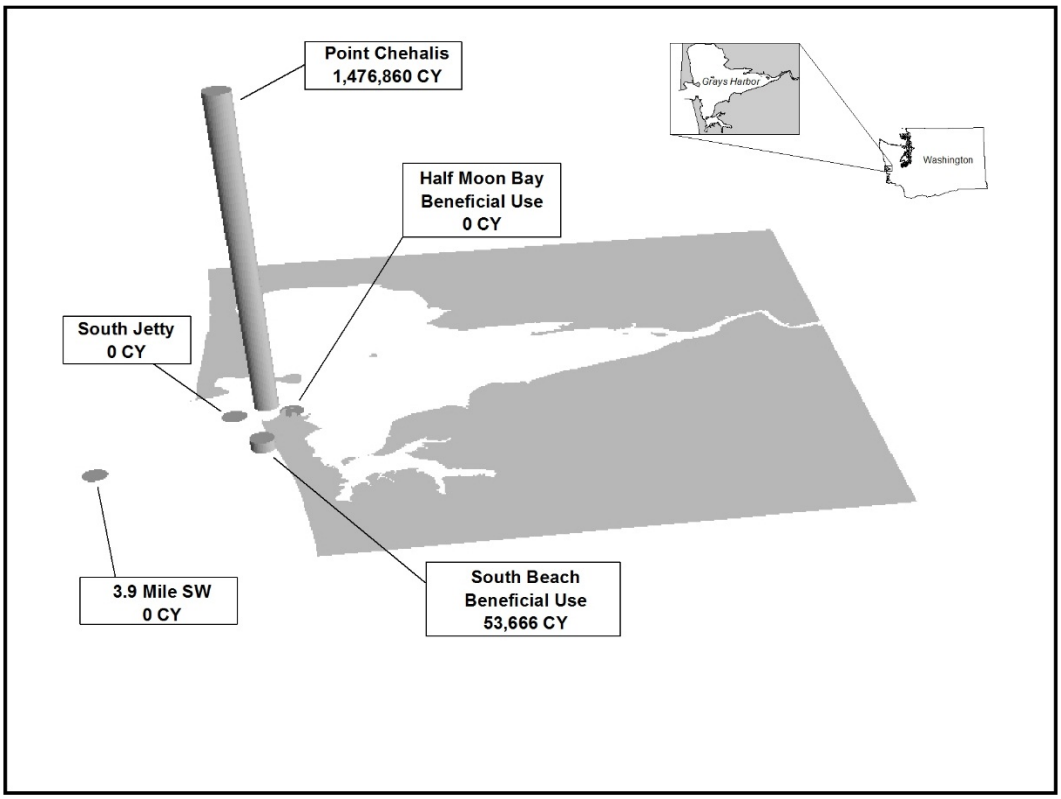

Figure 5-4. DY15 disposal volumes in Grays Harbor

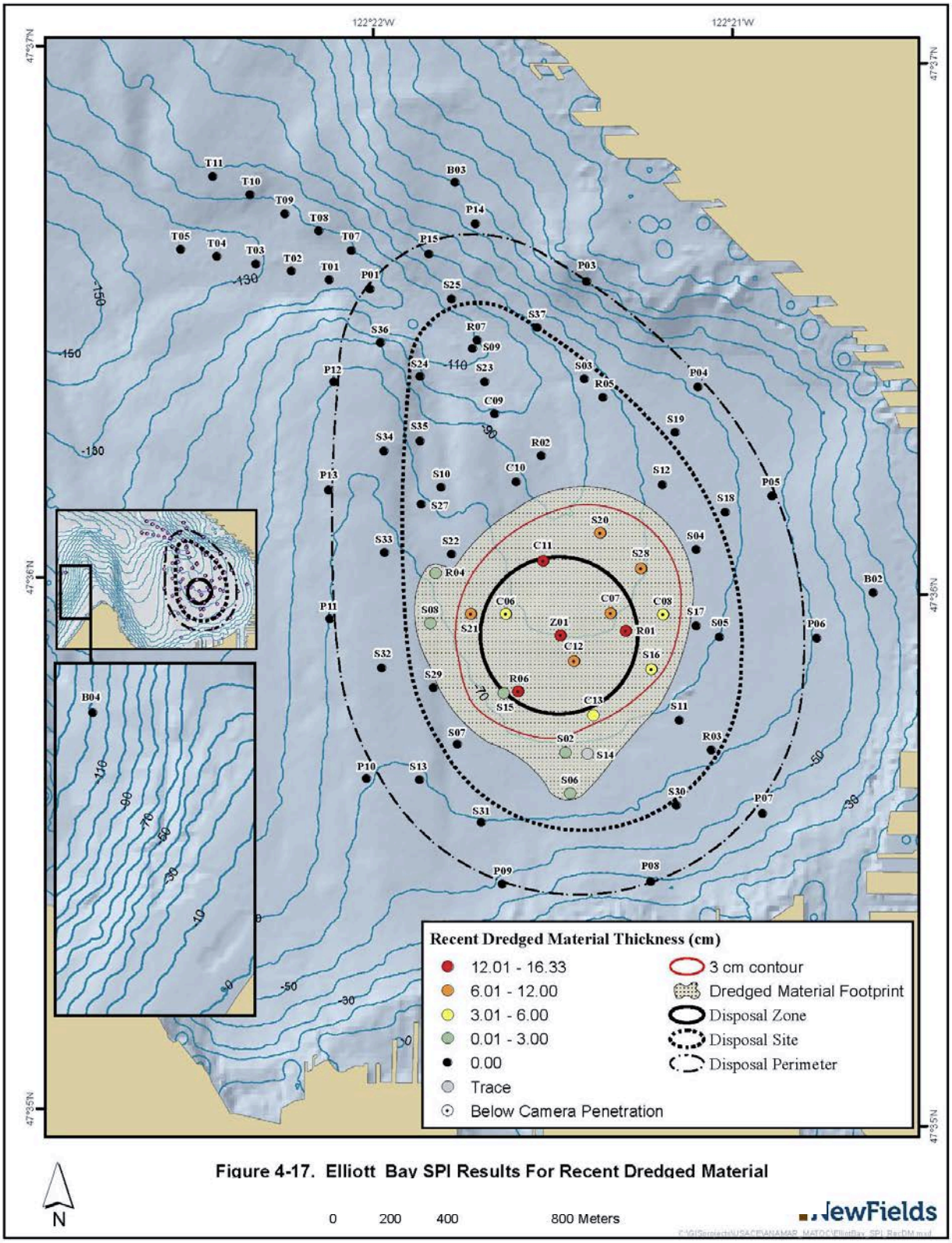

Figure 4-17. Elliott Bay SPI Results For Recent Dredged Material

Figure 5-5. Elliott Bay SPI results for recent dredged material

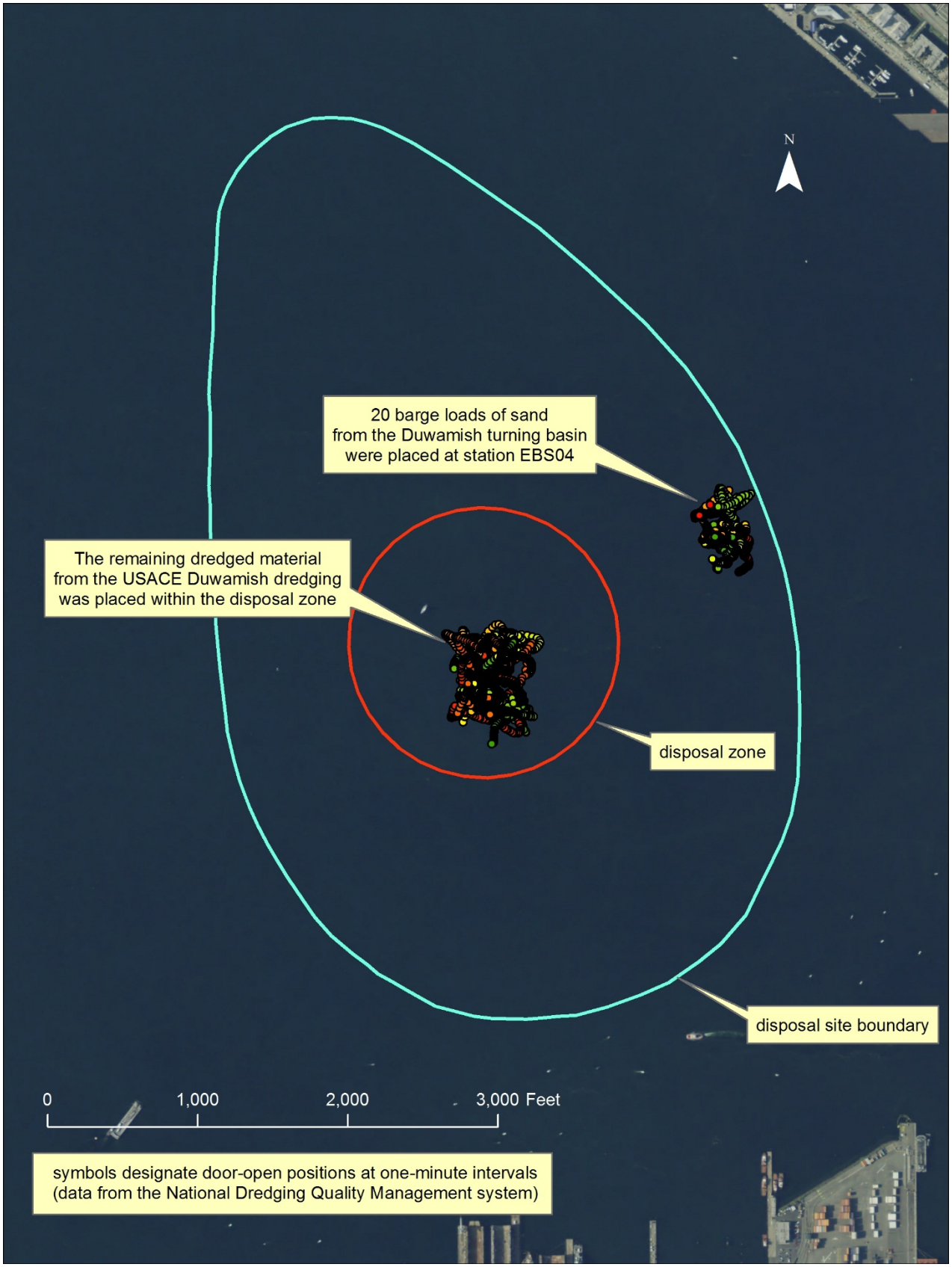

Figure 5-6. Targeted disposal of Duwamish turning basin material to cover dioxin hotspot

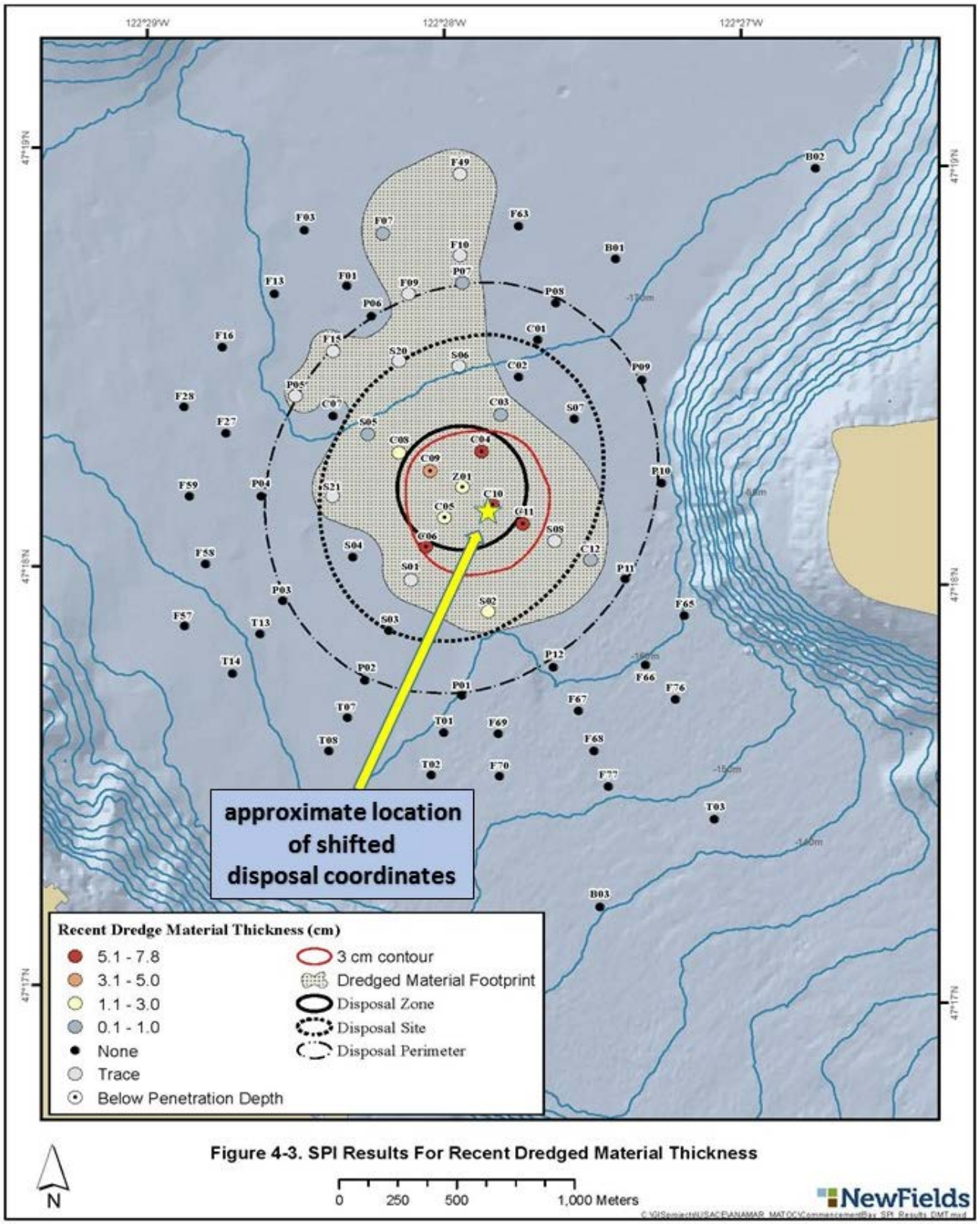

Figure 5-7. Commencement Bay SPI results for recent dredged material

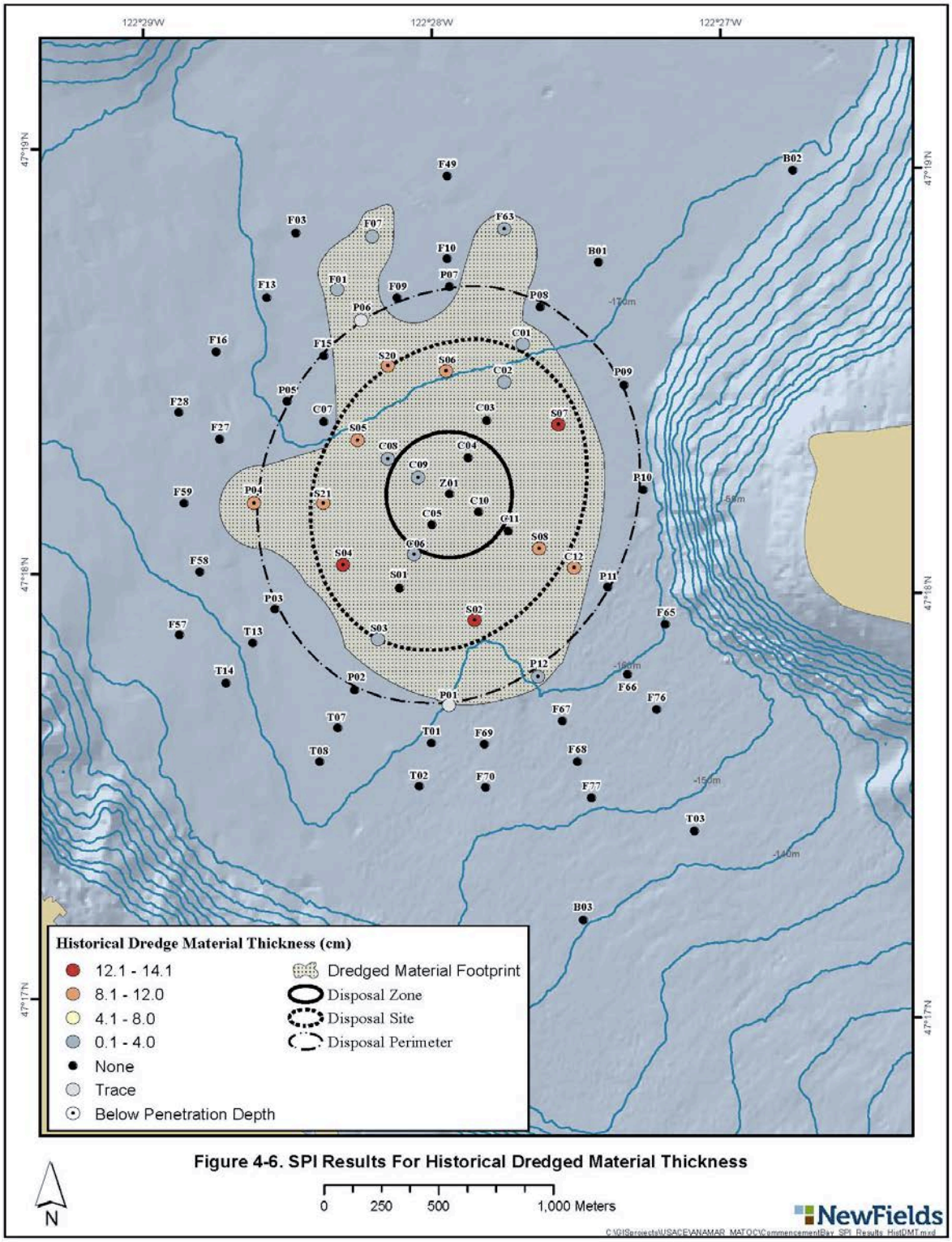

Figure 5-8. Commencement Bay SPI results for historical dredged material

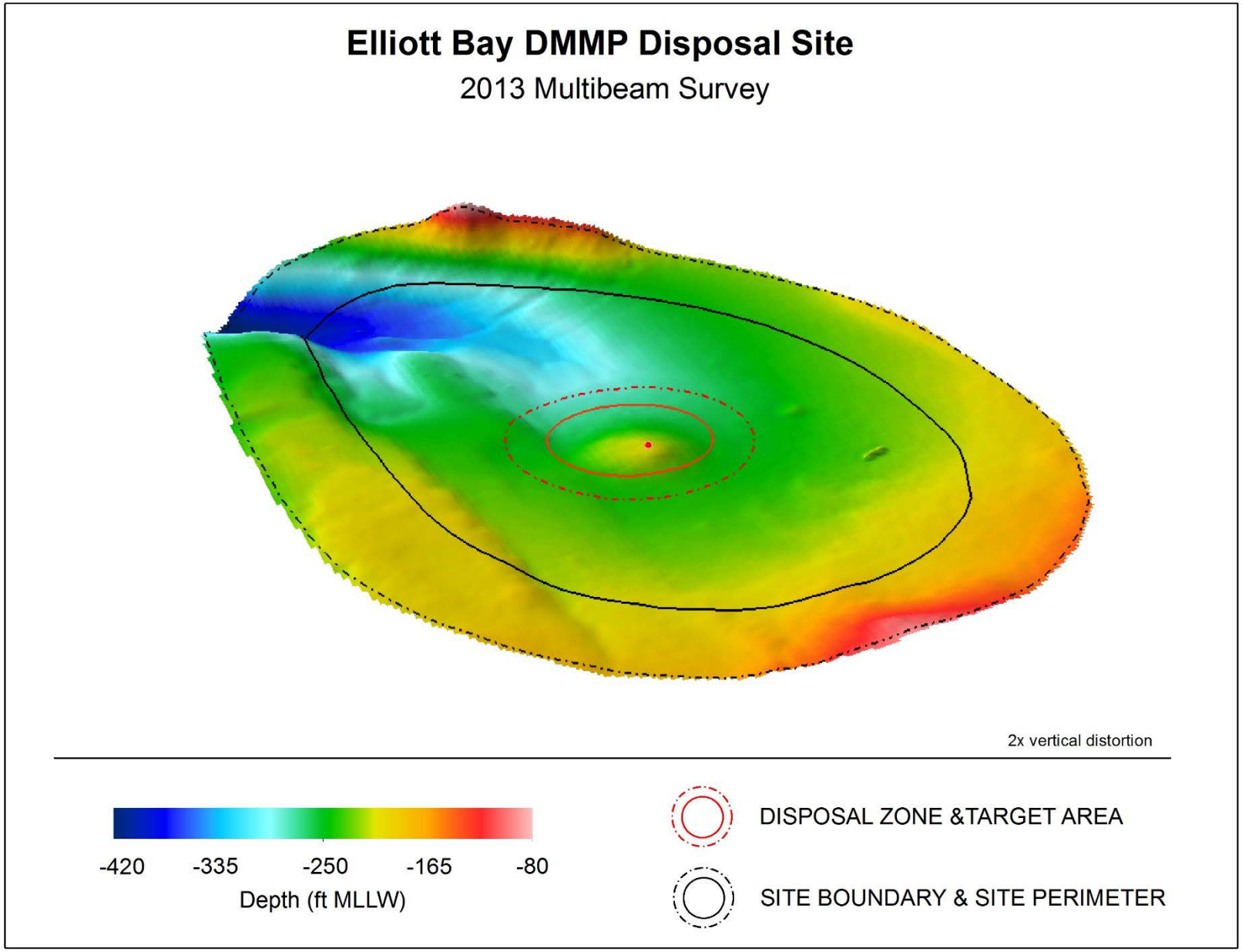

Figure 5-9. 3D rendering of the Elliott Bay multibeam bathymetric survey

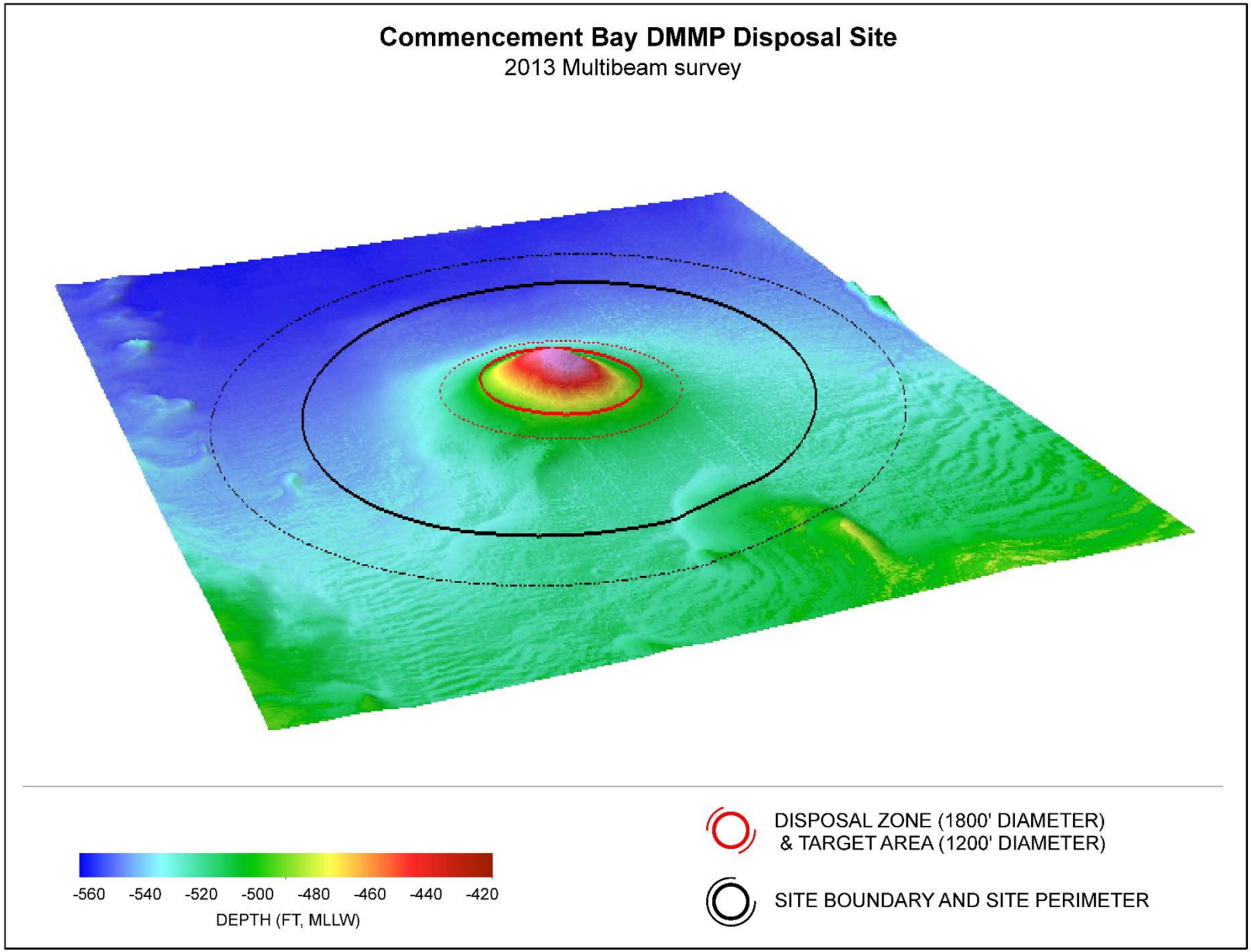

Figure 5-10. 3D rendering of the 2013 Commencement Bay multibeam bathymetric survey

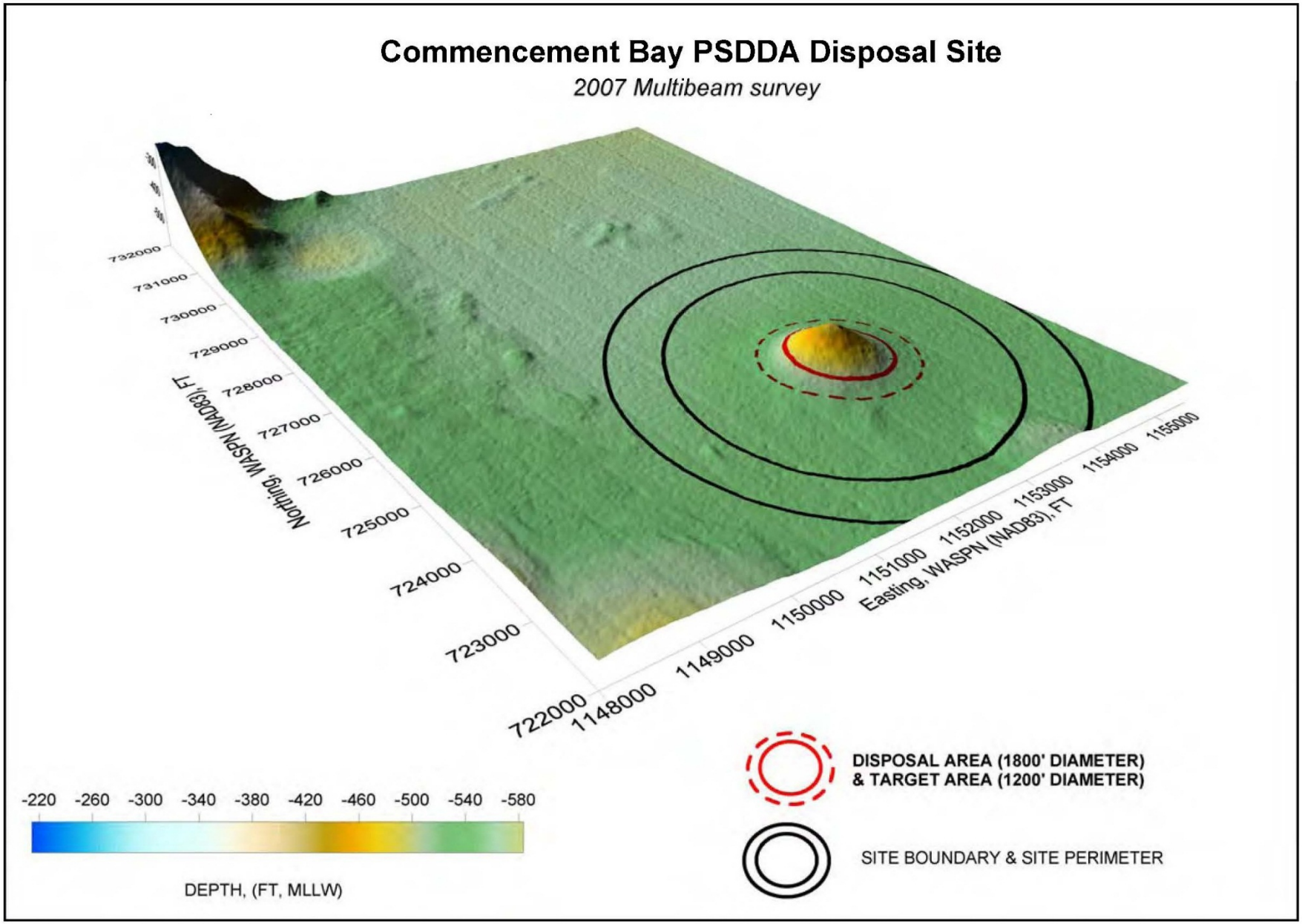

Figure 5-11. 3D rendering of the 2007 Commencement Bay multibeam bathymetric survey

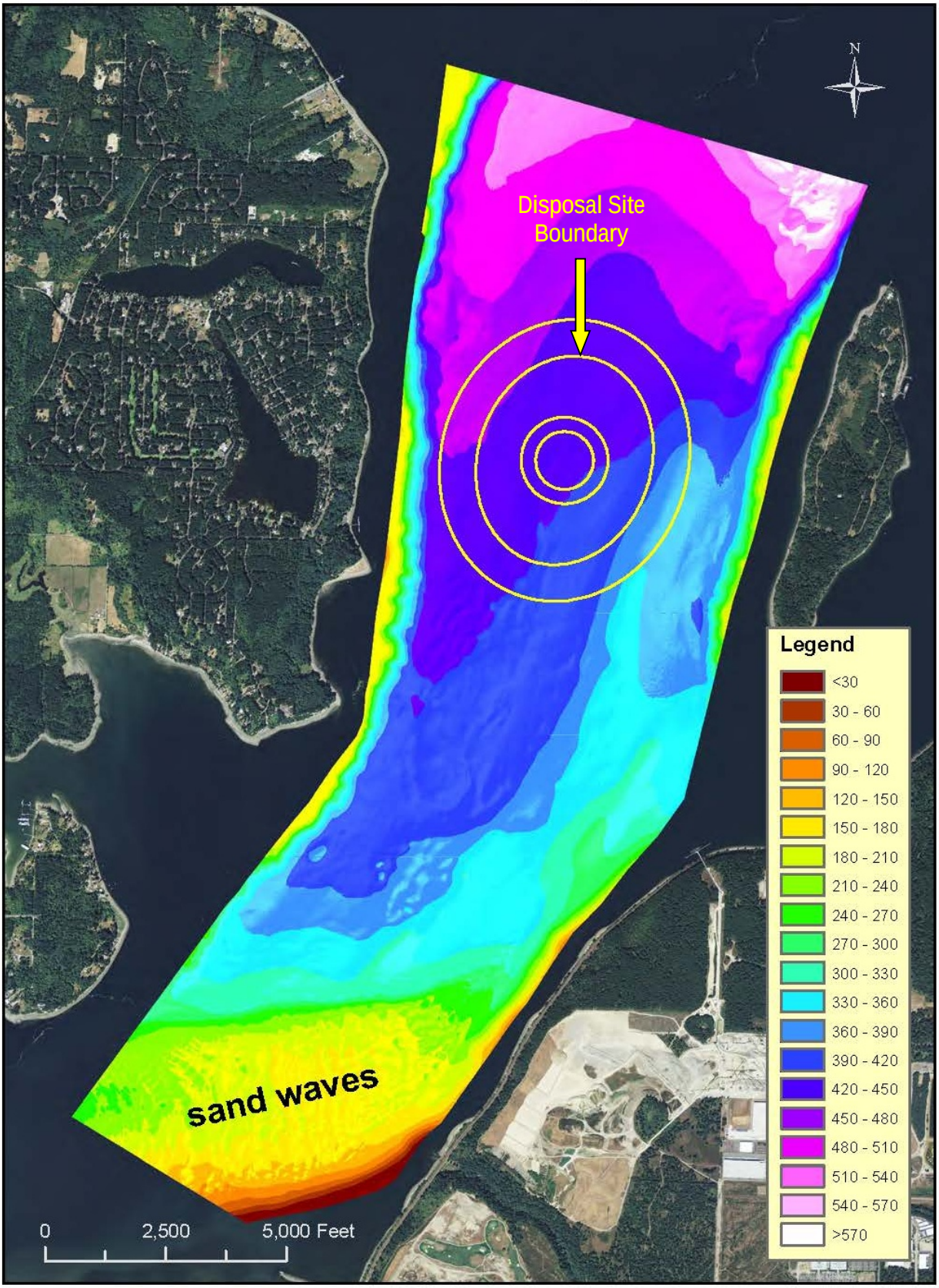

Figure 5-12. 2014 Anderson/Ketron multibeam bathymetric survey

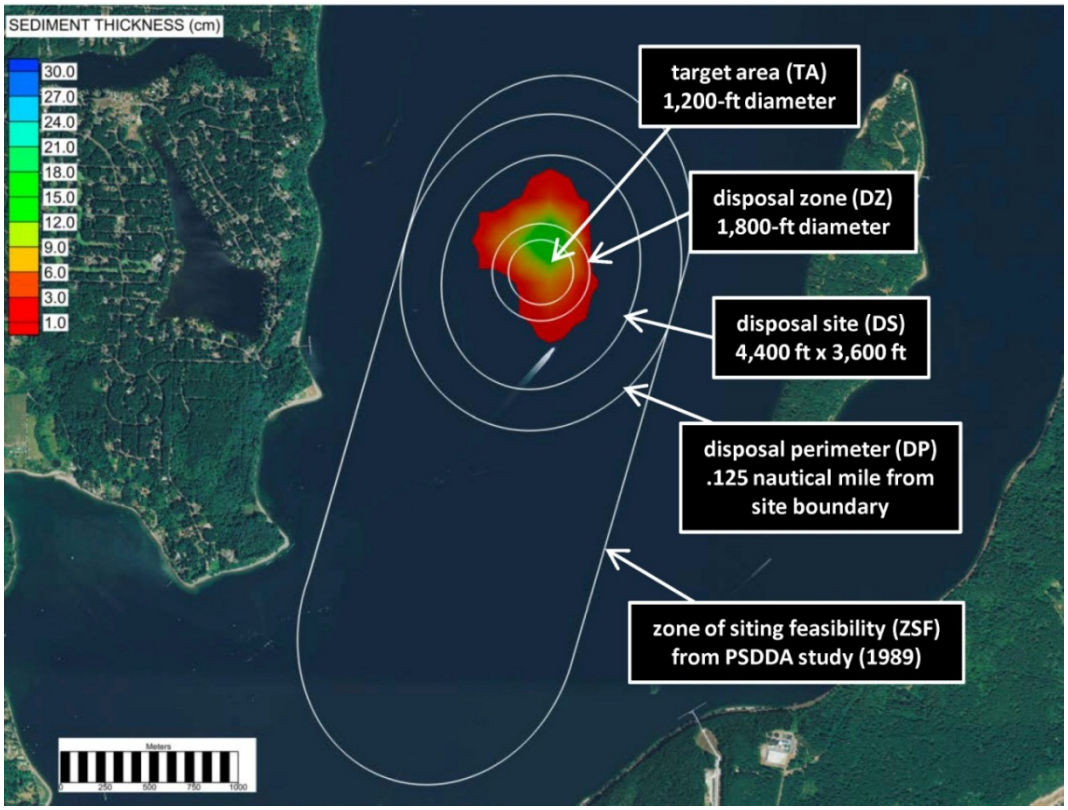

Figure 5-13. Modeled dredged material footprint after placement of 33,000 cy at the A/K site

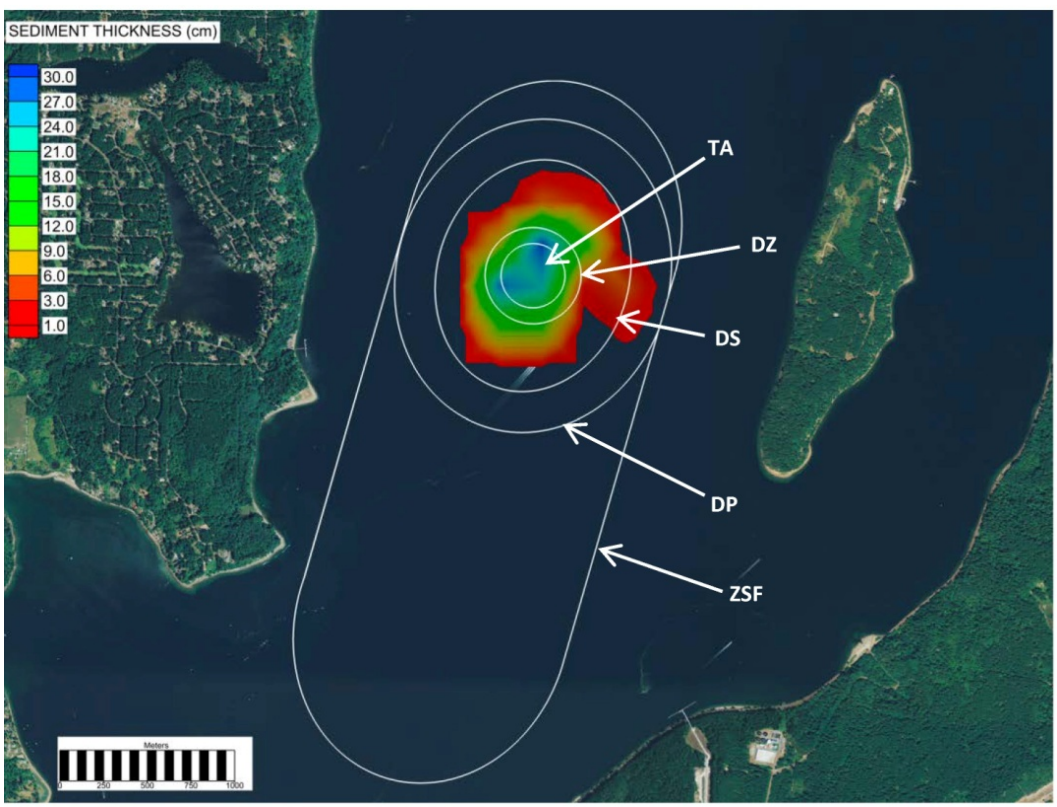

Figure 5-14. Modeled dredged material footprint after placement of 160,000 cy at the A/K site

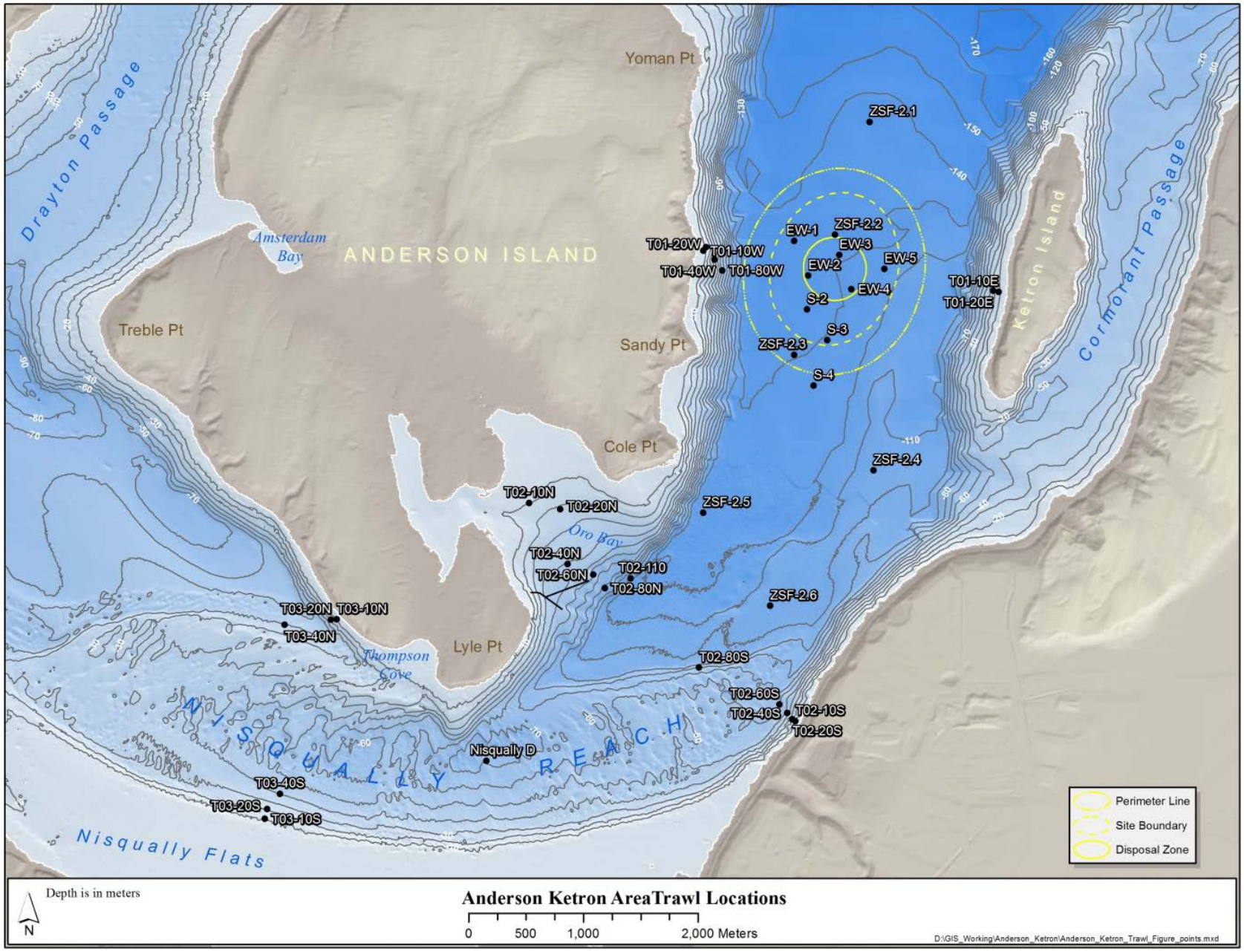

Figure 5-15. Epibenthic trawl stations in the vicinity of the A/K site

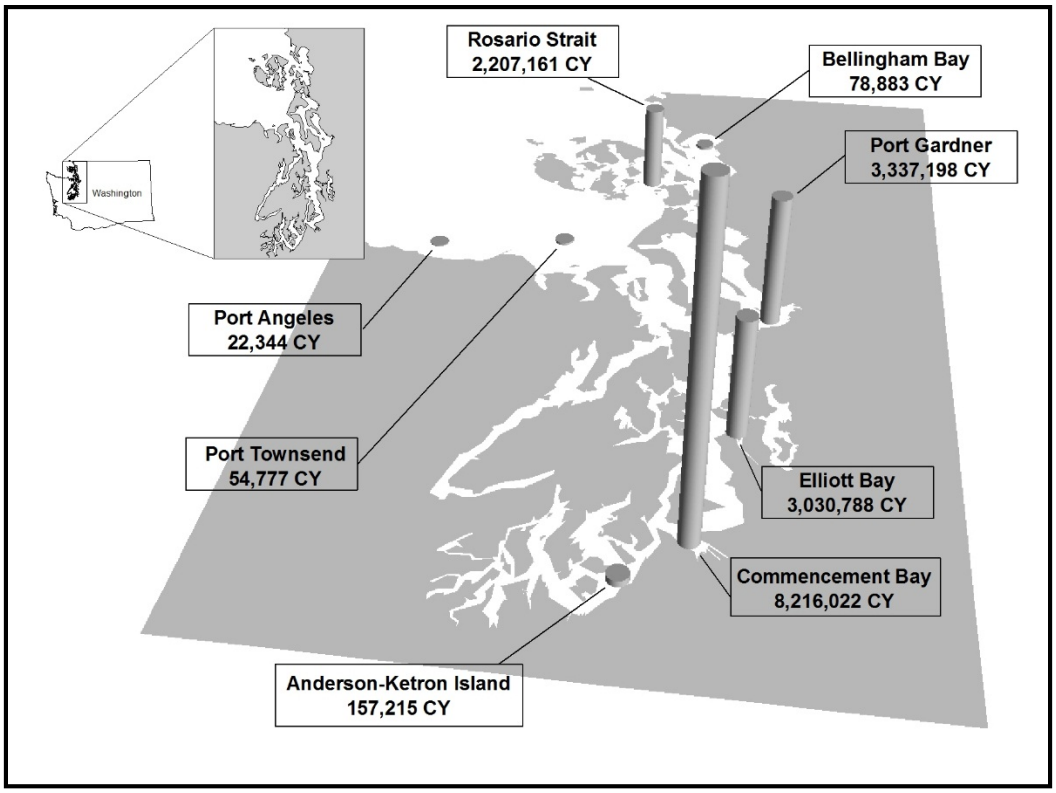

Figure 5-16. DMMP cumulative disposal volumes in Puget Sound 1989 – 2015

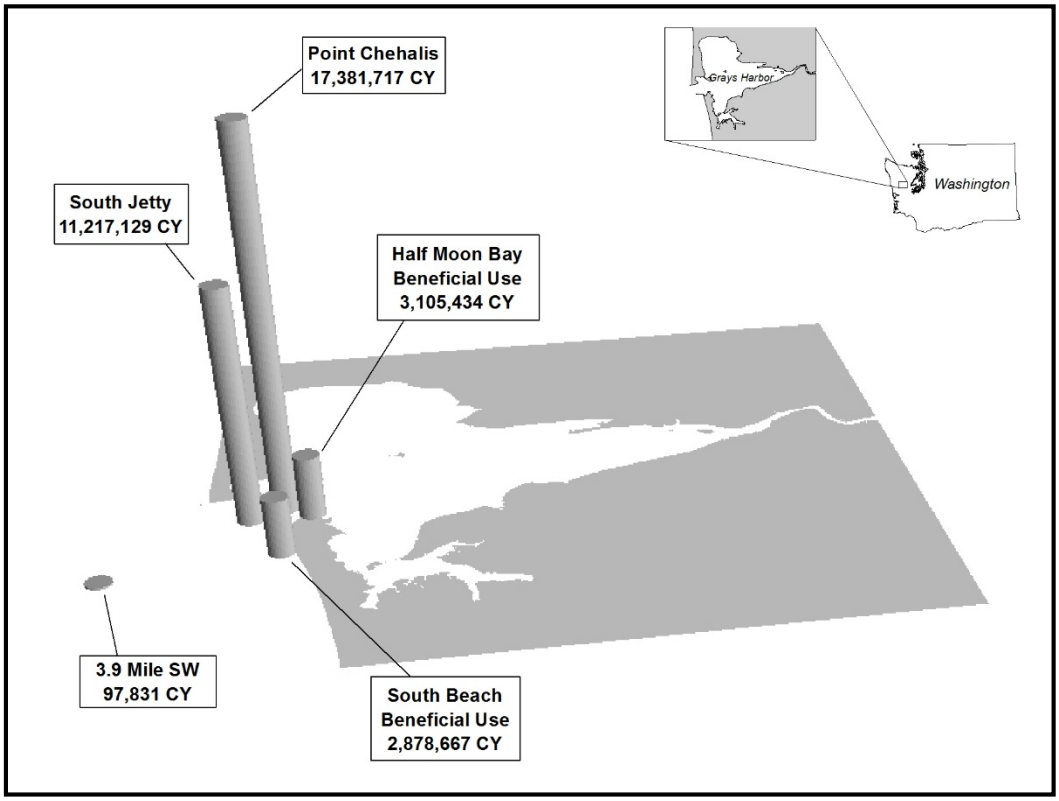

Figure 5-17. DMMP cumulative disposal volumes in Grays Harbor 1996 – 2015

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APPENDICES

Dredging Years 2014/2015

APPENDIX A – DY14/15 Guideline Values

- Table 8-2 from the 2014 DMMP User Manual
- Sediment Management Standards Chapter 173-204 WAC Benthic Criteria

Table 8-2. DMMP COCs and regulatory guidelines

	CHEMICAL	CAS[1] NUMBER	USE FOR MARINE PROJECTS. TBT, DIOXINS/FURANS AND GUAIACOLS ARE REQUIRED ONLY ON A PROJECT-SPECIFIC BASIS.			USE FOR FRESHWATER DREDGED MATERIAL WITHIN DMMP JURISDICTION.	
			DMMP MARINE GUIDELINES			**SMS FRESHWATER**	
			SL	**BT**	**ML**	**SL1**	**SL2**
STANDARD CHEMICALS OF CONCERN	METALS (mg/kg dry weight)						
	Antimony	7440-36-0	150	---	200	---	---
	Arsenic	7440-38-2	57	507.1	700	14	120
	Cadmium	7440-43-9	5.1	11.3	14	2.1	5.4
	Chromium	7440-47-3	260	260	---	72	88
	Copper	7440-50-8	390	1,027	1,300	400	1,200
	Lead	7439-92-1	450	975	1,200	360	> 1,300
	Mercury	7439-97-6	0.41	1.5	2.3	0.66	0.8
	Nickel	7440-02-0	---	---	---	38[2]	110
	Selenium	7782-49-2	---	3	---	11	>20
	Silver	7440-22-4	6.1	6.1	8.4	0.57	1.7
	Zinc	7440-66-6	410	2,783	3,800	3,200	>4,200
	ORGANOMETALLIC COMPOUNDS						
	Tributyltin ion (interstitial water; ug/L)	36643-28-4	---	0.15	---	---	---
	Tributyltin ion (bulk; ug/kg)[3]	36643-28-4	---	73	---	47	320
	Monobutyltin ion (bulk; ug/kg)	78763-54-9	---	---		540	>4,800
	Dibutyltin ion (bulk; ug/kg)	10-53-502	---	---		910	130,000
	Tetrabutyltin ion (bulk; ug/kg)	1461-25-2	---	---		97	>97
	PAHs (µg/kg dry weight)						
	Naphthalene	91-20-3	2,100	---	2,400	---	---
	Acenaphthylene	208-96-8	560	---	1,300	---	---
	Acenaphthene	83-32-9	500	---	2,000	---	---
	Fluorene	86-73-7	540	---	3,600	---	---
	Phenanthrene	85-01-8	1,500	---	21,000	---	---
	Anthracene	120-12-7	960	---	13,000	---	---
	2-Methylnaphthalene[4]	91-57-6	670	---	1,900	---	---
	Total LPAH	**---**	**5,200**	**---**	**29,000**	---	---
	Fluoranthene	206-44-0	1,700	4,600	30,000	---	---
	Pyrene	129-00-0	2,600	11,980	16,000	---	---
	Benz(a)anthracene	56-55-3	1,300	---	5,100	---	---
	Chrysene	218-01-9	1,400	---	21,000	---	---
	Benzofluoranthenes (b, j ,k)	205-99-2 205-82-3 207-08-9	3,200	---	9,900	---	---
	Benzo(a)pyrene	50-32-8	1,600	---	3,600	---	---
	Indeno(1,2,3-c,d)pyrene	193-39-5	600	---	4,400	---	---
	Dibenz(a,h)anthracene	53-70-3	230	---	1,900	---	---

	CHEMICAL	CAS[1] NUMBER	USE FOR MARINE PROJECTS. TBT, DIOXINS/FURANS AND GUAIACOLS ARE REQUIRED ONLY ON A PROJECT-SPECIFIC BASIS.			USE FOR FRESHWATER DREDGED MATERIAL WITHIN DMMP JURISDICTION.	
			DMMP MARINE GUIDELINES			**SMS FRESHWATER**	
			SL	**BT**	**ML**	**SL1**	**SL2**
	Benzo(g,h,i)perylene	191-24-2	670	---	3,200	---	---
	Total HPAH	**---**	**12,000**	**---**	**69,000**	---	---
	Total PAHs[5]	**---**				**17,000**	**30,000**
	CHLORINATED HYDROCARBONS (µg/kg dry weight)						
	1,4-Dichlorobenzene	106-46-7	110	---	120	---	---
	1,2-Dichlorobenzene	95-50-1	35	---	110	---	---
	1,2,4-Trichlorobenzene	120-82-1	31	---	64	---	---
	Hexachlorobenzene (HCB)	118-74-1	22	168	230	---	---
	beta-Hexachlorocyclohexane					7.2	11
	PHTHALATES (µg/kg dry weight)						
	Dimethyl phthalate	131-11-3	71	---	1,400	---	---
	Diethyl phthalate	84-66-2	200	---	1,200	---	---
	Di-n-butyl phthalate	84-74-2	1,400	---	5,100	380	1,000
	Butyl benzyl phthalate	85-68-7	63	---	970	---	---
	Bis(2-ethylhexyl) phthalate	117-81-7	1,300	---	8,300	500	22,000
	Di-n-octyl phthalate	117-84-0	6,200	---	6,200	39	>1,100
STANDARD CHEMICALS OF CONCERN	PHENOLS (µg/kg dry weight)						
	Phenol	108-95-2	420	---	1,200	120	210
	2-Methylphenol	95-48-7	63	---	77	---	---
	4-Methylphenol	106-44-5	670	---	3,600	260	2,000
	2,4-Dimethylphenol	105-67-9	29	---	210	---	---
	Pentachlorophenol	87-86-5	400	504	690	1,200	>1,200
	MISCELLANEOUS EXTRACTABLES (µg/kg dry weight)						
	Benzyl alcohol	100-51-6	57	---	870	---	---
	Benzoic acid	65-85-0	650	---	760	2,900	3,800
	Dibenzofuran	132-64-9	540	---	1,700	200	680
	Hexachlorobutadiene	87-68-3	11	---	270	---	---
	N-Nitrosodiphenylamine	86-30-6	28	---	130	---	---
	Carbazole	86-74-8				900	1,100
	PESTICIDES & PCBs (µg/kg dry weight)						
	4,4'-DDD	72-54-8	16	---	---	---	---
	4,4'-DDE	72-55-9	9	---	---		
	4,4'-DDT	50-29-3	12	---	---		
	sum of 4,4'-DDD, 4,4'-DDE and 4,4'-DDT	---	---	50	69		
	2,4'-DDD and 4.4'-DDD	---				310	860
	2,4'-DDE and 4,4'-DDE	---	---	---	---	21	33
	2,4'-DDT and 4,4'-DDT	---				100	8,100
	Aldrin	309-00-2	9.5	---	---	---	---

	CHEMICAL	CAS[1] NUMBER	USE FOR MARINE PROJECTS. TBT, DIOXINS/FURANS AND GUAIACOLS ARE REQUIRED ONLY ON A PROJECT-SPECIFIC BASIS.			USE FOR FRESHWATER DREDGED MATERIAL WITHIN DMMP JURISDICTION.	
			DMMP MARINE GUIDELINES			SMS FRESHWATER	
			SL	BT	ML	SL1	SL2
	Total Chlordane (sum of cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlor, oxychlordane)	5103-71-9 5103-74-2 5103-73-1 39765-80-5 27304-13-8	2.8	37	---	---	---
	Dieldrin	60-57-1	1.9	---	1,700	4.9	9.3
	Heptachlor	76-44-8	1.5	---	270	---	---
	Endrin ketone	53494-70-5				8.5	>8.5
	Total PCBs (Aroclors)	---	130	38 [6]	3,100	110	2,500
	BULK PETROLEUM HYDROCARBONS (mg/kg)						
	TPH – Diesel	---				340	510
	TPH – Residual	---				3,600	4,400
NON-STANDARD COCs [7]	DIOXINS/FURANS						
	Total TEQ (pptr dry wt)	See DMMO Dioxin page	4 - 10[8]	10[8]	---	---	---
	GUAIACOLS						
	Guaiacol (2-methoxyphenol) and chlorinated guaiacols (3,4,5-trichloroguaiacol; 4,5,6-trichloroguaiacol; tetrachloroguaiacol)	---	No guidelines determined				

[1] Chemical Abstract Service Registry Number
[2] This Nickel SL1 value is based on the 90th percentile of soil background data from WA state (Ecology, 1994), and was adopted by the DMMP agencies at the 2014 SMARM (DMMP/RSET, 2014b)
[3] Bulk sediment measurement of TBT is used for z-sample evaluations or when porewater extraction cannot be accomplished.
[4] 2-Methylnaphthalene is not included in the summation for total LPAH.
[5] Total PAHs include sum of all PAHs listed, plus 1-methylnaphthalene
[6] This value is normalized to total organic carbon, and is expressed in mg/kg carbon.
[7] Analyses required only when there is sufficient reason-to-believe for presence in given project or location.
[8] Puget Sound only; see the text for other areas in Washington State.
Analytes printed in blue apply ONLY to freshwater.

	SMS Freshwater Sediment[a]		SMS Marine Sediment[b]		Marine Sediment AETs[c]	
Analyte	**SCO**	**CSL**	**SQS/SCO**	**CSL/SIZ Max**	**SCO**	**CSL**
Conventional Pollutants	**mg/kg dw**		**mg/kg dw**		**mg/kg dw**	
Ammonia	230	300				
Total sulfides	39	61				
Metals	**mg/kg dw**		**mg/kg dw**		**mg/kg dw**	
Arsenic	14	120	57	93	57	93
Cadmium	2.1	5.4	5.1	6.7	5.1	6.7
Chromium	72	88	260	270	260	270
Copper	400	1200	390	390	390	390
Lead	360	*> 1300*	450	530	450	530
Mercury	0.66	0.8	0.41	0.59	0.41	0.59
Nickel	26	110				
Selenium	11	*> 20*				
Silver	0.57	1.7	6.1	6.1	6.1	6.1
Zinc	3200	*> 4200*	410	960	410	960
Organometallics	**µg/kg dw**		**mg/kg dw**		**mg/kg dw**	
Monobutyltin	540	*> 4800*				
Dibutyltin	910	130000				
Tributyltin	47	320				
Tetrabutyltin	97	*> 97*				
Organic Chemicals	**µg/kg dw**		**µg/kg dw (except *)**		**µg/kg dw**	
2,4-Dimethylphenol			29	29	29	29
2-Methylphenol			63	63	63	63
4-Methylphenol	260	2000	670	670	670	670
Benzoic acid	2900	3800	650	650	650	650
Benzyl alcohol			57	73	57	73
Dibenzofuran	200	680	15*	58*	540	540
Phenol	120	210	420	1200	420	1200
N-nitrosodiphenylamine			11*	11*	28	40
Phthalates	**µg/kg dw**		**mg/kg OC**		**µg/kg dw**	
Bis(2-Ethylhexyl)phthalate	500	22000	47	78	1300	3100
Butylbenzyl phthalate			4.9	64	63	900
Diethyl phthalate			61	110	200	*>200*
Dimethyl phthalate			53	53	71	160
Di-n-butyl phthalate	380	1000	220	1700	1400	5100
Di-n-octyl phthalate	39	*> 1100*	58	4500	6200	6200

[a] All freshwater SMS values are dry weight normalized.

[b] Marine SMS values are dry weight normalized for metals and polar organics and normalized to total organic carbon for nonpolar organics.

[c] 1988 dry weight equivalents. Dry weight normalized AETs can be used when total organic carbon is outside the recommended range for organic carbon normalization.

> *italicized blue* "greater than" value indicates that the toxic level is unknown, but above the concentration shown.

*mg/kg OC ** No CSL value. ***Pentachlorophenol is in µg/kg dry weight

	SMS Freshwater Sediment[a]		SMS Marine Sediment[b]		Marine Sediment AETs[c]	
Analyte	**SCO**	**CSL**	**SQS/SCO**	**CSL/SIZ Max**	**SCO**	**CSL**
Pesticides and PCBs	**µg/kg dw**		**mg/kg OC**		**µg/kg dw**	
beta-Hexachlorocyclohexane	7.2	11				
Carbazole	900	1100				
Dieldrin	4.9	9.3				
Endrin ketone	8.5	*> 8.5*				
Total Aroclors	110	2500	12	65	130	1000
Total o, o' and p,p' dichlorodiphenyldichloroethanes (DDDs)	310	860				
Total o, o' and p,p' dichlorodiphenyldichloroethylenes (DDEs)	21	33				
Total o, o' and p,p' dichlorodiphenyltrichloroethanes (DDTs)	100	8100				
Polycyclic Aromatic Hydrocarbons	**µg/kg dw**		**mg/kg OC**		**µg/kg dw**	
Total PAHs	17000	30000				
LPAH			370	780	5200	5200
Naphthalene			99	170	2100	2100
Acenaphthylene			66	66	1300	1300
Acenaphthene			16	57	500	500
Fluorene			23	79	540	540
Phenanthrene			100	480	1500	1500
Anthracene			220	1200	960	960
2-Methylnaphthalene			38	64	670	670
Total HPAH			960	5300	12000	17000
Fluoranthene			160	1200	1700	2500
Pyrene			1000	1400	2600	3300
Benz[a]anthracene			110	270	1300	1600
Chrysene			110	460	1400	2800
Total benzofluoranthenes			230	450	3200	3600
Benzo[a]pyrene			99	210	1600	1600
Indeno[1,2,3-c,d]pyrene			34	88	600	690
Dibenzo[a,h]anthracene			12	33	230	230
Benzo[g,h,i]perylene			31	78	670	720
Bulk Petroleum Hydrocarbons	**mg/kg dw**		**mg/kg dw**		**mg/kg dw**	
TPH-Diesel	340	510				
TPH-Residual	3600	4400				
Chlorinated Organics	**ug/kg dw**		**mg/kg OC**		**ug/kg dw**	
1,2,4-Trichlorobenzene			0.81	1.8	31	51
1,2-Dichlorobenzene			2.3	2.3	35	50
1,4-Dichlorobenzene			3.1	9	110	110
Hexachlorobenzene			0.38	2.3	22	70
Hexachlorobutadiene			3.9	6.2	11	120
Pentachlorophenol	1200	*> 1200*	360***	690***	360	690

[a] All freshwater SMS values are dry weight normalized.

[b] Marine SMS values are dry weight normalized for metals and polar organics and normalized to total organic carbon for nonpolar organics.

[c] 1988 dry weight equivalents. Dry weight normalized AETs can be used when total organic carbon is outside the recommended range for organic carbon normalization.

> *italicized blue* "greater than" value indicates that the toxic level is unknown, but above the concentration shown.

*mg/kg OC ** No CSL value. ***Pentachlorophenol is in µg/kg dry weight

APPENDIX B – Bioassay Performance Standards and Evaluation Guidelines

- Marine Bioassays (Table 9-1 from the 2014 DMMP User Manual)
- Freshwater Bioassays (Table 9-5 from the 2014 DMMP User Manual)

Table 9-1. Marine 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 Mortality	$M_C \leq 10\%$	$M_R - M_C \leq 20\%$	$M_T - M_C > 20\%$ and M_T vs. M_R SS (p=.05) **AND**			
			$M_T - M_R > 10\%$	NOCN	$M_T - M_R > 30\%$	NOCN
Larval Development	$N_C \div I \geq 0.70$	$N_R \div N_C \geq 0.65$	$N_T \div N_C < 0.80$ and N_T/N_C vs. N_R/N_C SS (p=.10) **AND**			
			$N_R/N_C - N_T/N_C > 0.15$	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**			
			$MIG_T/MIG_R < 0.70$	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

Subscripts:
R = reference sediment
C = negative control
T = test sediment

Table 9-5. Freshwater biological criteria (test performance standards; 2-hit and 1-hit interpretation criteria) for each biological test.

Biological Test/ Endpoint [a]	Performance Standard[b]		Screening Level 1 (SL1)	Screening Level 2 (SL2)
	Control[c]	Reference		
Hyalella azteca				
10-day mortality	$M_C \leq 20\%$	$M_R \leq 25\%$	$M_T - M_C > 15\%$ and M_T vs M_C SD ($p \leq 0.05$)	$M_T - M_C > 25\%$ and M_T vs M_C SD ($p \leq 0.05$)
28-day mortality	$M_C \leq 20\%$	$M_R \leq 30\%$	$M_T - M_C > 10\%$ and M_T vs M_C SD ($p \leq 0.05$)	$M_T - M_C > 25\%$ and M_T vs M_C SD ($p \leq 0.05$)
28-day growth	$MIG_C \geq 0.15$ mg/ind	$MIG_R \geq 0.15$ mg/ind	$(MIG_C - MIG_T)/MIG_C > 0.25$ and MIG_T vs MIG_C SD ($p \leq 0.05$)	$(MIG_C - MIG_T)/MIG_C > 0.40$ and MIG_T vs MIG_C SD ($p \leq 0.05$)
Chironomus dilutus				
10-day mortality	$M_C \leq 30\%$	$M_R \leq 30\%$	$M_T - M_C > 20\%$ and M_T vs M_C SD ($p \leq 0.05$)	$M_T - M_C > 30\%$ And M_T vs M_C SD ($p \leq 0.05$)
10-day growth	$MIG_C \geq 0.48$ mg/ind	$MIG_R/MIG_C \geq 0.8$	$(MIG_C - MIG_T)/MIG_C > 0.20$ and MIG_T vs MIG_C SD ($p \leq 0.05$)	$(MIG_C - MIG_T)/MIG_C > 0.30$ and MIG_T vs MIG_C SD ($p \leq 0.05$)
20-day mortality	$M_C \leq 32\%$	$M_R \leq 35\%$	$M_T - M_C > 15\%$ and M_T vs M_C SD ($p \leq 0.05$)	$M_T - M_C > 25\%$ and M_T vs M_C SD ($p \leq 0.05$)
20-day growth	$MIG_C \geq 0.60$ mg/ind	$MIG_R/MIG_C \geq 0.8$	$(MIG_C - MIG_T)/MIG_C > 0.25$ and MIG_T vs MIG_C SD ($p \leq 0.05$)	$(MIG_C - MIG_T)/MIG_C > 0.40$ and MIG_T vs MIG_C SD ($p \leq 0.05$)

Notes:

M = Mortality; C = Control; R = Reference; T = Test; F = Final; MIG = Mean Individual Growth at time final; ind = individual; mg = milligrams.

[a] These tests and parameters were developed based on the most updated American Society for Testing and Materials protocols.

[b] Reference performance standards are provided for sites where the department has approved a freshwater reference sediment site(s) and reference results will be substituted for control in comparing test sediments to criteria.

[c] The control performance standard for the 20 day test (0.60 mg/individual) is more stringent than for the 10 day test and the agencies may consider, on a case-by-case basis, a 20 day control has met QA/QC requirements if the mean individual growth is at least 0.48 mg/individual.

APPENDIX C – DY14/15 Marine and Freshwater Guideline Exceedances

- Legend
- Marine DMMU guideline exceedances
- Marine Z-sample guideline exceedances
- Freshwater DMMU guideline exceedances
- Freshwater Z-sample guideline exceedances

APPENDIX C - LEGEND

S	=	reported concentration exceeds the marine screening level
S^{SL1}	=	reported concentration exceeds the freshwater screening level 1
S^{SL2}	=	reported concentration exceeds the freshwater screening level 2
S^{SQS}	=	reported concentration exceeds the marine sediment quality standard
B	=	reported concentration exceeds the bioaccumulation trigger (and SL, if it exists for that COC)
M	=	reported concentration exceeds maximum level
M^{CSL}	=	reported concentration exceeds marine cleanup screening level
BM	=	reported concentration exceeds bioaccumulation trigger and maximum level
U	=	detection limit exceeds either the screening level, bioaccumulation trigger, or maximum level
J	=	estimate
NA	=	not applicable
ND	=	not determined
NTR	=	no testing required
NH	=	no hit
2H	=	a hit under the two-hit interpretation guideline
1H	=	a hit under the one-hit interpretation guideline

DMMU Suitability Determination Qualifiers

PASS	=	test sediment passes DMMP guidelines for open-water unconfined disposal
$PASS^{VWA}$	=	test sediment passes DMMP dioxin guidelines for open-water unconfined disposal based on project volume-weighted average
$PASS^{BPJ}$	=	test sediment passes DMMP guidelines for open-water unconfined disposal based on best professional judgment
$PASS^{RR}$	=	test sediment passes DMMP guidelines for beneficial use based on implementation of risk reduction measures
FAIL	=	test sediment fails DMMP guidelines for open-water unconfined disposal
$FAIL^{C}$	=	DMMU found unsuitable for open-water disposal on the basis of chemistry data (and the absence of biological testing data)
$FAIL^{VWA}$	=	test sediment fails DMMP dioxin guidelines for open-water unconfined disposal based on project volume-weighted average

Anti-degradation Determination Qualifiers

PASS	=	test sediment meets the antidegradation guidelines
$PASS^{AD}$	=	test sediment passes antidegradation guidelines
FAIL	=	test sediment fails to meet the antidegradation guidelines

PROJECT:	City of Renton Lower Cedar River Section 205						Duwamish Yacht Club						La Conner Marina				MJB Travelift	Mulkiteo Multimodal			Port of Grays Harbor Terminals 1, 2, 3 & 4			
Date of SD:	12/4/2014						9/19/2013						10/20/2014				10/2/2013	6/5/2014			2/20/2015			
DY:	15						14						15				14	14			15			
Freshwater/Marine:	Marine						Marine						Marine				Marine	Marine			Marine			
DMMU or Sample ID:	DMMU1	DMMU2	DMMU3	DMMU4	DMMU5	DMMU6	DMMU1	DMMU2	DMMU3	DMMU4	DMMU5	DMMU6	N1	N2	S1	S2	DMMU3	DMMU1	DMMU2	DMMU3/3C	T1D1	T2D1	T2D2	T3D1
Assessment Rank:	M	M	M	M	M	M	H	H	H	H	H	H	L	L	L	L	M	M	H	H	L	LM	LM	LM
METALS (mg/kg)																								
Selenium																								
CHLORINATED HYDROCARBONS (ug/kg)																								
1,2,4-Trichlorobenzene																								
1,2-Dichlorobenzene																								
Hexachlorobenzene																								
PHTHALATES (ug/kg)																								
Dimethyl phthalate										237														
Butyl benzyl phthalate										74.5		211												
PHENOLS (ug/kg)																								
2,4-Dimethylphenol																								
Pentachlorophenol																								
MISCELLANEOUS EXTRACTABLES (ug/kg)																								
Benzyl Alcohol													180	140	130	140								
Benzoic Acid																								
Hexachlorobutadiene																								
PESTICIDES AND PCBs (ug/kg)																								
4,4'-DDT																								
Total Chlordane										5.59		2.93					4.9 U							
Dieldrin																	4.9 U							
Heptachlor																	2.5 U							
Total PCBs																	190 U							
OTHER CHEMICALS OF CONCERN																								
Tributyltin (ug/l porewater)																								
Tributyltin (ug/kg bulk)																								
Dioxins/Furans (pptr TEQ; u=1/2 DL)	0.62	0.77	--	--	--	--	6.72	4.16	4.23	20.94	6.43	10.74	--	--	--	--	9.99	3.63	1.26	0.67	10.49	6.04	8.79	5.59
OVERALL DMMU PASS/FAIL:	PASS	PASS	PASS	PASS	PASS	PASS	FAIL[VWA]	PASS[BPJ]	PASS[BPJ]	FAIL[C]	FAIL[VWA]	FAIL[C]	PASS[BPJ]	PASS[BPJ]	PASS[BPJ]	PASS[BPJ]	FAIL[C]	PASS	PASS	PASS / ND	PASS	PASS	PASS	PASS
z-sample associated with this DMMU	NTR	NTR	NTR	NTR	NTR	NTR	DC1,2	DC-3,4,5,6	DC-3,4,5,6	DC-10 DC-7,9,10,11	DC-7,9,10,11	DC-10 DC-11 DC-7,9,10,11	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR
Anti-Degradation PASS/FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS[BPJ]	PASS	PASS[BPJ]	FAIL	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS[BPJ]	PASS	PASS	PASS / ND	PASS	PASS	PASS	PASS
VOLUME (CY):	20,000	20,000	20,000	20,000	20,000	20,000	3,900	4,000	3,900	3,450	2,325	2,675	29,165	28,635	36,315	42,385	1,350	7,800	4,000	6400 / 2800	30,000	30,000	30,000	22,500

PROJECT:	Port of Grays Harbor Terminals 1, 2, 3 & 4 (cont.)		Port of Seattle Terminal 5				Port of Seattle, Terminal 5 Berth Deepening																			Port of Tacoma Pier 4 - Phase 1			
Date of SD:			10/1/2013				2/20/2015																			1/8/2015			
DY:			14				15																			15			
Freshwater/Marine:			Marine				Marine																			Marine			
DMMU or Sample ID:	T3D2	T4D1	S1 (not analyzed)	S2 (not analyzed)	S3-CS	S4-CS	S-1A	S-1B	S1-C	S2-A	S2-B	S2-C	S3-A	S3-B	S3-C	S4-A	S4-B	S5-A	S5-B	S6-A	S6-B	S7-A	S7-B	S8-A	S8-B	Top 2 ft (rip-rap) not sampled	DMMU P4-C1 0-4 ft	DMMU P4-C2 4-8 ft	DMMU P4-C3 8-12 ft
Assessment Rank:	LM	LM	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS (mg/kg)																													
Selenium																													
CHLORINATED HYDROCARBONS (ug/kg)																													
1,2,4-Trichlorobenzene																													
1,2-Dichlorobenzene																													
Hexachlorobenzene																													
PHTHALATES (ug/kg)																													
Dimethyl phthalate																													
Butyl benzyl phthalate																													
PHENOLS (ug/kg)																													
2,4-Dimethylphenol																													
Pentachlorophenol																													
MISCELLANEOUS EXTRACTABLES (ug/kg)																													
Benzyl Alcohol																													
Benzoic Acid																													
Hexachlorobutadiene																													
PESTICIDES AND PCBs (ug/kg)																													
4,4'-DDT																													
Total Chlordane					4.8 U	5.0 U										6.9 U													
Dieldrin					4.8 U	5.0 U										9.7 U													
Heptachlor					2.4 U	2.5 U																							
Total PCBs					169	203																							
OTHER CHEMICALS OF CONCERN																													
Tributyltin (ug/l porewater)					0.5																								
Tributyltin (ug/kg bulk)					390	160																							
Dioxins/Furans (pptr TEQ; u=1/2 DL)	3.99	5.77	--	--	4.08 J	6.15 J	0.585	0.155	0.186	7.213	0.297	0.15	3.878	0.539	0.197	5.056	1.689	2.457	0.18	1.358	0.114	0.421	0.419	0.389	0.326		2.127	0.248	0.135
OVERALL DMMU PASS/FAIL:	PASS	PASS	FAIL[C]	FAIL[C]	FAIL[C]	FAIL[C]	PASS	PASS	PASS	PASS[VWA]	PASS	PASS	PASS	PASS	PASS	PASS[VWA]	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	PASS	PASS	PASS
z-sample associated with this DMMU	NTR	NTR	S1-Z1 S1-Z2	S2-Z1	S3-Z1 S3-Z2 S3-Z3	S4-Z1 S4-Z2	S1-D/ZA S1-ZB	S1-D/ZA S1-ZB	S1-D/ZA S1-ZB	S2-D/ZA S2-ZB	S2-D/ZA S2-ZB	S2-D/ZA S2-ZB	S3-D/ZA S3-ZB	S3-D/ZA S3-ZB	S3-D/ZA S3-ZB	S4-C/ZA S4-ZB	S4-C/ZA S4-ZB	S5-C/ZA S5-ZB	S5-C/ZA S5-ZB	S6-C/ZA S6-ZB	S6-C/ZA S6-ZB	S7-C/ZA S7-ZB	S7-C/ZA S7-ZB	S8-C/ZA S8-ZB	S8-C/ZA S8-ZB	NTR	NTR	NTR	NTR
Anti-Degradation PASS/FAIL	PASS	PASS	FAIL	PASS	PASS/FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
VOLUME (CY):	22,500	24,000	365	365	3,475	3,650	1,251	2,593	2,068	856	1,510	1,652	531	1,066	1,199	1,555	2,292	1,665	2,233	1,661	1,835	1,277	1,986	1,149	1,908	2,300	9,000 total —>		

PROJECT:	Port of Tacoma Pier 4 - Phase 1 (cont.)					Shelter Bay Marina				Silver King Boat Basin Channel and Boat Ramp		USACE Duwamish Spokane St. Bridge		USACE Hylebos														
Date of SD:						12/9/2014				7/22/2013		7/31/2013		6/4/2014														
DY:						15				14		14		14														
Freshwater/Marine:						Marine				Marine		Marine		Marine														
DMMU or Sample ID:	A18	B14	B15	C4	C5	DMMU1	DMMU2	DMMU3	DMMU4	DMMU A	DMMU B	LDW02 (25.1 to -30 ft MLLW)	LDW02 (-30 to -32 ft MLLW)	A1	A2	B1	B2	B3	C1	C2	D1	D2	D3	D4	E1	E2	E3	E4
Assessment Rank:	H	H	H	H	H	M	M	M	M	LM	LM	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS (mg/kg)																												
Selenium														3.6 U	3.5 U	3.5 U	3.4 U	3.8 U	3.4 U	3.3 U	3.8 U	3.6 U	3.8 U	3.8 U	3.9 U		3.9 U	3.7 U
CHLORINATED HYDROCARBONS (ug/kg)																												
1,2,4-Trichlorobenzene																			41 U		43 U	50 U	53 U	53 U	53 U		56 U	
1,2-Dichlorobenzene																	43 U	42 U	41 U		43 U	50 U	53 U	3 U	53 U		56 U	
Hexachlorobenzene																	43 U	42 U	41 U		43 U	50 U	53 U	53 U	53 U		56 U	
PHTHALATES (ug/kg)																												
Dimethyl phthalate																												
Butyl benzyl phthalate																												
PHENOLS (ug/kg)																												
2,4-Dimethylphenol																	32 U	32 U	32 U		32 U	32 U	34 U	33 U	33 U		36 U	
Pentachlorophenol																	430 U	420 U	410 U		430 U	500 U	530 U	530 U	530 U		560 U	
MISCELLANEOUS EXTRACTABLES (ug/kg)																												
Benzyl Alcohol						81 J											86 U	84 U	82 U		86 U	99 U	110 U	110 U	110 U		120 U	
Benzoic Acid																	2000 UJ	2000 UJ	2000 UJ		2000 UJ	2000 UJ	2200 UJ	2100 UJ	2100 UJ		2300 UJ	
Hexachlorobutadiene															16		19 J	42 U	41 U	14	43 U	50 U	53 U	53 U	53 U	11 U	56 U	12 U
PESTICIDES AND PCBs (ug/kg)																												
4,4'-DDT																	14 U			45 U	15 U	27 U	12 U			13 U		
Total Chlordane										3.0 U	2.9 U			7.8 U		6.6 U	20 U	11 U	18 U	21 U	13 U	13 U	7.6 U		4.4 U	6.3 U		5.0 U
Dieldrin															2.3					3.4 U					2.3 U	2.4 U		
Heptachlor										3.0 U	2.9 U																	
Total PCBs																	263			168		165		215	152	207	140	
OTHER CHEMICALS OF CONCERN																												
Tributyltin (ug/l porewater)																	0.38				0.36	0.23	0.25	0.29		0.24 J		
Tributyltin (ug/kg bulk)																												
Dioxins/Furans (pptr TEQ; u=1/2 DL)	--	--	--	--	--	--	--	1.60	--	0.38	--	1.62	0.17	27.6	43.6	36.6	188.7	76.2	87.9	65	129.1	254	185.9	358.6	187.1	196.9	254.8	175.2
OVERALL DMMU PASS/FAIL:	PASS	PASS	PASS	PASS	PASS	PASS[BPJ]	PASS[BPJ]	PASS[BPJ]	PASS[BPJ]	PASS	PASS	PASS	PASS	FAIL[C]	FAIL[C]	FAIL[C]	FAIL[C]	FAIL[C]	FAIL[C]	FAIL[C]	FAIL[C]	FAIL[C]	FAIL[C]	FAIL[C]	FAIL[C]	FAIL[C]	FAIL[C]	FAIL[C]
z-sample associated with this DMMU	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	A1-Z	A2-Z	B1-Z	B2-Z	B3-Z	C1-Z	C2-Z	D1-Z	D2-Z	D3-Z	D4-Z	E1-Z	E2-Z	E3-Z	E4-Z
Anti-Degradation PASS/FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
VOLUME (CY):	<— 9,000 total					6,700	11,700	10,800	8,200	5,300	2,000	1,598	639	3,610	3,929	2,781	3,511	2,681	2,517	1,885	3,481	3,647	3,949	3,202	3,735	2,410	2,971	3,128

PROJECT:	USACE Kenmore								USACE Westhaven Cove				USACE Willapa																
Date of SD:	1/27/2015								12/4/2014				4/7/2015																
DY:	15								15				15																
Freshwater/Marine:	Marine								Marine				Marine																
DMMU or Sample ID:	DMMU1	DMMU2	DMMU3	DMMU4	DMMU5	DMMU6	DMMU7	DMMU8	DMMU1	DMMU2	DMMU3	DMMU4	Tokeland DMMU1	Tokeland DMMU2	Tokeland DMMU3	Tokeland DMMU4	Bay Center DMMU1	Bay Center DMMU2	Nahcotta DMMU1	Nahcotta DMMU2	Nahcotta DMMU3	Nahcotta DMMU4	Nahcotta DMMU5	Nahcotta DMMU6	Nahcotta DMMU7	Nahcotta DMMU8	Nahcotta DMMU9	Nahcotta DMMU10	Nahcotta DMMU11
Assessment Rank:	H	H	H	H	H	H	H	H	M	M	M	M	LM	L	LM	L	L	L	M	M	M	M	M	M	M	M	M	M	M
METALS (mg/kg)																													
Selenium																													
CHLORINATED HYDROCARBONS (ug/kg)																													
1,2,4-Trichlorobenzene																													
1,2-Dichlorobenzene																													
Hexachlorobenzene																													
PHTHALATES (ug/kg)																													
Dimethyl phthalate																													
Butyl benzyl phthalate																													
PHENOLS (ug/kg)																													
2,4-Dimethylphenol																													
Pentachlorophenol																													
MISCELLANEOUS EXTRACTABLES (ug/kg)																													
Benzyl Alcohol	82	120	130	91	100	64	150	110																					
Benzoic Acid			950					730																					
Hexachlorobutadiene																													
PESTICIDES AND PCBs (ug/kg)																													
4,4'-DDT																													
Total Chlordane													18 U	49 U	11 U	27 U													2.9 U
Dieldrin													4.8 U	4.9 U	4.8 U	4.9 U	5 U												
Heptachlor													14 U	2.5 U	4.8 U	9.6 U	5.3 U			1.8 U									
Total PCBs																													
OTHER CHEMICALS OF CONCERN																													
Tributyltin (ug/l porewater)																													
Tributyltin (ug/kg bulk)																													
Dioxins/Furans (pptr TEQ; u=1/2 DL)	12.95	23.17	14.68	9.51	10.02	8.76	7.36	8.16	1.5	6.37	5.13	2.65	2.08	1.20	2.71	1.80	1.33	0.62	1.58	1.97	1.16	2.21	2.3	2.82	2.58	3.16	3.69	2.15	2.38
OVERALL DMMU PASS/FAIL:	FAIL[C]	FAIL[C]	FAIL[C]	FAIL[VWA]	FAIL[C]	FAIL[VWA]	FAIL[VWA]	FAIL[VWA]	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
z-sample associated with this DMMU	DMMU1-Z	DMMU2-Z	DMMU3-Z	DMMU4-Z	DMMU5-Z	DMMU6-Z	DMMU7-Z	DMMU8-Z	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR
Anti-Degradation PASS/FAIL	PASS	PASS[BPJ]	PASS[BPJ]	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
VOLUME (CY):	3,750	3,700	3,800	3,750	3,700	3,800	3,750	3,750	4,090	14,530	14,010	14,490	31,860	20,740	45,560	22,450	44,510	21,850	15,250	15,260	15,260	15,260	12,860	15,180	15,410	15,260	15,260	15,260	14,180

Appendix C. Marine Guideline Exceedances - Z-samples

PROJECT:	Duwamish Yacht Club					Port of Olympia Berths 1, 2 and 3								Port of Olympia Swantown Boatworks	Port of Seattle Terminal 5								Port of Seattle Terminal 5 Berth Deepening							
Date of SD:	7/31/2013					7/1/2013								7/1/2013	10/1/2013								2/20/2015							
DY:	14					14								14	14								15							
Freshwater/Marine:	Marine					Marine								**Marine**	Marine								Marine							
DMMU or Sample ID:	z-sample DC-10	z-sample DC-11	z-sample DC1,2 (DMMU 1)	z-sample DC-3,4,5,6 (DMMUs 2 & 3)	z-sample DC-7,9,10,11 (DMMUs 4, 5 & 6)	SC-04-Z	SC-07-Z	SC-08-Z	SC-10-Z	SC-13-Z	SC-15-Z	SC-18-Z	SC-20-Z	SC-46-Z	S1-Z1	S1-Z2	S2-Z1	S3-Z1	S3-Z2	S3-Z3	S4-Z1	S4-Z2	S1-D/ZA	S1-ZB	S2-D/ZA	S2-ZB	S3-D/ZA	S3-ZB	S4-C/ZA	S4-ZB
Assessment Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS (mg/kg)																														
Mercury																						0.64 J[CSL]								
Nickel																														
Selenium																														
PAHs (ug/kg)																														
Pyrene																														
CHLORINATED HYDROCARBONS (ug/kg)																														
1,2,4-Trichlorobenzene																														
1,2-4-Trichlorobenzene (mg/kg OC-normalized)															1.0 U	2.5 U	3.8 U	1.3 U	1.1 U	1.2 U	1.9 U	1.4 U								
1,2-Dichlorobenzene																														
1,2-Dichlobenzene (mg/kg OC-normalized)																2.5 U	3.8 U													
1,4-Dichlorobenzene																														
1,4-Dichlorobenzene (mg/kg OC-normalized)																	3.8 U													
Hexachlorobenzene																														
Hexachlorobenzene (mg/kg OC-normalized)																0.60 U					0.49 U									
PHTHALATES (ug/kg)																														
Dimethyl phthalate		173																												
Butyl benzyl phthalate	183	389																												
Butyl benzyl phthalate (mg/kg OC-normalized)																5.7[SQS]														
PHENOLS (ug/kg)																														
Phenol																														
2,4-Dimethylphenol																														
Pentachlorophenol																														
MISCELLANEOUS EXTRACTABLES (ug/kg)																														
Benzyl Alcohol																														
Benzoic Acid																														
Hexachlorobutadiene																														
PESTICIDES AND PCBs (ug/kg)																														
4,4'-DDT																						14 UJ								
Total Chlordane															5.0 U	4.8 U		4.9 U	4.8 U	4.7 U	4.9 U	4.9 U								
Dieldrin															5.0 U	4.8 U		4.9 U	4.8 U	4.7 U	4.9 U	4.9 U								
Heptachlor															2.5 U	2.4 U		2.5 U	2.4 U	2.4 U	2.5 U	2.4 U								
Total PCBs																														
Total PCBs (carbon-normalized)															16[SQS]	17.2[SQS]					12.3[SQS]	17[SQS]								
OTHER CHEMICALS OF CONCERN																														
Tributyltin (ug/l porewater)															0.22															
Tributyltin (ug/kg bulk)															490	140		140		420	140	130								
Dioxins/Furans (pptr TEQ; u=1/2 DL)	--	--	9.07	11.07	13.66	25.9	57.4	26.9	36.5	50.8	0.18	65.9	131	0.44	12.3 J	2.36 J	1.04 J	5.34 J	1.16	9.03 J	5.08 J	6.66 J	0.185	0.162	0.135	0.479	0.197	0.228	0.225	0.276
Anti-Degradation PASS/FAIL	NA	NA	PASS[BPJ]	PASS[BPJ]	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	FAIL	FAIL	PASS	FAIL	FAIL	PASS	PASS[BPJ]	PASS	FAIL	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
VOLUME (CY):	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2,254	NA	1,948	NA	1,434	NA	2,994	NA

Appendix C. Marine Guideline Exceedances - Z-samples

PROJECT:	Port of Seattle Terminal 5 Berth Deepening (cont.)								USACE Hylebos															USACE Kenmore							
Date of SD:									6/4/2014															1/27/2015							
DY:									14															15							
Freshwater/Marine:									Marine															Freshwater							
DMMU or Sample ID:	S5-C/ZA	S5-ZB	S6-C/ZA	S6-ZB	S7-C/ZA	S7-ZB	S8-C/ZA	S8-ZB	A1-Z	A2-Z	B1-Z	B2-Z	B3-Z	C1-Z	C2-Z	D1-Z	D2-Z	D3-Z	D4-Z	E1-Z	E2-Z	E3-Z	E4-Z	DMMU1-Z	DMMU2-Z	DMMU3-Z	DMMU4-Z	DMMU5-Z	DMMU6-Z	DMMU7-Z	DMMU8-Z
Assessment Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS (mg/kg)																															
Mercury																0.456 SQS															
Nickel																								45 SQS	42J SQS	40J SQS	44J SQS	39J SQS	38J SQS	41 SQS	43 SQS
Selenium									3.5 U	3.9 U	3.4 U	3.2 U	3.4 U	3.2 U	3.7 U	3.8 U	3.6 U		4.0 U	3.9 U		3.7 U	3.8 U								
PAHs (ug/kg)																															
Pyrene																															
CHLORINATED HYDROCARBONS (ug/kg)																															
1,2,4-Trichlorobenzene														38 U		47 U	37 U	43 U													
1,2-4-Trichlorobenzene (mg/kg OC-normalized)																															
1,2-Dichlorobenzene														38 U		47 U	37 U	43 U													
1,2-Dichlobenzene (mg/kg OC-normalized)																															
1,4-Dichlorobenzene																															
1,4-Dichlorobenzene (mg/kg OC-normalized)																															
Hexachlorobenzene														38 U	31	47 U	37 U	43 U													
Hexachlorobenzene (mg/kg OC-normalized)																															
PHTHALATES (ug/kg)																															
Dimethyl phthalate																															
Butyl benzyl phthalate																															
Butyl benzyl phthalate (mg/kg OC-normalized)																															
PHENOLS (ug/kg)																															
Phenol																														130 SQS	
2,4-Dimethylphenol											64			32 U		32 U	32 U	32 U													
Pentachlorophenol																470 U		430 U													
MISCELLANEOUS EXTRACTABLES (ug/kg)																															
Benzyl Alcohol														76 U		93 U	73 U	85 U													
Benzoic Acid														2000 UJ		2000 UJ	2000 UJ	2000 UJ													
Hexachlorobutadiene														38 U	28	47 U	37 U	43 U	18	11 U											
PESTICIDES AND PCBs (ug/kg)																															
4,4'-DDT																16 U		39 U	41 U												
Total Chlordane												5.7 U	12 U		16 U	11 U	19 U	28 U	4.1 U	5.0 U	3.4 U	3.3 U									
Dieldrin															12 U		3.7 U	4.2 U	6.9 U												
Heptachlor															8.2 U		3.7 U	4.2 U	4.1 U												
Total PCBs													175		610	144	302	390	545												
Total PCBs (carbon-normalized)																															
OTHER CHEMICALS OF CONCERN																															
Tributyltin (ug/l porewater)											0.16 U					0.36	0.50	0.35			0.17 J										
Tributyltin (ug/kg bulk)																															
Dioxins/Furans (pptr TEQ; u=1/2 DL)	0.175	0.126	0.115	0.151	0.14	0.116	0.234	0.172	16.5	13	17.5	27.9	131	73.8	141.6	1160.8	516.9	691.4	1107.9	186.7	54.8	132.7	79.8	1.89	10.73	10.97	4.39	5.58	5.91	8.55	5.58
Anti-Degradation PASS/FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	PASS BPJ	PASS BPJ	PASS	PASS	PASS	PASS	PASS
VOLUME (CY):	2,634	NA	2,196	NA	2,949	NA	1,827	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Appendix C. Freshwater Guideline Exceedances - DMMUs

PROJECT:	Burbank Grain Facility	Kittitas Co. Boat Ramp	Longview Fibre / KapStone Kraft Paper Corp										Northwest Grain Growers	SPU, Chester Morse Lake	USACE/Ports Snake/Clearwater River							
Date of SD:	11/6/2014	7/26/2013	2/13/2014										10/6/2014	2/27/2014	2/18/2014							
DY:	15	14	14										15	14	14							
Freshwater/Marine:	Freshwater	Freshwater	Freshwater										Freshwater	Freshwater	Freshwater							
DMMU or Sample ID:	DMMU1	DMMU1	DMMU1	DMMU2	DMMU3	DMMU4	DMMU5	DMMU6	DMMU7	DMMU8	DMMU9	DMMU10	WGT-P	DMMU1	DMMU1	DMMU2	DMMU3	DMMU4	DMMU5	DMMU6	DMMU7	DMMU8
Assessment Rank:	M	M	LM	LM	LM	LM	LM	LM	LM	LM	LM	LM	LM	LM	L	L	L	L	L	L	L	L
METALS (mg/kg)																						
Cadmium		1.5[SL1 (a)]																				
PHENOLS (ug/kg)																						
Phenol																				170[SL1]		
4-Methylphenol															1,700[SL1]	630[SL1]	340[SL1]		1,300[SL1]	4,900[SL2]		
OTHER CHEMICALS OF CONCERN																						
Dioxins/Furans (pptr TEQ; u=1/2 DL)	--	--	--	--	--	--	--	0.97	--	1.39	--	--	--	--	--	--	--	--	--	--	--	--
BIOASSAYS																						
Chironomus (freshwater) growth		NH													NH	NH	NH		NH	NH		
Chironomus (freshwater) mortality		NH													NH	NH	NH		NH	NH		
Hyalella (freshwater)		NH													NH	NH	NH		NH	NH		
Bioassay Result:		PASS													PASS	PASS	PASS		PASS	PASS		
BIOACCUMULATION																						
Bioaccumulation result (P/F)																						
OVERALL DMMU PASS/FAIL:	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	NA	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
z-sample associated with this DMMU	DMMU1-Z	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	WGT-Z	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR
OVERALL ANTI-DEGRADATION PASS/FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
VOLUME (CY):	9,700	7,490	32,000	32,000	32,000	48,000	28,354	31,381	32,000	32,000	8,529	40,000	6,250	4,200	57,818	60,167	55,453	57,849	52,221	20,948	6,187	11,261

(a) the SL1 for cadmium at the time of the suitability determination was 1.1 mg/kg; it has since been raised to 2.2 mg/kg.

Appendix C. Freshwater Guideline Exceedances - DMMUs

PROJECT:	USACE/Ports Snake/Clearwater River (cont)						
Date of SD:							
DY:							
Freshwater/Marine:							
DMMU or Sample ID:	DMMU9	DMMU10	DMMU11	POC-GE	POC-RD	POC-CD	POL
Assessment Rank:	L	L	L	L	LM	LM	LM
METALS (mg/kg)							
Cadmium							
PHENOLS (ug/kg)							
Phenol							
4-Methylphenol				1,400[SL1]			
OTHER CHEMICALS OF CONCERN							
Dioxins/Furans (pptr TEQ; u=1/2 DL)	--	--	--	--	--	--	--
BIOASSAYS							
Chironomus (freshwater) growth				NH			
Chironomus (freshwater) mortality				NH			
Hyalella (freshwater)				NH			
Bioassay Result:				PASS			
BIOACCUMULATION							
Bioaccumulation result (P/F)							
OVERALL DMMU PASS/FAIL:	PASS	PASS	PASS	PASS	PASS	PASS	PASS
z-sample associated with this DMMU	NTR	NTR	NTR	NTR	NTR	NTR	NTR
OVERALL ANTI-DEGRADATION PASS/FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS
VOLUME (CY):	55,591	58,284	26,367	3,218	1,036	9,041	4,485

(a) the SL1 for cadmium at the time of the suitability determir

Appendix C. Freshwater Guideline Exceedances - Z-samples

PROJECT:	Burbank Grain Facility	Northwest Grain Growers	USACE Kenmore							
Date of SD:	11/6/2014	10/6/2014	1/27/2015							
DY:	15	15	15							
Freshwater/Marine:	Freshwater	Freshwater	Freshwater							
DMMU or Sample ID:	DMMU1-Z	WGT-Z	DMMU1-Z	DMMU2-Z	DMMU3-Z	DMMU4-Z	DMMU5-Z	DMMU6-Z	DMMU7-Z	DMMU8-Z
Assessment Rank:	M	LM	H	H	H	H	H	H	H	H
METALS (mg/kg)										
Nickel			45[SL1]	42J[SL1]	40J[SL1]	44J[SL1]	39J[SL1]	38J[SL1]	41[SL1]	43[SL1]
PHENOLS (ug/kg)										
Phenol									130[SL1]	
OTHER CHEMICALS OF CONCERN										
Dioxins/Furans (pptr TEQ; u=1/2 DL)	--	0.46	1.89	10.73	10.97	4.39	5.58	5.91	8.55	5.58
BIOASSAYS										
Chironomus (freshwater) growth			NH	NH	NH	NH	NH	NH	NH	NH
Chironomus (freshwater) mortality			NH	1H	NH	NH	NH	NH	NH	NH
Hyalella (freshwater)			NH	NH	NH	NH	NH	NH	NH	NH
Bioassay Result:			PASS[AD]	PASS[AD]	PASS[AD]	PASS[AD]	PASS[AD]	PASS[AD]	PASS[AD]	PASS[AD]
BIOACCUMULATION										
Bioaccumulation result (P/F)										
ANTI-DEGRADATION PASS/FAIL	PASS	PASS	PASS	PASS[BPJ]	PASS[BPJ]	PASS	PASS	PASS	PASS	PASS