SEDIMENT MANAGEMENT

ANNUAL REVIEW MEETING

FINAL

MEETING MINUTES

JULY 2012

Prepared for DMMP Agencies:

United States Army Corps of Engineers
Washington Department of Ecology
United States Environmental Protection Agency
Washington Department of Natural Resources

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Appendix II: Meeting Agenda

Appendix III: List of Attendees

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Appendix V: 2012 Agency Issue and Clarification Papers

List of Acronyms and Abbreviations

AFDW	ash free dry weight
BMP	best management practice
CCMP	Comprehensive Conservation and Management Plan
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CSL	Cleanup Screening Level
CSMP	Cooperative Sediment Management Program (Washington State)
CWA	Clean Water Act
DEQ	Oregon Department of Environmental Quality
DMMO	Dredged Material Management Office
DMMP	Dredged Material Management Program
DNR	Washington State Department of Natural Resources
DY12	dredge year 2012
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FCR	fish consumption rate
FPM	Floating Percentile Method
LEKT	Lower Elwha Klallam Tribe
MTCA	Model Toxics Control Act
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
PCB	polychlorinated biphenyl
PDMS	poly-dimethylsiloxane
PLP	Potentially Liable Party
PNWA	Pacific Northwest Waterway Association
PQL	practical quantification limit
PRG	Project Review Group
PSDDA	Puget Sound Dredged Disposal Analysis
PSEP	Puget Sound Estuary Program
PSET	Portland Sediment Evaluation Team
PTM	Particle Tracking Model
QA/QC	quality assurance/quality control
RDT	Regional Dredging Team
RI/FS	Remedial Investigation/Feasibility Study
RSET	Regional Sediment Evaluation Team
SEF	Sediment Evaluation Framework
SL	Screening Level
SMARM	Sediment Management Annual Review Meeting
SMS	Sediment Management Standards
SPME	solid-phase microextraction
SQS	Sediment Quality Standards
SQV	Sediment Quality Value
SRM	Sediment Reference Material
TEC	threshold effect concentration
TEQ	toxic equivalence

TOC	total organic carbon
TSS	total suspended solids
USACE	United States Army Corps of Engineers
WAC	Washington Administrative Code
ECOLOGY	Washington State Department of Ecology

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The 24th annual review of sediment management issues in the Pacific Northwest region was held on May 2, 2012 by the Cooperative Sediment Management Program (CSMP). The Sediment Management Annual Review Meeting (SMARM) was hosted by the U.S. Environmental Protection Agency (EPA), at the Federal Center South, Galaxy Conference Room in Seattle, Washington. Comments from the public were welcomed, with prior invitation to submit issues for consideration and discussion.

The Dredged Material Management Program (DMMP) is an interagency cooperative program that includes the U.S. Army Corps of Engineers (USACE), Seattle District, the EPA Region 10, the Washington Department of Natural Resources (DNR), and the Washington Department of Ecology (Ecology). These minutes include the DMMP's response to public issues raised at this year's SMARM meeting (Appendix I), meeting agenda (Appendix II), list of attendees (Appendix III), the speaker's presentation slides (Appendix IV), and the 2012 SMARM Clarification Papers (Appendix V).

WELCOME AND OPENING REMARKS

Stephanie Stirling (Moderator), recently retired from USACE, welcomed everyone to the 24th consecutive annual SMARM meeting. She briefly reviewed the history of the DMMP, stressing the collaborative process of the DMMP and its important role in the state's goal of cleaning up Puget Sound by 2020. According to Stephanie, a hallmark of the program is the civil discourse among all parties. Stephanie introduced the members of the head table, including Christine Reichgott (EPA, Manager, Environmental Review and Sediment Management Unit), David Kendall (USACE, Chief, Dredged Material Management Office), Kristin Swenddal (DNR, Manager, Aquatic Resources Division), and Jim Pendowski (Ecology, Manager, Toxic Cleanup Program). This will be the last meeting in the Galaxy Conference Room, as the USACE will move to an adjacent building next year. Stephanie advised everyone to please sign in at the back table and addressed a few "housekeeping" issues. She reminded everyone that the comment period had been extended to 60 days (July 2) to accommodate a few late papers. The host for these meetings rotates each year, and this year the host is EPA Region 10. The meeting location remains at the Corps because of free parking.

Stephanie then introduced Christine Reichgott to welcome those in attendance and to provide opening remarks. A Seattle native, Christine began her career with EPA in 1991 on the east coast, and then transitioned to Seattle as manager of NEPA review, which expanded in 2008 to include the Sediment Management and Ocean programs.

Stephanie Stirling

PP0.1 Welcome

PP0.2 Meeting Details

PPO.3 Cartoon

Christine Reichgott, EPA, thanked everyone for attending the meeting and called for a show of hands of folks who had attended these meetings in the past 5, 10, 15, and 20+ years. The response showed a commitment to the ongoing conversation and the important outcomes of these meetings, including the access to information, the opportunity to coordinate actions, identification of mutual questions and ways to research solutions, and the importance of communication and trust that continues after the meeting adjourns. Christine thanked all groups represented for their information and perspectives, with special recognition of the USACE as the "heavy lifter" for sediment management. From her perspective

at EPA, these conversations interweave daily with EPA's authorities and activities. Examples from her own unit at EPA include the following:

- Sediment disposal site selection authority under the Clean Water Act (14 disposal sites were designated off the Oregon Coast)
- Technical support to Superfund
- National Environmental Policy Act (NEPA) review (Snake River environmental impact statement (EIS) completed in 2011)
- Proposed revisions to Sediment Management Standards (SMS) review
- Proposed revisions to sediment testing procedures at regional and national levels
- Evolution of the National Ocean Policy and its role in this region
- Oversight of the National Estuary Program in Puget Sound.

Stephanie Stirling (Moderator), introduced the first agency speaker, Mike Rylko, EPA, Senior Technical Manager for Puget Sound.

AGENCY SUMMARY REPORTS, PART 1

1. EPA, Puget Sound Program Activities, Mike Rylko

Mike Rylko (EPA), began by informing the audience that he was going to depart a bit from sediment concerns and instead give a broad overview of the challenges to protect the Puget Sound ecosystem. Puget Sound is a local, state, and national estuary of significance under the National Estuary Program (NEP), which was established under Section 320 of the 1987 Clean Water Act (CWA) Amendments. A focus of this program is to protect aquatic systems and beneficial uses of these systems. Section 320 calls for each NEP to develop and implement a long-term Comprehensive Conservation and Management Plan (CCMP). The CCMP contains specific targeted actions to address water quality, habitat, and living resource challenges in its estuarine watershed.

Mike pointed out that the NEP encompasses geographic-based or place-based environmental protection, where cumulative effects and implications over long periods of time take center stage. Twenty years ago environmental protection was tightly focused on individual sites and individual permits. Today, the focus has expanded to include input from several programs over decades because most of the environmental challenges we face can not be solved in a short period of time. These are the facets of geographic-based management that NEP overlays with other programs under the Clean Water Act.

In 1988, Puget Sound was the first estuary to be approved and adopted under the NEP. Kathy Fletcher was the original director of the Puget Sound Water Quality Authority, the governing authority of the NEP in Washington. Despite some incremental successes of the program, everything changed in 2006 when all indicators of Puget Sound health were determined to be in decline, forcing EPA to identify Puget Sound as a national geographic priority, which in turn infused the local program with extra funding. Prior to 2006, the NEP delineated impact up to “head of tide”, but by 2007 after the Puget Sound Partnership was formed the program is now able to delineate impact farther up the watershed to the crest of the Cascade and Olympic mountains. This ecosystem-wide view has precipitated cross-border communication with our Canadian counterparts. Furthermore, species recovery and salmon recovery, which was not regulated from a stewardship perspective, has now been integrated with Puget Sound recovery under the Partnership. EPA previously stood back from Growth Management Programs, but soon recognized that land use issues had tremendous impacts on aquatic ecosystems and that ultimately EPA was not going to protect water quality by staying in the water column.

The Puget Sound Action Agenda was created by the Puget Sound Partnership, a community effort that engages the viewpoints of elected and public officials, tribal and business leaders, scientists, environmental groups, and the public. The agenda, which will be updated in a few months, is a broadly scoped roadmap for cleaning up, restoring, and protecting Puget Sound.

The National Estuary Program Management Conference is a collection of committees that guides the program and is based upon consensus-based decision-making and defined leadership, science, and implementation roles. No longer are individual agencies doing the work but entire management forums and caucuses are networked together in a common vision across all levels of government. Over the past 24 years there have been huge monetary investments in the cleanup of Puget Sound – totaling nearly 9 M dollars in NEP grants alone. At the same time additional dollars were also invested in Superfund cleanup and remediation and engineered water treatment facilities and infrastructure. Up 25-30 M in correcting problems and not preventing them.

Taking into consideration the projected 40% growth of this area, EPA is now focusing on long-term strategies for forward-looking protection instead of an emphasis on cleanup and remediation. Puget Sound is presently one of three large-scale initiatives (along with San Francisco Bay and Long Island Sound) that has seen increased funding in recent years largely because of the importance, complexity, and size of these places. This has averaged about 30-M/year, an investment that has presented logistical challenges with the management of hundreds of projects, some very large, by a small EPA team. Consequently, EPA is shifting from a "retail" to a "wholesale" approach by soliciting long-term commitments from the following local ecosystem lead organizations to collaborate on these four key ecosystem initiatives:

- Marine/Nearshore Protection and Restoration – Washington Department of Fish & Wildlife and DNR
- Watershed Protection and Restoration – Ecology
- Toxics & Nutrients Prevention, Reduction, and Control – Ecology
- Pathogens Prevention, Reduction, and Control – Washington Department of Health

Mike then quickly discussed EPA's 20 recovery targets for ecosystem protection, focusing on the targets that are most aligned with the work done by SMARM attendees:

1) **Nearshore Protection and Estuary Habitat Restoration** – Year 2020 target of protecting approximately 7,500 acres by work such as acquiring habitat, educating the public, mapping feeder bluffs, developing guidance on alternatives to armoring, protecting eelgrass beds, preventing oil spills, preventing invasive species, and removing derelict fishing gear.

2) **Toxics and Nutrients** – For toxics, the target of implementing findings of Toxics Loading Study, including the Puget Sound circulation box models, the evaluation of metals in roof runoff and transportation surfaces, and the prevention of petroleum releases from multiple sources. For nutrients, evaluate the relationships between shellfish recovery and nutrient levels as well as the implications of ocean acidification on shellfish beds. Low impact development is an important tool.

3) **Pathogens** – Target of upgrading 10,800 acres of shellfish beds by 2020 and protecting swimming beaches with a focus on septic systems, BMPs in agricultural sectors and enforcement, corrective strategies in loading reductions, septic system approaches by a watershed perspective, livestock pathogen reduction, and preventing/reducing pathogen loading from vessels.

4) **Watershed Protection** – The focus here is a much more localized scale—down to the catchment basin—and includes land use, working lands, and restoration and protection of watershed systems. The funding emphasizes multiple floodplain restoration planning projects, multiple market-based incentive programs, multiple growth management and critical area update planning projects.

Over 120 projects are discussed on EPA's website.

Mike Rylko

PP1.1 Puget Sound Map

PP1.2 Clean Water Act (CWA)

PP1.3 CWA – National Estuary Program

PP1.4 Geographic-based Environmental Protection

PP1.5 Puget Sound National Estuary Program History

PP1.6 Action Agenda

PP1.7 National Estuary Program – Management Conference

PP1.8 Linking Organizations, Roles, and Expertise – the Puget Sound Management Conference

PP1.9 Puget Sound Program Funding History

PP1.10 Secondary Ecosystem Challenges – Population and Climate Change

PP1.11 Federal Funding for Puget Sound through EPA Geographic Programs

PP1.12 EPA Puget Sound Funding Cooperative and Interagency Agreements

PP1.13 Current Funding Focus

PP1.14 2010 Recruitment for Lead Organizations

PP1.15 Puget Sound Recovery Targets

PP1.16 Nearshore Related Recovery Targets

PP1.17 Summary of Management Target for Sustaining Shorelines

PP1.18 Acres of Eelgrass in Puget Sound

PP1.19 Toxics Reduction Related Targets

PP1.20 Weighted Mean Sediment Quality Triad Index Scores in 8 Puget Sound Regions

PP1.21 Pathogen Related Recovery Targets

PP1.22 Nearshore Lead Organization – Key Investments

PP1.23 Toxics and Nutrients Lead Organization Priorities

PP1.24 FY ’10 &’11 Toxics and Nutrients Science Funding

PP1.25 FY ’10 & ’11 Toxics Management and Control

PP1.26 FY ’10 &’11 Funding Preventing Release of Toxics

PP1.27 FY ’10 & ’11 Nutrient Funding

PP1.28 FY '12 Toxics and Nutrient Funding Priorities

4PP1.29 Pathogen Lead Organization

PP1.30 Pathogen Lead Organization Control Strategy

PP1.31 Potential Growing Area Upgrades

PP1.32 Watershed Protection Lead Organization

PP1.33 Watershed LO Funding Emphasis in FY '10 & '11

PP1.34 Uses Watershed Protection Framework

PP1.35 Urbanization and Forest Changes, 1995-2002

PP1.36 Watershed Characterization Results – Prioritizing Water Flow Processes

PP1.37 WRIA 11 Characterization Results – Restoration & Protection Categories for Sediment

PP1.38 http://www.epa.gov/pugetsound/

2. USACE, Dredging Year 2012 DMMP Testing Activities, Lauran Warner

Lauran Warner, USACE**,** presented an overview of DMMP projects during the 2012 dredging year (June 16, 2011 to June 15, 2012). This was a relatively active year for the Dredged Material Management Office (DMMO) due in part to the USACE goal of evaluating every navigational channel. There were a total of 24 projects evaluated, 13 of which resulted in suitability determinations. Other types of evaluations included dioxin (1), volume revision (5), recency (3), anti-degradation (1), ranking (1), and progress memo (1). Of the 24 completed actions, 14 had chemical testing, 10 included dioxin testing, 2 had bioassay testing, and there was no bioaccumulation testing. Lauran provided maps showing the state-wide extent of projects.

Most material was found suitable for open-water disposal. Of the total 24 projects undertaken by the DMMP, half were entirely suitable for open water disposal. Two projects (Port of Tacoma and Bellingham Bay) had DMMU failures based on dioxin alone. Two other projects included DMMUs with dioxin failures but also failures of other chemicals of concern. Five projects passed dioxin testing.

Projects with either all material or a portion of the material deemed unsuitable for open-water disposal and their reasons are listed below:

- Harbor Village Marina, Lake Washington – PCBs, dioxins
- Lafarge NA, Duwamish River – PCBs, dioxins
- Port of Tacoma, Husky Terminal – Dioxins
- Seattle Iron & Metals, Duwamish River – PCBs, dioxins
- USACE, Duwamish Navigation Channel – Bioassays
- Bellingham Federal Channel - Dioxins
- Lakeshore Marina, Lake Chelan – Pesticides.

Half of the above projects with unsuitable material were associated with the Duwamish. Several new projects are in the pipeline for Puget Sound and the Columbia River, in addition to a navigation

improvement study in Grays Harbor. The Corps will launch a new website in a few weeks that will have easier search tools and simpler URLs. Lauran reminded folks that all old links will no longer work when the website is launched and to call the Corps if you need assistance locating information.

Lauran Warner

PP2.1 Dredging Year 2012 DMMP Testing Activities

PP2.2 DMMP Purpose

PP2.3 DMMP 101

PP2.4 DY12 Completed Actions

PP2.5 DY 2012 Suitability Determinations

PP2.6 DY 2012 Suitability Determinations

PP2.7 DY 12 Testing

PP2.8 Suitability by Volume Tested

PP2.9 Dioxin Testing 2012

PP2.10 Projects with Unsuitable Material

PP2.11 Suitability Overview

PP2.12 In the Pipeline

PP2.13 Website Changes Coming

PP2.14 For More Information

3. DNR, Disposal Site Management Activities, Celia Barton

Celia Barton, DNR, provided updates on three components of DNR's contribution: Shoreline permits for disposal sites, rockfish study, and DNR marine reserves and disposal sites.

Disposal Site Shoreline Permits - DNR secured new permits, or term extensions, for six Shoreline Permits in 2011. Terms generally range from a 5-year permit with 1-year extension (6 year term), to a 10-year permit with two 5-year extensions (20 year term). Permit fees range from $460/yr to $10/yr, depending on the permitting jurisdiction and term. One County is looking at a different way to authorize ongoing uses through an extended term with periodic reviews. The Bellingham Bay disposal site will need some discussion prior to moving forward on a Shoreline Permit application.

Rockfish Study - The 2010 Biological Opinion regarding DMMP disposal sites concluded that disposal *could* impact larval fish and recommended comprehensive ichthyoplankton surveys at disposal sites. The three species of interest are Yelloweye, Canary, and Bocaccio rockfish.

Rockfish larvae are very fragile and may have up to 70% mortality within 12 days of birth. The conservative estimate is that suspended sediment would affect larvae by injuring or killing them or altering their feeding rate, therefore all exposed larvae are assumed to die. The "Take" is the number of larvae estimated to be exposed to disposal events and is calculated by an estimated range of abundance, amount of water column altered, and number of disposal events.

DMMP was able to partner with NW Marine Science Center on the ongoing NMFS study to evaluate the ecological health of Puget Sound's pelagic food web. This allowed an expansion of sampling from 7 to 11 months, and accomplished a 47% cost savings though in-kind contributions from the NMFS study.

Field work is completed, data analysis is incomplete. Rockfish larvae require genetic analysis for identification to species level. Boccacio is the only species with visually identifiable larvae, and none have been found to date. The final report is expected from the NW Marine Science Center this summer. If the abundance of all rockfish larvae exceeds the Take total then DMMP will work with NMFS to determine if there is any impact to the listed species.

DNR Aquatic Reserves and Disposal Sites - Reserves are established on State Managed Aquatic Lands to provide benefits to native aquatic habitats and species. Only one disposal site is within a Reserve boundary. The Anderson / Ketron disposal site is within the Nisqually Reach Reserve boundary and remains an approved use within the Reserve contingent on the scientific oversight and management of the DMMP. DNR will continue to seek authorization of the site through local shoreline permits and will continue to authorize disposal of approved dredge material through the Site Use Authorizations.

Celia Barton

PP3.1 DNR Shoreline Permit Status

PP3.2 Shoreline Permit Update

PP3.3 Larval Rockfish Ichthyoplankton Study: DMMP Puget Sound Disposal Site Assessment

PP3.4 2010 ESA Consultation on DMMP Puget Sound and Strait of Juan de Fuca Sites

PP3.5 December 22, 2010 Biological Opinion Regarding DMMP Disposal Sites

PP3.6 Species of Interest

PP3.7 Species of Interest

PP3.8 Species of Interest

PP3.9 Species of Interest

PP3.10 Spawn Windows/Disposal Site Use

PP3.11 Spawn Windows/Disposal Site Use

PP3.12 Endangered Species Act Conservation Recommendations (BiOp)

PP3.13 NMFS (EPA Funded) Study: Evaluate Ecological Health of Puget Sound's Pelagic Foodweb

PP3.14 NMFS Study: Evaluate Ecological Health of Puget Sound's Pelagic Foodweb

PP3.15 Field Sampling

PP3.16 Field Sampling (continued)

PP3.17 Field Sampling (continued)

PP3.18 Preflexion Stage

PP3.19 Results (So Far)

PP3.20 Ichthyoplankton Study Results - *Sebastes* Abundance (January 2012)

PP3.21 Next Steps

PP3.22 Questions?

PP3.23 DNR Aquatic Reserves Program and Dredged Materials Disposal

PP3.24 What are Aquatic Reserves?

PP3.25 Reserves Statewide

PP3.26 Management Plan

PP3.27 Protection Island Reserve

PP3.28 Nisqually Reach Reserve

PP3.29 Nisqually Reach Reserve Management Plan

PP3.30 Nisqually Reach Reserve Management Plan

PP3.31 Continued Disposal Site Use

PP3.32 Questions?

4. EPA, RSET Update: Application of the Sediment Evaluation Framework for the Pacific Northwest, Jonathan Freedman

Jonathan Freedman, EPA, summarized the activities of the Regional Sediment Evaluation Team (RSET) and described the history and function of the team. This multiagency team was formed under the direction of the Regional Dredging Team (RDT) to revise the Lower Columbia manual (DMEF) for regional use. The team includes multiagency partners from all NW Corps Districts, EPA Region 10, NMFS, USFWS and other federal and state agencies that require sediment quality evaluation procedures. The 2002 DMEF manual update evolved into the creation of a regional sediment evaluation manual in September 2006 called the Sediment Evaluation Framework (SEF). The final SEF published in May 2009 provides a framework for the assessment and characterization of freshwater and marine sediments in Idaho, Oregon, and Washington.

The responsibilities of RSET include maintaining and revising the SEF, meeting monthly, conducting program reviews, receiving public input, developing and supporting the regional sediment database and coordinating with RDT on issues needing resolution. The RSET home page is located on the USACE Portland District website at http://www.nwp.usace.army.mil/environment/sediment.asp. Eric Braun (USACE, Navigation Program Manager) and Jonathan Freedman are co-chairs of the RSET policy group, which is composed of 12 members representing all three states. Stephanie Stirling departed from the team in November, and Mark Siipola is retiring. Jonathan acknowledged Mark's long history with the program and his contributions to regional sediment issues.

RSET activities of the past year included:

- Second annual RSET public meeting occurred on November 10, 2011.
- Third meeting scheduled for October 17, 2012 at the Seattle District Office.
- Continued dialogue with Pacific Northwest Waterway Association (PNWA) and their members on issues raised in project reviews, mostly involving permit processing time.
- Chapter 11 (QA/QC Guidance and Data Management) revisions that will include current guidance from RSET member agencies. Hope to have draft out by October 2012 meeting.
- Freshwater standards are undergoing rulemaking in Washington. EPA must concur on water quality standard revision.
- RSET team members developing paper on post-dredge z-layer monitoring in Portland Harbor.

Jonathan next talked about bioaccumulation and how target tissue levels in SEF don't provide clear guidance on how to assess bioaccumulation in sediment. The Oregon Department of Environmental Quality (ODEQ) has proposed a regional risk management framework for evaluating bioaccumulatives. Future RSET guidance will identify and address differences among state policies and guidance, federal law, and SEF.

Activities of the Portland Sediment Evaluation Team (PSET), formerly called the Project Review Group (PRG), during the past year included:

- Weekly project review calls, biannual face-to-face meetings
- Use of SharePoint data-share site to review and store materials
- Review of 20 projects in FY2012 thus far
- Portland District sampling and analysis plan guidance completed in late 2011
- Lower Willamette project team will be staffed by PSET members to ensure consistency
- PSET will continue to coordinate with the DMMP including grain size clarification, new surface material, and bioassay procedure revisions
- Working with DMMP to ensure consistency of RSET QA/QC procedures with Puget Sound protocols.

A USACE moratorium on dredging and sampling has slowed activities in Idaho. However, the Walla Walla Corps office sampled the Snake/Clearwater River confluence in late 2011. Results are not yet available. The draft Snake River Programmatic Sediment Management Plan is finally out for public review.

Additional regional and national topics that were addressed included:

- Beneficial use at 404 sites at mouth of Columbia will be used for first time this year
- In July 2012 EPA will complete final designation on two ocean disposal sites on Oregon Coast at Yaquina, which will be the last new designated sites in the foreseeable future
- Exploring options for developing advanced identification of 404 disposal sites in Willamette River for clean dredged material
- The National Combined Dredged Material Testing Manual is merging the 1991 Testing Manual (Green Book) with the 1998 Inland Testing Manual. Should be out soon for public review.
- Several updates of the National Ocean Policy were discussed.

Jonathan Freedman

PP4.1 Regional Sediment Evaluation Team (RSET) Update

PP4.2 Regional Sediment Evaluation Team (RSET)

PP4.3 RSET Policy Team Background and Responsibilities

PP4.4 RSET Home Page: http://www.nwp.usace.army.mil/environment/sediment.asp

PP4.5 RSET Policy Group

PP4.6 Activities in Past Year

PP4.7 Activities in Past Year – continued

PP4.8 Bioaccumulation

PP4.9 Activities in Past Year (PSET)

PP4.10 Activities in Past Year (DMPP – PSET Coordination)

PP4.11 Activities in Past Year (Idaho)

PP4.12 Other Regional Sediment Management Initiatives

PP4.13 Mouth of the Columbia River Dredged Material Disposal Sites and Bathymetry

PP4.14 Oregon Coast Disposal Sites and Status

PP4.15 National Initiatives

PP4.16 Questions?

Morning Break

AGENCY SUMMARY REPORTS, PART II

5. Ecology, Sediment Management Standards Rule Revisions, Chance Asher

Chance Asher, Ecology, provided a timeline for the rule revision as well as an overview of what sections of the rule are being revised. Ecology intends to release the draft rule language and supporting documents by July 2012. These revisions are being added to clarify the existing rule regarding human and ecological health risk, background concentrations, and freshwater standards. Revisions are being limited to Part V: Sections 500 through 590 to address cleanup. Section 571 (now changes to Section -561) will establish a two risk level approach for human health risk, incorporated into the current SMS two-tier framework. A default fish consumption rate will also be incorporated into this section. Section 574 (now changed to Section -564) will establish a general ecological health screening process which will also be incorporated into the SMS two-tier framework.

Section 570 (now changed to Section -560) will incorporate two types of background- Natural background (MTCA) and Regional background (SMS). Regional background is a new concept that is akin to CERCLA anthropogenic background. Both backgrounds will be incorporated into the current SMS two-tier framework. Section 573 (now changed to Section -563) will add both chemical and biological criteria for freshwater, designed for the protection of the benthic community only. SMS Section 500 was revised to address cleanup process decision making, while SMS Section 560 (now changed to Section -550) and 585 (now changed to Section -580) were revised for clarity and to align with MTCA requirements for the remedial investigation/cleanup action plans. SMS Section 580 (now changed to Section -570) was revised to provide clarity and align remedy selection with MTCA. Chance then proceeded to provide more details on the proposed changes, as well as to indicate what would be specified in rule versus what would be clarified in guidance.

The two-tier framework for background was described as allowing a cleanup standard set within a range between an upper and lower tier. For the upper tier, Regional background is incorporated, which is a new term and concept similar to CERCLA anthropogenic background. Regional background allows influence of stormwater, but excludes the ability to sample within a discharge zone or near any specific source. The lower tier, incorporates MTCA Natural background, and is the goal for sediment quality. For human health, the upper tier is 1X10-5 total site risk, the lower tier 1X10-6 risk for individual chemicals and 1X10-5 for multiple chemicals and exposure pathways; both tiers use a hazard quotient (HQ) of 1. A default value for fish consumption will be in the rule, and Ecology is considering adding two other exposure parameters: site use factor and fish diet fraction (tribal RME scenario default for both is 1, but can be adjusted where appropriate). The formula was provided and explained in slide 10. Slide 11 summarized what will be in the rule (reasonable maximum exposure tribal scenario, risk levels, fish consumption rate (FCR), site specific FCR criteria, tissue testing, regional background definition) and what will be in guidance (conceptual site model; risk equations, exposure parameters other than FCR, fish diet fraction and site use factor, evaluating compliance, establishing background, and sampling protocols).

In slides 11 through 14, Chance explained how risk and background concentrations will be used to establish cleanup standards, providing details of the two-tiered approach that encompasses background, practical quantitation limits, and risk (includes protection of benthic community, human health risk, and ecological risk, as well as ARARs).

Comments and Questions

Question: Debra Williston (King County). Can you clarify again what the risk level is the lowest of? Can you have the same number as the upper and lower level?

Response: Chance Asher. Yes that's true, you could. The hazard quotient is the same for both tiers, but the upper tier is a risk level of 10-5 for single or multiple carcinogens, which is different from the lower tier of 10-6 for single carcinogens.

Comment: Doug Hotchkiss (Port of Seattle). And very possibly you will.

Question: John Wakeman (USACE). Chance, to make reference to tissue background, in this particular slide you referred only to sediment background. I kind of understood you to say that tissue should only be used from the perspective of compliance at a site, is that right?

Response: Chance. Yes, we are referring to sediment concentrations here, but tissue testing could be used to determine whether or not you are in compliance with the sediments standard and also for screening chemicals of concern during the RI/FS process, to compare to background.

Question: Allison Hiltner (EPA). Is Ecology envisioning publishing a list of what natural background values are and what regional background values are in different areas?

Response: Chance. That's a goal if we get the funding, but the legislature is not supportive of that, so our program is scrambling trying to find the funds to do this, but that would be the goal. What we need to be careful about is publishing a number that's not in rule. We have to have some flexibility around that, but the goal is to develop a process on how background can be calculated and go out and supplement data that we currently have , fill data gaps , and publish that information, and then you'll come to a value. Where we have to be careful, if we have numbers and we say absolutely you have to use this number that's not in the rule. We chose not to put that in the rule because we know those concentrations are changing over time. The big question is how much time. And it might change on how we end up calculating background over time, because we learn more.

Question: Tim Thompson (SEE). Can you comment about how this program is going to interface with the dredged material management program? Are we now going to have to manage our dredged material to regional or natural background?

Response: Chance. We are working pretty intimately with the DMMP folks who were in our work group. DMMP is currently managing dioxin based on Puget Sound wide natural background concentrations. I doubt very much you would end up with a regional background concentration at disposal sites opposite of the framework that we currently have in the SMS rule. It's likely that you may end up managing based on a Puget Sound natural background concentration, different than embayment specific natural background, that would flow well with the framework that we currently have in the rule, meaning the SQS or the lower tier. So the answer is yes and no.

Question: (Unknown). So, in terms of the tissue testing, do you carry that to background? Have you made any progress or thought about what the background data set would be for tissue and whether there is any funding to get a data set?

Response: Chance. Yeah, we have thought about that. What we would like to do, if we can supplement some natural background data, is do the paired tissue and sediment chemistry together. We've got some of that information. We did do a pretty thorough search last year on trying to find any paired tissue and sediment chemistry data that was out there. We put quite a bit into our environmental information management database, so that's good, and we did that with the intent that we knew that we would need to do some more sampling but wanted to find out what was already out there that just wasn't in our database. So I think that answered part of your question. The other part is we have been looking at options and we are dealing with this on site and currently just looking at reference areas for tissues for natural background concentrations as an option. We may decide that there are other reference areas out there that are more appropriate we may establish. Did that answer your question?

Comment: (Unknown): Are you looking at it all in terms of a Puget Sound-wide data set?

Response: Chance. Yes, we are. But we have also found that when it comes to areas that are less urban, like Port Gamble, those concentrations that meet the definition of natural background can be lower than the Puget Sound-wide concentration for sediments. I'm not sure if that is the case for tissue, but we will definitely look at that.

Question: Unknown. So for calculating human health cleanup criteria, are you guys working with your water quality standards program on calculating human health criteria as it relates to discharges?

Response: Chance Asher. Yeah, that's a good question. We are trying. And I hesitate because it is sediment and water and it's discharge permits and the cleanup. But we meet with them every other week to talk about these issues. We are working pretty closely with them on the issue of fish consumption rate, what they may end up using to calculate given all criteria. I have a slide and I will talk about what those processes are and how parallel or not parallel we are. So the general answer is yes, but there are a lot of questions about how you establish a protective concentration for a discharger that protects both water and sediment. The science isn't really great. There is modeling, but it only works for certain chemicals, so yeah, but we don't have really good answers for every single chemical. Sometimes that has to be site-specific criteria development.

Chance's talk (cont.)

In slide 15, Chance discussed SMS rule revision decisions that were made regarding remedy selection (consideration of net environmental benefit, technical effectiveness, and costs; permanent to the maximum extent practicable), potentially eliminating the use of cost to establish cleanup standards, liability settlements, and the recontamination issue. For recontamination, Ecology allows for releasing potentially liable party (PLP) from liability for recontamination of a site unit if ongoing releases are not from or under the authority of the PLP.

Slide 16 covered the topic of source control and the rule revision, clarifying that PLP sources will need to meet the cleanup standard, that the PLP can be released from liability of recontamination if their source control is met and maintained, and that if they are unable to meet the standards, Sediment Impact

Zones may be used if necessary. 303D listing of waterbodies would remain the same- current policy places sediment cleanups in Category 4B.

Comments and Questions (cont.)

Question: Tom Gries (Ecology). It does beg the question of how you are going to use practical quantification limits (PQL) to calculate a natural or a regional background.

Response: Chance Asher. We are struggling through that right now. We do recognize that's a big issue when you have a background concentration based on estimated values. So if folks have strong opinions, I'd like to hear what they are.

Question: Debra Williston (King County). So, when you did the survey of laboratories for PQLs, was that sediment testing done with very clean material or was it with material that you were really going to find, which is sediments that were kind of messy, with lots of interferences?

Response: Chance. I really want to put Roger on the spot, and Joyce as well, because Joyce Mercuri did a survey as well. I would like you guys to answer those questions.

Response: Roger McGinnis (Hart Crowser). They were laboratory-determined PQLs and method detection limits based on the standard method, and it was a clean matrix.

Response: Chance. So, Roger said it was based on standard methods and it was a clean matrix. Joyce?

Response: Joyce Mercuri (Ecology). That's all I was going to say. They run a calibration standard and that's how they figure out the PQL, so it's not based on a specific sample.

Response: Chance. So, clean, clean and more clean. It's really the best you can do. Did I get that right?

Comment: Roger McGinnis. Sometimes.

Comment: Karl Hornyik (Onsite Environmental). Everybody stole my thunder, that was the question I was going to ask, but I guess I'll just comment on it. That is a frequent issue with sites and cleanup. Frequently it is coming from a clean matrix, no problem, but what we run into a lot is dirty samples that are contaminated with other things than what it's being analyzed for and having to raise PQLs, and of course not being able to arrive at the data that work well in spreadsheets, or whatever, you know, to calculate, so I guess I'm just throwing that comment out there.

Response: Chance. So, the comment boiled down is when you've got really dirty sediment with matrix interference and how it will actually meet a very low PQL. Correct?

Comment: Right, correct.

Response: Chance. We recognize that. That is why we chose when we did the survey we took out the very low values and the very high values and used a median. The goal is to have a reasonable, achievable value that is conservative and repeatable.

Comment: Karl Hornyik. Well, the problem I think is that when you ask any lab what their PQL is, it is generally based on the extraction procedure and whatever their instrument is capable of achieving. But

for us, PQL, depending on the sample matrix and whatever other contaminants might be in there, could easily go up, you know a dilution factor of 1,000 times. So even if you're throwing out the high/low value, which may compensate for the different types of instrumentation being used, still when you present a client with data that, say you're looking for tetrachloroethene or something, and they saw 1,000 parts per million of mineral spirits or something in the sample, that may not be usable at all. Anyway, it's a high number and it kind of puts the lab in a tough spot.

Response: Chance. So, lots of concerns about interferences and meeting that level. Teresa would like respond to that.

Response: Teresa Michelsen (Ecology). There are a couple of points in the paper which Chance had mentioned. One of them is, we are trying to make very, very clear that these are not recommended PQLs for the RI. These are cleanup standards based on PQL distributions, so you will only use whatever PQL is appropriate during the RI based on your interferences, your sediment matrices, whatever site-specific issues that you have. It could be higher than, or lower than, this ultimate value that is established at the end of the RI/FS as a cleanup standard. And the other point is that there is also a process in the paper for establishing site-specific values. These are kind of programmatic values that we developed based on surveys. But if there is a really good reason on your site, which you should know by the time you get through the RI, when you have a weird matrix or whatever and you just can't meet that control, even though keep in mind that this is for compliance monitoring is that your site should by the time you are doing this monitoring. If your site is weird and there is some good reason to establish a different PQL as the cleanup standard, there is a process for this.

Response: Chance. These are great comments. I would encourage anybody to read that issue paper.

Chance's talk (cont.)

Chance then said that the Freshwater Standards discussion would take place after lunch, and finished her section with a slide on establishing practical quantitation limit (PQL) based cleanup standards. She overviewed the PQL issue paper that was provided in the back of the room and will be posted on the DMMO website, before wrapping up with a few summary slides on the guidance documents being developed to support the rule revision (Human Health, Implementation of freshwater standards, Establishing natural and regional background, establishing compliance at a cleanup site, establishing PQLs for a cleanup site), how the SMS rule process fits in with the separate but parallel processes of updating the fish consumption rate and Water Quality Standards rulemaking process, and the timeline for the process.

Questions and Comments (cont.)

Comment: Dave Bradley (Ecology). I work with Chance in the Cleanup Program. Just a couple of updates on what the water quality program is doing. They have had a series of meetings with different stakeholders. What it looks like now, they've gotten a lot more suggestions on things that address the net implementation rules, but right now they're assessing the schedule, whether that's going to happen this year or next year. I think the key point is they're going to do the implementation rule before they pick up the actual updating of the numbers in the rule based on types of new fish consumption rates. And that's to get at your question earlier. That's the second half of the two-step process. But again,

there's been a lot of dialogue on the actual implementation tool--how big the tools are-- which may impact the schedule.

Response: Chance. So, is that correct then, Dave? This may not end up being July?

Comment: Dave Bradley (Ecology). That is very correct.

Question: Unknown. Is the revised fish consumption rate technical report going to be out at the same time?

Response: Chance. Yes, it will be because we need to make a decision and incorporate that rate into the rule. It is not going to be out necessarily for public comment, but it will be out to support how we came up with that number that gets plunked into Section 561 of the SMS rule.

Lunch Break

Questions and Comments (cont.)

Question: John Wakeman (USACE); It's based on being able to test on differences from the surroundings. But what I heard this morning was that there was going to be some additional decision about picking tissue, some additional consideration of tissue natural background. That's a little different paradigm. I just wanted to highlight the question associated with it. It seems like there is a cross-walk there between the programs.

Response: Chance. So, the question was if we were looking at the options of using tissue chemistry to help screen chemicals of concern and evaluate compliance with sediment cleanup standards, how does that transition with the dredge program, the DMMP framework of looking at the difference between the disposal site and background and the surrounding environment? I do think that we are cross-walking pretty well, but there are differences when you're talking about a cleanup site vs. a disposal site, so that's as far as I'm going to go with that one. Well, we've got it recorded so let me think about it, John.

Question: Tad Deshler (Windward). So, you mentioned that you've got draft rule language on the web, then you talked about the formal comment period being in July, so are you anticipating providing the comments now in full?

Response: Chance. We've gone through this whole comment period that closed in January, but it doesn't mean that you can't look at what we have on the web and send comments in now. I cannot guarantee you'll get a response back, but if you've got some concerns let me know. But it might also help prep you for the formal comment period. The rule that we have online now is different than actually what we have drafted right now. That's based on all the comments we got from the advisory group, and then we also got public comments, and there were audience members that had commented as well. So what you can see on the web now is different based on the presentations that we've made. For example, the option of tissue testing is not in the version that is online now. So that version that is online now was written in October 2011, and so we have had 6+ months to noodle through lots of changes, and I think improvements. A long, windy way of saying it's still very informal.

Comment: Tad Deshler (Windward). So, the answer to my question, the information in your presentation isn't there in the rule online.

Response: Chance. Correct. So you would want to look at the rule online and then incorporate what we have in the presentation about what is new in the rule.

Question: Debra Williston. I want to go back to your fish consumption rate. You made a comment that there is going to be a default number that might go up. Can you tell me why you think it might go up? I'm thinking small streams, small lakes, and consumption rates based on Puget Sound based surveys where you have a large shellfish consumption…I was just curious why you're assuming that now.

Response: Chance. So the question was on fish consumption rates and we're looking to put a single default in the rule. I mentioned that site specifically it may well be higher than the default, and the question is why are we assuming that? That it won't go down. Small streams and waterbodies can't support that rate, it doesn't make sense to have one default if you can't adjust down. Did I get it right? Yeah, we are still considering that option. We're hearing quite strongly from a lot of folks that we don't want to adjust down from a default rate. I am going to be getting out of my knowledge base really darn quick here. But the surveys that were looked at were not just Puget Sound. There was also the Columbia River.

Comment: *Debra Williston (King County).* That's a large river. I'm talking small creeks, small lakes, that's still not the same thing.

Response: Chance. So, the concern is small creeks and small lakes, still not the same thing…it can't support, for example, 175 grams per day in Port Gamble.

Comment: *Debra Williston (King County).* It might not be able to sustain that.

Response: Chance. It might not be able to sustain that. We are looking at another of two other options, which is site use factor and fish diet fractions to help somewhat mediate a fish consumption rate where you have a water body that can't sustain that, you could use those exposure parameters to help adjust that. Those are some options. We haven't absolutely settled that we will adjust down on fish diet fraction and site use faactor, but we are looking at that. We haven't absolutely made that decision. So it's here in the public comments records that it doesn't make sense for a water body that can't sustain a default fish consumption rate. We are having workshops this month, three of them I believe. I think there's one in Seattle, no Tacoma. It's on their web site, and the presentation has the links to get to there.

Question: Joyce Mercuri (Ecology). I'm not sure if you're prepared to talk about this right now, but could you talk a little bit about the sediment recovery zones and how it fits into the framework?

Response: Chance. So just a quick Recovery Zone 101, the rule was originally written without the knowledge that that we would have bioaccummulatives that were going to cause toxicity or human health risk at special levels, and that they would be ubiquitous. So it was written originally so that if you had a cleanup site and you didn't immediately meet the lower tier, which at the time was a sediment quality standard, that you would have to have a separate recovery zone issued, which basically gave you legal cover for a certain period of time to meet that lower tier. So let's say a site where cleanup standards are set at 5, but you're unable to meet that right away – you've got 10. So you get a separate recovery zone to get that 5 over time, usually through monitoring natural recovery. So we look at that only because we are talking about really low levels, cleanup standards which are much, much lower. We are looking at adding more flexibility for the time that you're allowed to meet your standard. We are looking at not issuing separate recovery zones automatically if you have not met the lower tier, but

issuing separate recovery zones if you haven't met the standard that you're required to meet after active cleanup, which could be above that lower tier. So we are trying to set it up so that we don't have to automatically issue separate recovery zones. We aren't sure what that would really get us because a lot of those requirements to monitor and naturally recover are already going to be in the consent decree and the cleanup action plan. So the recovery time frame we've extended and changed, what standards you have to meet with the extended we've changed. So we are trying to adjust that a bit. Did that help?

Comment: Joyce Mercuri. Yeah, thanks, a little bit.

Question: Erika Hoffman (EPA). Are sediment recovery zones the same as sediment impact zones?

Response: Chance. They are common, but in essence they are meant to accomplish the same thing. A sediment impact zone is what we would issue an NPDES permitted discharger if they were contaminating the sediments above the sediment quality standard. Then we would issue them a sediment impact zone until they met that standard. And that would give them legal cover to meet that over time, by implementing best management practices (BMPs), treatment, and all of that. A separate recovery zone is for cleanup sites, so it's not necessarily the NPDES discharger, but the liable party, and again the same premise, to get some legal cover to meet that over time.

Question: Debra Williston (King County). When you said the maximum allowable level, that's going to be the top…. What if you have a stormwater or NPDES-permitted discharge where you'd use the best available treatment and you still can't meet the cleanup standards. What happens then?

Response: Chance. That's the sediment impact zone, giving more time to determine how to meet the standards. So you get more time to meet it…over time. I don't mean to laugh. The people are really smiling at me right now, so it's an automatic reaction. We are talking about likely for these types of cleanup standards. We are going to take a long time to get down to these very low standards, so we have to look at it that way now. Before, it was maybe a 10-year window, a 5- to 10-year window that we looked at before our cleanup standards were met, but that's not the reality any more. We realize that.

Question: Kathy Godfredsen (Windward). Not to sound like a broken record about this human health thing, but I would give you an opportunity to say why you decided not to have a two-tier for human health similar to the risk range in CERCLA? For example, having 10^{-6} to a 10^{-4} range?

Response: Chance. So the question is, you will notice when we talked about human health in the two-tier framework we did have two risk levels, that essentially when we're talking about the reality of cleanup sites you're going to have multiple contaminants and it's going to collapse. That's true. There may be some sites where you have just PCBs and it would make a difference, or just mercury, no not mercury, but a carcinogenic chemical, but in general it probably will collapse for a lot of sites. It was a policy decision for us not to increase the risk level any more. We basically thought the upper tiers would be more like the MTCA method C-type approach, which is a little different, and the program wasn't comfortable moving to a CERCLA-type risk range, which is a 10^{-4} to 10^{-6} range. So that was a policy decision.

Chance Asher

PP5.1 Sediment Management Standards Rule Revisions

PP5.2 SMS Rule Timeline – 2012

PP5.3 Why do we need to revise the SMS Rule?

PP5.4 What are the rule revisions?

PP5.5 What are the rule revisions (cont)?

PP5.6 What are the rule revisions (cont)?

PP5.7 SMS Rule Revision Issues – The Dirty Dozen + 1

PP5.8 SMS Rule Revision Decisions – Background

PP5.9 SMS Rule Decisions – Human Health

PP5.10 SMS Human Health Revisions Yay! Math!

PP5.11 SMS Revisions – Human Health Goal: Establish a Simple Risk Management Process to Develop Sediment Cleanup Standards

PP5.12 How are Risk Based and Background Concentrations Used to Establish Cleanup Standards?

PP5.13 Cleanup Standards – Fun Detail in Sections -570 - 574

PP5.14 Establishing Cleanup Standards – Section -570

PP5.15 SMS Rule Revision Decisions

PP5.16 SMS Rule Revision Decisions

PP5.17 SMS Rule Revision Decisions Establishing PQL Based Cleanup Standards

PP5.18 Guidance Development for Rule Revisions

PP5.19 Three Separate but Integrated Processes

PP5.20 SMS Rule Timeline – 2012

AGENCY SUMMARY REPORTS, PART II (cont.)

6. Ecology, Freshwater Standards, Laura Inouye

Laura Inouye, Ecology, presented the freshwater standards overview, commenting that co-author of the presentation, Russ McMillan, was unable to attend due to illness. The freshwater standards were developed to be consistent with the current SMS paradigm, providing both chemical and biological standards in a two tiered structure that allows some adverse effects and where biological criteria override chemical criteria. Biological criteria are based on sediment bioassays, which are intended to protect the function and integrity of a benthic community. The suite of species is representative of native species, and bioassays include both acute and chronic endpoints which were used to establish regulatory effects levels. Chemical criteria were developed using the Floating Percentile Model, which is a multivariate method optimized to predict both presence and absence of toxicity. The chemical criteria were developed using synoptic regional data.

Laura overviewed the history of the development of the standards, which began in 1998, as well as the various reviews undertaken during the process. Bioassays were selected based on multiple factors, including species distribution, sensitivity, availability of standardized tests, and inclusion of sub-lethal endpoints. SQS effects were established at minimal detectable differences from control, and CSLs effect levels were set above the SQS allowing minor adverse effects, consistent with the marine bioassay standards. The rule allows flexibility to add alternative bioassay endpoints (biomass) or new bioassays (mussels, snails) as they become available.

Laura then reviewed feedback Ecology received from the various peer review processes. Ecology has addressed questions regarding the representativeness of the data, as well as the ability to use alternative bioassays on a site specific basis. New statistical methodologies were used to evaluate the performance of the standards in order to address the low ratio of hits and no hits in the dataset. Although several reviewers were concerned about the level of protection (allowing 20% false negatives), Ecology believes that it is an appropriate level for the regulatory process, as it balances false negatives and false positive rates for individual bioassays, and the standards were based on the most sensitive bioassay for each chemical of concern. There were also reviewer comments regarding the SQS hit definitions, which Ecology defends as they are based on minimal detectable differences. In using bioassays to develop chemical criteria, Ecology used a risk management approach rather than a risk assessment approach, which strived to maximize reliability (ability to predict both presence and absence of toxicity), which is a fundamental difference for most other sediment quality value (SQV) sets. Regional data was used that reflects both the mixtures and levels of contaminants found in the Northwest.

Laura presented a slide that visually showed the concept of predictability, using an actual example of differences in reliability for the SQS and a similar and commonly used SQV, the threshold effect concentrations (TECs).

Laura then overviewed the feedback Ecology heard that was still being addressed- clarification that sediment quality standard (SQS) is a “no adverse effect level”, not a “no effect level”, responding to questions on the development of the minimal significant differences used for the biological criteria, and potential addition of the biomass endpoint to the rule.

Laura closed with a slide summarizing that the development of biological and chemical criteria have been improved through the substantive scientific review process, and that the criteria’s strength are in the added flexibility that is allowed in implementation of the SMS rule and the consistency with the framework of the marine criteria, and that it will provide more consistency and predictability for cleanup decisions. The final slides provided links to information on the SMS rule revision process.

Comments and Questions

Comment: Glen St. Amant, Muckleshoot Tribe. I’ve got a question about the compatibility with the marine sediment criteria. If freshwater standards are different and higher than marine standards and you have a situation where freshwater sediments are migrating into a marine setting where in the marine setting you would be exceeding marine standards, how would you consider that?

Response: *Chance*. That's a great question. The most protective standard would apply. That is written into the rule and more attention will be given in the guidance document.

Laura Inouye

PP6.1 Freshwater Standards

PP6.2 Freshwater Sediment Standards

PP6.3 Scientific Review of Criteria and Development

PP6.4 Fundamentals of Biological Criteria

PP6.5 What We Heard From the Peer Review Process

PP6.6 What We Heard From the Peer Review Process (continued)

PP6.7 What We Heard From the Peer Review Process (continued)

PP6.8 Using Bioassays to Develop Chemical Criteria

PP6.9 Predicting Biological toxicity

PP6.10 What We Heard From the Peer Review Process

PP6.11 In Closing

PP6.12 Information on the SMS Rule Revisions

PP6.13 Contacts for the SMS Rule Revisions

SCIENCE AND TECHNOLOGY UPDATES

7. Lafarge, Lafarge Contaminated Sediments Transloading Facility, Mike Depew

***Mike Depew*,** a 27-year technical manager at the LaFarge cement plant on the Duwamish River, provided an overview of the company's role in the cleanup of Slip 4. The Lafarge facility is located at RM 1.1 and has been operating there since 1967, currently as a cement distributor. When the kiln at the plant closed down permanently in October 2010, the company was looking for new ways to keep the facility viable. Lafarge was invited to participate in the Slip 4 project by Allied, who was hired by General Construction to do the dredging and cleanup at Slip 4.

Mike described the minimal modifications that needed to be made to the Duwamish facility to accommodate the off-loading of dredged sediments from barges and the loading of the material into rail cars. As a cement plant, they are considered a mine and are governed by the Mine Safety and Health Administration. A health and safety plan was prepared specific to Slip 4 work, all employees and subcontractors were HAZWOPER trained, and appropriate safety and hazard gear was installed at the plant before commencing with the work.

Using photographs, Mike guided the audience through all facets of the operation, emphasizing the measures used to prevent spillage into the water and on the apron as the clamshell bucket deposited dredged sediment and associated water from the barge into the containment vault. Formerly used for holding clay used in making cement and later as a stormwater settling pond, the containment vault was an integral component in the transloading operations. From there the material was loaded into 20-ft, plastic-lined, steel boxes using an excavator and weighed on a scale before being placed in a "3 pack" rail car configuration on BNSF rail spurs located onsite.

Comments and Questions

Question: (Unknown). What about the water that is associated with the sediments?
Response: Mike Depew. That's a good question and it came up many times in preparation for the project. The barges are dewatered at the site and arrived at the Lafarge plant quite wet, but the water we received essentially went into the containers and into the landfill. It didn't make sense to try to separate the water and do any treatment because Lafarge doesn't have permitting to discharge any of the sediment-associated water. Stormwater from the vault area, the tarping, and the container loading area went into the boxes and to the landfill with the exception of five tanker trucks that we pumped water into and a handful of vactor truckloads. However, all of that water went to the landfill as well.

Question: Justine Barton (EPA). How many cubic yards were handled?
Response: Mike. Approximately 10,000 cubic yards or 17,000 short tons of material

Question: Doug Hotchkiss (Port of Seattle). What was your throughput rate when you were up and going in the middle of the operations or, in other words, cubic yards a day?
Response: Mike. We were doing 800 tons/day at one barge per day, working a single shift.

Question: Erika Hoffman (EPA). Could you ramp it up to handle more cubic yards for a project on the Duwamish?
Response: Mike. We're expecting that we can approach 3,000 tons per day, working 24 hours a day and 7 days a week. Barge unloading can run about 200 tons per hour. We can put on 2nd and 3rd shifts and work weekends.

Mike Depew

PP7.1 Welcome

PP7.2 Safety

PP7.3 Safety

PP7.4 Vicinity Map

PP7.5 Site Plan

PP7.6 Waterfront Crane

PP7.7 Spill Apron

PP7.8 Secondary Spill Protection

PP7.9 Barge Unloading with Spotter

PP7.10 Containment Vault

PP7.11 Containment Vault

PP7.12 Empty Barge

PP7.13 Overview of Barge Unloading

PP7.14 BNSF Rail

PP7.15 Rail 3 – Pack

PP7.16 Rail 3 – Pack

PP7.17 Top Pick Reach Stacker

PP7.18 Top Pick Reach Stacker

PP7.19 Liner Installation

PP7.20 20' Container with Liner

PP7.21 Excavator

PP7.22 Excavator

PP7.23 Container Loading

PP7.24 Loaded Containers

PP7.25 Excavator

PP7.26 Vault Cleaning

PP7.27 Vault Cleaning

PP7.28 Clean Vault

PP7.29 Roosevelt Landfill Trailer Tipper

PP7.30 Permits

PP7.31 Partnerships

PP7.32 Questions?

8. USACE, Sediment Bioavailability Assessment Using Passive Samplers, Mandy Michalsen

Mandy Michalsen, USACE, began her talk with a drawing showing different-sized contaminant molecules in solution with a cell membrane with different-sized pore openings. The drawing illustrated that properties of a contaminant molecule (size in the illustration) can make the contaminant more or

less available for uptake by the cells. This concept extends to sediment bioavailability as bulk sediment chemical concentrations have been demonstrated to be poor predictors of tissue concentration and toxicity.

Mandy offered that bulk sediment concentrations paired with equilibrium partitioning showed some improvement to predict the bioavailable portion of contaminants in sediments, as outlined in EPA (2003, 2007) guidance documents. However, equilibrium partitioning appears to overestimate toxicity by 100-fold. Black-carbon-adjusted equilibrium partitioning appears to underestimate toxicity.

An alternative is to measure porewater contaminants using a solid-phase microextraction (SPME) filter sampler containing sorbent polymer PDMS (poly-dimethylsiloxane). These samplers are easily deployable in the field and can achieve a low ng/L detection rate with 1-cm resolution.

The SPME samplers were field-tested at two Superfund wood treatment sites, Puget Sound Resources and Wyckoff, with the objectives to 1) measure near-surface porewater concentrations and compare to surface water quality standards, and 2) determine any trends with depth. At Puget Sound Resources results showed no striking trends with depth, no exceedances of water quality standards, and thus no migration of contaminants through the cap. At Wyckoff, an added objective was to compare collocated bulk sediment and porewater results. Deuterated performance reference compounds were included in the Wyckoff study to correct for progress toward equilibrium during the 7 day deployment period. Although the results are preliminary, results at Wyckoff indicate that further investigation may be warranted to assess through-cap migration in one location.

Direct porewater measurement [using SPME samplers] is advantageous because it is a better proxy for bioavailability, deployable in near-surface sediment or surface water column, capable of cm-level depth resolutions, capable of ng/L detection limits that allow assessment of concentration gradients, and while available from only a few commercial or research labs, is not cost prohibitive. It is an ideal approach for monitoring activated carbon-amended sediments.

This work was a collaborative process undertaken by the USACE (Mandy Michalsen and John Wakemen), EPA Region 10 (Howard Orlean, Justine Barton, Ravi Sanga, Rene Fuentes, and Maja Tritt) and Professor Danny Reible and Xioang Lu at the University of Texas at Austin.

Comments and Questions

Question: Janet Knox (Pacific Groundwater Group). Deuterated PAHs, run that by me again?

Response: Mandy Michalsen. Deuterated PAHs means that their molecular weights are different from PAHs found in the environment so that when samples are run through the chromatograph/mass spectrometer, the reference compounds can be distinguished from those in the environment.

Question: Janet Knox. What would the correction factor be then?

Response: Mandy. Loss of the labeled reference compound from the SPME during deployment is a direct function of the progress towards equilibrium uptake of the non-labeled compound found in the environment. As a conceptual example, if the progress towards equilibrium uptake for a particular contaminant is 50% over 7 days, you can adjust the measured concentrations by a factor of 2 to estimate the true equilibrium pore water concentration present in the environment.

Question: Sue Dunnihoo (ARI). How do you load deuterated PAH?

Response: Mandy. Labeled compounds were rolled in a tube with the fibers for approximately 1 day until steady state was achieved. They were then dried.

Question: Debra Williston (King County). Is this being done at a university level rather by contractors?

Response: Mandy. There is an EPA-approved method for the fibers. Can you order from a lab? The answer is yes. Can you order a pre-assembled sampler for deployment in the field? The answer is also yes.

Comment: John Wakeman (USACE). Two sources are Danny Reible at the University of Texas and Steve Hawthorne at the University of North Dakota.

Mandy Michalsen

PP8.1 Sediment Bioavailability Assessment Using Passive Samplers

PP8.2 Bioavailability

PP8.3 Bulk Sediment Concentrations Are Poor Predictors of Toxicity

PP8.4 Estimating Bioavailability from Bulk Sediment Has Limitations

PP8.5 Measuring Porewater Contaminants

PP8.6 Solid-Phase Microextraction (SPME)

PP8.7 Pacific Sound Resources (PSR) Superfund Site, EPA Region 10

PP8.8 SPME Fiber Field Demonstration at PSR

PP8.9 SPME Fiber Results

PP8.10 SPME Fiber Results

PP8.11 SPME Fiber Field Demonstration at Wyckoff/Eagle Harbor Superfund Site

PP8.12 SPME Fiber Field Demonstration at Wyckoff/Eagle Harbor

PP8.13 Corrections for Steady State

PP8.14 Concentration Depth Profiles Allow Assessment of Through-Cap Migration

PP8.15 Bulk Sediment Estimated Porewater vs. Measured Porewater

PP8.16 Take Home Messages

Afternoon Break

STATUS REPORTS

9. EPA, Update on Development/Implementation of Dioxin/PCB Sediment Reference Material, Justine Barton

Justine Barton, EPA, presented an update on the DMMP's development of a regional sediment reference material (SRM). This sediment contains known levels of dioxins and PCBs, and can be concurrently analyzed with environmental samples, serving as a QA/QC tool for regional programs. Presentations at the past two SMARMs have documented the selection, field sampling and processing details involved in producing the SRM. Justine reviewed the past work and then presented new information on the results of the sediment testing multi-lab round robin and SRM acceptance limits for PCB Aroclors (1260) and for 17 CDD/CDF congeners. Specific acceptance limits are detailed in the slides. For upcoming dredging year 2013, the DMMP agencies will consider the limits advisory and will review and apply results on a case by case basis.

Guidance outlining distribution details and reporting requirements is almost finalized and will be posted on the DMMO website, along with an electronic Request Form. Requesters must work through authorized agency contacts -- Seattle District Corps DMMO staff, Laura Inouye and Tom Gries (Ecology), and Justine Barton and Erika Hoffman (EPA). Donald M. Brown is the EPA Region 10 SRM Manager and will serve as manager and contact to Shaw Environmental, the current national EPA quality assurance technical services contractor. Shaw Environmental is storing and maintaining the SRM, managing the database that will track reported results over time, and will use reported data to recalculate acceptance limits once enough new data points are received.

Comments and Questions

Question: Roger McGinnis (Hart Crowser). Down the road when you set formal acceptance levels have you considered if you will use confidence levels or prediction levels?

Response: Justine Barton. No, we'll see how it goes. We were quite pleased with the results of the material. Lab results were very similar.

Question: Tad Deshler (Windward). Are the SRMs required for DMMO projects?

Response: Justine. We would discuss this on a case by case basis, but prefer they be used. SRMs have been used already for several projects.

Question: Sue Dunnihoo (ARI). Procedural question. Can the same SRM material be used for multiple projects? What is the ownership of that jar or does the lab get a new jar for each project?

Response: Justine. Not sure. Will need talk about that.

Question: Tom Gries (Ecology). You mentioned that reporting requirements would be in the package when the commercial lab receives the SRM. My question is if an entity wants this SRM they are going to contract with the lab, which will include two parties other than EPA. That contract usually has reporting requirements, too. So, should contracts also specify reporting requirements? With those

reporting requirements, you could add that once they obtain the 30-g vials the labs report all results and not just the one immediate to that project.

Response: Justine. OK, that's another thing to consider. There's going to be leftover material. That's a great question and I'll put it to the work group. Regarding reporting requirements, the sheet that comes with the SRM will be very general. We will fall back on the agency leads to track down those results out of the data package. Everyone has their own data reporting and summary sheets. We definitely want to get the data validation report.

Question: Brad Helland (Hart Crowser). Are the data used to generate the acceptance limits available?

Response: Justine. Not yet. We really need to get that report done so you can see how different labs stacked up, but you will not see which lab results go with which labs.

Question: Tim Thompson (SEE). Over the course of the first year, are you going to qualify or reject data outside the ranges?

Response: Justine. This will be done on a case by case basis based on who is using the material. In the case of the DMMP, we'll have to decide based on the project and chemicals of concern. We would have to look at the validation reports.

Comment: Tim Thompson. I might suggest that you give yourself a year's worth of data to see how laboratories perform before actually using it.

Response: Justine. The use of the SRM is advisory. The intention for this year is not a pass/fail, and I doubt that will ever be the intention. We are not part of that program at EPA.

Question: Diane McElhany (King County). Did you consider other Aroclors besides 1260?

Response: Justine. Yes, but we didn't feel confident about the acceptance limits. Those data will be reported. We actually got less PCBs than we were hoping for at T-117.

Justine Barton

PP9.1 Regional Sediment Reference Material (SRM)

PP9.2 What is the Regional SRM?

PP9.3 Field Sampling

PP9.4 T-117 Typical Sample (09/23/2010)

PP9.5 Field Sieving T-117 (09/23/2010)

PP9.6 Carr Inlet – Weighing Bucket (09/27/2010)

PP9.7 SRM Processing

PP9.8 T-117 Air Drying (09/30/2010)

PP9.9 T-117 Sample Retained on 20 Mesh Sieve (>850 um) 10/19/2010

PP9.10 T-117 Dry V-Blender Process (10/19/2010)

PP9.11 T-117 Bulk with 60 Mesh Sieve (<250 um)

PP9.12 Bottles with EPA QA Program Labels

PP9.13 Acceptance Limits

PP9.14 Aroclors

PP9.15 CDD/CDF

PP9.16 List of Analytes

PP9.17 SRM Distribution

PP9.18 SRM Distribution (con't)

PP9.19 SRM Distribution (con't)

PP9.20 Long-term Management

PP9.21 Next Steps

10. USACE, Dispersive Site Fate and Transport Modeling, Scott Brown and David Michalsen

At the request of stakeholders, the Dredged Material Management Program (DMMP) agencies initiated a study to investigate the fate and transport of dredged material placed at three dispersive open water disposal sites in the Strait of Juan de Fuca and Puget Sound (Port Angeles, Port Townsend, and Rosario Strait). Concerns over the potential for dredged materials to be transported in the vicinity of critical shellfish habitat have been identified by the Lower Elwha Klallam Tribe (LEKT) near Port Angeles, Sequim, and Port Townsend, Washington. To help build upon previous work used to initially locate the disposal sites, a field current profile survey and numerical modeling study were performed. The CMS-FLOW 2D depth-averaged variable grid hydrodynamic numerical model of the Puget Sound Basin was constructed and validated with the field data collected in August 2011 over a spring tide cycle. A particle tracking model (PTM) using historic sediment properties was utilized to simulate the initial decent and short term fate of sediment dumped in each of the three dispersive sites.

The net sediment pathways closely matched the net tidal currents modeled at each site. These were west at Port Angeles, west at Port Townsend, and southwest at Rosario Strait. Model results indicate only 1% of dredged materials reside in the surface layer following 24 hours of disposal and indicate low likelihood for transport toward interior shorelines. Sediment parcels were not present in WDFW shellfish areas following 72 hours into the PTM simulation. This suggests while dredged material at the sites is highly dispersive, the hydrodynamic conditions do not promote active transport or accumulation of sediments in critical shellfish beds.

Comments and Questions

Question: Tom Winter (PPS). Several slides back, you were showing the sediment mobility and they seem to be contradictory. One site was 100% and the other site was 10%.

Response: Scott Brown. Yes, at the Port Angeles site the bottom currents are essentially as high as the surface currents. At the other two sites, the current drops off as you get down to the bottom. So, at the Port Angeles site even with sands the velocities are high enough after three or four tide cycles to remobilize that sediment; whereas, at the other two sites once it gets below a certain depth it essentially is there on the bottom.

Comment: Tom Gries (Ecology). It seems like in relation to biological resources on or near the site this is all good news, but two of the dispersive sites are not so dispersive relative to sand.

Response: Scott Brown. If you look at the scale of how far the sediment is moving at these sites, it's actually on the order of several miles a day.

Question: Jonathan Freedman (EPA). Is there a longer-term model?

Response: David Michalsen. The uncertainty increases with time, and confidence in model results goes down.

Scott Brown and David Michalsen

PP10.1 Dispersive Site – Fate and Transport Modeling & Analysis, Rosario Strait, Port Townsend, and Port Angeles

PP10.2 Purpose and Scope

PP10.3 Outline

PP10.4 Shellfish Harvesting Areas

PP10.5 Background

PP10.6 Site Dimensions & Usage

PP10.7 Initial Site Selection Criteria (PSDDA 1989)

PP10.8 Original Fate & Transport Assumptions (EHI 1987; Crean 1983)

PP10.9 Field Data Collection

PP10.10 Field Data Collection

PP10.11 Numerical Modeling

PP10.12 Coastal Modeling System – FLOW (Militello et al. 2004)

PP10.13 CMS-FLOW Results

PP10.14 CMS-FLOW Validation

PP10.15 Coastal Modeling System – PTM (Demirbilek et al. 2008)

PP10.16 PTM – Model Scenarios

PP10.17 Port Angeles Site – PTM Results

PP10.18 Port Townsend Site – PMT Results

PP10.19 Rosario Strait Site – Results

PP10.20 PTM Results (Video)

PP10.21 Vertical Distribution of Sediment (PA & PT) (Video)

PP10.22 Vertical Distribution of Sediment (Rosario Strait) (Video)

PP10.23 Results/Discussion

PP10.24 Results/Discussion

PP10.25 Conclusions

PP10.26 References

CLARIFICATION PAPERS

11. Bioassay Endpoint Refinements: *Neanthes* Growth Bioassay and Bivalve Larval Test, David Kendall

David Kendall, USACE, began by acknowledging his coauthors on clarification paper, Russ McMillan (Ecology/TCP), who was out ill and unable to attend the SMARM, and Newfields, LLC coauthors, Bill Gardiner, Brian Hester, and Jack Word. He then summarized the purpose of the clarification paper, which was to provide method modifications intended to reduce confounding effects on test performance, for the Juvenile *Neanthes* growth bioassay, and the *Mytilus galloprovincialis* bivalve larval test[1]. The test protocol modifications were initially brought to the attention of the DMMP and SMS programs at the 2010 and 2011 SMARM by Jack Word and Bill Gardiner. The DMMP agencies subsequently decided to evaluate the protocol adjustments on Federal O&M projects and DMMP monitoring at the Port Gardner disposal site. SMS elected to apply these protocol adjustments at selective cleanup sites in woodwaste cleanup areas. These methods were developed and applied to a number of PSEP sediment evaluations during their initial development, which is much broader that those depicted. The DMMP and SMS have implemented twenty-seven changes to existing bioassay protocols between 1990 and the present to improve the performance of tests, which include five clarification papers focused on the echinoderm/bivalve larval test, and five clarification papers and one issue paper focused on the *Neanthes* growth bioassay.

Reference performance failures in the *Neanthes* test have been noted in many previous Grays Harbor O&M testing projects. The sediment found in the guts of worms is the source for the variability in the testing outcomes when compared to reference sediment. Control sediments generally consist of coarse sand, and can lead to performance failures in fine-grained reference sediment. Other biomass-based tests (e.g., *Chironomus* test, and *Neanthes* 28-day test, utilizing the ERDC protocol) use ash-free-dry weight to remove the interfering sediment mass from the biomass/growth measurement. The data

[1] This protocol modification would also work for the oyster, *Crassostrea gigas*

collected within DMMP and SMS demonstrate that observed sediment in the guts of control worms averaged 31 to 34 percent, and 20 to 28 percent in reference sediment, and 18 to 26 percent in test sediments. An example of reference performance failure was presented for Grays Harbor O&M testing accomplished in 2012. The ash free dry weight (AFDW) protocol reduced the source of variability and the test met the reference performance standard. A brief summary of the Ash-Free-Dry Weight Protocol followed.

David then briefly described the Bivalve larval test. The test is initiated with non-swimming larvae, early in larval development, which rest on the sediment surface. At approximately 12 to 24 hours the larvae develop to the point that they are swimming, rising off the sediment surface, where they continue their development to the D-shaped larval stage at test termination. The sediment larval test has had a long history of indiscriminate failures when testing sediments with fine-grained sediments or flocculent layers, particularly fine clay and wood waste. The larval test failures in these kinds of sediments were generally not related to sediment chemistry, and the low to intermediate recoveries of larvae, were due to entrainment of normal larvae, and not due to delayed development of larvae, as all the recovered larvae were normal "D-shaped" larvae. It should be noted that substantial layers of fine-grained material settle on the sediment surface during the first 12 to 24 hours of the test, during the time when non-swimming larvae are near or on the sediment surface. This thin layer is not a natural occurrence, but an artifact of the test, and entrains some of these normal, healthy larvae.

Larval entrainment has long been recognized as a concern for this test by the PSDDA agencies and SMS, and was noted in the 1989 PSDDA Larval Workshop, in the 1990 PSDDA Bioassay Workshop, and was a topic of research evaluated by EPA and the PSDDA agencies in a 1993 Methods Refinement effort. Newfields subsequently developed the resuspension method in 2009, to evaluate the recovery of bivalve larvae buried in the flocculent layers, focusing on addressing lab artifact entrainment. The method uses a perforated plunger to gently resuspend sediments at the end of the normal PSEP protocol. The resuspension method was briefly summarized.

The results of the resuspension protocol when applied to Port Gamble Remedial Investigation bivalve larval results, found significant improvements in the testing outcomes attributable to the resuspension results as compared to the PSEP protocol results, which were briefly summarized. The regulatory tool improvement process available to DMMP and SMS utilizes the SMARM as the forum to make changes when needed to the testing process. SMS provides the flexibility to implement new protocols under Section 110(6) and Section 130 of SMS.

Clarification: The DMMP and SMS propose reporting *Neanthes* Growth results on an AFDW basis rather than on dry weight basis.

Clarification: The DMMP and SMS propose adding the resuspension procedure to the standard PSEP protocol when testing sediments with high concentrations of fines, wood waste or other flocculent material. For routine testing of sediments with lower fractions of fines, wood waste or flocculent material, the standard PSEP protocol should be used. DMMP dredging project proponents may elect to use the resuspension protocol at their discretion. Under the SMS, Ecology or the Principle Liable Party

(PLP) may elect to use the resuspension protocol at their discretion if they have concerns about false positives due to larval entrainment.

David indicated that both the DMMP and SMS intend to evaluate the effects of the resuspension endpoint protocol on the Echinoderm Larval Test with *Dendraster excentricus* to assess protocol improvements relative to entrainment.

Comments and Questions

Question: Tim Thompson (SEE). You're at critical stage of larval development, giving them an extra 6-8 hours of development time. What you're seeing may be an artifact of extra development time. Northwestern Aquatics has never seen this problem. May have a develop time issue with this protocol? Should look at older data. You have a 48-hr test going over 50 hours now.

Response: Brian Hester (Newfields). Time endpoint doesn't change from standard 48 hours. The resuspension procedure is done earlier in the day before you hit the typical time point.

Question: Tim. It could make an SQS pass.

Response: Brian. Not seeing developmentally delayed larvae. It was a recovery issue of all larvae in the chamber; not an issue of normal/abnormal. Resuspension procedure helped free up those larvae that were entrained. It increased total number, and didn't increase the number of samples that passed.

Question: Tim. Will this procedure involve observations, or will it be used to make decisions?

Response: David Kendall. To make decisions. Limiting its application at this point. No large changes in results using modified protocol compared to those using standard protocol. Limiting it to areas of wood waste and fine-grained material where there's a concern for larvae to be entrained.

Comment: Teresa Michelsen (Ecology). Made a huge difference in Port Gamble. Sites passed where previously failed and failed where previously passed. Interpretation doesn't always go one way.

Question: Joyce Mercuri (Ecology: took Jim Pendowski's place at the front table for Ecology). . Is there a downside to using the method all the time? Only for floccular environments, and that's subjective somewhat.

Response: David. Used the procedure on five projects. No change in DMMP results, but there was for Port Gamble (the larvae being entrained). Would like it to be open to case-by-case basis.

Comment: Joyce Mercuri. As a site manager, I would like to use the same method for all other sites.

Response: David. Maybe a clarification in the future based on additional data. This procedure provides another tool in the toolbox.

Comment: Tom Gries (Ecology). Should probably set some thresholds and percent of grain size fraction recommendations. Need a detailed SOP that is very detailed and replicable among labs.

Response: David. We have a SOP attached to the clarification paper. We will add more detail to protocol if needed before finalizing clarification paper.

David Kendall, Russ McMillan, Bill Gardiner, Brian Hester, and Jack Word

PP11.1 Bioassay Endpoint Refinements: Neanthes Growth and Bivalve Larvae Bioassays

PP11.2 Clarification Purpose

PP11.3 Background

PP11.4 Bioassay Protocol Adjustments History (1989 – present)

PP11.5 *Neanthes* Growth Test - Concerns

PP11.6 *Neanthes* Test

PP11.7 Percentage of *Neanthes* Dry Weight Attributable to Sediment Retained in the Gut

PP11.8 Example: Grays Harbor O&M 2012

PP11.9 Example: Grays Harbor O&M 2012

PP11.10 Example: Grays Harbor O&M 2012

PP11.11 ADFW Protocol Modification

PP11.12 PSEP Bivalve Larval Test

PP11.13 PESP Bivalve Larval Test – Concerns

PP11.14 PESP Larval Test – Concerns

PP11.15 Perforated Plunger Used to Gently Resuspend Sediments

PP11.16 Resuspension Effects: Port Gamble RI, 2011

PP11.17 Scatterplot of % Fines versus PSEP and Resuspension Protocol (Port Gamble Remedial Investigation 2011)

PP11.18 Resuspension Protocol Summary

PP11.19 Regulatory Tool Improvement Process

PP11.20 Proposed DMMP/SMS Changes

PP11.21 Proposed DMMP/SMS Changes

PP11.22 Echinoderm Larval Test: Requires Further Evaluation

PP11.23 Questions?

***Stephanie Stirling*,** introduced the final speaker and noted that there were no pubic issue papers submitted.

12. USACE, Clarification/Issue Papers, David Fox

David Fox, USACE, called everyone's attention to the following two clarification and two issue papers:

- Use of Practical Quantitation Limits – SMS
- Bioassay Endpoint Refinements – SMS/DMMP
- Integration of Dioxin Data into Ranking Determinations – DMMP
- Transition form DAIS to EIM – DMMP

Regarding the two issue papers, the December 2010 guidelines for dioxin have now been applied for over a year, prompting the question as to how to use these dioxin numbers for ranking projects. Consensus is to use best professional judgment. DIAS has become outdated and difficult to use so EIM has become the primary repository for environmental data. The transition to EIM will occur in DY13.

The clarification and issue papers can be found on the DMMO website: http://www.nws.usace.army.mil. Search for "Dredged Material Management". The website will be changing soon. Comments are due July 2, 2012 and can be directed to the author or the DMMO staff member.

David Fox

PP12.1 Clarification/Issue Papers

PP12.2 Integration of Dioxin Data into Ranking Determinations

PP12.3 Transition from DAIS to EIM

PP12.4 Comments

SUMMARY AND CLOSING

Stephanie Stirling, concluded the 24th annual SMARM by announcing that the clarification and issue papers were currently on the website and that the SMARM presentation will be on the website soon.

Stephanie Stirling

PP13.1 Thank You

PP13.2 Comments Due July 2, 2012

PP13.3 Photo of Rufous Hummingbird

Meeting Adjourned

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APPENDIX I

DMMP / SMS Responses to Public Comment / Issue Papers

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Post SMARM Comment Letters

1) **Tom Gries (not representing Ecology)**

2) **Tim Thompson (SEE, LLC: Science & Engineering for the Environment)**

3) **Paul McCollum, Port Gamble S'Klallam Tribe, Natural Resources Director)**

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DMMP/SMS CLARIFICATION PAPER

BIOASSAY ENDPOINT REFINEMENTS: BIVALVE LARVAL AND NEANTHES GROWTH BIOASSAYS

COMMENTS, TOM GRIES (NOT REPRESENTING ECOLOGY), JULY 2, 2012

BIVALVE LARVAL BIOASSAY REFINEMENT

I believe that "entrainment" of non-swimming bivalve larvae does not occur by fines particles settling to the bottom of the test chamber as much as the much larger larvae slowly settling into clay/fine wood debris that, through winnowing, has accumulated on the surface of the settled sediment layer. Maybe "entrapment" would be a better term to describe a problem where non-swimming larvae settle into fine sediments/wood debris and then cannot escape when they become motile. Regardless, I believe that the overall false positive rate for samples containing clays and very fine wood debris, if known, is probably unacceptable and needs to be addressed for these types of samples.

That being said, I offer several comments regarding the proposed clarification:

1. The DMMP analysis appear to demonstrate that there is no need to change the protocol for samples that contain relatively low % fines ("Protocol Comparison – DMMP"). E.g., the following are not likely to be significantly different:

PSEP Control DMMP Average: 91.4 % (84.8 – 94.4%)
Resuspension DMMP Control Average: 95.2 % (86 – 99.7%)

PSEP DMMP Reference Average: 82.6 % (62.7 – 92.4%)
Resuspension DMMP Reference Average: 83.0 % (78.8 – 87.6%)

PSEP DMMP Treatment Average: 80.0 % (43 – 94.4%)
Resuspension DMMP Treatment Average: 77.1 % (30.9 – 98.6%)

The applicability of the proposed clarification is appropriately limited to projects/samples of concern (containing fines or fine wood debris) determined on a case-by-case basis.

2. To ensure reproducibility and comparability of results across/between labs, proposed changes to any toxicity test protocol that have a potentially large impact on final test interpretations should be based on a detailed SOP (preferably developed with input from multiple labs). The "SOP" referenced in response to my question about this during the SMARM probably lacks sufficient detail to ensure reproducibility/comparability. The clarification should not be adopted by either program *unless* accompanied by a detailed SOP, e.g., including design specifics for the plunger used to mix samples at the test's end.

3. I have suggested on several occasions that the DMMP should consider requiring a longer sediment settling time prior to introducing the larvae. Implementing this change to the protocol might address the potential problem of entrainment of bivalve larvae in the water column by settling fine grained material. This simpler change should be evaluated because it would not

introduce any additional inter-laboratory variability and doesn't "beg for" an SOP. However, it may not address the problem if caused by entrapment by the already-settled surface sediments.

4. Regarding the "Protocol Comparison – SMS Program" … another concern involves the replicate variability and statistical power resulting from the modified protocol. Most of the interpretations that changed from a "hit" to a "no hit" (Table 2) *may* have been due to a change in level of significance compared to reference sample results (S → N). For example, what would the error bars or confidence intervals look like that should have been included Figures 4a-d? Is there a statistical difference between the lines represented in Figure 5 for samples > 50% fines? I believe that the power is probably equal to or better than that of the existing protocol, but that cannot be determined from the evidence presented. For this reason, the DMMP/SMS Program should not implement the proposed change to the standard protocol *until* it first analyzes its inherent variability and statistical power.

5. The analysis of modified protocol results appears to be based on a Port Gamble data set that is very limited, somewhat unique, and conducted by external parties that could potentially have a conflict of interest. I suggest that a similar analysis should be conducted by a more independent party, and using a data set that includes other sites known to contain different types of high fines sediments, *prior* to adopting the clarification,.

6. Relevant conclusions/ recommendations of the larval workshop conducted in January 1998 could also be mentioned on page 4.

In summary, the clarification probably should be adopted by both the DMMP and the SMS Program BUT not before addressing comments #2, #4 and #5 (at least).

NEANTHES GROWTH BIOASSAY REFINEMENT

No substantive comment. The supporting evidence does not suggest that the proposed change will result in broad/large impact in final test determinations. However, it will affect interpretation of some samples, makes sense, involves using a standardized method, and is easy to implement.

July 2, 2012

Dr. David Kendall
Dredged Material Management Office
U.S. Army Corps of Engineers
Seattle District

Sent via email

Dear Dr. Kendall,

This letter is submitted as a "friend of the Dredged Material Management Program (DMMP)" response to the DMMP/SMS Clarification Paper titled *Bioassay Endpoint Refinements: Bivalve Larval and Neanthes Growth Bioassays.* That paper, which is dated online as April 27, 2012 was presented at the 2012 Sediment Management Annual Review Meeting (SMARM) in May 2012.

I would suggest that the larval modifications are not yet fully tested or vetted, and as such it is premature to implement in the DMMP. My thoughts for your consideration as the DMMP goes forward include:

1. **Restrict the total test time to 48 hours.** This test time was first developed by Peter Chapman, adapted by the Puget Sound Estuary Program, ASTM and subsequently by EPA. The development time is based upon an abundance of scientific literature that shows that bivalve larvae at 20ºC will develop to the so-called "D-shaped" larva within 48 hours. The sediment standards used not only in the DMMP, but also in the Sediment Management Standards, are largely based upon the 48-hour bivalve development (and to some extent the Microtox) Apparent Effects Thresholds (AETs). To be consistent within the program, the total exposure time should be limited to 48-hours. This may require developing supporting data to a further protocol change that would mix the sediments at 42 hours, followed by 6 hours settling and resampling. Newfields and Ecology made a comment at the 2012 SMARM that they were working on that specific modification – those data should be made available and evaluated prior to making any changes to the DMMP procedure.

2. **Prior to implementing any protocol modifications, extract larval data from the DAIS and/or EIM database to determine if there is a persistent problem with fine-grained sediment and larval development.** The relationship between fine-grained sediments and larval development was examined in the 1993 EPA "*Refinements to Current PSDDA Bioassays*". In that study, the residual sediments were actually examined for entrained larvae; only underdeveloped or decaying oyster and echinoderm larvae were observed entrained in the sediments.

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The principle data used for the proposed modification is that from Port Gamble – and that data is for larvae that have developed for up to 56 hours. What is not clear in those data is whether the entrainment is due to fine grained sediments, or possibly from fine humic material that is associated with the wood waste from the former mill site. The scatter plots (Figure 5) for fines vs. normal larval development presented in the Clarification Paper are not convincing; the line is fairly flat and the data scattered. However, this is an example of what should be done with the existing DAIS/EIM data to determine if there is a real need for the proposed modification.

3. **Develop a broader data set to support any protocol modification.** The data upon which the proposed modification is based is restricted to a limited number of samples taken within Port Gamble. There are only 15 sets of test data (i.e., individual locations) that are cited in Clarification Paper for which a different answer was derived. All of those are based on the extended development time. Furthermore, the data presented in the modification paper is based on the number of normal larvae, with no discussion of whether there was an increase in the total number of larvae recovered. An expectation of an extended development period is that more larvae would develop to the prodissoconch (i.e., "normal" stage. What is not clear in the modification paper is whether the total number of recovered larvae with the resuspension significantly increased.

There are clearly issues highlighted in the Newfields/Ecology dataset that warrant additional focus. However, my respectful recommendation is that the DMMP hold the modification until such time as sufficient data has been generated and existing data reviewed.

Thank you for the opportunity to submit these thoughts.

Sincerely,

Timothy A. Thompson
Senior Environmental Scientist

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PORT GAMBLE S'KLALLAM TRIBE
31912 Little Boston Rd. NE – Kingston, WA 98346

August 21, 2012

David R. Kendall, PhD
Chief, Dredged Material Management Office
Seattle District Corps of Engineers
P.O. Box 3755
Seattle, WA 98124-2255

Dear Dr. Kendall:

The Port Gamble S'Klallam Tribe opposes the Washington State Department of Ecology's (DOE) use of new sediment testing methods for the Port Gamble Bay cleanup of the Pope and Talbot mill site under the State Model Toxics Control Act. The Tribe is concerned that proper procedure was not followed for approving the new methods and that this will affect the quality of the cleanup. We are opposed to the use of the new methods at this time, until more work is completed to address remaining concerns. If the method is applied to the Port Gamble Bay endpoints, then the most conservative outcomes from both methods should be used. The mid bay, for example, has a high percentage of fine sediment, making the method selection even more critical.

Two bioassay methods were used to assess the toxicity of wood waste on marine life in Port Gamble Bay. These include the *Mytilus* larval development bioassay and the polychaete growth assay. Due to the high false positive rate of these tests, two new testing techniques were used on these bioassays in order to eliminate the false positive results. Resuspension was used for the larval development bioassay while ash-free-dry-weight was used for the polychaete growth test. Many samples that initially exceeded cleanup screening levels (CSL) or sediment quality standards (SQS) became compliant with standards using the new testing methods.

The Sediment Management Standards (SMS) allow for the use of "alternate biological tests" (WAC 173-204-315), but note that they "shall be subject to the review and approval of the department using the procedures of WAC 173-204-130(4)." The referenced section states that, "Any person or the department may propose an alternate technical method to replace or enhance the application of a specific technical method required under this chapter." However, "the department shall provide advance review and approval of any alternate technical method proposed prior to its application" (WAC 173-204-130(4)). Further, "The department shall maintain a record of the department's decisions concerning application for use of alternate technical methods pursuant to this subsection. The record shall be made available to the public on request." The record of the Department's decisions regarding the use of the re-suspension method for the larval bioassay test should be provided as part of the Remedial Investigation (RI), if such a record exists.

The SMS program proposed adding the re-suspension procedure at the May 2012 Sediment Management Annual Review Meeting, and is accepting comments on this proposal until July 2, 2012. Since the SMS require that Ecology "shall provide advance review and approval of any alternate technical method proposed prior to its application", it appears the use of the alternate bioassay methods, prior to their review and approval, was premature and not consistent with SMS requirements.

Ecology has frequently referred to its authority, under WAC 173-204-110(6) to make case-specific decisions using best professional judgment and the latest scientific knowledge. However, the referenced subsection states that "Nothing in this chapter shall constrain the department's authority to make appropriate sediment management decisions on a case-specific basis using best professional judgment and latest scientific knowledge for cases where the standards of this chapter are reserved or standards are not available." Since this section is specific to those cases where the standards are reserved or where standards are not available, it does not seem to apply to case-specific adjustments where standards already exist.

More specifically regarding the use of alternatives to the standard method procedures, it is not clear from the limited data whether the additional time allowed between the termination of the standard test (48 hours) and the termination of the resuspension test (70 hours) may have been a controlling factor in the increased proportion of normally developed larvae. In other words, the increased time allowed may have been responsible for the increased proportion of normally developed larvae in site sediments, as opposed to the effects of burial or entrainment in fine sediment or flocculent material. As stated in the Port Gamble Sediment Evaluation laboratory report, "the test was terminated approximately 48 hours after initiation, when 90% of the control larvae had achieved the prodissoconch I stage", then, after "allowing settlement overnight" the resuspension test "was terminated approximately 70 hours after initiation". It does not appear that there is enough data to determine the effect that this significant increase in the test time (22 hours) may have had on the rate of larval development.

More testing of these elements of the method would help to identify other factors that may be influencing the results. It would also provide a stronger basis for standardizing the methods so that Ecology could accredit labs that would be using these new alternative methods. At this point it does not appear that Ecology has accredited any labs to use these procedures for characterizing sediments at cleanup sites.

Therefore, the Port Gamble S'Klallam Tribe currently opposes using the larval resuspension and ash-free-dry-weight method endpoints as a basis for the Port Gamble Bay cleanup. DOE's procedure for approving testing methods should be consistent with SMS requirements and additional testing should be done to address inaccuracies and reduce uncertainty associated with these new methods.

Sincerely,

Paul McCollum
Natural Resources Director
Port Gamble S'Klallam Tribe

cc: Russ McMillan

DMMP/SMS Responses to SMARM Comments and post-SMARM Comments.

SMS Issue Paper: Use of Practical Quantitation Limits to Establish Cleanup Standards

1. Roger McGinnis (Hart Crowser)

a. **Problem Statement: Remedial Investigation Data Reporting. There is unknown precision (uncertainty) in values reported below the PQL. It should be emphasized that reported concentrations below the PQL must be considered estimates and should not be used for calculating risk unless the uncertainty is explicitly stated. In addition, it is not appropriate to make risk or concentration comparisons to other datasets where concentrations are also below the PQL since there is uncertainty in both datasets.**
SMS Response. Ecology expects that all values reported below the PQL will be appropriately qualified to indicate that the values are estimates, in accordance with standard QA/QC practice. The issue paper states that Ecology intends these values to be J-qualified (or equivalent). Ecology must address human health risk from bioaccumulative compounds as part of a Remedial Investigation to determine site boundaries, evaluate cleanup actions, and set cleanup standards. Unfortunately, many of these compounds exist and present risks at very low levels. Some risks are calculated using TEQs, which may be composed of unqualified concentrations above the PQL, qualified concentrations above and below the PQL, and undetected data for various congeners. There is no way to quantify the uncertainty associated with such a calculation, yet it must be done to meet various rule requirements. Similarly, risk and natural background comparisons are unavoidable in making key decisions about a cleanup site, even in the face of considerable uncertainty associated with concentrations below the PQL or MDL. Ecology intends to describe and discuss these uncertainties narratively in risk assessment and natural background comparison sections of Remedial Investigations.

b. **Existing Rules and Guidance. While the 10-times rule is often achievable, depending upon how the MDL is determined, the PQL may be greater than 10 times the MDL. Method detection limits are typically determined in two different ways depending upon the analytical method requirements. The MDL is the Student t-value for the 99 percent confidence level at n-1 degrees of freedom, times the standard deviation of seven replicate measurements of a low concentration standard, or the estimated detection limit is the concentration corresponding to an instrument signal to noise ratio of 2.5.**

For example, for dioxin and PCB congener analyses where the standard concentrations and, therefore, the PQLs, are specified by the methods (EPA Methods 1613 and 1668, respectively), the second method for determining detection limits is specified. Method specified quantitation limits and typical detection limits for dioxins are summarized below:

Dioxin Congener	Solid PQL (ng/kg)	Typical Estimated Detection Limit
2,3,7,8-TCDD	1	0.01
1,2,3,7,8-PECDD	5	0.01
1,2,3,4,7,8-HXCDD	5	0.01
1,2,3,6,7,8-HXCDD	5	0.01
1,2,3,7,8,9-HXCDD	5	0.01
1,2,3,4,6,7,8-HPCDD	5	0.02
OCDD	10	0.1
2,3,7,8-TCDF	1	0.01
1,2,3,7,8-PECDF	5	0.01
2,3,4,7,8-PECDF	5	0.01
1,2,3,4,7,8-HXCDF	5	0.01
1,2,3,6,7,8-HXCDF	5	0.01
1,2,3,7,8,9-HXCDF	5	0.01
2,3,4,6,7,8-HXCDF	5	0.01
1,2,3,4,6,7,8-HPCDF	5	0.02
1,2,3,4,7,8,9-HPCDF	5	0.02
OCDF	10	0.1

While some laboratories can include a lower concentration calibration standard at additional cost, this lower concentration standard is typically one-half the minimum concentration specified by the method. The PQL will still be greater than 10 times the MDL even using this lower concentration standard. If dioxin congener PQLs are reported on a toxics equivalent (TEQ) basis (sum of PQLs times their respective TEFs), the total TEQ is 11.4 ng/kg. The same calculation using estimated MDLs results in a MDL TEQ of 0.03

ng/kg, significantly less than one tenth the PQL value. Therefore, the requirement that the PQL is no greater than 10 times the MDL cannot be applied in all cases and there must be flexibility based on analytical method requirements.

SMS Response. It appears that different definitions are being used to make the MDL/PQL comparison, as Ecology has completed evaluations of two recent laboratory surveys including dioxins/furans and found that PQLs for dioxins/furans based on 2,3,7,8-TCDD TEQs are just under 10x MDLs, on average. We believe two differences between Ecology's and the above evaluation may account for the differing conclusions:

- Ecology is not assuming that EPA method-specified PQLs are the lowest routinely achievable PQLs, as noted in the issue paper. We requested and will request in the future that laboratories provide us with their best routinely achievable values and are using those to determine median PQLs. These values may reflect the lower calibration standard described above. However, given the high human health risks associated with dioxins/furans at these low concentrations, Ecology believes this is a reasonable modification to request.
- MDLs reported by Ecology-accredited laboratories in 2011 were significantly higher than the estimated detection limits described above, by about a factor of 10. This may be related to the differing definitions of the two terms.

Ecology does recognize that there may be times when it is not possible for the PQL to be less than or equal to 10x the MDL, especially if the definitions of the PQL and MDL change over time. PQL-based cleanup standards for such chemicals would be developed on a case-by-case basis using the latest available science. A statement to this effect will be added to the paper.

2. Larry Dunn (Lower Elwha Klallam Tribe)

a. **In reference to the proposed use of less than the best available PQL for SMS cleanup. Below is a quote from the National Toxics Rule which I find to be on point in addressing the issue of setting a PQL standard based criteria. It addresses an issue I have continually been concerned about since hearing about the Ecology position of using less than best available PQLs. This appears to be in direct conflict with EPA guidelines for water quality which are directly related to SMS standards. As this so eloquently states, essentially the object of standards is protect life and human health, not to make it easier for labs to meet a standard. If there is no pushing for lower limits there is no motivation for improved technology. PQLs should be based upon the best available technology and science not on the availability of how many labs can meet it and it seems that EPA scientists recognized this in writing the Preamble to the National Toxics rule. It further brings into question the idea of the PQL being written into the SMS rule as a default standard at all. It seems to me that the current proposed standard, as was the previous standard, is in conflict with the National Toxics Rule, and I believe that states are required to be at least as protective as the National standards. I think that the PQL issue would be best addressed in the**

feasibility and cost analysis, not as a default standard. Best available science and technology is how we advance and improve and should be driven by a desire to be protective of human health as well as aquatic life, unfortunately labs are driven by money and unless there is a financial motivation to lower PQLs there will be little effort to do so, so if a lab gets the best available PQL and it can be successfully replicated, they should be rewarded with the contracts in cleanups and Ecology should be pushing PRPs to use those labs that have the lowest PQL in an effort to meet the criteria of protecting aquatic life and human health.

The quote below is from the Preamble to the National Toxics Rule, which, among other things, promulgated human health water quality criteria for Washington.

> ***EPA is aware that the criteria promulgated today for some of the priority toxic pollutants are at concentrations less than EPA's current analytical detection limits. Analytical detection limits have never been an acceptable basis for setting standards since they are not related to actual environmental impacts. The environmental impact of a pollutant is based on a scientific determination, not a measuring technique which is subject to change. Setting the criteria at levels that reflect adequate protection tends to be a forcing mechanism to improve analytical detection methods. As the methods improve, limits closer to the actual criteria necessary to protect aquatic life and human health become measurable. The Agency does not believe it is appropriate to promulgate criteria that are not sufficiently protective.***

SMS Response. Unlike the above quote, Ecology is not promulgating by rule human health-based cleanup standards that apply to all sites. Instead, the SMS rule describes a process by which site managers at individual sites will evaluate natural or regional background concentrations, risk-based concentrations, and PQLs to determine, on a site-specific basis, the cleanup standards that will apply to that site for decision-making and compliance purposes. Background and risk-based concentrations may vary from site to site, and PQLs will vary over time (likely declining). In this issue paper, Ecology is describing a process that Ecology will use to identify currently available PQLs at a given point in time as guidance to site managers in completing the required process under the rule.

Other EPA programs have taken a markedly different tack than described in the above preamble. For example, in setting National Primary Drinking Water Regulations, EPA has set PQL-based standards for Maximum Contaminant Levels in drinking water using several methods [Federal Register Volume 75, Number 59 (Monday, March 29, 2010)]:

- The PQL that 75% of laboratories reporting data can meet
- The Method Reporting Limit (MRL; similar to a PQL) that 80% of laboratories reporting data can meet

- 10x the MDL if the above data are not available

These approaches are less stringent than the approach Ecology proposes in the Issue Paper.

Ecology believes the best available science and technology is that which Ecology-accredited laboratories can achieve. As noted in the Issue Paper, Ecology is requesting that each laboratory provide its best available methods and refinements to those methods and report those associated MDLs and PQLs, rather than simply accepting EPA CLP MDLs and PQLs, which tend to be higher. Occasionally, MDLs and PQLs from specialty laboratories may be removed from consideration for good reason. For example, if only one or two laboratories in the country can achieve much lower PQLs, Ecology cannot guarantee that these laboratories will remain available over the full course of the post-cleanup monitoring period for a site, or that those laboratories would have the capacity and availability to handle all monitoring for all such sites. For dioxins/furans, there were additional considerations relating to blank-contamination that appeared to rule out lower PQLs than the remaining laboratories were able to achieve.

By selecting only PQLs lower than EPA CLP protocols and choosing a median or mean value from among the remaining laboratories, Ecology is selecting a PQL that will typically be below the 50th percentile of available PQLs. This will tend to add downward pressure to analytical capabilities along with all of the other market forces that have and will continue to do so as we move into a time when concerns about bioaccumulative contaminants come more strongly to the fore.

b. Toxics is proposing to use the Dioxin TEF on individual congeners to establish a site cleanup PQL, by my understanding of the TEF/TEQ method it is restricted to establishing the mixture potential toxicity relative to 2,3,7,8-TCDD and that there hasn't been sufficient study of the individual chemicals or how they interact to have confidence in the TEFs for individual congeners. This being the case multiplying any congener specific number by its TEF to establish any cleanup number seems to me to be outside of the methodology and very unreliable. Doesn't MTCA indicate that the TEFs should added together and then the TEQ used based upon the 2,3,7,8-TCDD standard? That would make the site PQL that for 2,3,7,8-TCDD would it not?

SMS Response. MTCA follows the standard procedure of multiplying concentrations for individual congeners by their TEFs, then summing all the resulting values to produce a TEQ that represents the toxicity of the entire mixture relative to 2,3,7,8-TCDD. MTCA also requires selection of a cleanup standard that is the highest of the risk-based concentration, natural background concentration, and PQL. A health risk-based TEQ is based on the relative toxicity of the mixture compared to 2,3,7,8-TCDD. Such a TEQ should not be compared only to the concentration of 2,3,7,8-TCDD, as that would only represent part of the mixture that was present (or potentially present in the case of a PQL). In order to accurately compare

these three types of values in setting a cleanup standard, all three must be in the same units, i.e., TEQs. The Issue Paper has been revised to clarify this process.

c. **Seems to me that using a PQL for a site cleanup standard at all is in conflict with the EPA Toxics Rule preamble [see above]. It appears that the framing scientists considered the potential for the application of PQLs and intentionally addressed that as an inappropriate standard.**
SMS Response. See response above to the purpose of EPA's preamble vs. the purpose of the issue paper. Practically speaking, site-specific cleanup standards at Superfund sites may also be set using the PQL if risk-based concentrations cannot be measured, as there is little alternative from a compliance monitoring standpoint. In addition, please note that MTCA, as well as cleanup under the SMS rule, is not a federally delegated program and Ecology may follow its own procedures for State cleanup sites. MTCA requires the use of the PQL as a cleanup standard if it is higher than the risk-based concentration and natural background, and the MTCA rule is not currently open for revision.

d. **An additional question I have is there seems to be a push in Ecology to get PLPs to use labs that can meet an average standard in detection limits, is this over labs that are able to reliably produce lower limits? If this is the case shouldn't the agency be pushing to use those labs that are able to reliably produce the lowest detection limits, thus providing the best protection as well as an impetus for labs to constantly improve their technology, not stop at the average since that is where the money is. Since it seems that Ecology would be penalizing those labs that make the investment to improve their detection limits, bypassing them in the award process for contracts for labs that only meet an average standard, isn't it counter to the goal of improving measuring techhniques.**
SMS Response. Ecology will continue to encourage use of laboratories with the lowest achievable detection limits and the best available methods during investigations at cleanup sites, especially for contaminants with high health risks at low concentrations. Even when a PQL-based cleanup standard is set at a median value on a site-specific basis, use of a laboratory with the lowest possible PQLs would be prudent to ensure compliance with that standard. Setting a site-specific cleanup standard at the lowest possible PQL would result in a high likelihood that monitoring programs would not meet that standard at most sites; there should ideally be a margin between the PQL that can be achieved in practice and the cleanup standard used to evaluate compliance to allow for analytical variability and matrix effects in individual samples. In addition, the lower the concentration, the higher the variability and uncertainty around those values. Issues such as matrix effects, interferences, and blank contamination become increasingly problematic, as many of the commenters have pointed out (see 1a, 3a, 5a, 6a). It is important that values selected as cleanup standards are measurable with a reasonable degree of certainty and accuracy under a variety of site conditions.

3. Jessi Massingale (Floyd|Snider)

a. **We believe that from the Ecology Sediment PQL Issue Paper from SMARM that you may be currently working on establishing PQL based cleanup standards for sediments formally under the SMS revisions. We hope that the PQL development process will include considerations for the potential matrix effects between freshwater and saltwater sediments, high organic content sediments, and wood waste sediments.**
SMS Response. At this time, we are not working on developing specific values in guidance or for the SMS revisions. The Issue Paper instead describes the process that would be used for developing PQL-based cleanup standards for individual sites, as needed. The Issue Paper has been revised to note that departures from the standard process may be needed if the site has unusual matrix issues (keeping in mind that compliance with a cleanup standard is measured after the site has been cleaned up, so some non-natural matrix effects should be reduced at that point).

4. Tom Gries (Ecology)

a. **It does beg the question of how you are going to use practical quantification limits (PQLs) to calculate a natural or a regional background.**
SMS Response. Methods for using undetected concentrations (below the MDL) and concentrations between the MDL and PQL in calculating background concentrations will be addressed as part of the guidance being prepared along with the SMS rule updates.

5. Debra Williston (King County)

a. **So, when you did the survey of laboratories for PQLs, was that sediment testing done with very clean material or was it with material that you were really going to find, which is sediments that were kind of messy, with lots of interferences?**
SMS Response. They were laboratory-determined PQLs and method detection limits determined using calibration standards.

6. Karl Hornyik (Onsite Environmental)

a. **That is a frequent issue with sites and cleanup. Frequently it is coming from a clean matrix, no problem, but what we run into a lot is dirty samples that are contaminated with other things than what it's being analyzed for and having to raise PQLs, and of course not being able to arrive at the data that work well in spreadsheets, or whatever, to calculate. The problem I think is that when you ask any lab what their PQL is, it is generally based on the extraction procedure and whatever their instrument is capable of achieving. But for us, PQL, depending on the sample matrix and whatever other contaminants might be in there, could easily go up a dilution factor of 1,000 times. So even if you're throwing out the high/low value, which may compensate for the different types of instrumentation being used, still when you present a client with data that, say you're looking for tetrachloroethene or something, and they saw 1,000 parts per million of mineral spirits or something in the sample, that may not be usable at all. Anyway, it's a high number and it kind of puts the lab in a tough spot.**

SMS Response. In the Issue Paper, it is stated that these are not recommended PQLs for the Remedial Investigation. These are cleanup standards based on PQL distributions. During the Remedial Investigation, whatever PQL is appropriate based on site-specific interferences, sediment matrices, etc. would be used. It could be higher than or lower than this ultimate value that is established at the end of the Remedial Investigation/Feasibility Study as a cleanup standard. These are essentially programmatic PQL-based cleanup standards that Ecology will develop based on surveys of laboratories. However, there is also a process for developing a site-specific PQL-based cleanup standard. The reasons for doing so would become clear as the Remedial Investigation progresses. For example, you may have an unusual matrix and the PQL cannot be met that was established through the programmatic process described in the Issue Paper.

Clarification Paper: Bioassay Endpoint Refinements: Bivalve Larval and Neanthes Growth Bioassays

1. **Tom Gries (not representing Ecology)**
   a. **The DMMP analysis appear to demonstrate that there is no need to change the protocol for samples that contain relatively low % fines.**

      DMMP Response. We agree and that is why we are not proposing to make the resuspension protocol a formal change to the DMMP bioassay testing protocol at this time.
      SMS Response. We also agree that there is limited benefit to applying this to sediments without a flocculent layer. The challenge here is that fines alone do not provide the only indicator there may be flocculent material that warrants the revised protocol.

   b. **To ensure reproducibility and comparability of results across/between labs, proposed changes to any toxicity test protocol that have a potentially large impact on final test interpretations should be based on a detailed SOP.**

      DMMP/SMS Response. We agree. This should be captured in the SMARM follow-up for both DMMP & SMS (whether as an addendum to the current protocol or a complete protocol)

   c. **DMMP should consider requiring a longer sediment settling time prior to introducing the larvae.**

      DMMP/SMS Response. This may not resolve the problem of "entrainment" since it may be that the non-swimming embryos sink to the bottom and become trapped in the fluff layer, and are not necessarily being "dragged" out of the water column by material that is still settling after the current 4 hour settling period. The DMMP evaluated longer settling time (24 hours) in Oyster (*Crassostrea gigas*) and Echinoderm (*Dendraster exentricus*)(PSDDA 1993) and concluded that longer settling times reduced

mortality/abnormality for these two species. However, the study also showed that the 24-hour settling time was the least accurate in predicting sediment contamination, and therefore, was not recommended for use in the regulatory program at that time. We are unsure whether a longer settling time would improve the Mussel (*Mytilus galloprovincialis*) larval test performance, but have concerns about whether it also would be less sensitive to contaminated sediments similar to the other two species, and have no plans to evaluate this issue further at this time.

d. Regarding protocol comparisons – SMS Program – another concern involves replicate variability and statistical power resulting from the modified protocol.

DMMP/SMS Response. This can be summarized and reported quite simply. We have confidence that the variability will be shown to be much lower for resuspension endpoint, but this is a valid request to see the data.

e. The analysis of the modified protocol results appear to be based on Port Gamble data set that is very limited, somewhat unique, and conducted by external parties that could potentially have a conflict of interest. Conduct a similar analysis by a more independent party, using a data set that includes other sites known to contain different types of high fines sediments prior to adoption of the clarification.

SMS Response.

- The Port Gamble study was developed and performed by Ecology and Ecology's contractor for the State's Remedial Investigation. This study was done to augment Ecology's Port Gamble Bay Remedial Investigation and included stations selected to address two primary goals. First, to resample stations where previous bivalve larval results had been affected by reference performance limit failures, and second, to ensure a data set was developed for the resuspension endpoint that represented a wide range of the conditions thought to affect entrainment.
- The issue of entrainment or entrapment of larvae in flocculent material has been recognized as a problem with the protocol since the early years the bivalve larval test has been used in the northwest. This confounding factor has often been assumed to contribute to poor reference sediment performance for this bioassay. Previous rounds of bioassays run using the standard protocol for Port Gamble have been plagued by poor reference performance, so Ecology chose to examine the test using both endpoints on a case-by-case basis (as allowed under the SMS). The results support the hypothesis that larvae continued to develop normally but were not counted at test termination due to entrapment. For this reason, Ecology interpreted the results using the resuspended endpoint. There have been relatively few studies performed where the flocculent material was as frequently encountered and as abundant as at this site. More supporting

data will always be welcomed but when the potential benefits of the resuspension endpoint is weighed against the limited potential detriment, there appears to be good reason to include this as an available tool for evaluating the toxicity of sediments.

f. **Relevant conclusions/recommendations of the larval workshop conducted in January 1998 could also be mentioned on page 4 of clarification paper.**

DMMP/SMS Response. The January 1998 larval workshop has been added to the list of background history discussion on larval bioassay performance issues.

2. **Tim Thompson (SEE, LLC).**
   a. **Restrict the total test time to 48 hours.**

DMMP/SMS Response. The specific 48-hour time limit is not consistent with ASTM or current PSEP guidance. There is a range provided in these tests to allow for development to prodissoconch I larvae in the controls. For mussels that is 48 to 60-h. While quite often the 48-h time period is sufficient, there are tests where the additional time is needed and we therefore would recommend against restricting the test to 48-h specifically. The test temperature for mussels is not 20°C as indicated in your comment, but is actually 16°C.

   b. **Prior to implementation, extract larval data from DAIS and/or EIM to determine if there is a persistent problem with fine-grained sediment and larval development.**
   DMMP/SMS Response.

See response to **1.a**. – Fines alone may not always be the best indicator of flocculent material that traps larvae. Still, this may be worth going further back in the data sets to examine the correlation between fine-grained (reference) sediments and reference failures. Looking at the correlation with other test sediments may be less instructive due to contaminant effects.

   c. **Develop a broader data set to support any protocol modification.**
   DMMP/SMS Response.

More data is always good, and we will look at additional data as it becomes available to further evaluate this endpoint relative to protocol modifications.

3. **Paul McCollum (Natural Resources Director/Port Gamble S'Klallam Tribe)**
   a. **If the method is applied to Port Gamble Bay endpoints, then the most conservative outcomes from both methods should be used.**

SMS Response. The data developed using the normal and resuspended endpoints for the Port Gamble supplemental remedial investigation allowed a closer look at how the confounding factor of trapping larvae in a flocculent layer affects the test interpretation. Ecology specifically chose to assess both endpoints to distinguish between true toxicity and 'apparent' toxicity which could incorrectly be interpreted as greater sensitivity. When the test chambers are set up, 18 grams of sediment are shaken in 950 ml of seawater then allowed to settle for 4 hours prior to introducing the non-swimming larvae. The sediments settle out progressively; first the heaviest, coarsest sands followed by lighter and finer fractions, and lastly, a layer of the slowest settlng, flocculent materials. Then larvae are introduced to the chamber. The standard endpoint calls for decanting the overlying water off at the end of the test and counting the normally developing larvae. Since the larvae are introduced as non-swimming, negatively buoyant embryos, many are trapped in the flocculent layer and despite continuing to develop normally, the standard protocol results in poor recovery of these larvae. The effect of this poor recovery was seen as additional biological exceedances of SQS and CSL level effects. When these same test chambers were then resuspended, allowing these normally developing larvae to swim up into the water column, the subsequent test termination and higher recovery revealed fewer actual exceedances, confirming the standard test termination incorrectly attributed a toxic effect to the poor recoveries. This indicates the standard method for terminating the test is not a more conservative endpoint, rather it fails to account for an artifact of the test protocol that results in poor larval recovery. It is critical that the test outcomes accurately reflect true toxicity and where confounding factors can be resolved and eliminated, the SMS regulation accommodates site specific decisions to do so.

b. **The Sediment Management Standards (SMS) allow for the use of "alternative biological tests" (WAC 173-204-315), but note that they 'shall be subject to the review and approval of the department using the procedures of WAC 173-204-130(4)." The referenced section states that "Any person or the department may propose an alternate technical method to replace or enhance the application of a specific technical method required under this chapter." However, "the department shall provide advance review and approval of any alternate technical method proposed prior to its application" (WAC 173-204-130(4)." Further, "The department shall maintain a record of the department's decisions concerning application for use of alternate technical methods pursuant to this subsection. The record shall be made available to the public on request." The record of the Department's decisions regarding the use of the re-suspension method for the larval bioassay test should be provided as part of the Remedial Investigation (RI), if such a record exists. The SMS program proposed adding the re-suspension procedure at the May 2012 Sediment Management Annual Review Meeting, and is accepting comments on this proposal until July 2, 2012. Since the SMS require that Ecology "shall provide advance review and approval of any alternative technical method proposed prior to its application", it**

appears the use of the alternative bioassay methods, prior to their review and approval , was premature and not consistent with SMS requirements.

SMS Response. Distinction between Ecology's programmatic effort through SMARM and site specific decisions authorized by the SMS:

The clarification paper presented at SMARM recommends improved endpoints for these two bioassays for both the DMMP and SMS programs. The SMARM process is the programmatic approach developed for adaptively managing the dredge management and sediment cleanup programs and solicits public input on proposed modifications to these programs. This is separate from, and does not restrict Ecology's authority under the SMS to make site-specific decisions to use improved methods at a site.

Technical bases for choosing to use revised endpoints:
The determination to use revised bioassay endpoints at Port Gamble was the result of earlier bioassays that were troubled by reference failures and test sediments with low (larval) recoveries but high percent normal larvae, that did not correspond to chemical levels and were thought to be at least partly driven by the flocculent, wood waste-derived material present at Port Gamble Bay. The choice to use the Ash-Free-Dry-Weight (afdw) for the Neanthes test was based on the recommended ASTM protocols and the national trend in using this endpoint for sediment ingesting organisms when measuring growth.

Regulatory basis for Ecology's decisions at Port Gamble:
The SMS grants authority to Ecology to make site specific decisions regarding use of improved methods to replace or enhance technical methods when those decisions will improve the department's ability to implement and meet the intent of the SMS. Also, any proposed changes to be used at a site must be reviewed and approved by the department prior to being used, but this site specific decision is separate from the SMARM process used in proposing and adopting programmatic changes. The site specific basis for Ecology's choosing and approving the revised endpoints is recorded in the sampling and analysis plan (Port Gamble Bay Supplemental Remedial Investigation, Port Gamble, WA, Combined Sampling and Analysis Plan and Quality Assurance Project Plan, 2011) that was reviewed and approved by Ecology, prior to performing the work. This document was made available to the Port Gamble S'Klallam Tribe. For clarity, a link to the authorizing SMS language in WAC 173-204-130(4) is provided below.

http://apps.leg.wa.gov/wac/default.aspx?cite=173-204-130

c. **Ecology has frequently referred to its authority, under WAC 173-204-110(6) to make case-specific decisions using best professional judgment and the latest scientific knowledge. However, the referenced subsection states that "Nothing in this chapter**

shall constrain the department's authority to make appropriate sediment management decisions on a case-specific basis using best professional judgment and latest scientific knowledge for cases where the standards of this chapter are reserved or standards are not available." Since this section is specific to those cases where the standards are reserved or where standards are not available, it does not seem to apply to case-specific adjustments where standards already exist.

SMS Response. See response to 3.b. above.

d. **It is not clear from the limited data, whether the additional time allowed between the termination of the standard test (48 hours) and the termination of the resuspension test (70 hours) may have been a controlling factor in the increased proportion of normally developed larvae. … It does not appear that there is enough data to determine the effect that this significant increase in the test time (22 hours) may have had on the rate of larval development.**

SMS Response. This was recognized as a possible issue and was addressed in two ways. First, for the Port Gamble test, the percent abnormality of recovered larvae for the standard protocol (at 48 hrs) was compared to that of the resuspension protocol (at 70 hrs) and was found to be the same. If the improved normal recoveries were due to increased time for development, percent abnormality should decrease in the later samples (since percent abnormality includes any larvae that are not fully developed). The similarity in the percentage of abnormal larvae indicates that development was not delayed hence the additional time did not result in more larvae reaching the prodissiconch stage 1. Second, the clarification paper identifies the point at which the resuspension occurs would be several hours prior to the normal 48 hr termination of the test, to allow enough time for the sediments to resettle prior to normal termination, altogether avoiding the issue of additional time for development of larvae.

e. **Therefore, the Port Gamble S'Klallam Tribe currently opposes using the larval resuspension and ash-free-dry weight method endpoints as a basis for the Port Gamble Bay Cleanup. DOE's procedure for approving testing methods should be consistent with SMS requirements and additional testing should be done to address inaccuracies and reduce uncertainty associated with new methods.**

SMS Response. Ecology has carefully considered and correctly followed regulatory procedures for implementing the revised bioassay endpoints at Port Gamble. The Tribe's disagreement with these decisions is noted.

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APPENDIX II

Meeting Agenda

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2012 SEDIMENT MANAGEMENT ANNUAL REVIEW MEETING

Final AGENDA
May 2, 2012
Federal Center South, Seattle
Hosted by the Environmental Protection Agency, Region 10

8:30 Registration and Coffee

9:00 Welcome - Stephanie Stirling - Meeting Moderator

9:05 Opening Remarks - Christine Reichgott, EPA, Manager, Environmental Review and Sediment Management Unit

9:15 Meeting Road Map - Stephanie Stirling, Moderator

9:20 Agency Summary Reports, Part I

- EPA, Puget Sound Program Activities, Michael Rylko
- Corps, DY2012 Testing Activities, Lauran Warner
- DNR, Disposal Site Management Activities, Celia Barton
- RSET Activities Update, Jonathan Freedman, EPA

10:20 BREAK

10:40 Agency Summary Reports, Part II - Ecology

- Rule revision overview including Background, Human Health, Fish Consumption Rates, Chance Asher

11:40 LUNCH

12:40 Agency Summary Reports, Part II - Ecology (continued)

- Freshwater Sediment Standards, Laura Inouye and Russ McMillan
- Q&A for Rule Revision, Chance Asher and Ecology Staff

1:30 Science and Technology Updates

- Lafarge Contaminated Sediments Transloading Facility, Mike Depew, Lafarge
- Sediment Bioavailability Assessment Using Passive Samplers, Mandy Michalsen, Corps

2:00 BREAK

2:15 Status Reports

- Update on Development/Implementation of Dioxin/PCB Sediment Reference Material, Justine Barton, EPA
- Dispersive Site Fate and Transport Modeling, Scott Brown and David Michalsen, Corps

2:45 Clarification Papers

- Bioassay Endpoint Refinements: Bivalve Larval Test and Neanthes Growth Bioassay, David Kendall (Corps), Russ McMillan (Ecology/TCP), Bill Gardiner, Brian Hester, Jack Word (NewFields)
- Other DMMP Clarification Papers: Dioxin Ranking; Transition from DAIS to EIM, David Fox, Corps

3:15 Public Issue Papers (none submitted to date)

4:30 Adjourn (tentative)

DEADLINE FOR SMARM COMMENTS IS JULY 2, 2012

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APPENDIX III

List of Attendees

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APPENDIX IV

PowerPoint Slides for Each Speaker

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WELCOME

24th Sediment Management
Annual Review Meeting
May 2, 2012

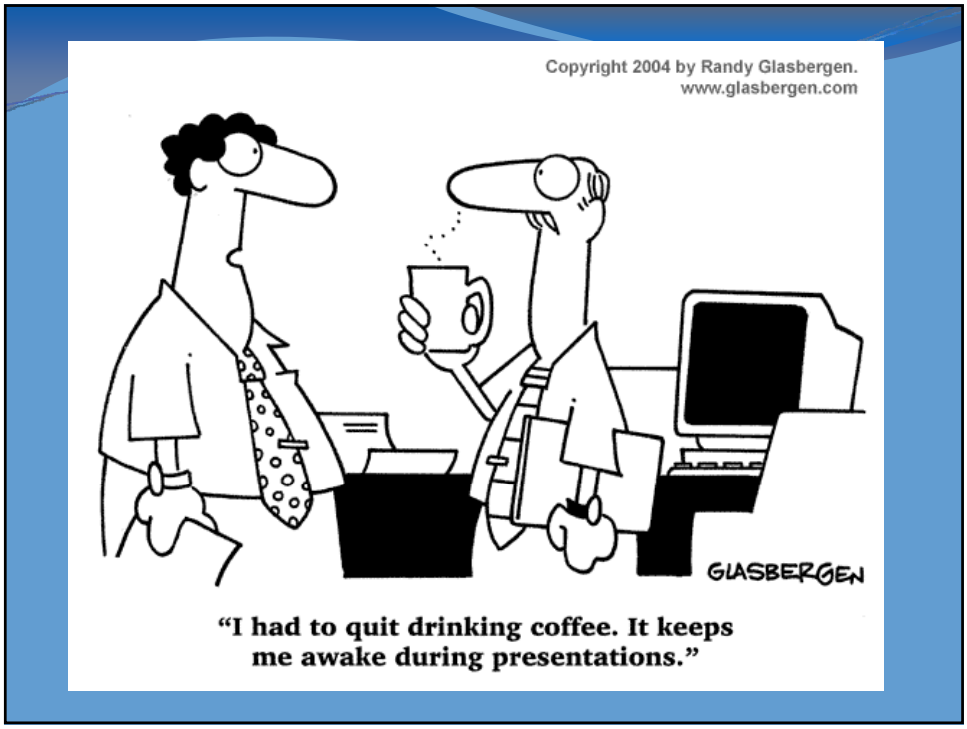
EPA United States Environmental Protection Agency
DEPARTMENT OF ECOLOGY State of Washington
WASHINGTON STATE DEPARTMENT OF Natural Resources

0.1

Meeting Details

- Please sign in
- Agendas on back table
- Stay on schedule
- Please state your name for the record when asking a question or making a comment
- Comments due by July 2, 2012

0.2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"I had to quit drinking coffee. It keeps me awake during presentations."

Puget Sound - An Estuary of Local, Regional and National Significance

1.1

Clean Water Act (CWA)

SEC. 101. (a) The objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters.

- This provides the foundation for linking the domains of water, land, ecology and human health and well being.

1.2

CWA – National Estuary Program

- The NEP was established under Section 320 of the 1987 Clean Water Act (CWA) Amendments as a U.S. Environmental Protection Agency (EPA) ***place-based program to protect and restore the water quality and ecological integrity of estuaries of national significance***

- Section 320 calls for each NEP to develop and implement a ***Comprehensive Conservation Management Plan*** (CCMP). The CCMP is a long-term plan that contains specific targeted actions designed to address water quality, habitat, and living resources challenges in its estuarine watershed.

1.3

Geographic-based Environmental Protection

Managing for Long Term Ecosystem Sustainability

- Anticipatory
- Integrates major domains at a system scale
- Integrates environmental, social, economic considerations

Geographic/Watershed-based Protection Approach

- Requires increased consensus and integration of actions in a systems context
- Addresses cross program/cross media effects

Single Program 'Comprehensive' Planning

- Individual programs begin to look more at the systems they are working within
- Cumulative effects begin to be addressed

Single Program with Individual Permit/ Site Management Focus

- Reactive
- Centralized decision making
- Narrow focus with limited context

1.4

Puget Sound National Estuary Program History

- **1988** - Puget Sound designated a National Estuary Program (NEP)
- **1991** - Management Plan approved by EPA
- **2006** – EPA identifies Puget Sound as a National Priority in *"2006-2011 Strategic Plan"*
- **2007** – Puget Sound Partnership formed by State in response to blue ribbon panel recommendations – integrating salmon recovery with PS recovery.
- **2008** – Puget Sound Action Agenda for 2020 adopted.

1.5

1.6

National Estuary Program – Management Conference

- Each NEP has a Management Conference made up of diverse stakeholders including citizens, local, state, and Federal agencies, as well as with non-profit and private sector entities. Using a consensus-building approach and collaborative decision-making process, the Management Conference works closely together to implement the CCMP

- The Management Conference ensures that the CCMP is uniquely tailored to the local environmental conditions, is based on local input, and supports local priorities.

Linking organizations, roles and expertise – the Puget Sound Management Conference

Puget Sound Program Funding History

~20 FTE level of effort (2006 survey)

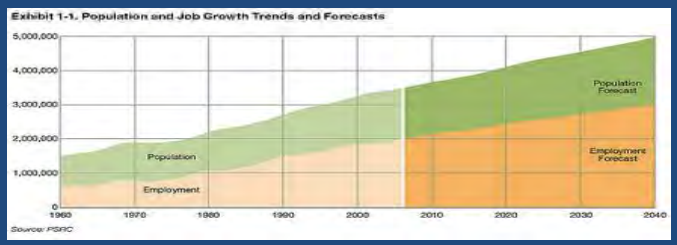
1988 - 2006		
NEP Grants to Puget Sound		**$8,995,000**
Superfund Cleanup in Puget Sound		**$302,850,000** **
acres cleaned up	728	
volume dredged (cy)	3,768,658	
acres capped	223	
** NOTE: Estimated cost of the cleanup performed; primarily expenditures by responsible parties.		
CW SRF loans within Puget Sound		**$462,257,000**
[loans since 1990, WA CWSRF is 83.3% EPA capitalized]		

1.9

Secondary Ecosystem Challenges – Population and Climate Change

Accommodating an increase from 3.5 to 5 million people in the Puget Sound Basin by 2025 (40% increase) while

- holding the line on further degradation and
- restoring the overall system



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Federal Funding for Puget Sound through EPA Geographic Programs

FY	NEP Base funding	Supplemental NEP Funds	West Coast Estuaries Initiative
FY12	598,000	30,000,000	
FY11	598,800	36,000,000	
FY10	800,000	50,000,000	
FY09	600,000	20,000,000	
FY08	591,750	19,685,000	5,000,000*
FY07	418,000	1,000,000	2,500,000
FY06	492,600	2,000,000	
FY05	511,966		
FY04	507,584		

*

1.11

EPA Puget Sound Funding Cooperative and Interagency Agreements

FY09	FY10	FY11	FY12	FY13
18	75	109	102	90

1.12

Current Funding Focus

- Integrate land use and watershed management
- Fill gaps in scientific understanding
- Manage Action Agenda implementation by the Conference (Puget Sound Partnership)
- Four State ecosystem lead organizations:
  - marine/nearshore protection
  - watershed protection
  - toxics and nutrients reduction
  - pathogens reduction
- Support Tribal capacity and implementation projects
- Promote Education, Outreach and Stewardship

1.13

2010 Recruitment for Lead Organizations

Solicited applicants to act as a Lead Organization for actions in four key areas of ecosystem restoration and protection:

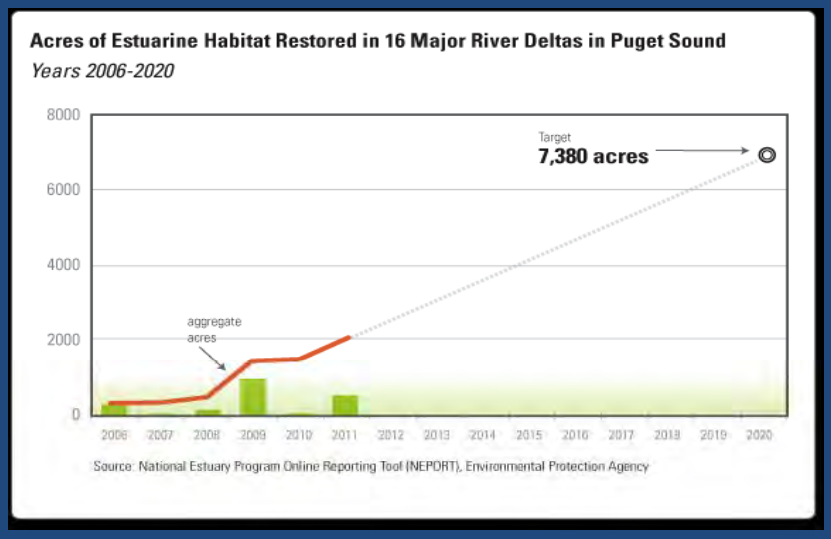
- Marine and Nearshore Protection and Restoration – *WDFW and DNR selected*
- Watershed Protection & Restoration – *Ecology selected*
- Toxics and Nutrients Prevention, Reduction, and Control – *Ecology selected*
- Pathogens Prevention, Reduction, and Control – *Department of Health selected*

1.14

Puget Sound Recovery Targets

1.15

Nearshore Related Recovery Targets



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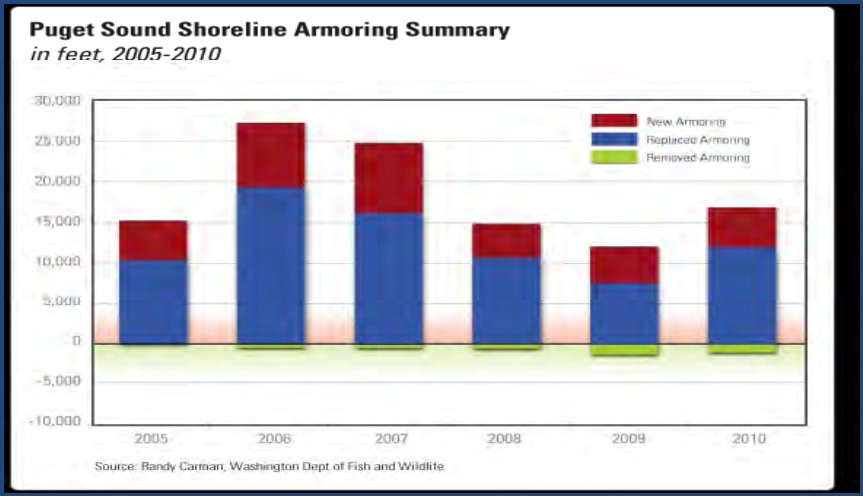
Summary of Management Target for Sustaining Shorelines



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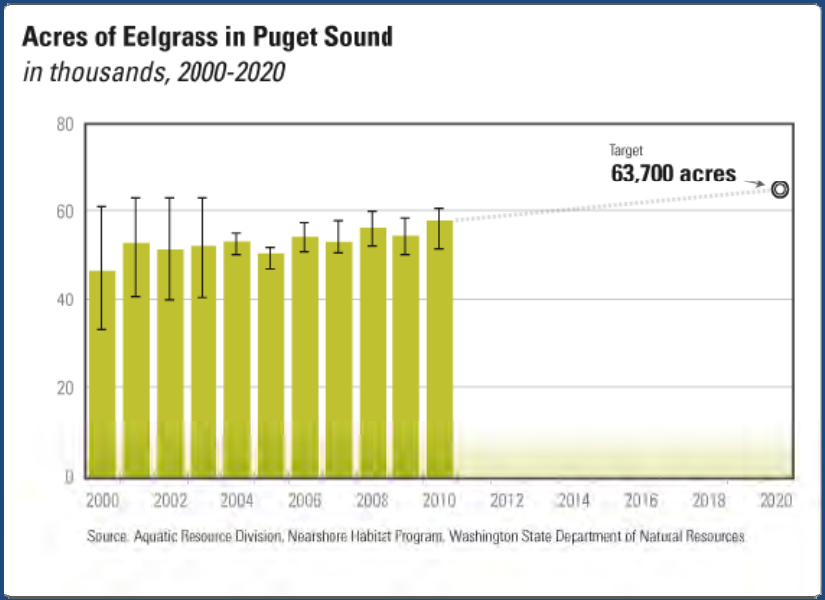

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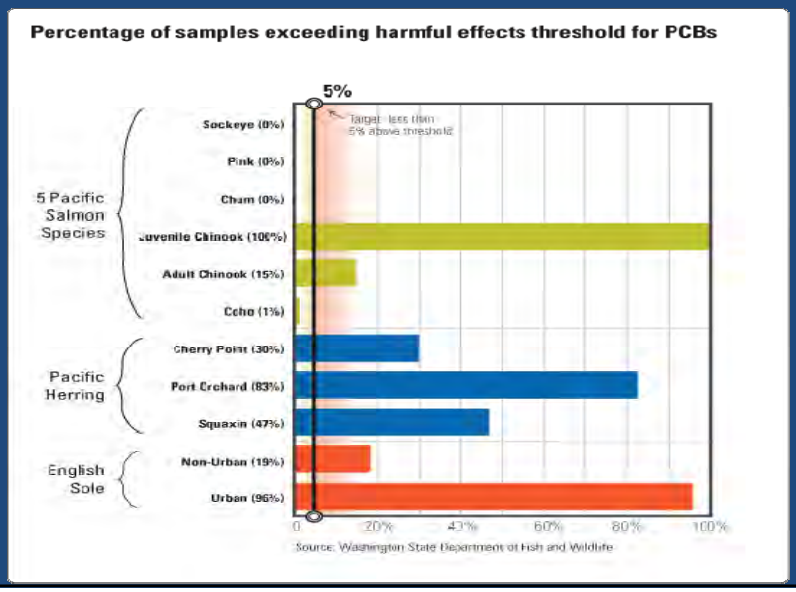
Toxics Reduction Related Targets



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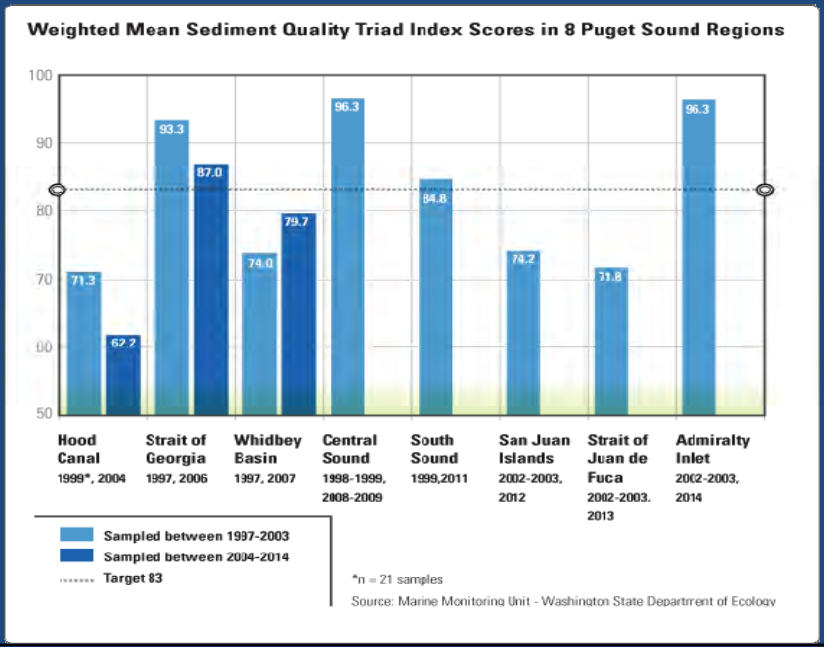

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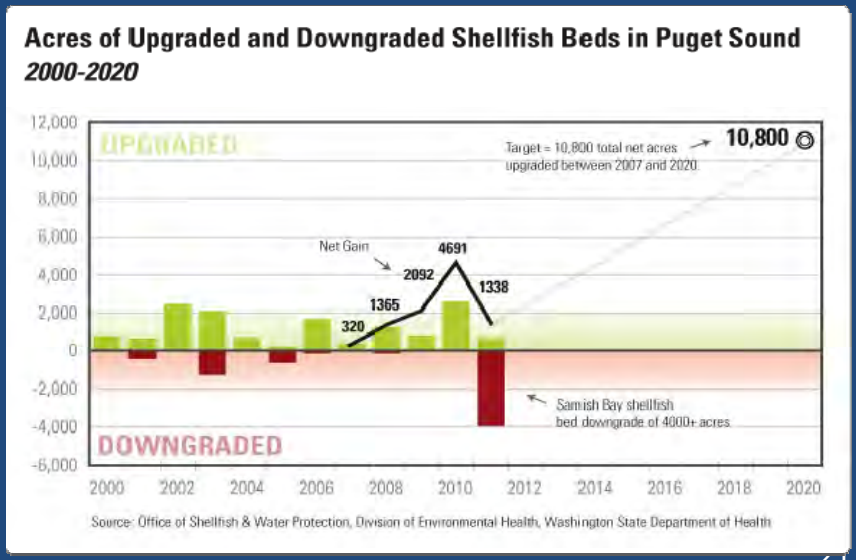
Pathogen Related Recovery Targets



Nearshore Lead Organization – Key investments

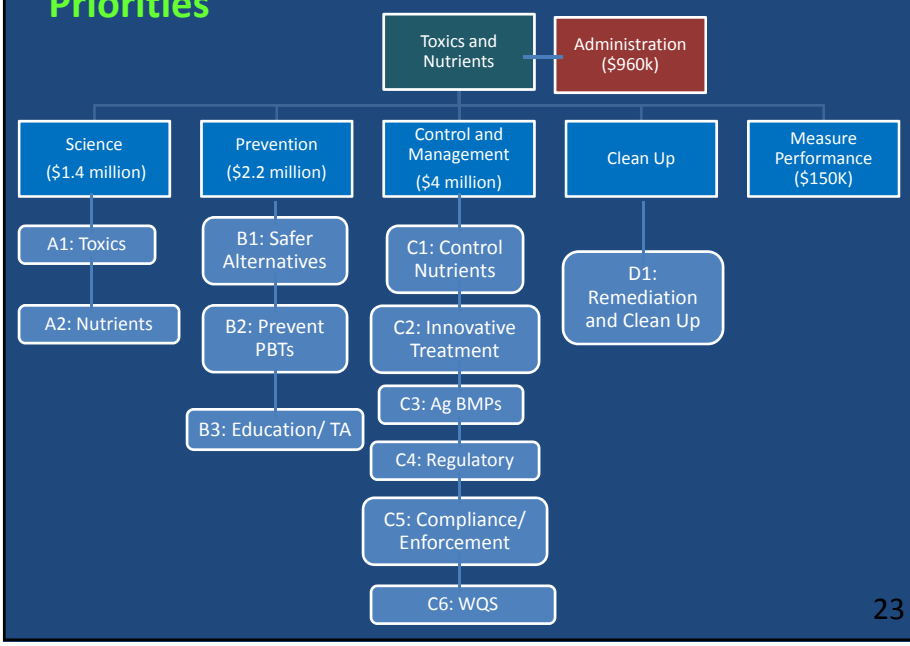
Continuing Work Includes:

- Projects that improve compliance with and enforcement of regulatory programs addressing shoreline and marine development
- Acquisitions in order to protect high value habitat from threats of development
- Projects to engage and educate the public in jurisdictions updating their Shoreline Master Programs
- Mapping Puget Sound feeder bluffs in order to provide information necessary to protect nearshore drift cell processes
- Developing guidance on alternatives to hard armoring of the shoreline.

We also anticipate initiating new subawards for projects in the following areas:

- Oil spill prevention
- Invasive species prevention
- Removal of derelict fishing gear
- Habitat restoration

Toxics and Nutrients Lead Organization Priorities



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FY '10 & '11 Toxics and Nutrients Science Funding

- **Toxics**: Implement findings from Toxics Loading Study
  - Build on Puget Sound circulation box model
  - Evaluate metals in roof runoff
  - Evaluate petroleum releases
- **Nutrients**: Unmet needs from ongoing DO studies
  - Interaction between shellfish and nutrients
  - Evaluate nutrient fluxes from sediments
  - Ocean acidification

1.24

FY '10 & '11 Toxics Management and Control

- **PAHs**: Remove creosote pilings and woodstove buy-back
- **PBDE's**: Enforce product ban
- **Oil/Petroleum**: Drips and leaks program
- **Individual training**: Landscaper certification program
- **Safer alternatives**: Collaborative process to develop alternative assessment model

1.25

FY '10 & '11 Funding Preventing Release of Toxics

- **Low Impact Development**: Removal of toxics using rain gardens and pervious pavement
- **Water Quality Standards**: Fish consumption rate study
- **Local source control**: Hire 4 county staff ($1.2 million)

1.26

FY '10 & '11 Nutrient Funding

Septic systems

- Evaluate technologies to remove nitrogen

Agriculture

- Install BMPs: Linked with PIC programs
- Inspectors: Hire 2 in Whatcom County
- Effectiveness: Measure BMP performance

FY '12 Toxics and Nutrient Funding Priorities

Toxics

- Implement findings from Toxics Loading Study
- Write and implement chemical action plans
- Conduct safer alternative assessments

Nutrients

- Implement findings of DO studies
- Implement additional Agricultural practices
- Implement TMDLs

Pathogen Lead Organization

Improve people's health by ensuring shellfish are safe to eat, beaches are safe for swimming, and on-site sewage, greywater reuse, and reclaimed water systems are properly managed.

1.29

Pathogen Lead Organization Control Strategy

- Preventing/reducing pathogen loading from on-site sewage systems (OSS Mgmt)
- Implementing watershed-based corrective action and management approaches
- Preventing/reducing pathogen loading from rural/agricultural areas and livestock facilities
- Preventing/reducing pathogen loading from commercial and/or recreational vessels (NDZ)

1.30

Potential Growing Area Upgrades

Shellfish Acreage Projections for EPA	
FFY 12	
Quartermaster Harbor	150
Hood Canal 9	250
Henderson Inlet	95
Birch Bay	128
Sub-Total	***623***
FFY 13	
SW Whidbey	300
Holmes Harbor	100
Kingston	180
Oakland Bay	475
Samish Bay	2,000
Sub-Total	***3,055***

1.31

Watershed Protection Lead Organization

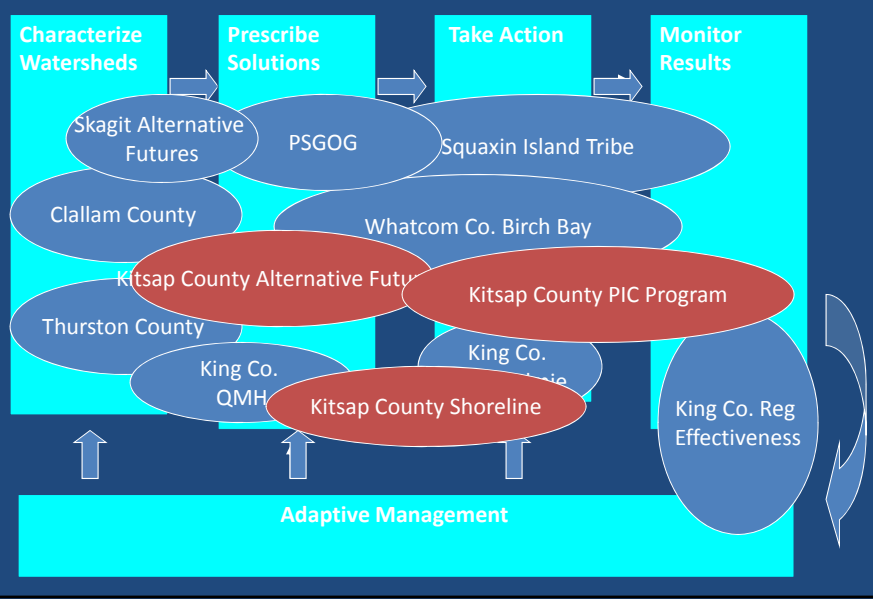
- Ecology with Commerce co-lead
- Builds on ongoing Watershed Characterization Priorities
- Integrates Stormwater into watershed scale management approaches
- Addresses Land Use, Working Lands, and Restoration/Protection of watershed systems

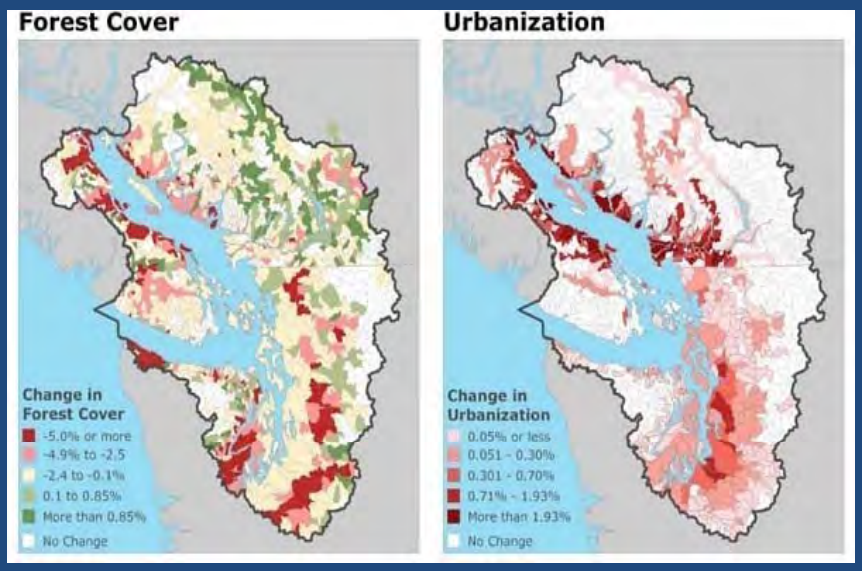
1.32

Watershed LO Funding Emphasis in FY'10 & '11

- Multiple floodplain restoration planning projects
- Multiple market-based incentive programs including TDR's
- Multiple growth management and critical area update planning projects
- Land use change assessment updates
- Stormwater management and retrofit assessments

Uses Watershed Protection Framework

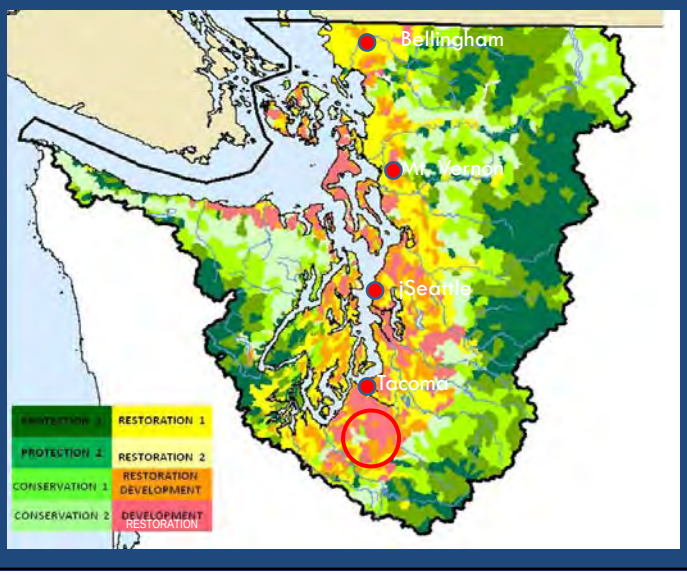




Urbanization and Forest Changes
1995 – 2002

1.35

Watershed Characterization Results – Prioritizing Water Flow Processes



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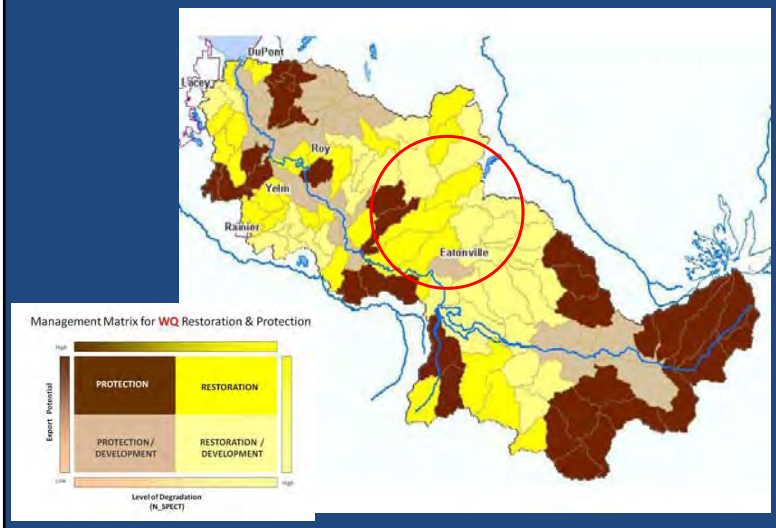
WRIA 11 Characterization Results – Restoration & Protection Categories for Sediment



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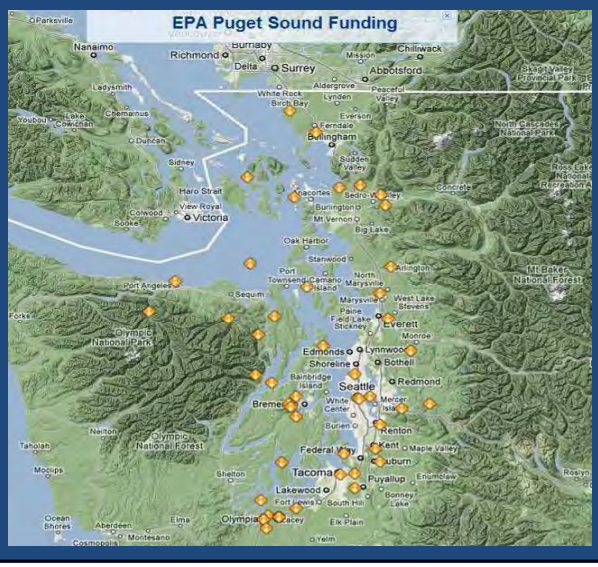
Visit our Puget Sound Web-page at: http://www.epa.gov/pugetsound/



1.38

Michael Rylko
Senior Technical Coordinator
Puget Sound National Estuary Program
USEPA Region 10
Office of Ecosystems, Tribal and Public Affairs
(206) 553-4014

Dredging Year 2012
DMMP Testing Activities

May 2, 2012
24th Sediment Management
Annual Review Meeting

Lauran Cole Warner
US Army Corps of Engineers

EPA United States Environmental Protection Agency
DEPARTMENT OF ECOLOGY State of Washington
WASHINGTON STATE DEPARTMENT OF Natural Resources

2.1

DMMP Purpose

Given:
existing regulations, current guidelines, and project proposal

Evaluate:
potential dredged material for suitability for open-water disposal and/or beneficial reuse

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2.2

DMMP 101

- DY 2012 = 16 June 2011 to 15 June 2012
- Decision Documents:
  - Suitability Determinations
  - Others:
    - Recency Extension
    - Exclusion from Testing
    - Volume Revision
    - Antidegradation Determination
    - Other projects and/or changes that require documentation

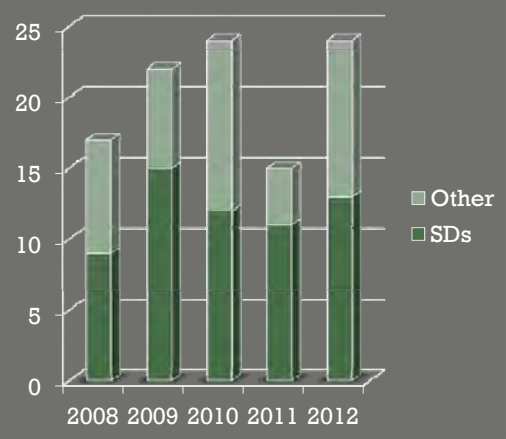
2.3

DY12 Completed Actions

Suitability Determinations (13)

Others:

- Dioxin (1)
- Volume Revision (5)
- Recency (3)
- Antidegradation (1)
- Ranking (1)
- Progress Memo (1)



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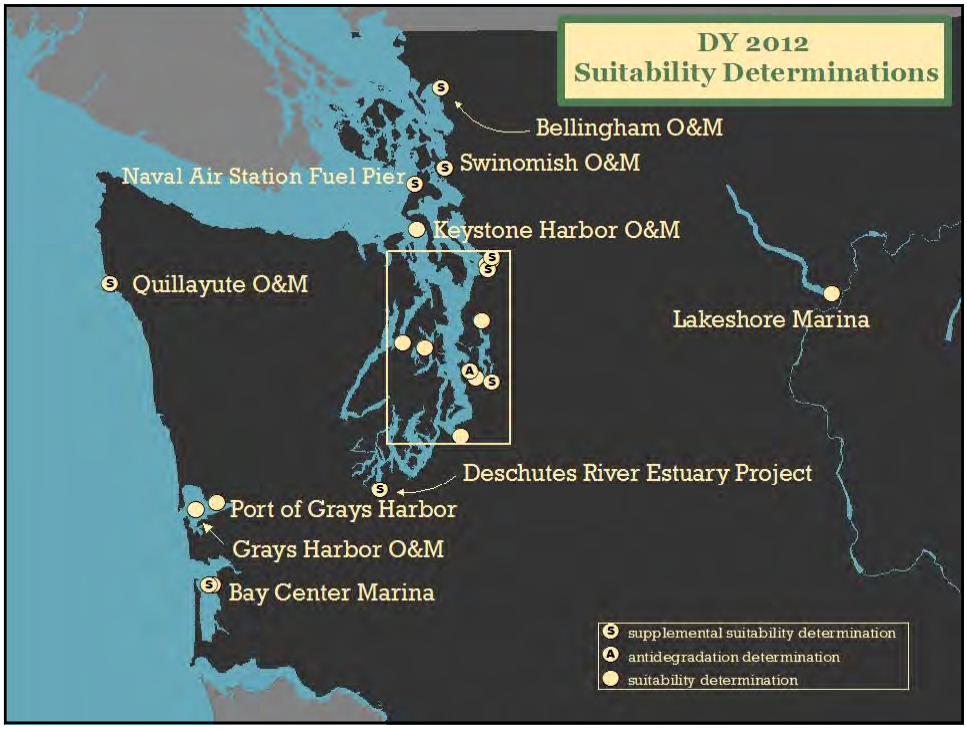
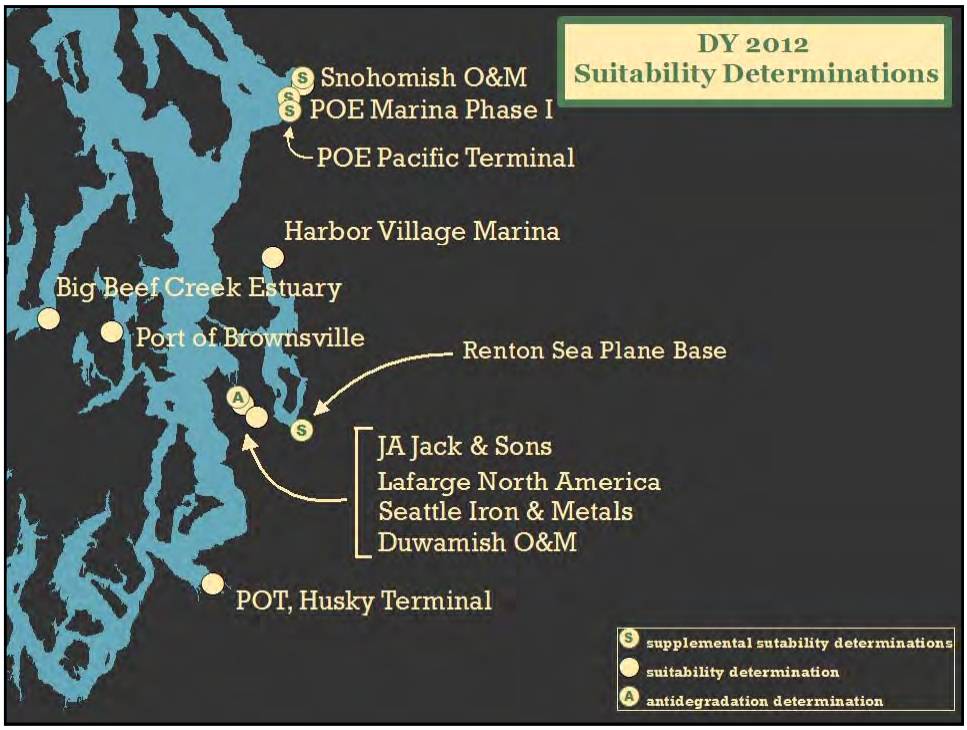

DY 2012
Suitability Determinations
Bellingham O&M
Swinomish O&M
Naval Air Station Fuel Pier
Keystone Harbor O&M
Quillayute O&M
Lakeshore Marina
Deschutes River Estuary Project
Port of Grays Harbor
Grays Harbor O&M
Bay Center Marina
supplemental suitability determination
antidegradation determination
suitability determination

2.5


DY 2012
Suitability Determinations
Snohomish O&M
POE Marina Phase I
POE Pacific Terminal
Harbor Village Marina
Big Beef Creek Estuary
Port of Brownsville
Renton Sea Plane Base
JA Jack & Sons
Lafarge North America
Seattle Iron & Metals
Duwamish O&M
POT, Husky Terminal
supplemental sutability determinations
suitability determination
antidegradation determination

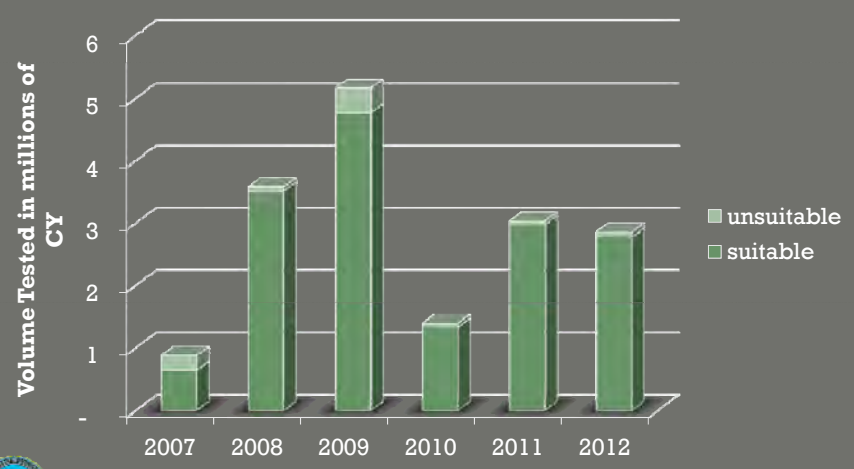
2.6

DY 12 Testing

- Out of 24 completed actions:
  - 14 - chemical testing
  - 10 - included dioxin testing
  - 2 - bioassay testing
  - *No* bioaccumulation testing

2.7

Suitability by Volume Tested



2.8

Dioxin Testing 2012

- 2 projects had failures based on dioxin alone
  - Port of Tacoma: Husky Terminal, Blair WW
  - Bellingham Bay: dioxin-only characterization of Federal Navigation Channels (I&J; Squalicum)
- 3 projects included dioxin failure, but other COCs as well
- 5 projects passed dioxin guidelines for all material

2.9

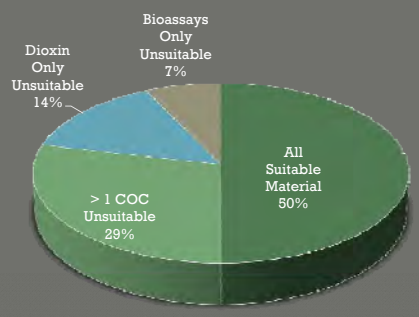
Projects w/unsuitable material

PROJECT	SUITABLE	UNSUITABLE	REASON	COMMENTS
Harbor Village Marina, Lake WA (Kenmore)	0	7,427 cy	PCBs, dioxins	Antideg. failure
Lafarge NA, Duwamish River	0	24,000 cy	PCBs, dioxins	Antideg. failure
Port of Tacoma, Husky Terminal (Blair WW)	26,150 cy	15,950 cy	Dioxins	VWA approach
Seattle Iron & Metals, Duwamish River	0	28,000 cy	PCBs, dioxins	Antideg. failure
USACE – Duwamish Navigation Channel	123,463 cy	3,630 cy	Bioassays	No SL exceedances
Lakeshore Marina, Lake Chelan	0	8,000 cy	Pesticides	Upland BU
TOTALS	**149,613 cy**	**87,007 cy**		

2.10

Suitability Overview

- 7/14 projects had at least *some* unsuitable
- 4/14 projects failed ALL project material
- Half of all projects (3/6) w/unsuitable material came from Duwamish



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2.11

In the Pipeline

Puget Sound area

Port of Everett Marina
Salmon Bay Marina
Olympia Yacht Club
Dunlap W. Bay Marina
Duwamish DMMU 15
Cap Sante Marina
Point Roberts Marina

Coast & Columbia

Owl Creek (Mouth of Cowlitz River)
Christensen Shipyard (Vancouver, WA)
Grays Harbor Deepening (Feasibility Study)

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2.12

Website changes coming

- Soon!
- More User-Friendly
- Easier search tools
- Simpler URLs

BUT

- No URLs from existing site will work

2.13

For more information:

http://www.nws.usace.army.mil

Search for
Dredged Material Management

2.14

DNR Shoreline Permit Status

2012 SMARM

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3.1

Shoreline Permit Update

Disposal Site	Jurisdiction	Expiration date	Term	Permit Fee
Anderson/Ketron	Pierce Co	Sept 10, 2013	5 yr (1 yr ext) (considering longer)	$1890 (2007) $855 ext (2012)
Port Gardner	City of Everett	Dec 15, 2014 (1 x 5 yr ext possible)	10 yr (2x 5 yr ext)	$2,000 (1999)
Commencement Bay	Pierce County	Sept 13, 2015	5 yr (1 yr ext)	$2,205 (2009)
Willapa	Pacific Co	Jan 31, 2016	5 yr	$780 (2010)
Port Townsend	Clallam Co	Feb 2, 2016	5 yr (1 yr ext)	$1125 (2010)
Port Angeles	City of Port Angeles	May 24, 2016	5 yr	$750 (2010)
Grays Harbor	Grays Harbor Co	Dec 7, 2016 (1 x 5 yr ext possible)	10 yr (2x 5 yr ext)	$200 (2001)
Elliott Bay	City of Seattle	May 2, 2021	10 yr term	$3,311 (2010)
Rosario	Skagit Co	Sept 26, 2021	10 yr	$2,400 (2010)
Bellingham Bay	Whatcom Co	expired		$1,745 (2001)

3.2

Larval Rockfish Ichthyoplankton Study : DMMP Puget Sound Disposal Site Assessment

2012 SMARM

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3.3

2010 ESA Consultation on DMMP Puget Sound and Strait of Juan de Fuca Sites

- DMMP agencies submitted Programmatic Biological Evaluation (BiOp) – August 2010
- Initiated formal consultation with NMFS and USFWS on Puget Sound disposal sites
- Assessed all listed species: including rockfish - canary (*Sebastes pinniger*), yelloweye (*Sebastes ruberrimus*), and bocaccio (*Sebastes paucispinis*)

3.4

December 22, 2010 Biological Opinion regarding DMMP Disposal Sites

NMFS Biological Opinion concluded disposal *could* impact larval fish and recommended comprehensive ichthyoplankton surveys at disposal sites

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Species of interest

- Surveys found canary rockfish in the western Strait of Juan de Fuca near Freshwater Bay
- BiOp estimated extent of take is 37,519 larvae (2-14% of one spawn event)
- Spawn Jan-Mar (BC); Nov – Mar (CA)

Canary Rockfish
Sebastes pinniger
(threatened)

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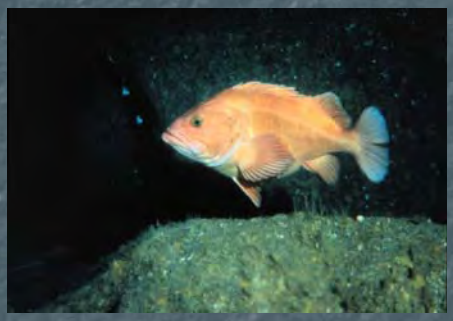
Species of interest



Yelloweye Rockfish
Sebastes ruberrimus
(threatened)

- Yelloweye rockfish are among longest-lived, reaching 100 years and maturing at 19-22 years
- Sedentary species, adults unlikely to be found at disposal sites due to preference for high relief habitats
- BiOp estimated extent of take is 88,092 larvae (3-7% of one spawn event)

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Species of interest

- Occurring in Central Puget Sound, Tacoma Narrows, Port Gardner, Port Susan, and the Strait of Juan de Fuca
- BiOp estimated extent of take is 781 larvae (.003-4% of one spawn event)
- Records of spawning Jan-Feb; and Nov - Apr

Bocaccio rockfish
Sebastes paucispinis
(endangered)

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Species of interest

- Ovoviparous - internal fertilization and maturation, with release of pelagic larvae
  - Larvae are pelagic for 3-12 months before settling into habitat as juveniles
- Larvae in Puget Sound occupy upper portions of water column at or near the surface
  - Mortality up to 70% within 7-12 days after birth
- Two spawn periods likely
  - Sampling will cover April - February

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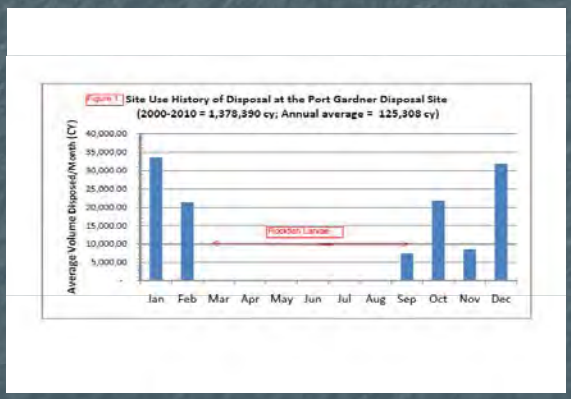
3.9

Spawn windows / Disposal Site Use



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Spawn windows / Disposal Site Use

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Endangered Species Act Conservation Recommendations (BiOp)

- Assess rockfish larvae presence and abundance –
  - monthly April-February (11 month period)
- Identify all larval fish collected at DMMP sites to family level
  - all rockfish larvae to genus level to the extent possible

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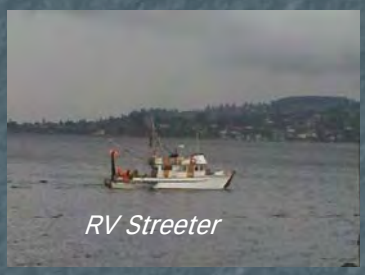
NMFS (EPA funded) Study: Evaluate Ecological Health of Puget Sound's Pelagic Foodweb



DMMP cooperative agreement to link into ongoing work by NMFS (Marine Science Center) to evaluate how food web conditions vary across Puget Sound

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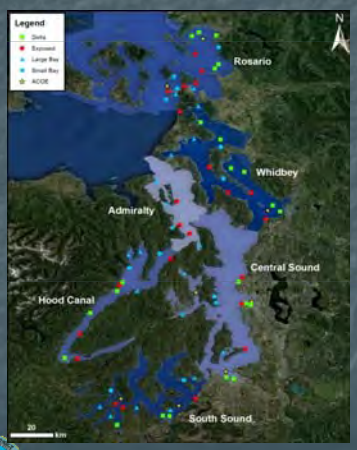
NMFS Study: Evaluate Ecological Health of Puget Sound's Pelagic Foodweb



Sampled at 102 stations for 7 months (including 6 disposal sites) with an additional 4 months at the DMMP disposal sites.

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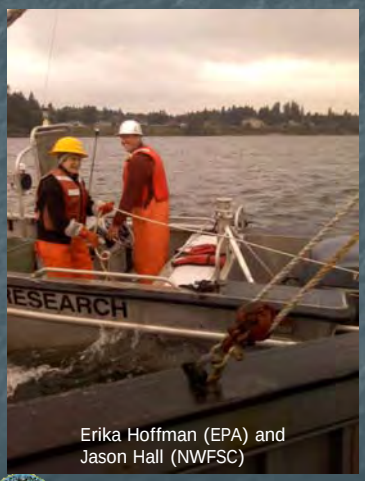
3.14

Field sampling



Erika Hoffman (EPA) and Jason Hall (NWFSC)

- DMMP funded field and laboratory technician
- Achieved 47% cost savings through in-kind contributions from NMFS
- DMMP staff sometimes able to provide time as crew to help

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Field sampling (continued)

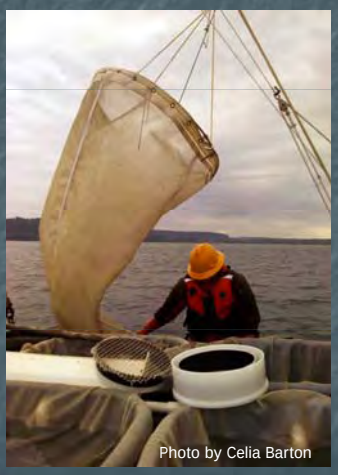

Photo by Celia Barton

- Used a 1 meter diameter net with a 500 micrometer mesh to collect larval rockfish
- Towed at 2-3 meter depth for 3 minutes
- Flow meter used for volume sampled

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Field sampling (continued)

Alicia Godersky (NWFSC)

- Conservation recommendation – "Enumerate all rockfish larvae collected at DMMP sites"
- Some samples sorted to preserve fish larvae in ethanol for genetic analysis if needed

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3.17

Preflexion stage

Photo by Alicia Godersky

Sebastes larvae from a sample

Early development stages are difficult to identify

- Only to genus level for most rockfish
  - There are three species of concern
  - Requires genetic analysis for species

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3.18

Results (so far)

- 43 samples processed so far, about 2/3 of total
- Boccacio one of few rockfish that can be visually identified to species
  - Most sensitive of the 3 species of concern
  - None found in samples so far

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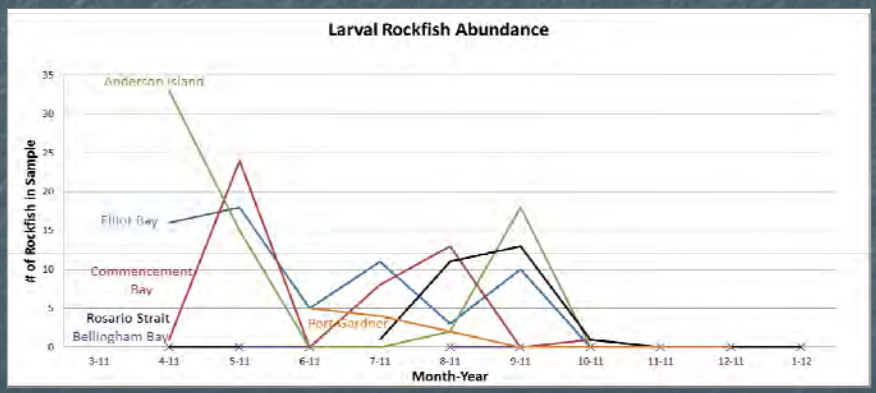
3.19

Ichthyoplankton Study results - *Sebastes* Abundance (January 2012)



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3.20

Next Steps

Final report from the Marine Science Center is expected this summer

If abundance of <u>all</u> rockfish larvae exceeds Take totals, we will need to work with NMFS to determine if there is any impact to listed species

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3.21

Questions?

Photo by Celia Baton

Photo by Celia Barton

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3.22

DNR Aquatic Reserves Program and Dredged Materials Disposal

2012 SMARM

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3.23

What are Aquatic Reserves?

Aquatic reserves are established by DNR to conserve state-managed lands that will provide benefits to health of native aquatic habitats and species.

3.24

Reserves Statewide

Several designated marine reserves throughout the State

DNR recognizes the need to balance different uses while gaining conservation benefits for important habitats and species

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Management Plan

Plan outlines how DNR will manage state-owned aquatic lands within the reserve

- Considers all existing uses, environmental conditions, and site-specific conservation targets
- Identifies goals and objectives and management actions

Each reserve site has specific management goals

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Protection Island Reserve

Currently there are 2 reserves near disposal sites

The Protection Island Reserve boundary does NOT include the Port Townsend disposal Site

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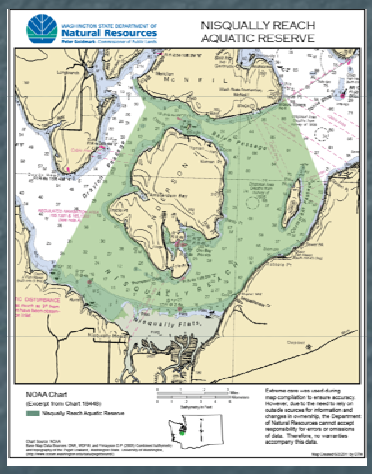
Nisqually Reach Reserve



This boundary DOES include the Anderson/Ketron disposal site

DMMP representatives participated in a public meeting to explain management of the dredge material program

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Nisqually Reach Reserve Management Plan

”The Anderson / Ketron deepwater disposal site is an approved use within the Reserve contingent on the scientific oversight and management of the DMMP” (page 49)

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3.29

Nisqually Reach Reserve Management Plan

”The DMMP solicits input and review through a transparent public process with an annual review (SMARM), issues discussion, clarification papers, disposal site monitoring results, and other publications” (page 50)

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3.30

Continued Disposal Site Use

- DNR will continue to seek authorization of the disposal site through shoreline permits
- DNR will continue to authorize disposal of approved dredge material through Site Use Authorizations.

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3.32

Regional Sediment Evaluation Team (RSET) Update:

Application of the Sediment Evaluation Framework for the Pacific Northwest (SEF)

Sediment Management Annual Review Meeting
May 2, 2012

4.1

Regional Sediment Evaluation Team (RSET)

A multi-agency group, originally formed under direction of the Regional Dredging Team (RDT) to revise the Lower Columbia manual (DMEF) for regional use by all NW Corps Districts, EPA Region 10, NMFS, USFWS, and other federal and state agencies who require sediment quality evaluation procedures.

The RSET Agencies:

4.2

RSET Policy Team Background and Responsibilities

- **Background:**
  - (2002) update the Lower Columbia Dredged Material Evaluation Framework (DMEF)
  - RSET mission evolved: revise and develop regional sediment evaluation procedures
  - Draft Sediment Evaluation Framework (SEF) – Sept. 2006
  - Final Sediment Evaluation Framework - May 2009

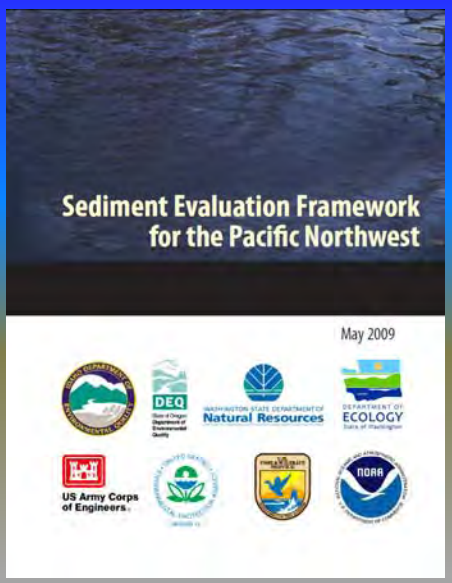
- **RSET Policy Team Responsibilities:**
  - maintain and revise SEF, as appropriate
  - Meet monthly to discuss issues of concern and set direction
  - Conduct regular program reviews; take public input on SEF and proposed improvements to consider modifications
  - Develop and support regional sediment database
  - Coordinate with RDT on issues needing resolution

4.3

RSET Home Page: located on Portland district website:

http://www.nwp.usace.army.mil/environment/sediment.asp

(Click on "Framework" under the RSET header)



Eric Braun

(503) 808-3721

Jonathan Freedman

(206) 553-0266

4.4

RSET Policy Group

Eric Braun Co-Chair, Corps NWD
Jonathan Freedman Co-Chair, EPA
David Gesl, Corps NWD
David Kendall, Corps, Seattle,
James McMillan, Corps, Portland
Russ Heaton, Corps, Walla Walla
Celia Barton WDNR
Nancy Munn, NMFS
Jeremy Buck USFWS
Jim Anderson, ORDEQ
Miranda Adams, IDEQ
Laura Inouye, WA DOE

4.5

Activities in Past Year

- Second Annual RSET public meeting November 10, 2011
- Third Annual Meeting scheduled October 17, 2011 at Seattle District Office
- Continued dialogue with PNWA and their members on issues raised in project reviews
  - Commitment to an "open door" to dredgers, labs, and consultants
  - PNWA issues appear most related to permit processing time
  - Complex characterizations in Portland Harbor Superfund site

4.6

Activities in Past Year - continued

- Chapter 11 updates (QA / QC guidance and data management): revisions will include current guidance from RSET member agencies. Updates have been delayed but moving forward again. RSET will seek public input on draft prior to annual meeting
- Freshwater standards: undergoing rulemaking in Washington. EPA must concur on WQ standards revision. RSET will consider for eventual inclusion in SEF
- RSET team members developing paper on post-dredge z-layer monitoring in Portland Harbor (2012 PIANC and Pacific WEDA conferences)

4.7

Bioaccumulation

- Target Tissue Levels in SEF don't provide clear guidance on how to assess bioaccumulation potential in sediment
- Pesticides and PCBs are showing up frequently in Willamette River sediments
- ODEQ has proposed a risk management framework for evaluating bioaccumulatives;
  - Future RSET guidance to identify and address differences between state policies & guidance, Federal law, SEF.

4.8

Activities in Past Year
(PSET)

- Portland Sediment Evaluation Team (formerly PRG), Portland District
  - Holds weekly project review calls, biannual face-to-face meetings
  - Uses SharePoint data-share site to review materials
  - Reviewed 20 projects in FY 2012 so far:
    - 7 in marine waters; 13 in fresh water; 5 Corps Civil Works projects, 15 projects from permit applicants
  - Portland District Sampling and Analysis Plan guidance complete late 2011
  - PSET members staff Lower Willamette Project team to ensure permit / 401 cert. / ESA & EPA cleanup requirements fit PSET recommendations

4.9

Activities in Past Year
(DMMP – PSET Coordination)

- Grain size clarification
- New surface material – RSET is adapting DMMP approach for use in other areas
- RSET Will review DMMP clarification to bioassay procedure revisions, may adopt
- Working with DMMP to ensure consistency of RSET QA/QC procedures with PS protocols

4.10

Activities in Past Year (Idaho)

- Draft Snake River management plan out for public review this year
- Federal project at the Snake / Clearwater River confluence sampled in late 2011, results not yet available

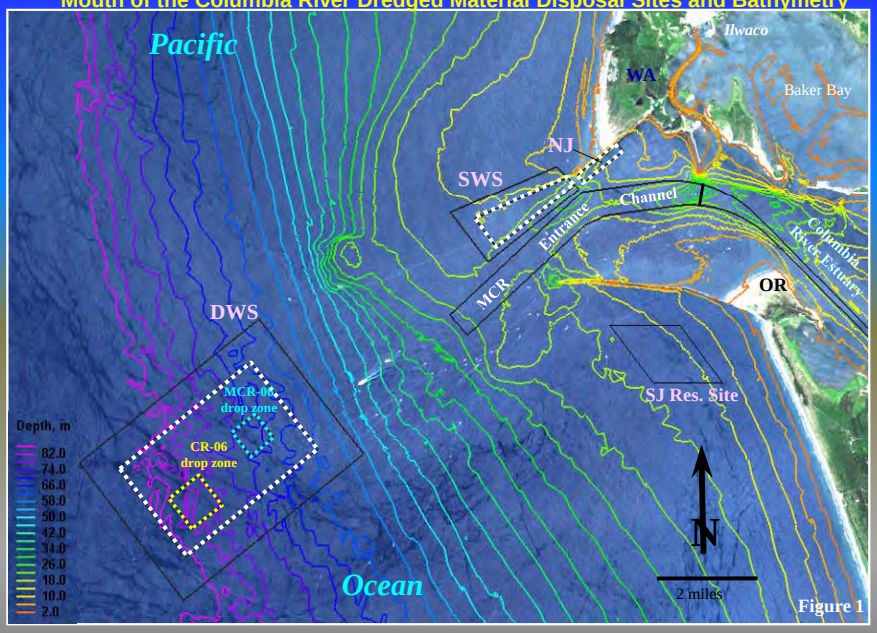
4.11

Other Regional Sediment Management Initiatives

- Beneficial use 404 sites at Mouth of the Columbia should see use for 1st time this year
- EPA completing final designation (July 2012) of two ocean disposal sites on Oregon coast at Yaquina
  - Last ocean disposal site designations for foreseeable future in Pacific Northwest (7 sites since 2009)
  - Many sites shallow and dispersive (different than PS sites
- Exploring options for developing advanced ID 404 disposal sites in Willamette for clean dredged material;

4.12

Mouth of the Columbia River Dredged Material Disposal Sites and Bathymetry



DWS= Deep Water Site, 102 MPRSA NJ Site = North Jetty disposal site, 404 CWA SJ Res. Site = South Jetty research site,
SWS= Shallow Water Site, 102 MPRSA (formally Site E, 103 MPRSA)

4.13

Oregon Coast Disposal Sites and Status*

MCR – 2 sites (2005)

Yaquina – 2 sites (July 2012)

Siuslaw – 2 sites (2010)

Umpqua – 2 sites (2009)

Coos Bay – 3 sites (2006)

Coquille – 1 site (1990)

Rogue – 1 site (2009)

Chetco – 1 site (1991)

*year site was designated by EPA is in parenthesis

4.14

National Initiatives

- **Combined Dredged Material Testing Manual - merging 1991 Ocean Testing Manual (Green Book) with the 1998 Inland Testing Manual. Delayed, now moving again.**

- **National Ocean Policy update:**
  - ***Stewardship of Oceans, Coasts, Great Lakes:*** **2010 Executive Order adopted recommendations of the Ocean Policy Task Force, chartered a National Ocean Council. Implementation Plan just went through public review, final due June 2012.**
  - ***Coastal Marine Spatial Planning*****: one of 9 identified "priority objectives"; improve & integrate agency oversight.**
  - ***Regional Planning Bodies will*** **develop CMS Plans. West Coast RPB is the entire continental U.S. Pacific Coast, similar to our existing *West Coast Governor's Agreement* on Ocean Health (2006).**
  - **West Coast Regional Planning Body conversations are underway.**
  - **More info at www.whitehouse.gov/oceans**

QUESTIONS?

Sediment Management Annual Review Meeting

Sediment Management Standards Rule Revisions

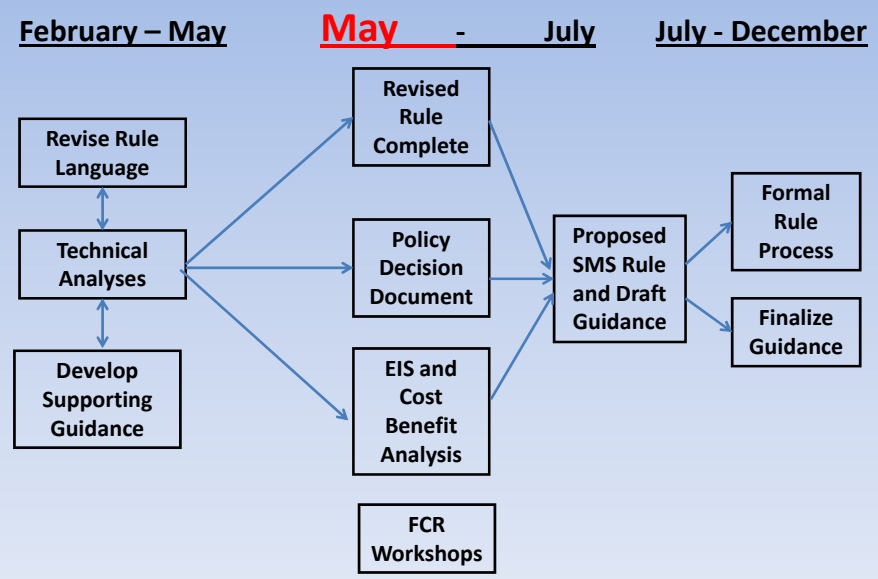
Department of Ecology
Toxics Cleanup Program

Chance Asher

May 2012

5.1

SMS Rule Timeline - 2012



5.2

Why do we need to revise the SMS rule?

Lack of clarity in the SMS rule leads to unpredictable and inconsistent cleanup decisions

- **Human Health Risk**: SMS limited to narrative standard
- **Ecological Health Risk**: SMS not clear on ecological risk from bioaccumulatives /toxicity to higher trophic levels
- **Background Chemical Concentrations**: SMS rule does not address anthropogenic background (MTCA/CERCLA)
- **Freshwater Sediment Standards**: SMS rule limited to a narrative standard for benthic community protection

5.3

What are the rule revisions?

Revisions are limited to Part V: Sections -500 through - 590 to address cleanup.

- **Bioaccumulatives - Human Health Risk:**
  - *SMS section - 571.*
  - Established two risk levels.
  - Incorporated into the current SMS two tier framework.
  - Incorporating updated fish consumption rate.
- **Bioaccumulatives - Ecological Health Risk:**
  - *SMS section -574.*
  - Establishes a general screening process.
  - Incorporated into the current SMS two tier framework.

5.4

What are the rule revisions (cont)?

- **Background Chemical Concentrations:**
  - *SMS section -570*.
  - Incorporated two types of background: Natural background (MTCA) and Regional background (SMS).
  - Regional background - new concept akin to CERCLA anthropogenic background.
  - Incorporated into the current SMS two tier framework.

- **Freshwater Sediment Standards:**
  - *SMS section -573.*
  - Promulgating both chemical and biological standards.
  - Protection of the benthic community only.

What are the rule revisions (cont)?

- **Expectations**
  - *SMS section -500*
  - Addresses cleanup process decision making
- **Remedial Investigation/Cleanup Action Plan:**
  - *SMS sections -560 and -585.*
  - Revised for clarity – separated RI/FS from CAP
  - Aligned with MTCA requirements
- **Remedy Selection:**
  - *SMS section -580.*
  - Revised for clarity – separated out RI/FS
  - Aligned with MTCA requirements
  - Clarified sediment specific requirements

SMS Rule Revision Issues – The Dirty Dozen +1

Degree of specificity in rule vs guidance

Background:
- Measurable difference - Regional and Natural background
- Two tier framework – Regional background as the cap
- Who establishes background

Human Health:
- Level of risk and default fish consumption rate

Remedy Selection: MTCA PMEP requirements; Sediment specific DCA

Liability Settlements: When is the PLP actually done?

Source Control:
- Recontamination from non PLP stormwater
- Intersection with water quality standards and 303(d) list

Freshwater Standards
- Biological interpretation criteria – defining an exceedance
- Site specific biological and chemical criteria
- Metals concentrations (zinc, lead, copper)

7

5.7

SMS Rule Revision Decisions - Background

- **Two tier framework.** Retain SMS two tier framework – cleanup standards set within a range between an upper and lower tiers.

- **Regional background:**
  - New term and concept
  - Upper tier and can be the cap for a cleanup standard
  - Includes influence of stormwater
  - Excludes ability to sample within discharge zone
  - Similarities to CERCLA anthropogenic background concept

- **MTCA Natural background:**
  - Same definition as in MTCA, anthropogenic and natural contaminants from natural and anthropogenic sources
  - Lower tier and is the goal for sediment quality

8

5.8

SMS Rule Decisions – Human Health

- **Two tier framework.** Retain the current SMS two tier framework – cleanup standards set within a range between an upper and lower bound.
- **Risk and Exposure parameters:**
  - Lower tier: 10^{-6} risk for individual chemicals; HQ = 1
  - Upper tier: 10^{-5} total site risk; HQ = 1
  - Single default fish consumption rate
  - Site use factor: guidance
    - Default of 1 (tribal scenario)
    - Ability to adjust downward where appropriate (??)
  - Fish diet fraction: guidance
    - Default of 1 (tribal scenario)
    - Ability to adjust downward where appropriate (??)
- **Tissue testing** Allow for tissue chemistry results to:
  - Screen chemicals of concern; comparison to background
  - Evaluate compliance with the **sediment** cleanup standard

9

5.9

SMS Human Health Revisions Yay! Math!

Risk Based Concentration for carcinogens (like dioxin, PCBs)

$$\left[\frac{(CR \times BW \times AW \times UCF)}{(SFo \times FCR \times DF \times EF \times ED \times SL \times SUF)}\right] \times (Sfoc/BSAF)$$

Abbreviation	Parameter Name	Default Value
CR	Cancer Risk	10^{-6} individual chemical (lower tier) 10^{-5} total site risk (upper tier)
SUF	Site Use Factor	1.0
FCR	Fish Consumption Rate	175 grams per day (for example)
DF	Fish Diet Fraction	1.0
EF	Exposure Frequency	365 days per year
ED	Exposure Duration	70 years
BSAF	Biota Sediment Accumulation Factor	Site specific

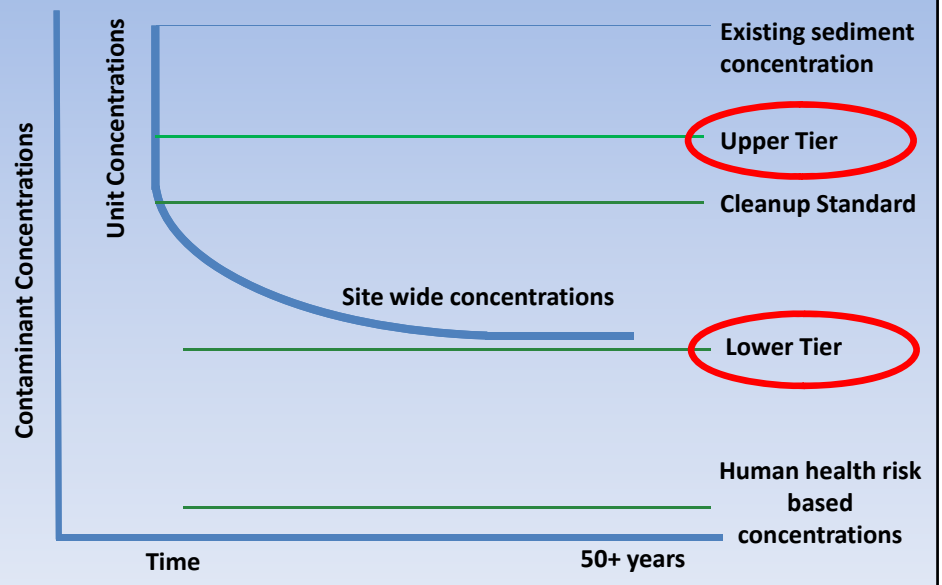
5.10

SMS Revisions - Human Health
GOAL: Establish a simple risk management process to develop sediment cleanup standards

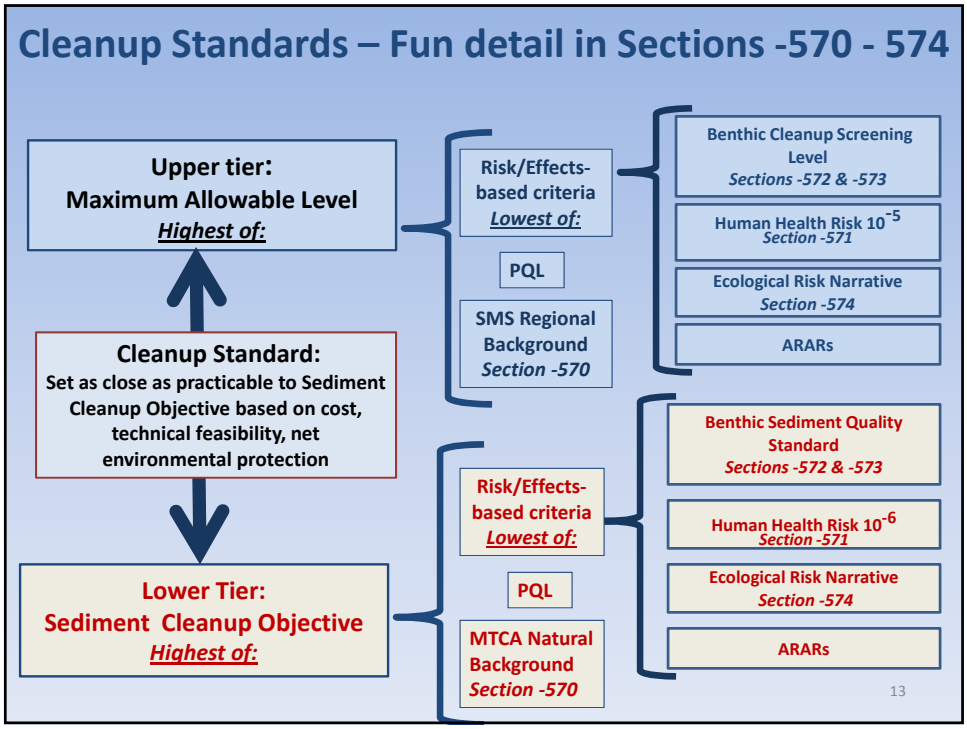
Rule	Guidance
Reasonable Maximum Exposure Scenario	Conceptual Site Model
Risk Levels	Equations: Cancer and Non-Cancer
Fish Consumption Rate (FCR)	Other Exposure Parameters: Site Use Factor, Fish Diet Fraction
Site Specific FCR Criteria	Evaluating Compliance
Tissue Testing	Establishing Background
Regional Background Definition	Sampling Protocols

5.11

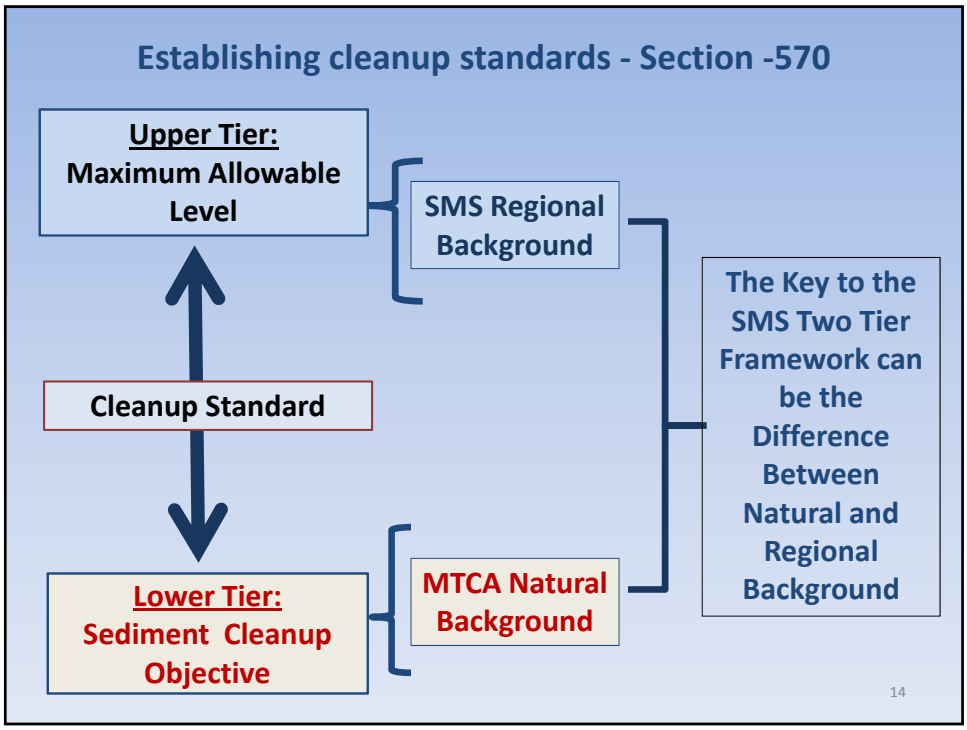
How are risk based and background concentrations used to establish cleanup standards?



5.12


Cleanup Standards – Fun detail in Sections -570 - 574
Upper tier:
Maximum Allowable Level
Highest of:
Risk/Effects-based criteria
Lowest of:
PQL
SMS Regional Background
Section -570
Benthic Cleanup Screening Level
Sections -572 & -573
Human Health Risk 10-5
Section -571
Ecological Risk Narrative
Section -574
ARARs
Cleanup Standard:
Set as close as practicable to Sediment Cleanup Objective based on cost, technical feasibility, net environmental protection
Lower Tier:
Sediment Cleanup Objective
Highest of:
Risk/Effects-based criteria
Lowest of:
PQL
MTCA Natural Background
Section -570
Benthic Sediment Quality Standard
Sections -572 & -573
Human Health Risk 10-6
Section -571
Ecological Risk Narrative
Section -574
ARARs
13

5.13


Establishing cleanup standards - Section -570
Upper Tier:
Maximum Allowable Level
SMS Regional Background
Cleanup Standard
Lower Tier:
Sediment Cleanup Objective
MTCA Natural Background
The Key to the SMS Two Tier Framework can be the Difference Between Natural and Regional Background
14

5.14

SMS Rule Revision Decisions

- **Remedy Selection:**
  - **Consideration of cost:** Retain SMS methodology to use net environment benefit, technical effectiveness, and cost to determine cleanup standards.
  - **MTCA requirements.** Permanent to the maximum extent practicable; sediment specific DCA

- **Liability Settlements:**
  - Allow settlements (contribution protection, covenant not to sue) for discrete site units within a larger site.
  - Allow for a process to settle liability for the larger site.

- **Recontamination:** Allow Ecology options for releasing PLP liability for recontamination of a Site Unit if ongoing release is:
  - Not from the PLP or
  - Not under the authority of the PLP

15

5.15

SMS Rule Revision Decisions

Source Control:

- What does it mean in the context of cleanup?
  - Meet and maintain cleanup standard from PLP sources
- What about recontamination of cleanups from stormwater?
  - Liability settlement if PLP source control met and maintained.
- What does it mean in the context of NPDES permitted dischargers?
  - If the discharger is a PLP, must meet and maintain cleanup standard.
- How do the rule revisions affect water quality standards?
  - Current rule addresses sediment and water interactions – both must be protected.
  - Sediment Impact Zones if necessary.
- How will the rule revisions affect 303(d) listings
  - Current policy places sediment cleanups in Category 4B

Freshwater Standards: Afternoon discussion – I'm getting hungry

16

5.16

SMS Rule Revision Decisions
Establishing PQL based cleanup standards

Cleanup standard is the highest of:

- Natural background (MTCA) or Regional background (SMS)
- Human health or ecological risk based concentration
- Practical Quantitation Limit (PQL)

Use of PQL Based Cleanup Standards – Issue Paper:

- A proposed approach for establishing a PQL based cleanup standard
- Goal is to have a reproducible, consistent approach
- Survey of laboratories to determine achievable PQLs
- From the distribution:
  - Remove the lowest and highest values
  - Determine the median value
  - For congeners, PQLs for each congener weighted by their TEF then summed

Guidance Development for Rule Revisions

- Assessing human health risk.
- Implementing freshwater sediment standards.
- Establishing natural and regional background.
- Establishing compliance at a cleanup site.
- Establishing practical quantitation limits at a cleanup site.
- Drafts will be available when the rule is out for public comment (summer 2012).

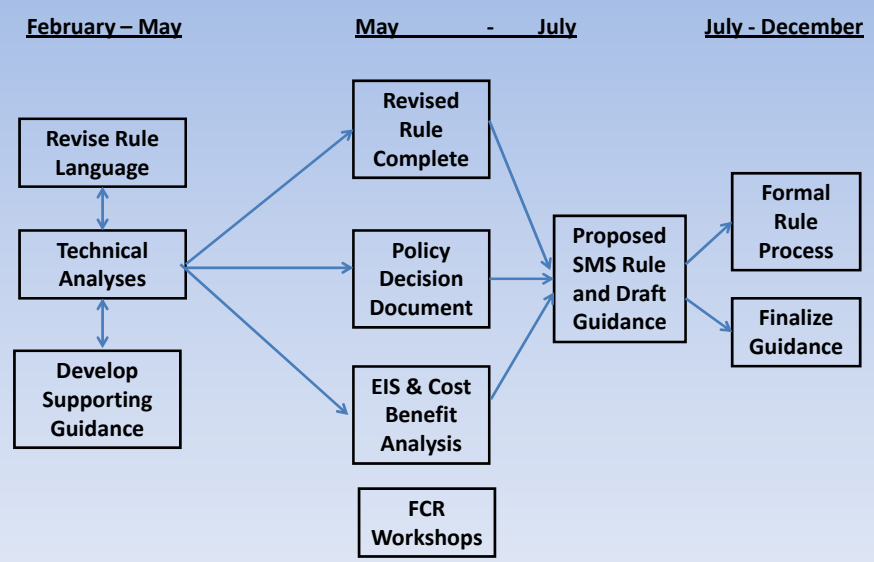
Three Separate But Integrated Processes:

- SMS Rulemaking for Cleanup
- *Updated Fish Consumption Rates*
- Water Quality Standards Rulemaking

2010 - 2011	Jan – June 2012	July 2012 – Dec 2012	2013
• SMS Advisory Groups • SMS Rule Drafted	• SMS Rule Updated • Guidance Drafted	• SMS Rule Public Comment • Formal SMS Rule Process • Guidance Finalized	• SMS Rule Adopted and Implemented
• Updated Default FCR Technical Work and Informal Public Comment	*• Revise FCR Technical Report Based on Public Comment*	*• Incorporate Updated FCR into the SMS Rule Part V to Establish Cleanup Standards*	
• Informal Public Input on WQS Implementation Tools	• Refine WQS Implementation Tools • WQS Implementation Tools Rule Drafted	• WQS Implementation Tools Rule Public Comment	• WQS Imp. Tools Rule Adopted • HH WQS Rulemaking

5.19

SMS Rule Timeline - 2012



5.20

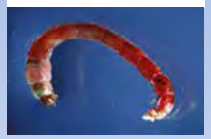
Freshwater Standards

Laura Inouye
SEA Program

Russ McMillan
Toxics Cleanup Program

6.1

Freshwater Sediment Standards



- **Consistency with current SMS paradigm:**
  - Chemical and Biological criteria.
  - Two tier structure: SQS and CSL
  - Allowance of some adverse effects.
  - Biological criteria overrides chemical.
- **Biological criteria → Sediment bioassays**
  - Protect functions and integrity of a benthic community.
  - Suite of species selected to be representative of native species.
  - Acute and chronic endpoints used to establish regulatory effects levels.
- **Chemical criteria → Floating Percentile Model**
  - Multivariate method using synoptic, regional data.
  - Optimized to most accurately predict both presence and absence of toxicity.

6.2

Scientific Review of Criteria and Development

- Ecology began development of freshwater sediment criteria (SQVs) in 1998; evaluation of existing standards lead to the development of the FPM (Ecology 2002)
  - Dr. Teresa Michelsen, Avocet
- RSET began updates to the SQVs in 2007.
  - EPA, Corps, USFWS, NMFS, Oregon DEQ, Ecology
- MTCA/SMS Science Panel Review
  - 5 experts in fields ranging from toxicology to environmental cleanup representing government, academia and consulting.
- Sediment Work Group Review
  - 8 regional and national experts specializing in sediment cleanup and management.
- Additional Scientific Peer Review
  - 4 nationally recognized sediment experts representing EPA, USGS, NOAA, and academia.
- Sediment Management Annual Review Meetings

6.3

Fundamentals of Biological Criteria

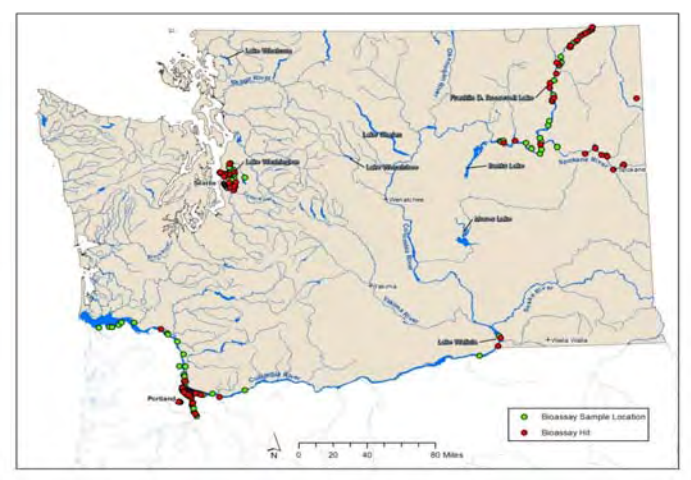
How are bioassay endpoints established?
How are chemical criteria developed from bioassay endpoints and how they are used in implementing the rule?

- Bioassay species were selected due to wide distribution and appropriate sensitivity.
- Selected the best available tests - ASTM and EPA protocols.
- Added chronic, sub-lethal tests.
- Established SQS effects levels at Minimum Detectable Difference from control.
- Established CSL effects level set above SQS, allowing minor adverse effects in a manner consistent with marine bioassay standards.
- Flexibility to add bioassay endpoints (biomass) or new bioassays (mussels/snails) as available.

6.4

What we heard from the peer review process

- Feedback we have addressed:
  - Data representative of freshwater sediments in the region
  - Ability to use other bioassays on a site specific basis



What we heard from the peer review process

- Feedback we have addressed (continued):
  - Low ratio of hits and no hits (15%/85%) in the data set
    - New Statistical analysis- Reliability evaluation improved through addition of new metrics.
      - Bias
      - Odds ratio
      - Hanssen-Kuipers discriminant – a version of the kappa statistic
      - New metrics confirm criteria are predictive of toxicity
    - Model is designed to work with variable hit rates.
  - Level of protection: 20% false negative rate
    - Balancing of false negative and false positive rates for individual bioassays.
    - Final values selected based on most sensitive bioassay

What we heard from the peer review process

- Feedback we have addressed (continued):
  - Level of protection:
    - Balancing of false negative and false positive rates for individual bioassays (selection of 20% false negative rate).
    - Selection of minimal detectable difference for SQS bioassay hit definitions
- Final values selected based on most sensitive of the ten bioassay endpoints (introduces further conservatism into the SQVs).

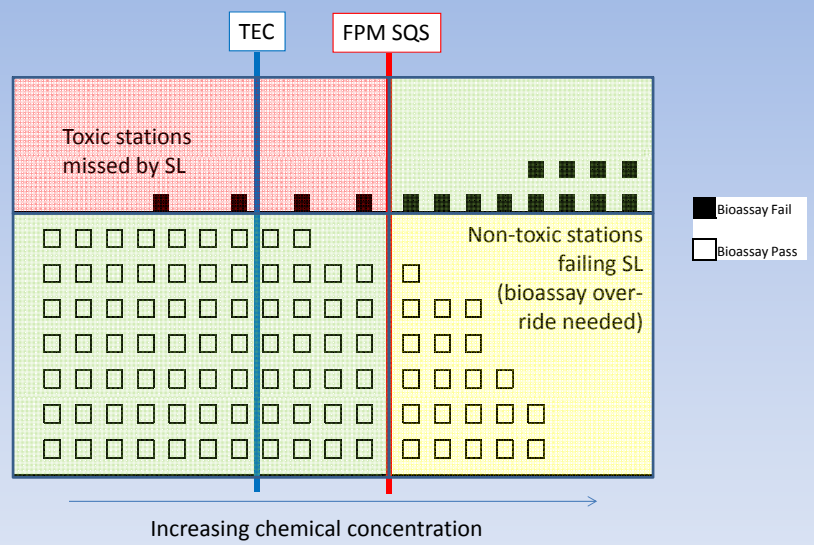
6.7

Using Bioassays to Develop Chemical Criteria

- Developing Chemical Criteria - Goals
  - Risk management rather than risk assessment approach.
  - Maximize reliability = ability to accurately predict both presence and absence of toxicity.
    - Fundamental difference from most other SQV sets.
  - Regional data reflecting the mixture of contaminants commonly found in NW.
  - QA2 data level review.

6.8

Predicting Biological Toxicity



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6.9

What we heard from the peer review process

- Feedback we are still working on addressing:
  - Biological criteria:
    - SQS is “no adverse effect level”, not a “no effect level”.
    - Biological tests and endpoints: How a biological exceedance is determined: Minimal detectable difference – use of 10% or higher?
    - Use of “biomass” endpoint in the rule

6.10

In Closing

- Development of both biological and chemical criteria have been improved through substantive scientific review.
- Strengths of criteria are in the added flexibility allowed in implementation through the SMS rule.
- Consistent and compatible with the current SMS framework for marine criteria.
- Will provide more consistency and predictability for cleanup decisions.

Information on the SMS Rule Revisions

- **General information:** http://www.ecy.wa.gov/programs/tcp/regs/2011-SMS/2011-SMS-hp.html
- **Preliminary Draft SMS Rule Language:**
  - http://www.ecy.wa.gov/programs/tcp/regs/2011-SMS/adv-comm/mtg-111209/111209-mtg-mat.html
- **Advisory Group comments on draft SMS rule language:**
  - http://www.ecy.wa.gov/programs/tcp/regs/2011-SMS/adv-comm/sms-rule-comments.html
- **Draft Fish Consumption Rate Technical Report:**
  - http://www.ecy.wa.gov/toxics/fish.html
- **Public comments on the draft FCR Technical Report:**
  - http://www.ecy.wa.gov/programs/tcp/regs/2011-SMS/fish-consump-com.html
- **Freshwater Sediment Standards SQV Technical Report:**
  - http://www.ecy.wa.gov/programs/tcp/regs/2011-SMS/adv-comm/mtg-111209/111209-mtg-mat.html

Contacts for the SMS Rule Revisions

- SMS rule language and general rule questions/comments:
  - Chance Asher, SMS rule technical lead
    - (360) 407-6914 chance.asher@ecy.wa.gov

- SMS Freshwater sediment standards :
  - Russ McMillan, Freshwater standards technical lead
    - (360) 407-7536 russ.mcmillan@ecy.wa.gov

- Fish consumption rates:
  - Martha Hankins, Policy Unit supervisor
    - (360) 407- 6864 martha.hankins@ecy.wa.gov

Welcome

Mike Depew, Technical Manager

7.1

Safety

- Governed by Mine Safety and Health Administration
- Health and Safety Plan approved for project (88 pages)
- All employees HAZWOPER trained
  - Lafarge
  - Contractors hired by Lafarge

7.2

Safety

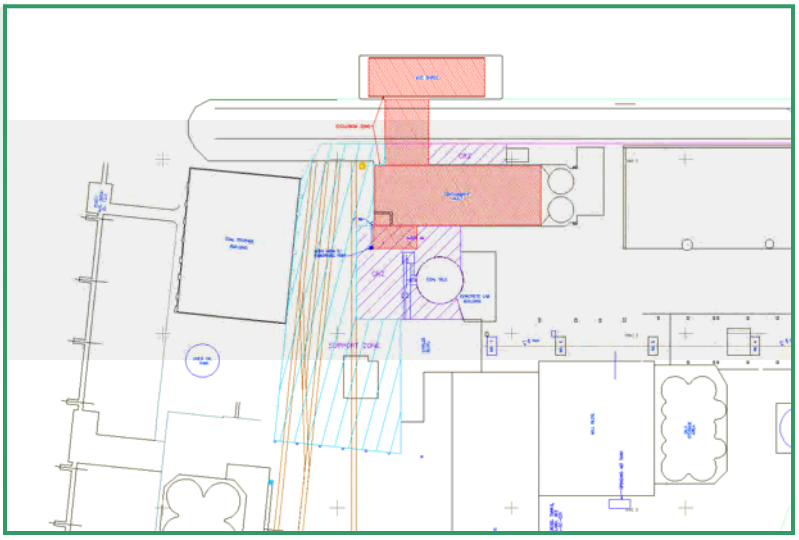
- Eye wash stations
- Emergency containment sand

7.3

Vicinity Map

7.4

Site Plan

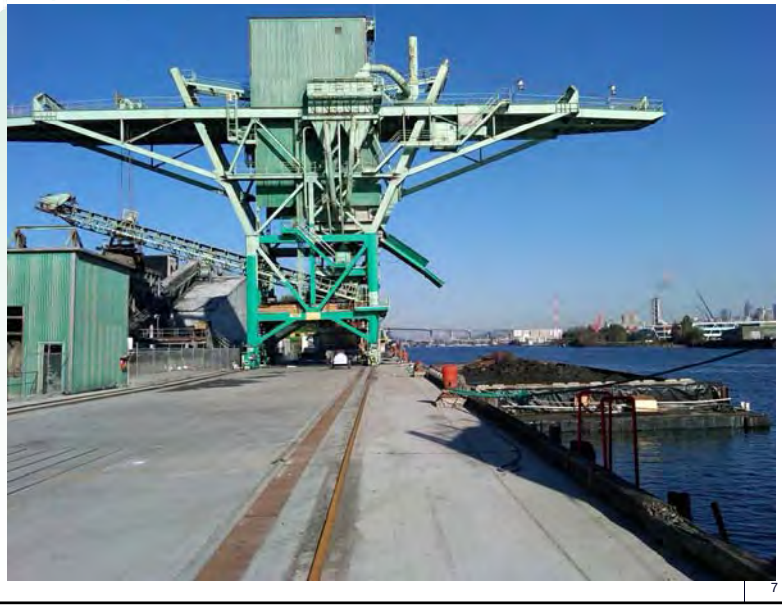


7.5

Waterfront Crane

7.6

Spill Apron



7.7

Secondary Spill Protection

7.8

Barge Unloading with Spotter

7.9

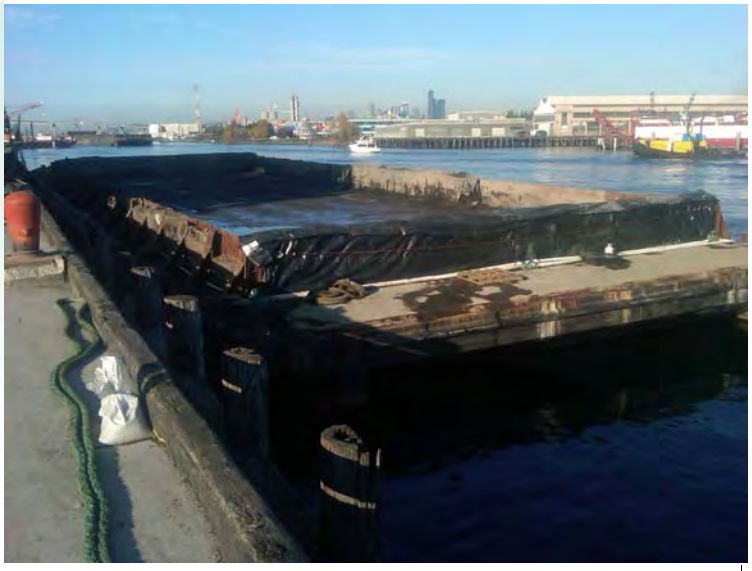
Containment Vault

7.10

Containment Vault

7.11

Empty Barge



7.12

Overview of Barge Unloading

7.13

BNSF Rail

7.14

Rail 3 - Pack

7.15

Rail 3 - Pack

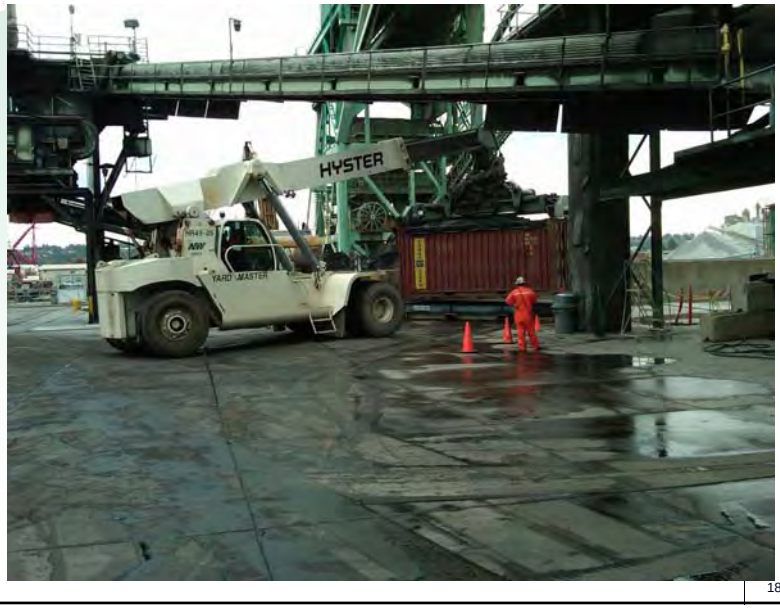
7.16

Top Pick Reach Stacker

17

7.17

Top Pick Reach Stacker



18

7.18

Liner Installation

7.19

20’ Container with Liner

7.20

Excavator

7.21

Excavator

7.22

Container Loading

23

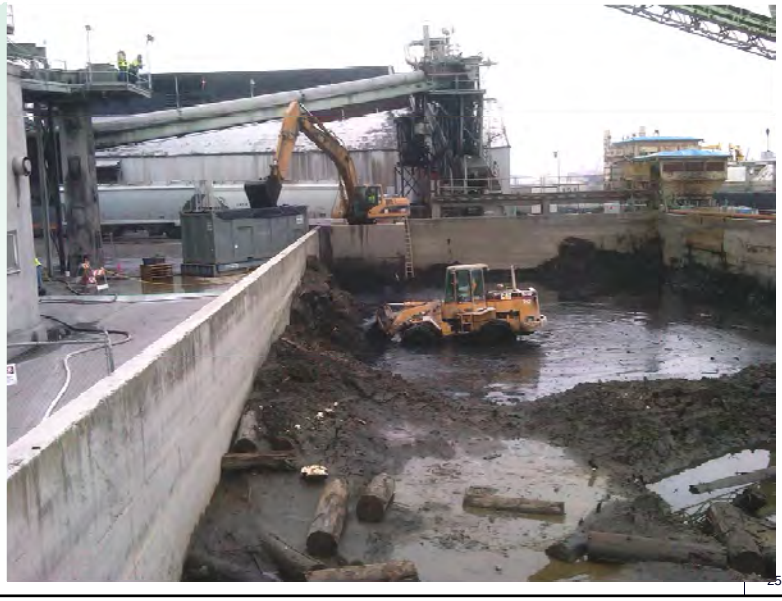
7.23

Loaded Containers

24

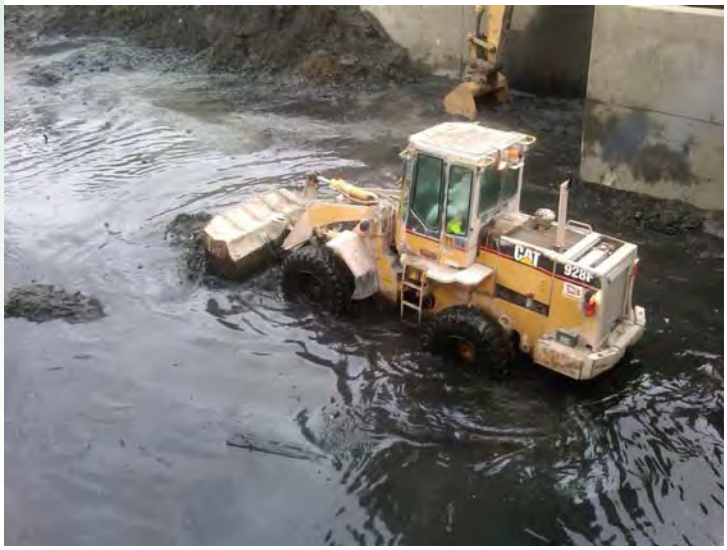
7.24

Excavator



7.25

Vault Cleaning



7.26

Vault Cleaning

7.27

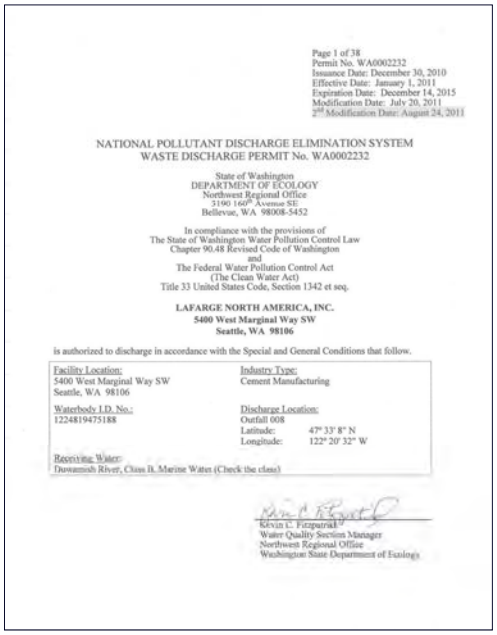
Clean Vault

7.28

Roosevelt Landfill Trailer Tipper

Permits

- NPDES minor modification
  - SWPPP amendment No. 2
- King County Solid Waste Permit



Page 1 of 38
Permit No. WA0002232
Issuance Date: December 30, 2010
Effective Date: January 1, 2011
Expiration Date: December 14, 2015
Modification Date: July 20, 2011
2nd Modification Date: August 24, 2011

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT No. WA0002232

State of Washington
DEPARTMENT OF ECOLOGY
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1342 et seq.

LAFARGE NORTH AMERICA, INC.
5400 West Marginal Way SW
Seattle, WA 98106

is authorized to discharge in accordance with the Special and General Conditions that follow.

Facility Location: 5400 West Marginal Way SW Seattle, WA 98106	Industry Type: Cement Manufacturing
Waterbody I.D. No.: 122481947518 8	Discharge Location: Outfall 008 Latitude: 47° 33' 8" N Longitude: 122° 20' 32" W
Receiving Water: Duwamish River, Class B, Marine Water (Check the class)	

Kevin C. Fitzpatrick
Water Quality Section Manager
Northwest Regional Office
Washington State Department of Ecology

Partnerships

- Win – Win partnerships
- Lafarge is motivated for successful projects
- Mutual Priorities
  - Safety
  - Environmental stewardship
  - Ethical standards

Questions?

What questions or comments do you have?

Sediment Bioavailability Assessment Using Passive Samplers

Mandy Michalsen, PhD, PE
John Wakeman
Seattle District USACE

Prof. Danny Reible, PE
Xioang Lu
University of Texas at Austin

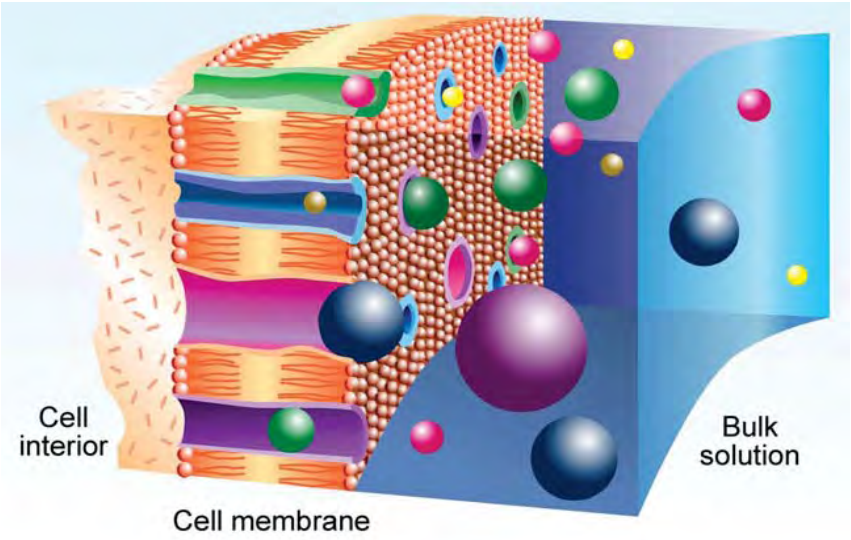
Howard Orlean RPM, Justine Barton
Ravi Sanga RPM, Rene Fuentes, Maja Tritt
EPA Region 10

US Army Corps of Engineers ®

1

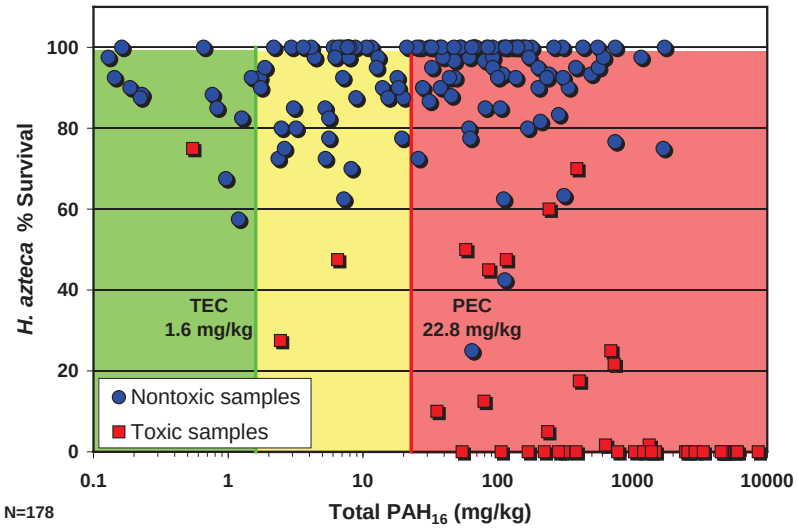
8.1

Bioavailability



8.2

Bulk Sediment Concentrations Are Poor Predictors of Toxicity



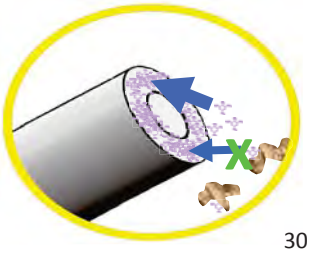
Source: Survey To Characterize PAH Toxicity and Bioavailability at MGP and Al Smelter Sites, accomplished by Alcoa and SCBA. http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/FINAL_2006_SMARM_minutes.pdf

Estimating Bioavailability from Bulk Sediment Has Limitations

- Prediction of toxicity – from EPA (2003) and EPA (2007):
  - Use Equilibrium Partitioning (EqP) to determine concentration
  - Calculate the ratios of individual PAHs to their Final Chronic Values (“Toxicity Units”, TU)
  - Add these to determine ΣTU
  - Compare to a ΣTU of 1.0 – the probable effect level using the narcosis model
- Caveats:
  - EqP overestimates toxicity by 100x.
  - Also, “black carbon” adjusted EqP tends to under predict toxicity (Gschwend, et al. 2010)

Measuring Porewater Contaminants

- Solid Phase MicroExtraction (SPME)
- Sorbent Polymer PDMS (poly-dimethylsiloxane)
  - Thickness of glass core: 114-108 µm
  - Thickness of PDMS coating: 30-31 µm
  - Volume of coating: 13.55 (±0.02) µL PDMS per meter of fiber
  - Easily capable of measuring ng/L concentrations
- Field deployable system under development
- ng/L detection with 1 cm resolution



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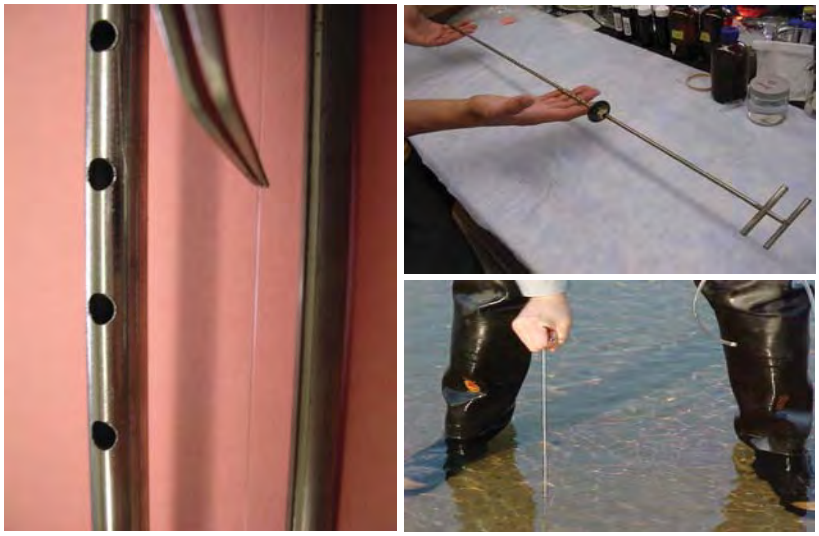
8.5

Solid-Phase Microextration (SPME)



8.6

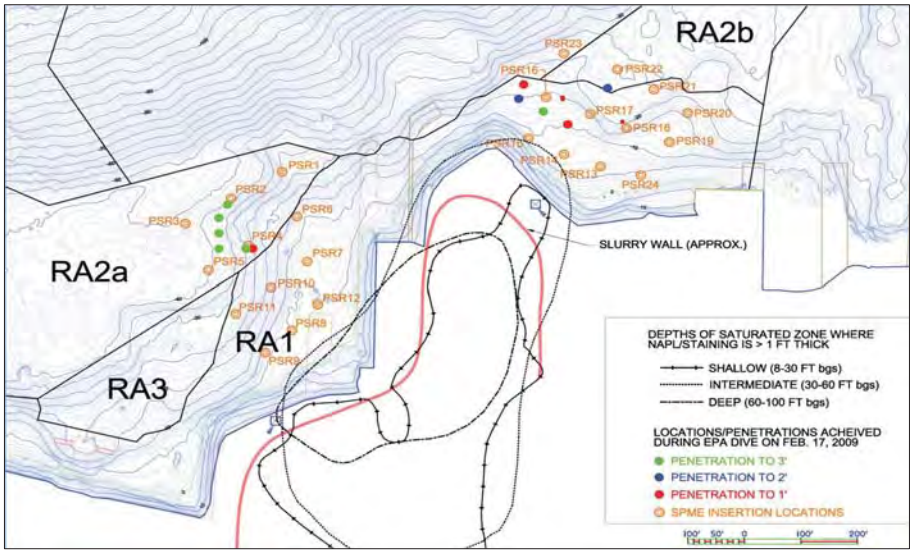
Pacific Sound Resources (PSR) Superfund Site, EPA Region 10

- Site Background
  - Wood Treatment Operation 1909-1994
  - Upland area unit 25 acres
  - Marine sediment unit 58 acres
  - Remedial action included dredging, capping and institutional controls and upland source control measures
- Study Objectives
  - Measure near-surface porewater concentrations
    - *Exceedance of surface water quality criteria?*
  - Measure porewater concentrations with depth in the sediment cap
    - *Concentration gradients indicate contaminant migration through cap?*

7

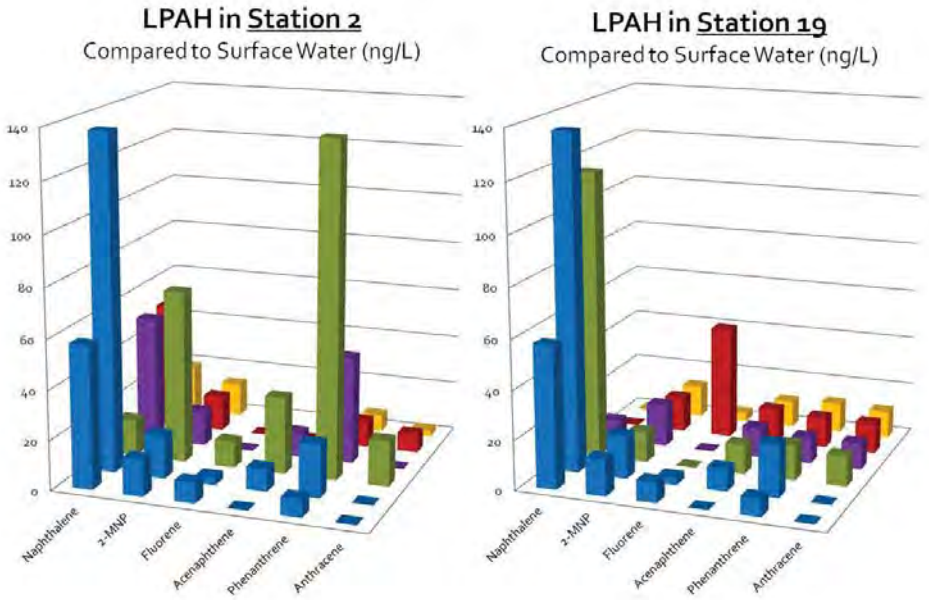
8.7

SPME Fiber Field Demonstration at PSR



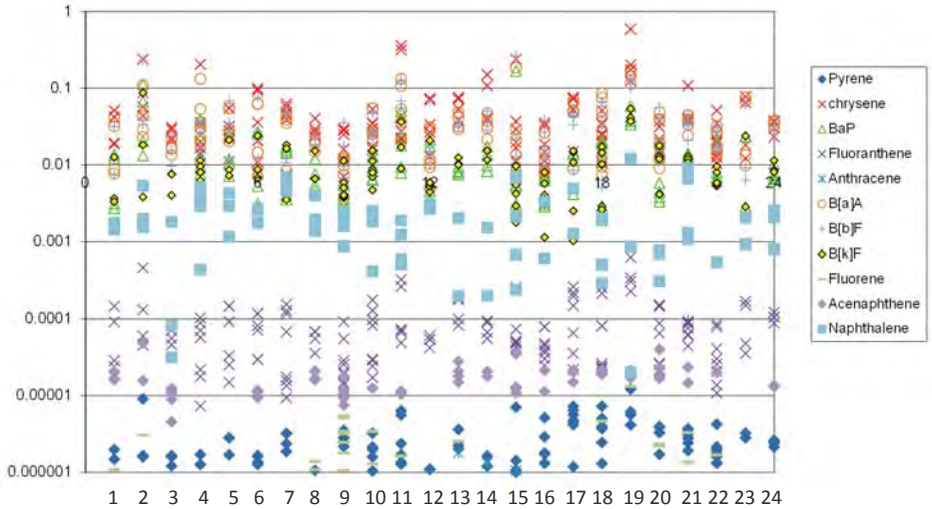
8.8

SPME Fiber Results



8.9

SPME Fiber Results



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8.10

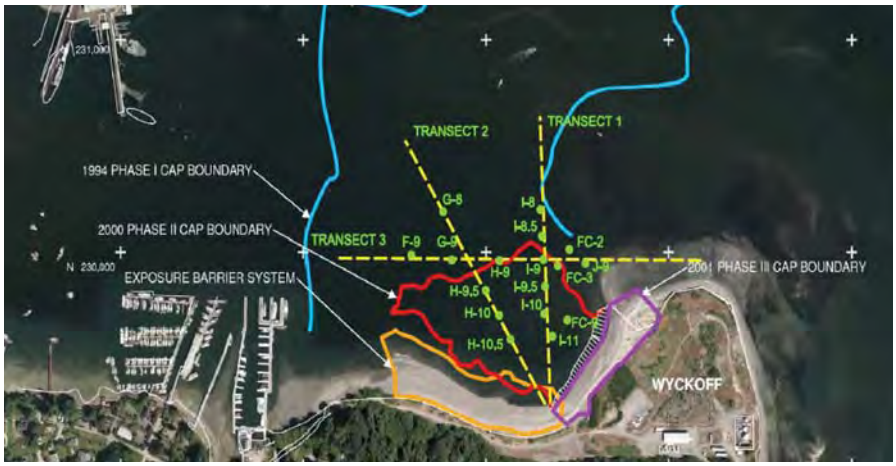
SPME Fiber Field Demonstration at Wyckoff/Eagle Harbor Superfund Site

- Site Background
  - Wood treatment operation
  - Added to NPL in 1987
  - COCs include PAHs, PCP and metals
  - Remedial actions included capping ~ 70 acres with clean sediment in addition to upland source control measures
- SPME Study Objectives
  - Measure near-surface porewater concentrations
    - *Exceedance of surface water quality criteria?*
  - Measure porewater concentrations with depth in the sediment cap
    - *Concentration gradients indicate contaminant migration through cap?*
  - Compare colocated bulk sediment and porewater results
    - *Would the two methods support different conclusions if used alone?*

11

8.11

SPME Fiber Field Demonstration at Wyckoff/Eagle Harbor



12

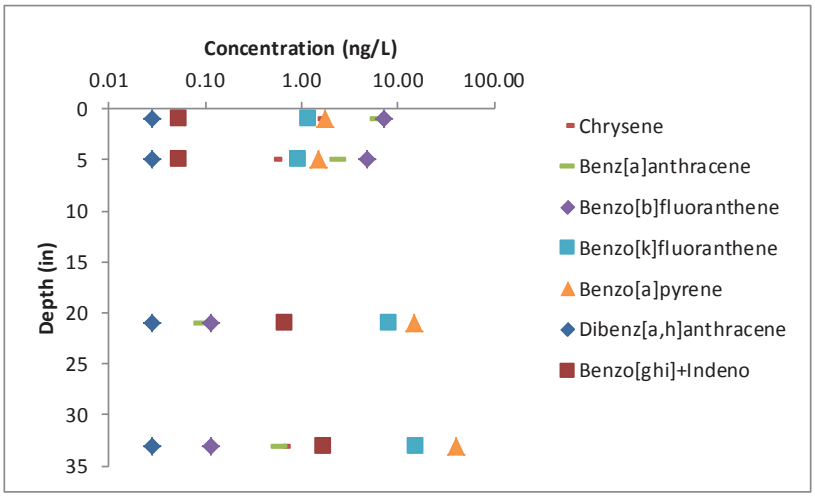
8.12

Corrections for Steady State

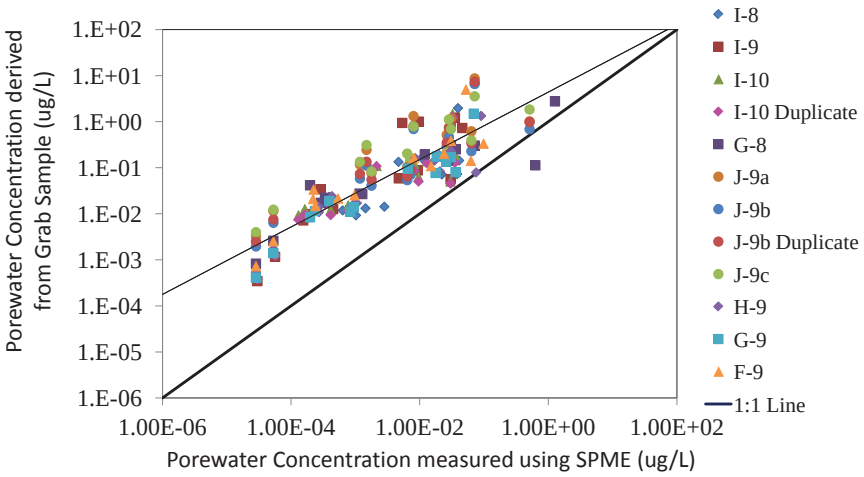
- Deuterated PAHs are ideal performance reference compounds (Gschwend et al. 2009)
  - fluoranthene-d10
    chrysene-d12
    benzo[b]fluoranthene -d12
    and
    dibenz[a,h]anthracene -d14

Compound	logKow	Correction Factor for 1000/1071µm fiber	Correction Factor for 1000/1060 µm fiber
Naphthalene	3.37	0.90	0.91
Acenaphthene	3.92	0.84	0.87
Fluorene	4.18	0.81	0.84
Anthracene	4.54	0.76	0.79
Phenanthrene	4.57	0.75	0.79
Pyrene	5.18	0.64	0.68
Fluoranthene	5.22	0.63	0.67
Benzo[b]fluroanthene	5.8	0.51	0.56
Chrysene	5.86	0.50	0.54
Benz[a]anthracene	5.91	0.49	0.53
Benzo[k]fluroanthene	6	0.47	0.51
Benzo[a]pyrene	6.04	0.46	0.50
Benzo[ghi]perylene +Indeno(1,2,3-cd)pyrene	6.5	0.36	0.41
Dibenz[a,h]anthracene	6.75	0.32	0.36

Concentration Depth Profiles Allow Assessment of Through-Cap Migration



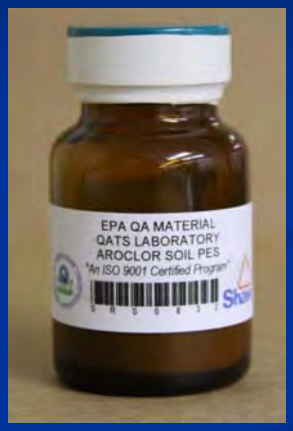
Bulk Sediment Estimated Porewater vs. Measured Porewater



Take Home Messages

- Benefits of direct porewater measure
  - Better proxy for bioavailability
  - Deployable in near surface sediment/surface water column
  - cm-level depth resolution and ng/L DLs allow assessment of concentration gradients/migration potential
  - Not cost prohibitive**
- Ideal approach for monitoring activated carbon-amended sediments
  (Gidley et al. *Environ. Sci. Technol.* 2012, 46, 5032–5039)

Regional Sediment Reference Material (SRM)



9.1

What is the Regional SRM?

- QA/QC tool -- a known sediment reference material concurrently analyzed with environmental samples
- Targets regionally important COCs -- dioxins & PCBs
- Independent, stand alone material from local waters, not directly linked to a specific location, with COCs at levels close to screening levels
- Developed by DMMP work group working with EPA OEA via the QATS contractor (Shaw Environmental, Las Vegas)

9.2

Field Sampling

- Targeted dioxin 4-10 ng/kg TEQ dry weight; Aroclors 70-130 ug/kg dry weight
- Used double Van Veen to sample Budd Inlet, T-117, and Carr Inlet – 27 5-gal buckets
- Overnight shipped to QATS lab, Las Vegas
- Field sampling report July 2011 – includes QAPP and all sampling specifics

9.3

T-117 typical sample (09/23/2010)

9.4

Field sieving T-117 (09/23/2010)

9.5

Carr Inlet – weighing bucket (09/27/2010)

9.6

SRM Processing

- Target location sediments were air dried, sieved using 60 mesh sieve (<250 um) per ASTM E-11, and homogenized separately
- Initial range finding chemical analyses (Aroclors and Dioxins/Furans, Grain Size, TOC) were conducted
- Our intention was to combine and homogenize the samples to create 100 kg of final SRM
- T-117 selected

United States Environmental Protection Agency

Department of Ecology

Washington State Department of Natural Resources

9.7

T-117 air drying (9/30/2010)

United States Environmental Protection Agency

Department of Ecology

Washington State Department of Natural Resources

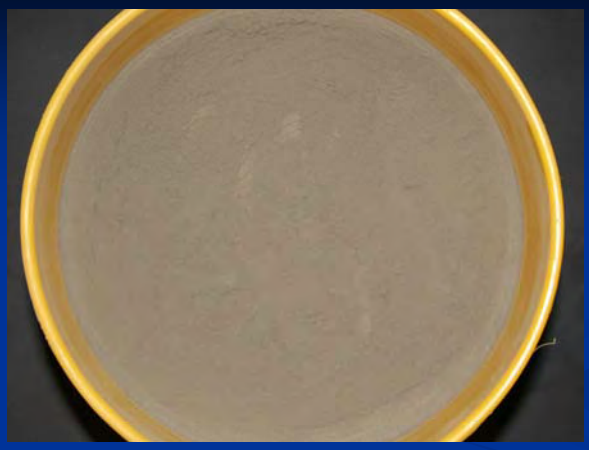
9.8

T-117 sample retained on 20 mesh sieve (>850 um) 10/19/2010

9.9

T-117 dry V-blender process (10/19/2010)

9.10



T-117 bulk with 60 mesh sieve (<250 um)

9.11

Bottles with EPA QA program labels

9.12

Acceptance Limits

- Guidance values are based on round robin data, implications associated with meeting or not is case by case depending on goals of a program/project
- For upcoming dredging year 2013, the DMMP will review results on a case by case basis and will consider the values advisory

Aroclors

- 12 lab round robin (including commercial and CLP labs)
- Acceptance limit for Aroclor 1260 set at the 95% confidence interval:
  - Warning low 41 ug/kg
  - Warning high 180 ug/kg
  - Average concentration 108 ug/kg

CDD/CDF

- 10 lab round robin (including commercial and CLP labs)
- Acceptance limit of +- 50% action low and action high set for each congener
- Using the action low and high the TEQ = 2.73 to 8.2 ng/kg dry weight (average concentrations TEQ = 5.47 ng/kg dry weight)

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Washington State Department of Natural Resources

Analyte	CAS No.	Ave. Conc. ng/kg	Action Low (-50%)	Action High (+50%)
1,2,3,4,6,7,8-HpCDD	35822-46-9	90.6	45.3	136
1,2,3,4,6,7,8-HpCDF	67562-39-4	18.7	9.36	28.1
1,2,3,4,7,8,9-HpCDF	55673-89-7	1.63	0.815	2.44
1,2,3,4,7,8-HxCDD	39227-28-6	1.59	0.797	2.39
1,2,3,4,7,8-HxCDF	70648-26-9	3.02	1.51	4.53
1,2,3,6,7,8-HxCDD	67653-85-7	3.88	1.94	5.82
1,2,3,6,7,8-HxCDF	57117-44-9	1.09	0.545	1.64
1,2,3,7,8,9-HxCDD	19408-74-3	3.04	1.52	4.55
1,2,3,7,8,9-HxCDF	72918-21-9	0.511	0.255	0.77
1,2,3,7,8-PeCDD	40321-76-4	1.08	0.542	1.63
1,2,3,7,8-PeCDF	57117-41-6	1.23	0.613	1.84
2,3,4,6,7,8-HxCDF	60851-34-5	1.83	0.917	2.75
2,3,4,7,8-PeCDF	57117-31-4	1.07	0.533	1.60
2,3,7,8-TCDD	1746-01-6	1.05	0.525	1.57
2,3,7,8-TCDF	51207-31-9	1.11	0.557	1.67
OCDD	3268-87-9	811	406	1217
OCDF	39001-02-0	58.4	29.2	87.6

SRM Distribution

- Finalizing guidance for distribution and reporting – draft final
- Agency contacts / authorized agency requesters: Corps DMMO, Laura Inouye – Ecology, Justine Barton / Erika Hoffman – EPA
- Puget Sound SRM Request Form – electronic fillable form

9.17

SRM Distribution (con't)

- Form processed through Donald Brown EPA Region 10 SRM manager to Shaw Environmental
- SRM will arrive with handling and storage instructions, data reporting requirements, chain of custody, etc.

9.18

SRM Distribution (con't)

- All information relative to the SRM, including associated QA data, will be sent to original agency contact – who will see it is submitted to Donald Brown
- Shaw Environmental will use reported data to recalculate acceptance limits – likely after approx. 30 new data points received

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9.19

Long-term Management

- Shaw Environmental will store and maintain SRM, incl. stability testing and database to track reported results over time

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9.20

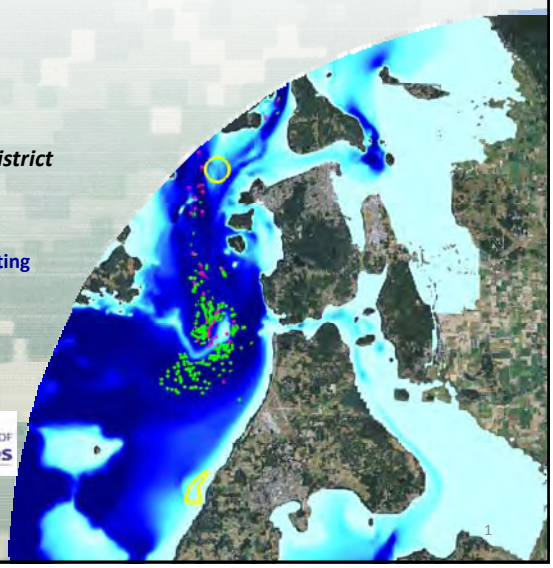
Next steps:

- CB congener data
- Finalize distribution and reporting guidance
- Document production of the SRM

Dispersive Site - Fate and Transport Modeling & Analysis
Rosario Strait, Port Townsend, and Port Angeles

Scott Brown, Coastal Engineer
Dave Michalsen, PE, Coastal Engineer
U.S. Army Corps of Engineers, Seattle District

Sediment Management Annual Review Meeting
2 May 2012



US Army Corps of Engineers
BUILDING STRONG.

1

10.1

Purpose and Scope

- What is the potential for dredged materials placed at the dispersive open water PSDDA sites to be transported toward surrounding shellfish habitat?
  - At the request of stakeholders, in 2011 the DMMP agencies initiated a numerical modeling analysis and field study to help answer this question

10.2

Outline

- Shellfish harvesting areas
- Dispersive PSDDA Sites – background and original assumptions for site locations
- ADCP Field data collection (August 2011)
- Numerical modeling analysis
  - Strategy, Calibration/Validation, Production Runs
- Results & Discussion
- Conclusions

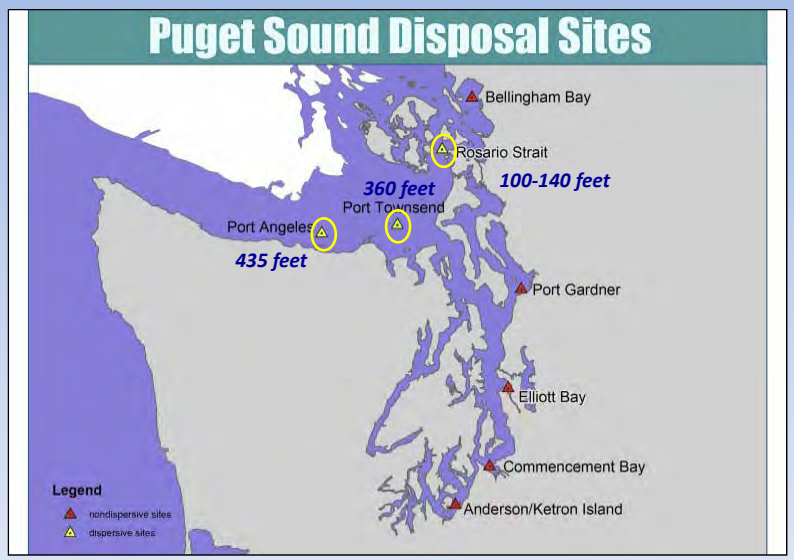
10.3

Shellfish harvesting areas

- WDFW Commercial Geoduck Fisheries
  - Freshwater Bay (near Port Angeles)
  - Dungeness / Sequim Bay (near Port Townsend)
  - Protection Island (near Port Townsend)
  - Point Partridge (Whidbey Island)

10.4

Background



10.5

Site Dimensions & Usage

Dispersive PSDDA Site	Depth (feet)	Dimensions	Dredging Year[1] Usage	Cumulative Volume 1989-2011 (CY)
Port Angeles	435	7000' x 7000' circular	91, 92, 93, 94, 95, 96, 98, 99, 02, 03, 04, 05, 06, 07, 09, 11	**22,344**
Port Townsend	361	7000' x 7000' circular	93, 98, 99, 07, 09,10	**54,777**
Rosario Strait	97-142	6000' x 6000' circular	96	**1,978,623**

[1] Dredging year: June 16 through June 15 of ensuing year. A dredging year overlaps two calendar years

10.6

Initial Site Selection Criteria (PSDDA 1989)

- Maximum dispersion of the material is desired; therefore the site should be in an area of high current (i.e., average current speed > 25 cm/sec).
- The site should be buffered by a minimum of 1 nautical mile from shorelines and human use areas as measured from the edge of the disposal zone
- The site should be located at a minimum depth of 180 feet to avoid sensitive biological resources.
- The sites should be located so that the ultimate fate of dispersed material will not have a significant adverse impact on natural resources.

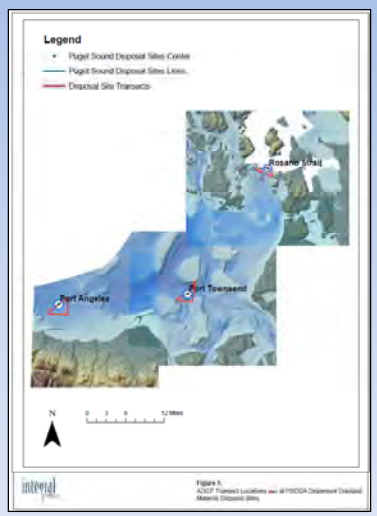
10.7

Original Fate & Transport assumptions (EHI 1987; Crean 1983)

- Available drifter data were utilized to estimate far field dispersion from the placement sites.
  - Drift cards were placed near the Port Townsend site in 1976 and 1980 and were observed to reach beaches within the inner Strait of Juan de Fuca.
  - It was speculated dredge material residing in the surface microlayer (top 0.1 mm of water column) following release is expected to do the same.
  - It was assumed a maximum of 5% of the original dredge volume could be suspended within the upper water column (i.e. top 1 m surface layer)

10.8

Field Data Collection

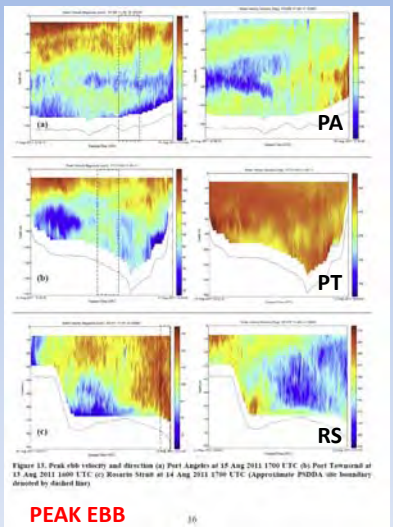


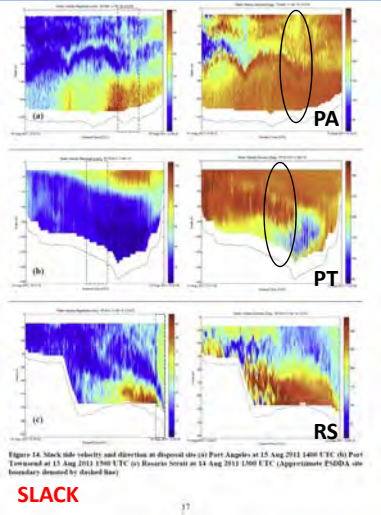
12-16 August 2011 Current Profile Survey

- Integral Consulting Inc. (WADNR task order)
- 300 kHz RDI/Teledyne Workhorse Sentinel ADCP
  - 2 to 4 meter depth bins
- Transect loops over 24 hrs
  - PA: 8
  - PT: 6
  - RS: 12

10.9

Field Data Collection





10.10

Numerical Modeling

- Strategy - First Tier analysis

- 2D depth averaged hydrodynamic model
  - Should be acceptable for determining trends in net sediment transport
  - LATER - Add levels of complexity if warranted
    - 3D circulation (i.e. upwelling/vertical mixing)
      - Wind/Wave generated currents
      - Freshwater plumes from Elwha/Dungeness R.
      - Etc.

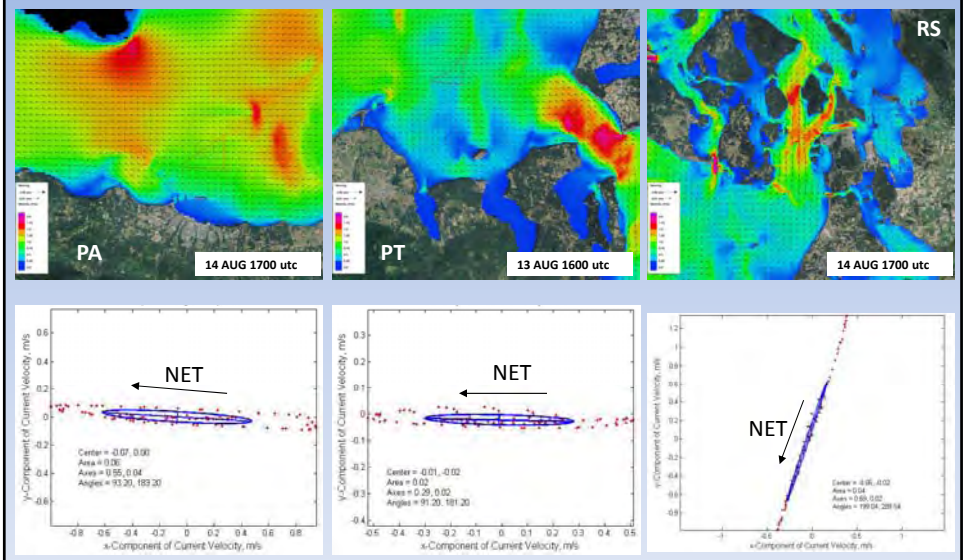
10.11

Coastal Modeling System – FLOW (Militello et al. 2004)

- 2D depth averaged tidal circulation model
- Forced by water surface elevation time series generated by tidal constituents at two offshore boundaries
  - Neah Bay
  - Cherry Point
- Telescoping grid for high resolution
- Implicit numerical solver allows longer time steps for longer model simulations

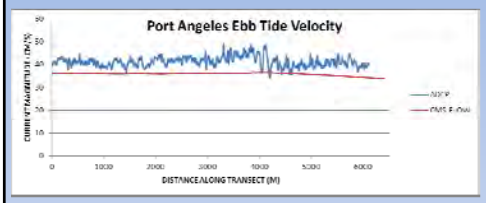
10.12

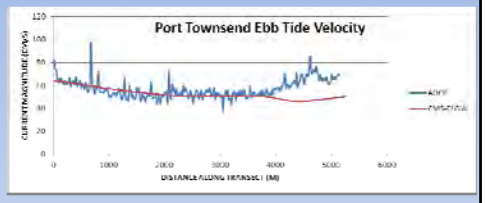
CMS-FLOW Results

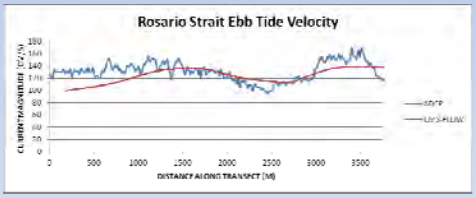


10.13

CMS-FLOW Validation







10.14

Coastal Modeling System – PTM (Demirbilek et al. 2008)

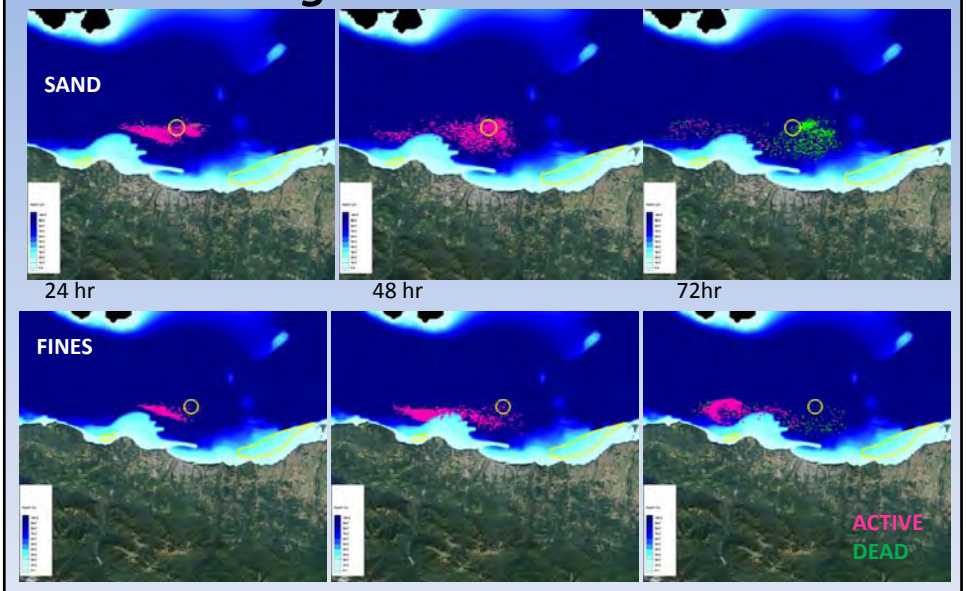
- Lagrangian particle tracking model (PTM)
  - tracks individual particles through space & time
- Simulates process of advection, diffusion, settling, deposition, and re-suspension
- Sediment source release is defined by mass per unit time (kg/s)
- Sediment grain size specified (d35, d50, d90)

PTM - Model Scenarios

Scenario	Project	DMMU	DMMU Volume (CY)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	d_{50} (mm)
Port Angeles (sand)[1]	USACE Port Townsend O&M (DY09)	C2	500	0.6	5	94.9	0.3	0.1
Port Angeles **(fines)**	Holnam Inc. / Ideal Cement (DY96)	C1	18,200	**5.5**	**47.8**	**46.7**	**0.3**	**0.03**
Port Townsend (sand)	USACE Port Townsend O&M (DY09)	C2	500	0.6	5	94.9	0.3	0.1
Port Townsend **(fines)**	Point Hudson Marina (DY06)	C1	10,300	**13.8**	**45.7**	**40.4**	**0**	**0.03**
Rosario Strait (sand)	USACE Swinomish (DY95)	C2	48,000	0	0	92	8	0.2
Rosario Strait **(fines)**	USACE Bellingham O&M / Squalicum Waterway (DY92)	C8	4,073	**10.3**	**90.1**	**1.4**	**0**	**0.002**

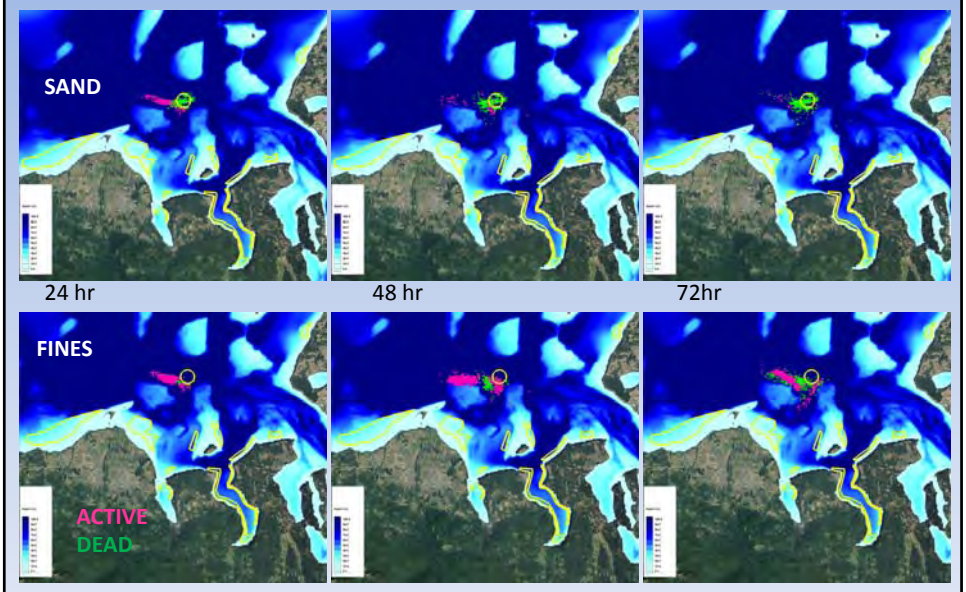
[1]hypothetical scenario; did not actually occur

Port Angeles Site – PTM Results



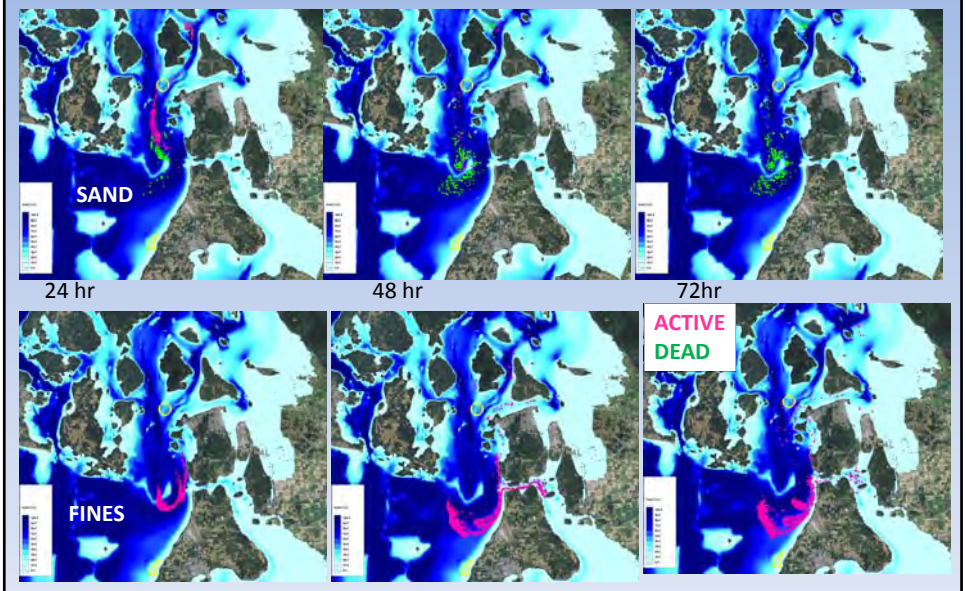
10.17

Port Townsend Site – PTM Results



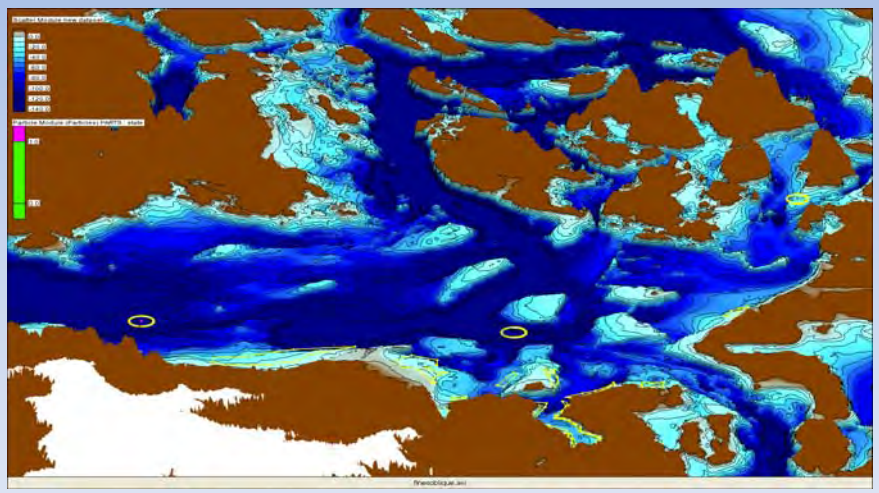
10.18

Rosario Strait Site -Results



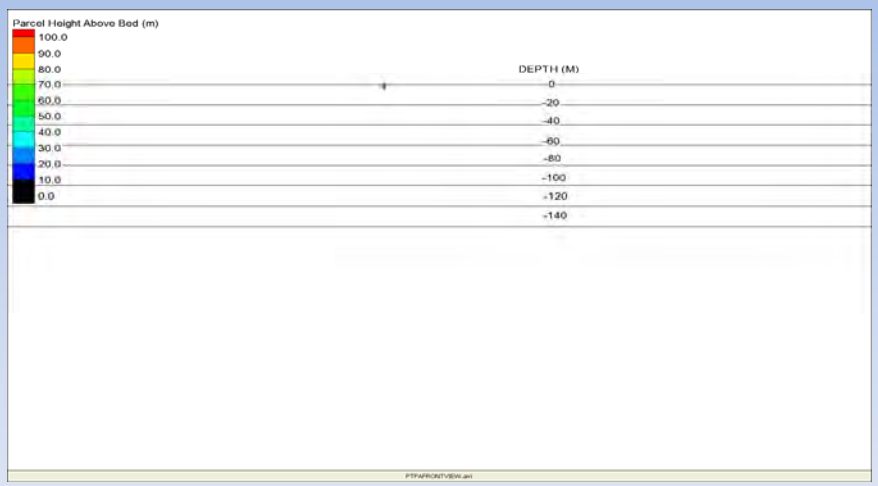
10.19

PTM Results (Video)



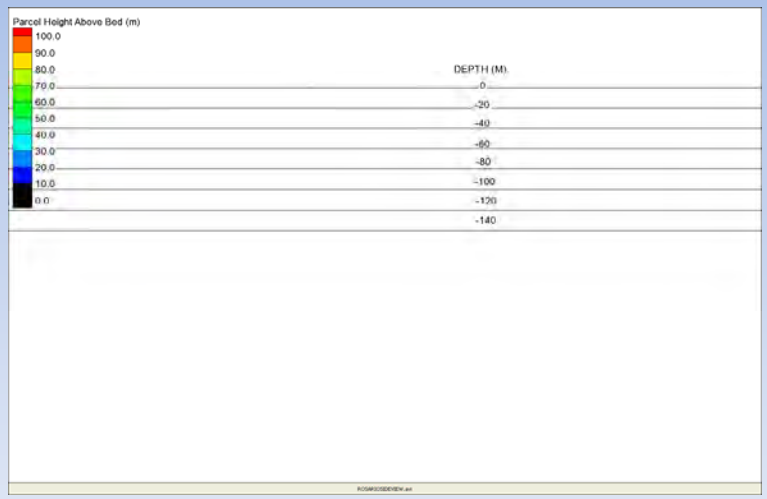
10.20

Vertical Distribution of Sediment (PA & PT)



10.21

Vertical Distribution of Sediment (Rosario Strait)



10.22

Results / Discussion

- Peak spring tides (ebb/flood) observed to have uniform velocity and direction with depth
- Vertical stratification in currents most pronounced during slack tide at Port Townsend/Port Angeles
- ***Sands scenario*** - Less than **10%** of sediments are mobile at PT/RS after 72 hours
- ***Sands scenario*** – **100%** of sediments are mobile at PA after 72 hours
- ***Fines scenario*** – sediments remain mobile in lower water column after 72 hour simulation (all sites)

Results / Discussion

- ***Fines Scenarios*** – 99% of sediments are below 1m surface layer after 18 hours
  - In 2D sense, this suggests no mechanism for onshore transport of sediments as fate would be driven almost entirely by tidal currents

Conclusions

- Recent measured data & modeling analysis aligns with initial fate and transport assumptions (EHI 1987) during original site placement
  - However, there is likely less then 5% of dredge material residing in surface layer after 24 hours
  - model results indicate <1%.
- Sediment parcels were not present in WDFW shellfish areas after 72 hours.
  - After 72 hours model simulations become less accurate due to multiple uncertainties affecting circulation such as wind, waves, etc.

References

Crean, P.B.. 1983. The development of rotating, non-linear numerical models (GF2, GF3) simulating barotropic mixed tides in a complex coastal system located between Vancouver Island and the Mainland. Can. Tech. Rept. Hydrogr. Ocean Sci. 31-65 p.

Demirbilek, Z., Connell, K. J., MacDonald, N.J., and Zundel, A. K. 2008. Particle Tracking Model in the SMS 10: IV. Link to Coastal Modeling System, Coastal and Hydraulics Engineering Technical Note ERDC/CHL CHETN-IV-71. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Evans Hamilton Inc. (EHI). 1987. Literature search on dispersive sites for dredged material in northern Puget Sound and Strait of Juan de Fuca.

Militello, A., Reed, C. W., Zundel, A. K., and Kraus, N. C. 2004. Two dimensional depth-averaged circulation model M2D: Version 2.0, Report 1: Technical documentation and user's guide, Coastal and Hydraulics Laboratory Technical Report ERDC/CHL TR-04-2, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

PSDDA 1989. Disposal Site Selection Technical Appendix – Phase II (North and South Puget Sound).

Bioassay Endpoint Refinements: Neanthes Growth and Bivalve Larvae Bioassays

David Kendall (Corps)
Russ McMillan (Ecology)
Bill Gardiner, Brian Hester, Jack Word (Newfields, LLC)

11.1

Clarification Purpose

To provide method modifications intended to reduce confounding effects on test performance for:

- ❑ Juvenile ***Neanthes*** growth bioassay
- ❑ ***Mytilus galloprovincialis*** bivalve larval test

11.2

Background

- Public Issue Papers brought to the attention of DMMP and SMS at 2010 SMARM and 2011 SMARM
- DMMP agencies subsequently reviewed recommended protocol adjustments and decided to evaluate:
  - 2010 monitoring at Port Gardner
  - Federal Dredging Projects with toxicity testing:
    - Grays Harbor O&M – 2011
    - Grays Harbor O&M – 2012
    - Duwamish O&M – 2011
- SMS elected to apply protocol adjustments to selective cleanup sites in woodwaste cleanup areas:
  - Port Gamble

United States Environmental Protection Agency · Department of Ecology State of Washington · Washington State Department of Natural Resources

11.3

Bioassay Protocol Adjustments History (1989 – present)

- Between 1990 – present the DMMP agencies and SMS implemented twenty-seven changes to existing bioassay protocols to improve the performance of tests (http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=dmmo&pagename=Bioassays)
  - Five clarification papers focused on the echinoderm/bivalve larval test
  - Five clarification papers and one issue paper focused on the *Neanthes* growth bioassay
  - Five clarification papers focused on the Amphipod bioassay

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11.4

Neanthes Growth Test - Concerns

- Reference failures particularly with fine sediments
- Varying amounts of sediment appearing in worms
- Coarse sand used as control substrate
- Other biomass-based tests with sediment "engulfers" use ash-free-dry weight to remove sediment mass
  - ***Chironomus* test with "worm-like" larvae (Sibley et al. 1997)**
  - ***Neanthes* test developed by USACE-ERDC**

11.5

Neanthes Test

- Sediment in gut of *Neanthes* worms can affect results
  - Federal projects in Grays Harbor have experienced frequent performance failures
- Comparisons of varying grain sizes can affect reference or treatment performance
- AFDW eliminates source of variability and allows for a more accurate comparison of changes in tissue biomass
- AFDW is consistent with other national methods
- Test, endpoint (growth), and criteria remain unchanged and consistent with PSEP, DMMP and SMS
- Test interpretation is based on comparison to reference sediment for DMMP and SMS

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11.6

Percentage of *Neanthes* dry weight attributable to sediment retained in the gut

- Controls
  - DMMP Average: 31 % (22–37%)
  - SMS Port Gamble Average: 21%
  - Totals: SMS Average: 34 % (21–46 %)
- Reference
  - DMMP Average: 20 % (15–31%)
  - SMS Port Gamble Average: 21%
  - Totals: SMS Average: 28 % (19–34 %)
- Treatments
  - DMMP Average: 18% (11 – 28%)
  - SMS Port Gamble Average: 15 % (7 – 18 %)
  - Totals: SMS Average: 26 % (17-40 %)

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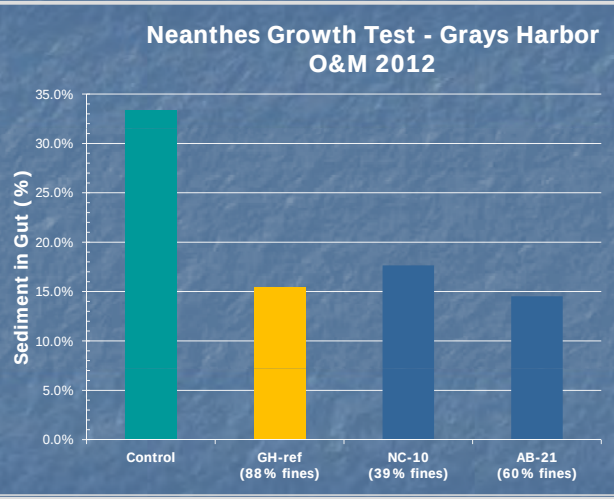
11.7

Example: Grays Harbor O&M 2012



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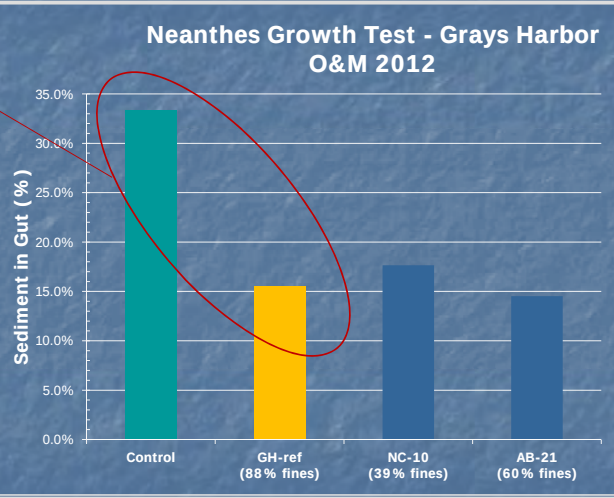
11.8

Example: Grays Harbor O&M 2012

Can lead to reference failures



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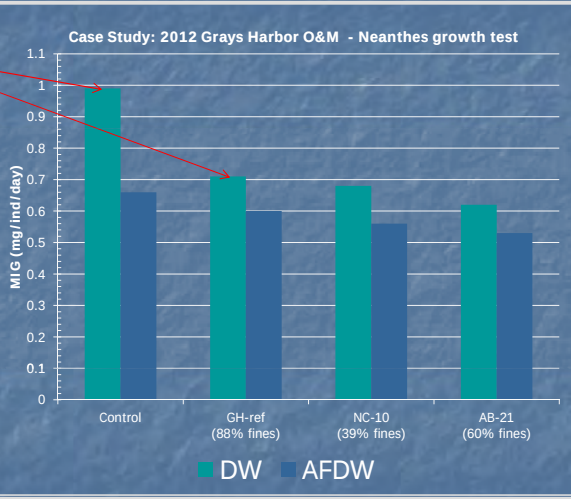
11.9

Example: Grays Harbor O&M 2012

Reference performance failure, relative to control



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11.10

AFDW Protocol Modification

- At the end of 20-day exposures, place all worms in pre-labelled, pre-ashed (500˚C for 2 hours) tared aluminum weigh boats
- Dry tissues for 24 hours at 60˚C
- Measure "dry weight"
- Bake tissues in Muffle Furnace at 500˚C for 2 hours
- Get ashed weight (e.g., weight of inorganic residue)
- Subtract ashed weight from dry weight

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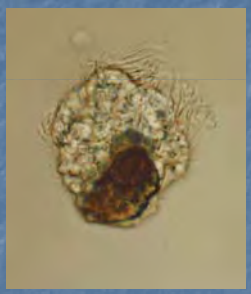
11.11

PSEP Bivalve Larval Test

Early in test

Non-swimming larvae rest on bottom, early cell division



Approximate 12-24h

Swimming forms rise off of sediment, begin gut/shell development

Later in test

Swimming, normal D-larvae, feeding in water column

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11.12

PSEP Bivalve Larval Test - Concerns

- Indiscriminate failures in sediment with fine sediments or flocculent layers, particularly fine clay
- Larval failures not related to sediment chemistry
- Low to intermediate recoveries of larvae, not delayed
- All recovered larvae were normal "D-shaped" larvae
- Substantial layer of fine-grained material settled on sediment surface during first 12-24 hours of test
- Layer is not a natural occurrence, artifact of procedure

PSEP Larval Test - Concerns

- Entrainment has long been recognized as a concern for the benthic larval test
  - 1989 PSDDA Larval Workshop
  - 1990 PSDDA Bioassay Workshop
  - EPA Larval Test Methods Refinements (1993)
- "Resuspension" method developed in 2009 to attempt to recover bivalve larvae that may be buried in flocculent layers
- To address lab artifact, not physical effects that may be present in the field

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Perforated Plunger used to gently resuspend sediments

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11.15

Resuspension effects: Port Gamble RI, 2011

- 15 of 31 treatments were unchanged
- 8 of 16 SQS exceedances changed to passes
- 5 of 6 CSL exceedances changed to passes
- 1 of 6 CSL exceedances changed to an SQS exceedance
- 2 passes changed to SQS exceedances as a result of improved reference performance

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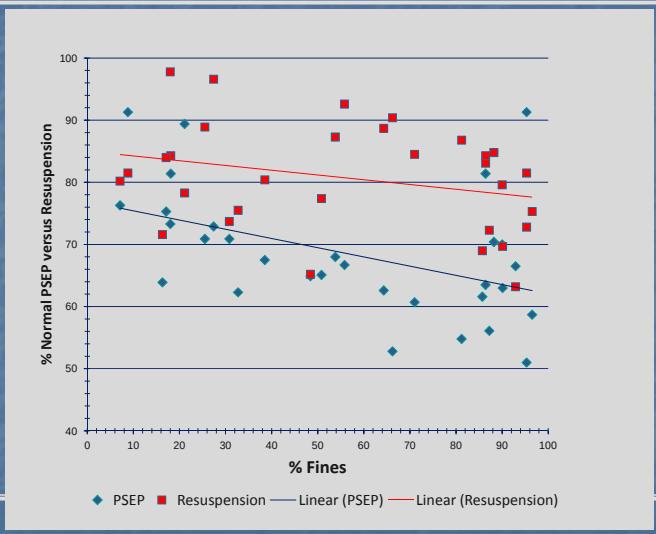
11.16

Scatterplot of % Fines versus PSEP and Resuspension Protocol (Port Gamble Remedial Investigation 2011)



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11.17

Resuspension Protocol Summary

- At the end of exposure period resuspend contents of test for approximately 10 seconds, until the sediment and water are homogenized
- Note the time resuspension initiated
- Corresponding control & reference sediments are also mixed at this time
- Allow at least 6 to 8 hours for sediment to settle; sufficient settling to allow enumeration
- After settling is complete, test is terminated and counted following the standard PSEP method

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11.18

Regulatory Tool Improvement Process

- The Sediment Management Annual Review Meeting (SMARM) process provides the forum for DMMP and SMS to make changes to regulatory tools when needed.
- Sediment Management Standards provide flexibility for implementing new protocols:
  - Section -110(6): case specific decisions using latest science and best professional judgment.
  - Section -130: Use of alternate methods reflective of the latest science and best professional judgment of Ecology.
  - Identification and discussion of SMS rule, policy, technical and scientific protocols.

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11.19

Proposed DMMP/SMS Changes

- ***Neanthes* Growth Test** – Report results on an ash-free dry-weight basis rather than on a dry-weight basis. The AFDW procedure eliminates weight from sediment in the gut, thereby providing a more accurate measurement of the change in biomass during the exposure period.

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11.20

Proposed DMMP/SMS changes

- **Bivalve Larval Test** – Add the resuspension procedure to the standard PSEP protocol when testing sediments with high concentrations of fines, wood waste or other flocculent material. For routine testing of sediments with lower fractions of fines, wood waste or flocculent material, the standard PSEP protocol should be used.
  - DMMP Dredging project proponents may elect to use the resuspension protocol if they have concerns about false positives due to entrainment.
  - Ecology SMS or the PLP may elect to use the resuspension protocol at their discretion if they have concerns about false positives due to larval entrainment.

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11.21

Echinoderm Larval Test: Requires Further Evaluation

- The DMMP and SMS intend to evaluate the effects of the resuspension endpoint protocol on the Echinoderm Larval Test (*Dendraster excentricus*) to assess potential protocol improvements relative to confounding effects from larvae entrainment

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11.22

Questions ?
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Clarification/Issue Papers

- Use of Practical Quantitation Limits – SMS
- Bioassay Endpoint Refinements – SMS/DMMP
- Integration of Dioxin Data into Ranking Determinations - DMMP
- Transition from DAIS to EIM - DMMP

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12.1

Integration of Dioxin Data into Ranking Determinations

- Use best professional judgment
- Case-by-case basis
- Sampling density appropriate for project and subareas within a project

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12.2

Transition from DAIS to EIM

- DAIS has become outdated and difficult to maintain
- EIM has become the primary repository for environmental data
- Transition to EIM to occur in DY13

12.3

Comments

- Papers can be found on the DMMO website:

http://www.nws.usace.army.mil

Search for
Dredged Material Management

- Comments due July 2
- Send comments to author or DMMO staff member

12.4

THANK YOU !!

24th Sediment Management
Annual Review Meeting

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13.1

Comments Due July 2, 2012

Submit Comments to
david.r.kendall@usace.army.mil

13.2

13.3

APPENDIX V

2012 Agency Issue and Clarification Papers

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DMMP/SMS CLARIFICATION PAPER

BIOASSAY ENDPOINT REFINEMENTS: BIVALVE LARVAL AND NEANTHES GROWTH BIOASSAYS

Prepared by David Kendall, (U.S. Army Corps of Engineers) and Russ McMillan, (Washington State Department of Ecology) for the DMMP agencies and SMS Program, and Bill Gardiner, Brian Hester, and Jack D Word (NewFields, LLC).

INTRODUCTION/BACKGROUND

Bioassays are used in the Dredged Material Management Program (DMMP) to evaluate toxicity in sediments proposed for dredging, and in the Sediment Management Standards (SMS) Program to assess toxicity at cleanup sites. Agency decisions based on bioassay results can have significant economic and environmental consequences; therefore it is critical that these tests provide meaningful results. The DMMP and SMS have both relied on an adaptive management approach to examine and adopt improvements to bioassays. Proposed changes are presented for public review as issue or clarification papers through the Sediment Management Annual Review Meeting (SMARM) process. Since PSDDA/DMMP implementation in 1988, a total of twenty-seven changes to existing bioassay protocols having been made though the SMARM process. A complete list of these changes can be found in **Table 1**.

At the 2010 SMARM, potential method modifications to improve the performance of the juvenile *Neanthes* growth bioassay and the *Mytilus galloprovincialis* bivalve larval bioassay tests[1] were presented (Gardiner, W., 2010). Additional data to further support these method modifications were presented at the 2011 SMARM (Word, J., 2011). Several federal navigation projects have since been used as test cases, as well as results from monitoring at the DMMP disposal site in Port Gardner. Case studies from cleanup areas in Port Gamble are provided to illustrate the effects of bioassay endpoint adjustments relative to reducing false positive results.

This clarification paper summarizes the confounding factors associated with these two tests, the proposed methodological revisions to address these confounding factors and the results of side-by-side comparisons of the existing and modified protocols conducted by the DMMP and SMS programs.

PROBLEM IDENTIFICATION

The purpose of this clarification paper is to provide method modifications intended to reduce the following confounding grain-size effects in the juvenile *Neanthes* growth bioassay and the *Mytilus galloprovincialis* bivalve larval test:

[1] The DMMP agencies and SMS Program have not evaluated the effects of the resuspension endpoint protocol relative to the Sediment Echinoderm Larval Test (*Dendraster excenctricus*), but intend to evaluate this endpoint adjustment in the future to assess potential performance improvements to the sediment echinoderm larval test.

- For the *Neanthes* growth test, there is considerable variation in weights of animals at test termination due to sediments retained in the guts of test organisms being unintentionally included in the measured biomass. Organisms ingesting coarse-grained sediment have higher inorganic gut content than those grown in fine-grained sediment.

- For the bivalve larval test, the existing test-termination protocol can lead to poor recovery of normal surviving larvae, artificially elevating the toxicity ascribed to some sediment samples.

  For the bivalve larval test, these confounding factors appear to be more of a problem when testing sediments from areas with particularly high contents of clay and fine grained woody material.

***Neanthes* Growth Test.**

Background: The *Neanthes* test provides a chronic measure of toxicity, evaluating the growth of worms over a 20-day exposure period (Peeler, M. 1992*)*. Juvenile worms, early in development, are placed in sediment and fed every two days to promote growth. Worms at the end of the test are dried overnight at 60°C, and then weighed. The performance of reference sediments is evaluated by comparison of growth to that in the negative control sediment ($MIG_R/MIG_C > 0.80\%$)[2]. If the performance standard is met, growth in test sediments is then compared to growth in both the reference and control sediments. If the performance standard is not met, test sediments can only be compared to the control.

The Problem: The *Neanthes* test has been frequently subject to reference performance failures, particularly when testing sediments with a high fines content. Coarse sand is used as the negative control substrate, and retention of coarse sediments in the gut of control worms at the end of the test artificially inflates the growth rate when compared to growth in fine-grained reference and test sediments.

Proposed Solution: A simple method of eliminating the bias due to gut content is to use an ash-free dry-weight (AFDW)[3] endpoint, which represents the mass of biological tissue after subtracting the weight of inorganic materials present in the gut of animals being tested. It is instructive to note that the following biomass-based tests with sediment "ingesters" already use an AFDW endpoint:

- *Chironomus* growth test (Sibley et al. 1997)
- *Neanthes* growth test developed by USACE-ERDC (Bridges, T.S, J.D. Farrar 1997)

[2] MIG = mean individual growth rate (mg/individual/day)
[3] After determining the dry weight, worms are placed in a muffle furnace @500°C for two hours and the weight of the ashed residue is measured. This weight is then subtracted from the dry weight to determine the ash-free dry weight. See **Attachment 1** for more complete protocol description.

Dry-weight versus AFDW performance - DMMP: The DMMP agencies have conducted side-by-side testing comparing the existing Puget Sound Estuary Program protocol (based on dry weight) and the modified AFDW protocol. This testing has been performed on sediments from three federal O&M projects, including two testing rounds for the Grays Harbor Navigation Channel, and one testing round for the Duwamish Navigation Channel. It was also performed as part of DMMP monitoring at the Port Gardner disposal site in 2010. Side-by-side testing was especially pertinent for the Grays Harbor project, as reference sediment performance failures had been documented there in dredging years 2001, 2005, 2009, 2011 and 2012.

Comparison of dry-weight and AFDW measurements in worms exposed to different sediments illustrates the effects of gut-related sediment on the assessment of growth in this bioassay. Figures 1a – d present MIG based on dry weight and AFDW for the four DMMP studies where side-by-side testing was performed. No differences were observed between treatments and reference sediments using either dry-weight or AFDW MIG. However, a large enough difference was observed in dry-weight MIG between control and reference sediments for the two case studies in Grays Harbor for the reference to fail the performance guidelines (**Figure 1b-c**). The AFDW adjustment improved the performance, but the reference sediment still failed the performance guideline for the 2011 Gray Harbor testing, whereas the AFDW adjustment enabled the reference sediment to meet the performance guideline in the 2012 Grays Harbor testing. In general, the performance of the *Neanthes* test improved using the AFDW values as compared with the PSEP dry-weight measurements. For these four studies, coarse-grained controls were observed to have an average of 31% of the worm weight attributable to sediments in the gut of the worms, as compared to an average of 20% in reference sediments and 18% in treatment exposures (**Figures 2a-d**).

Dry-weight versus AFDW performance - SMS Program: Ecology evaluated the implementation of the AFDW protocol for the *Neanthes* growth test during the Port Gamble remedial investigation conducted during the summer of 2011. All 12 of these sediments passed the Neanthes growth test SQS and CSL biological standards for both dry-weight and AFDW measures (**Figure 1e**). Dry-weight MIG values were consistently higher than those based on AFDW, although the overall difference between dry weight and ash-free dry weight was slightly less than reported for the DMMP program. Coarse-grained sand in the gut contributed 21% of worm weight in the control, and an average of 21% for the three reference sediments. The mean weight contributed by gut contents for the 12 test sediments was 15% and ranged from 7% to 18%, (**Figure 2e**).

Bivalve Larval Test.

Background: The existing PSEP bivalve larval sediment bioassay provides a measurement of normal larval development in the presence of sediment. The protocol requires shaking 18 grams of sediment in 950 mL of water and allowing the suspended sediments to settle out over a four hour period. The test is initiated with non-swimming 2-hour-old embryos that develop into swimming larvae with shells. The larvae are

allowed to develop into D-shell-stage larvae. At the end of the test (~48 hours) the overlying water is gently stirred – without disturbing the sediment at the bottom of the test chamber - then decanted. Aliquots of the decanted water are collected and enumerated, with larvae scored as normal or abnormal. Developmentally-delayed larvae are counted as abnormal. Larvae that have died during testing decompose quickly and are generally not recovered.

The Problem: Observations during testing have shown that initial shaking of sediment in the water and settling prior to introducing the embryos results in a stratification of the sediment by grain size. As would be expected, the coarser material settles first, followed by the finer fractions. For some sediments this can result in a substantial layer of fine-grained material that may continue to settle during the first 12-24 hours of the test. The early non-swimming larvae can become entrained in this layer, which ultimately prevents them from swimming up into the overlying water. These entrained larvae are then missed when the overlying water is decanted off for counting upon test termination.

Entrainment of larvae does not appear to be related to sediment chemistry. Examination of larvae recovered from the flocculent layer has shown them generally to be normal "D-shaped" larvae. Therefore, the loss of these larvae prior to enumeration biases the results.

Entrainment of larvae was recognized as an issue early in the development of this bioassay protocol and has been discussed at several workshops held by the DMMP agencies (PSDDA 1989; PSDDA 1990). The agencies subsequently attempted to resolve some of the problems with false positives during 1993 methods refinement effort (EPA, 1993), due to presence of suspended sediment in test chambers, and sensitivity to ammonia, and grain size. The results of this effort highlighted and documented the problems, but did not resolve them.

Proposed Solution: Bill Gardiner and Brian Hester at NewFields developed a laboratory protocol in 2009 with a step added to the standard PSEP protocol to address the larval entrainment issue. It involves conducting the standard PSEP larval test, but with a modified test-termination procedure. At the end of the exposure period, the water, larvae and settled sediment are homogenized using a perforated plunger. The contents are then allowed to settle at least 6-8 hours. After settling, the overlying water is decanted, aliquots are collected, and larvae are enumerated as in the standard protocol. This adjustment allows for the recovery of any larvae trapped in fine sediments or flocculent materials. The full protocol is described in **Attachment 1**.

Protocol Comparison - DMMP: The DMMP agencies evaluated the resuspension protocol using the same studies cited above for the *Neanthes* test (Port Gardner disposal site monitoring (2010), Grays Harbor O&M testing 2011 & 2012, and Duwamish O&M testing 2011. Generally, use of the resuspension adjustment made little difference in the results of the larval testing **Figures 3a-d**. However, none of the sediments evaluated within the four case studies had high concentrations of wood waste or fine-grained/ flocculent material. The only 1-hit response occurred in the Duwamish Waterway O&M characterization and was confirmed by both the PSEP and resuspension protocols

(Sample T15 in **Figure 3d**). Of the eight samples for which 2-hit responses were observed, half were confirmed by both protocols and half scored hits under one protocol but not the other. None of these 2-hit responses were corroborated by the other bioassays in the testing suite (amphipod mortality and *Neanthes* growth).

Protocol Comparison - SMS Program. Ecology has evaluated the development and application of the resuspension protocol in recent testing of Port Gamble sediments. Outcomes were compared for 31 test sediments ranging from very fine-grained sediments with wood waste to sands with low organics (**Figure 4a-b**). The greatest increase in the number of recovered normal survivors using the resuspension protocol was generally associated with those samples with higher percent fines and organic matter (**Figure 5**: *Scatterplot of % change in normal survivors vs % fines*, **Table 2**). Comparing the outcome of the resuspension protocol to the PSEP protocol, the following were observed:

- 15 of 31 treatments were unchanged
- 8 of 16 SQS exceedances changed to passes
- 5 of 6 CSL exceedances changed to passes
- 1 of 6 CSL exceedances changed to an SQS exceedance
- 2 passes changed to SQS exceedances as a result of improved reference performance

The improved recovery of normal larvae was seen in 29 of 31 test sediments and in 4 of 6 reference sediments. This supports the conclusion that the resuspension protocol provides an improvement for the bivalve larval bioassay in sediments where entrainment occurs. This potential for entrainment can be partly determined by looking at the percent fines in a sediment, but other factors such as the presence and nature of wood waste should also be considered. It is interesting to note that improved recovery in fine-grained reference sediments reduces the frequency of reference failures and may result in some test sediments failing that would otherwise have passed using the standard PSEP protocol. This occurred for 2 of the 31 test sediments from the Port Gamble case study.

PROPOSED CLARIFICATIONS

The **DMMP agencies and the Sediment Management Standards program** propose the following change to the protocol for the ***Neanthes* growth test**:

1) Report results on an ash-free dry-weight basis rather than on a dry-weight basis. The AFDW procedure eliminates weight from sediment in the gut, thereby providing a more accurate measurement of the change in biomass during the exposure period.

The **DMMP agencies** propose the following clarification regarding the **sediment bivalve larval test**:

2) Add the resuspension procedure to the standard PSEP protocol when using the bivalve larval bioassay to test sediments with high concentrations of fines, wood

waste or other flocculent material. This decision should be made in coordination with the DMMP agencies. For routine testing of sediments with lower fractions of fines, wood waste or flocculent material, the standard PSEP protocol should be used. However, dredging project proponents may elect to use the resuspension protocol if they have concerns about false positives due to entrainment.

The **Sediment Management Standards program** proposes the following clarification to the **sediment bivalve larval test**:

3) Add the resuspension procedure to the standard PSEP protocol when using the bivalve larval test to determine compliance with the SMS for sediments with high concentrations of fines, wood waste or other flocculent material. For routine testing of sediments with lower fractions of fines, wood waste or other flocculent material, the standard PSEP protocol will be used. However, Ecology or the PLP may elect to use the resuspension protocol at their discretion if they have concerns about false positives due to larval entrainment.

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Table 1. Bioassay Protocol Refinements History in the Dredged Material Management Program (DMMP) and Sediment Management Standards (SMS) Program

Year	Title	Paper Type
2008	Reference Areas for Freshwater Bioassays	Clarification
2005	**Sediment Larval Test Species Recommended for Toxicity Testing by the DMMP Program**	Clarification
2004	**Ammonia and Sulfide Guidance Relative to *Neanthes* Growth Bioassay**	Clarification
2002	Ammonia and Amphipod Toxicity Testing	Clarification
2001	**Reporting Ammonia LC50 Data for Larval and Amphipod Bioassays**	Clarification
1998	BIOSTAT Software for the Analysis Of DMMP/SMS	Technical
1999	Use Of Amphipod, *Eohaustorius Estuarius,* Relative to Grain Size and Salinity	Clarification
1997	Selection of Negative Control Sediments and Use of Control Sediments as Reference Sediments	Clarification
1996	Statistical Evaluation of Bioassay Results	Clarification
1996	**Neanthes 20-Day Bioassay - Further Clarification on Negative Control Growth Standard, Initial Size, and Feeding Protocol**	Clarification
1995	**Interim Growth Rate and Mortality Guidelines for the *Neanthes* 20-Day Growth Bioassay**	Clarification
1995	In-Batch Testing for Reference Sediments for PSDDA Bioassays	Clarification
1994	Restriction on exotic species importation	Clarification
1994	**Interim Revised Performance Standards for the Sediment Larval Bioassay**	Revised Clarification
1994	***Neanthes* 20-Day Bioassay - Interpretation Clarifications**	Clarification
1993	Species Substitution for the 10-Day Amphipod Bioassay	Clarification
1993	**The *Neanthes* 20-Day Bioassay - Requirements for Ammonia/Sulfides Monitoring and Initial Weight**	Clarification
1992	**Implementation of the *Neanthes* 20-Day Sediment Bioassay**	Issue
1991	Modifications to Holding Time for Biological Testing	Issue
1991	Echinoderm Embryo Sediment Bioassay Protocol	Clarification
1991	PSDDA Requirement to Collect and Report Amphipod Reburial Data	Clarification
1990	Wet Sieving Method for Reference Sediment Grain Size Matching	Clarification
1990	Requirements for Analyzing Sediment Conventionals	Clarification
1990	Echinoderm Bioassay Guidelines	n/a
1990	Collection of Reference Sediment Samples	n/a
1990	Amphipod Bioassay Protocol	n/a
1990	Activities to Provide Better Reference Areas	Status

Documentation for changes on DMMO website at:
http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=dmmo&pagename=Bioassays

Table 2. Bivalve Larval Test, Port Gamble Remedial Investigation 2011. Case study comparing of outcomes based on PSEP and Resuspension protocols.

Treatments	Percent Fines	Mean Number Normal PSEP*	Mean Number Normal Resuspension*	Signficance Relative to Reference	Standard	Resuspension
PG11-BW-01-S	18.10	81.4	84.3	N**	Pass	Pass
PG11-BW-02-S	8.80	91.3	81.5	N → S	Pass	Pass
PG11-BW-03-S	21.10	89.4	78.3	N → S	Pass	Pass
PG11-BW-04-S	71.00	60.7	84.5	S → N	CSL	Pass
PG11-BW-05-S	64.30	62.6	88.7	S → N	SQS	Pass
PG11-BW-06-S	66.20	52.8	90.4	S → N	CSL	Pass
PG11-BW-07-S	53.80	68.0	87.3	S → N	SQS	Pass
PG11-BW-08-S	88.20	70.4	84.8	S → N	SQS	Pass
PG11-BW-09-S	86.40	63.5	83.1	S → N	SQS	Pass
PG11-BW-10-S	81.20	54.8	86.8	S → N	CSL	Pass
PG11-BW-11-S	85.70	61.6	69.0	S	SQS	SQS
PG11-BW-12-S	48.40	64.9	65.2	S	SQS	SQS
PG11-BW-13-S	87.20	56.1	72.3	S	CSL	Pass
PG11-BW-14-S	90.00	70.0	79.6	S → N	SQS	Pass
PG11-BW-15-S	90.10	63.0	69.7	S	SQS	SQS
PG11-BW-16-S	92.90	66.5	63.2	S	SQS	SQS
PG11-BW-17-S	30.80	70.9	73.7	S	SQS	Pass
PG11-BW-18-S	86.40	81.4	84.3	S	CSL	SQS
PG11-BW-19-S	95.30	91.3	81.5	S	SQS	SQS
PG11-BW-20-S	96.50	58.7	75.3	S	SQS	Pass
PG11-BW-21-S	95.30	51.0	72.8	S	CSL	Pass
PG11-MS-01-S	27.40	72.9	96.6	N	Pass	Pass
PG11-MS-02-S	18.00	73.3	97.8	N	Pass	Pass
PG11-MS-03-S	25.50	70.9	88.9	S	Pass	Pass
PG11-MS-04-S	55.80	66.7	92.6	S → N	SQS	Pass
PG11-MS-05-S	17.10	75.3	84.0	S	Pass	Pass
PG11-MS-06-S	50.80	65.1	77.4	S	SQS	SQS
PG11-MS-07-S	32.70	62.3	75.5	S	SQS	SQS
PG11-MS-08-S	7.10	76.3	80.2	S → N	Pass	SQS
PG11-MS-09-S	16.30	63.9	71.6	S	SQS	SQS
PG11-MS-10-S	38..5	67.5	80.4	S	Pass	SQS

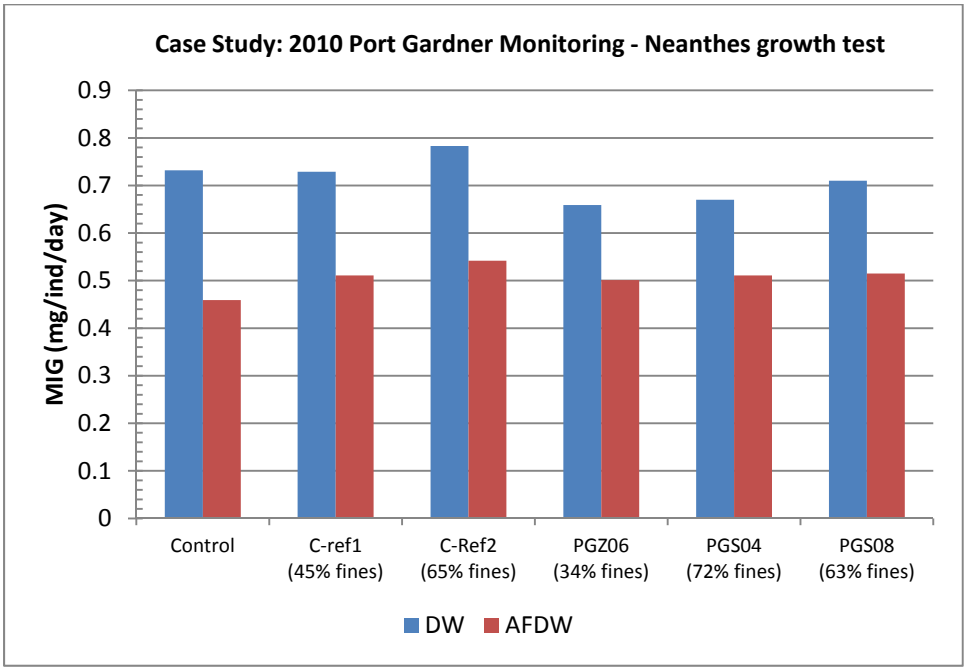
* 'Mean Number Normal = mean normal survivors at time final

**N=Not Significant, S= Significant

Figures 1-5 (Case Studies: DMMP and SMS).

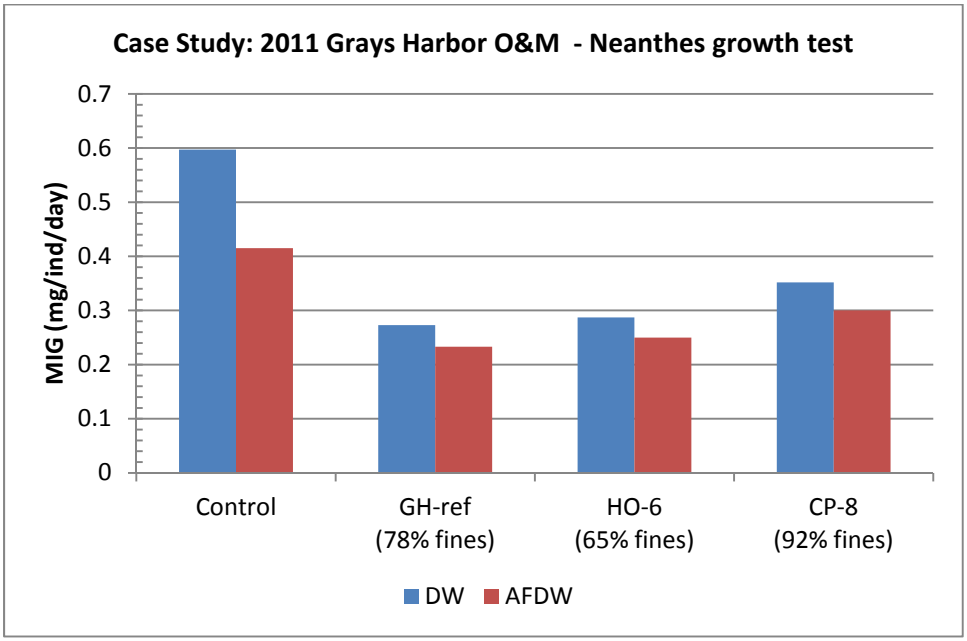
A) Case Studies: *Neanthes* growth test[1]:

Change in MIG (Mean Individual Growth) based on the three measures relative to control, reference and treatments. Biggest impact has been observed in control versus reference performance evaluations for Grays Harbor O&M Characterizations in 2011 and 2012, where the reference failed the control performance guidelines as illustrated in Figures 1b-c.

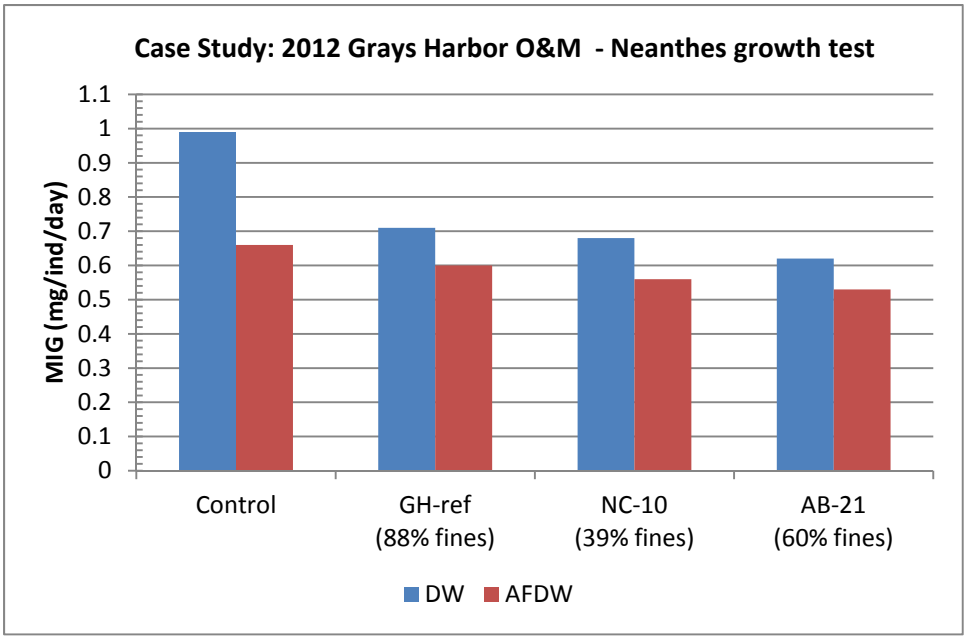


1a) Port Gardner Disposal site monitoring – 2010 (No hits)

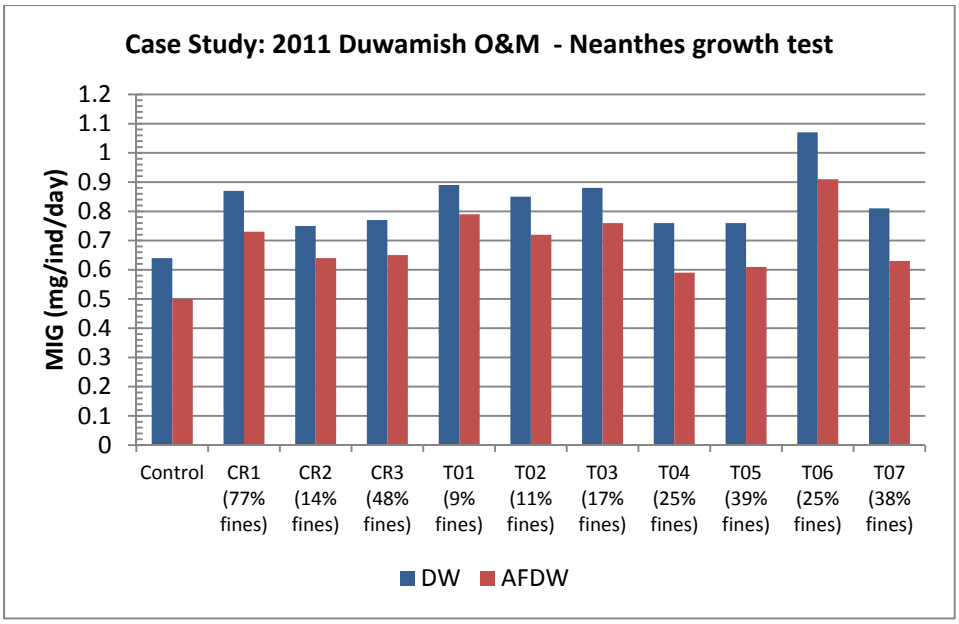
[1] Percent fines denoted in parenthesis on all figures

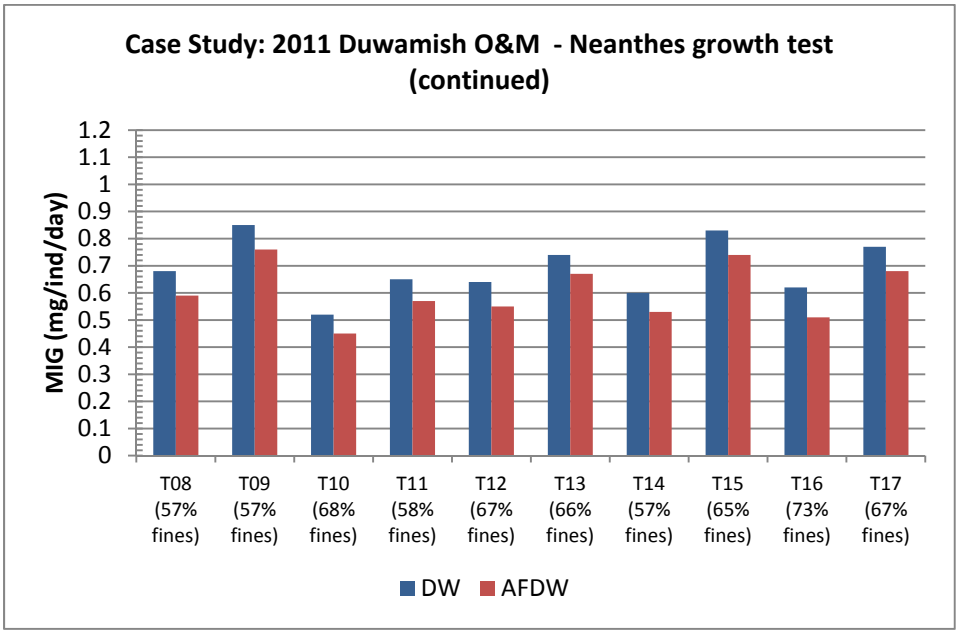


1b) Grays Harbor O&M Characterization – 2011 (No hits)



1c) Grays Harbor O&M Characterization – 2012 (No hits)





1d) Duwamish O&M Characterization – 2011 (17 DMMUs characterized) (No hits)

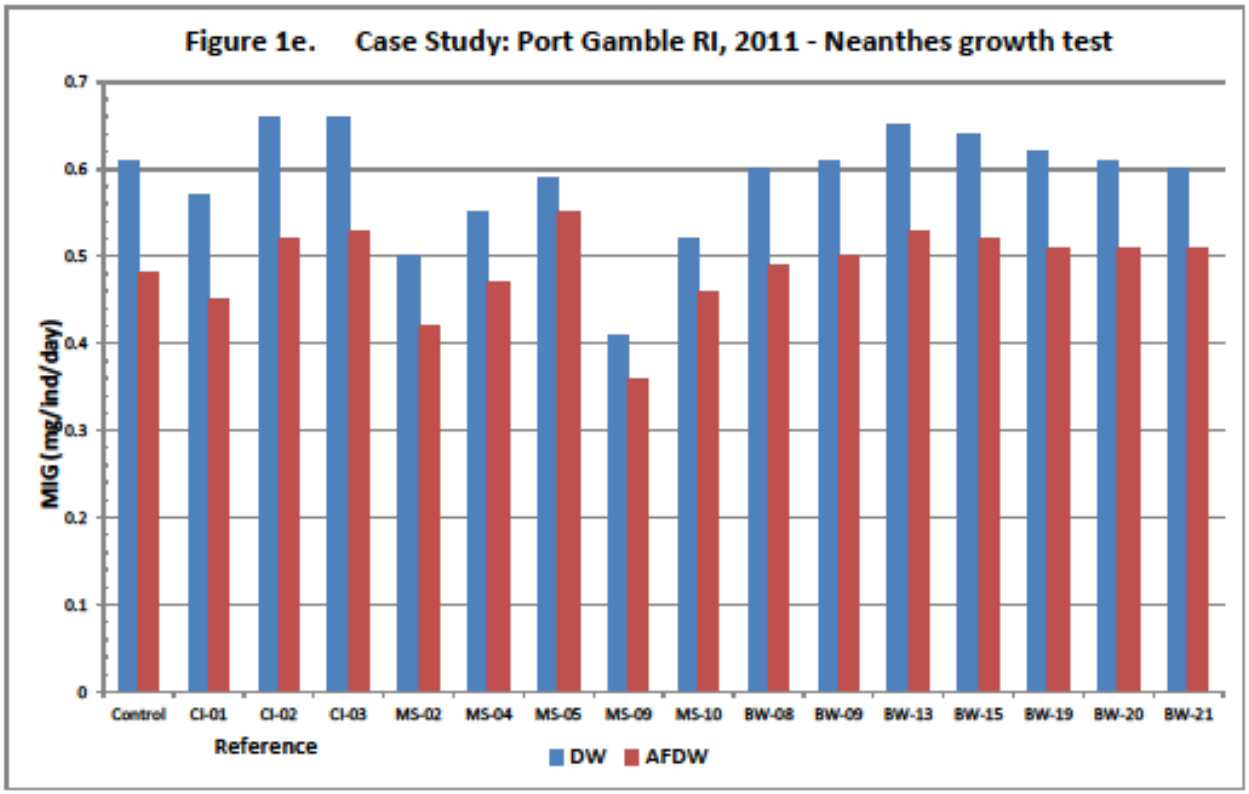


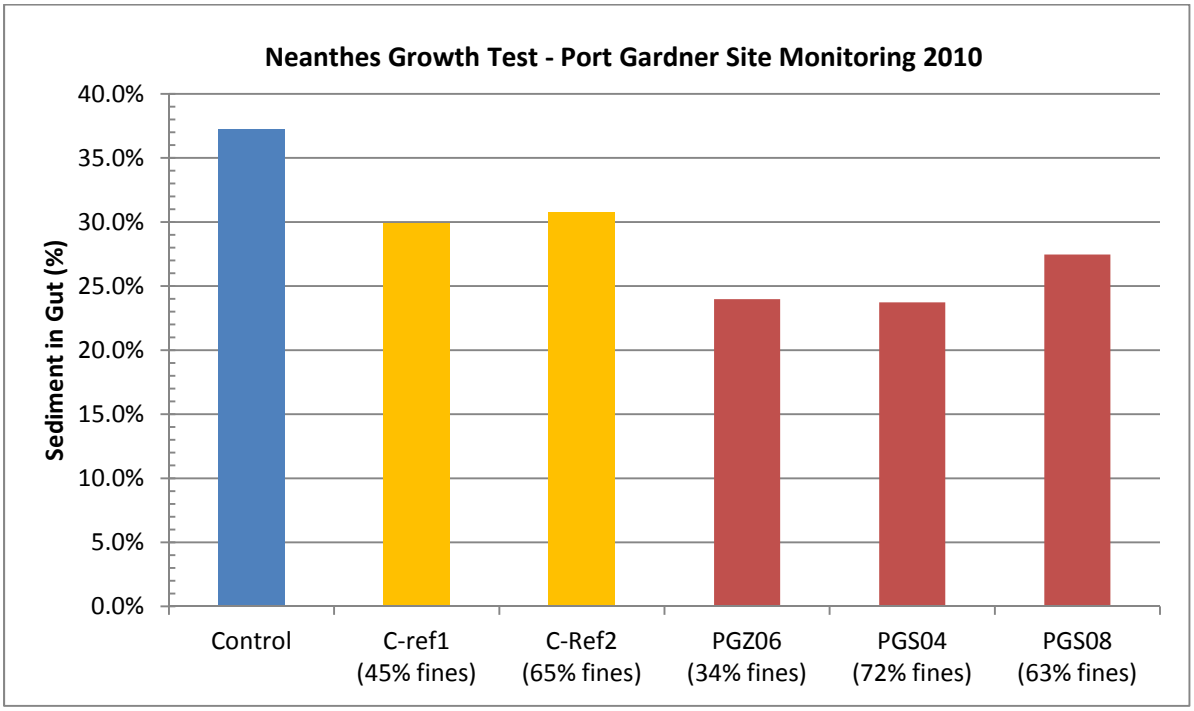
Figure 1e. SMS Case Study: Port Gamble RI, 2011 (No SQS Hits).

Percentage of organism dry weight that is attributable to sediment retained in the gut:

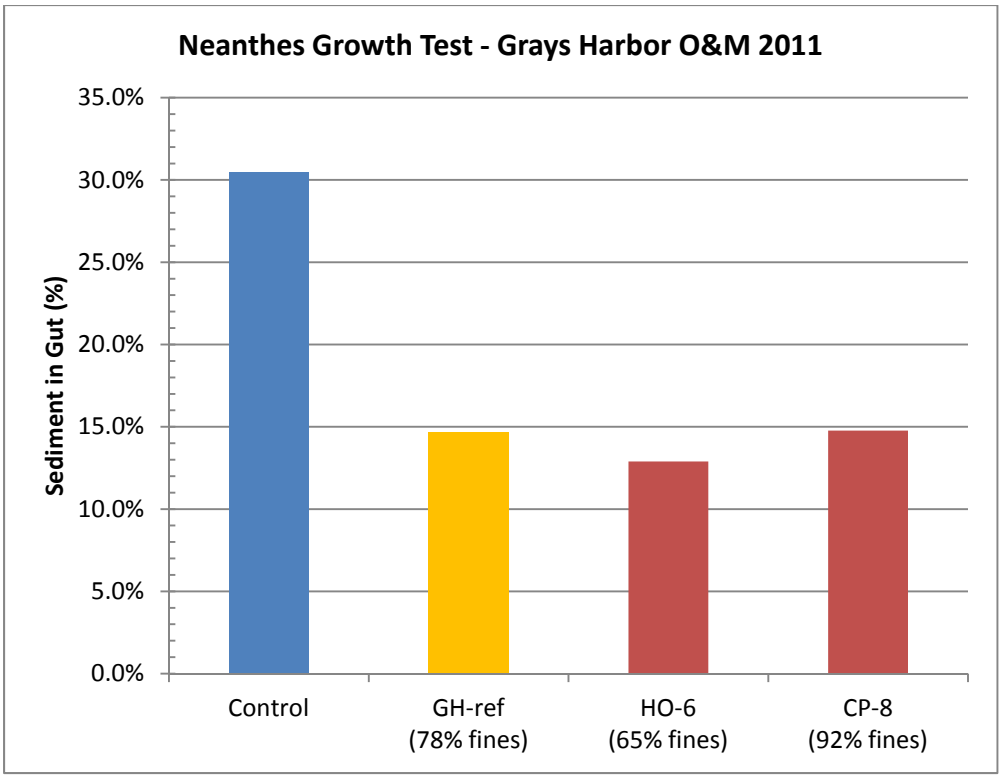
Controls: DMMP Average: 31 % (22 – 37%); SMS Average: 21%

Reference: DMMP Average: 20 % (15 – 31%); SMS Average: 21%

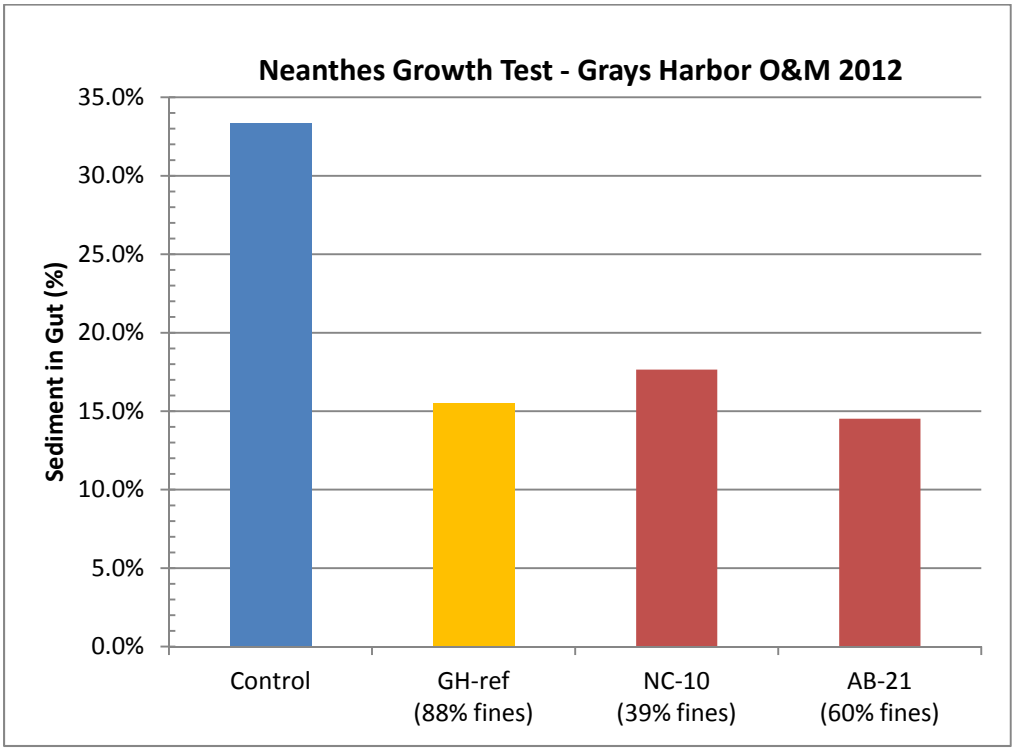
Treatments: DMMP Average: 18% (11 – 28%); SMS Average: 15 % (7 – 18%)



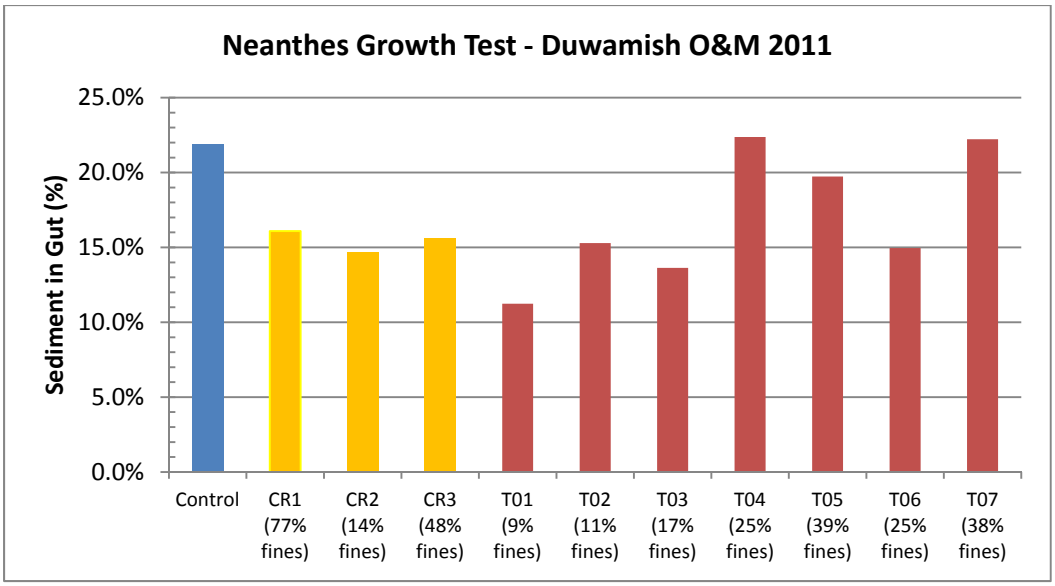
2a) Port Gardner Disposal Site Monitoring 2010 – comparative sediment in gut

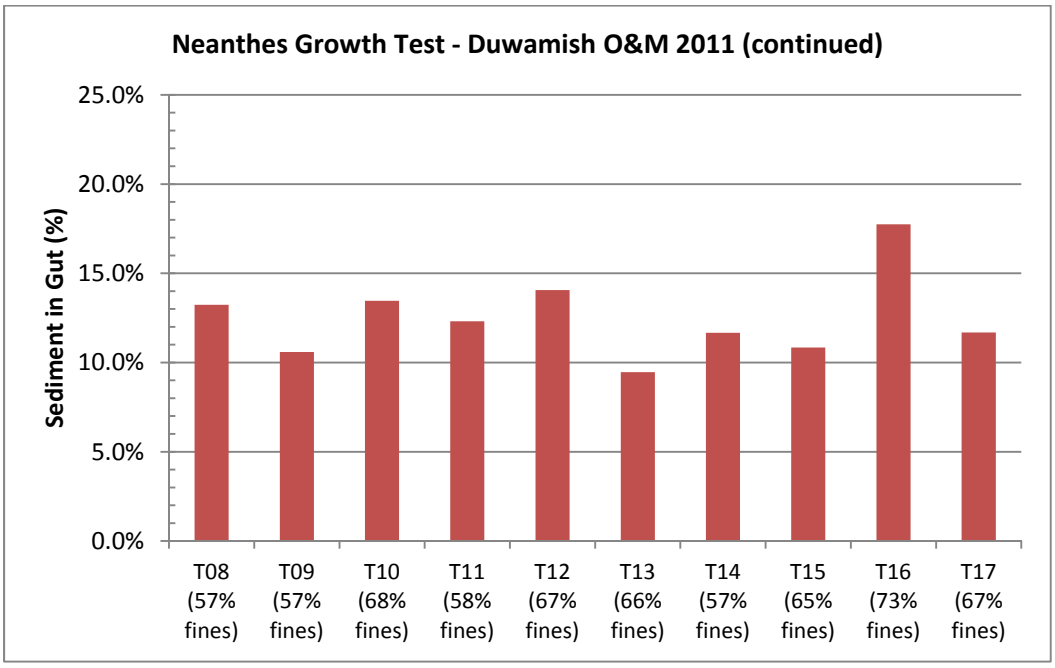


2b) Grays Harbor O&M 2011 – comparative sediment in gut

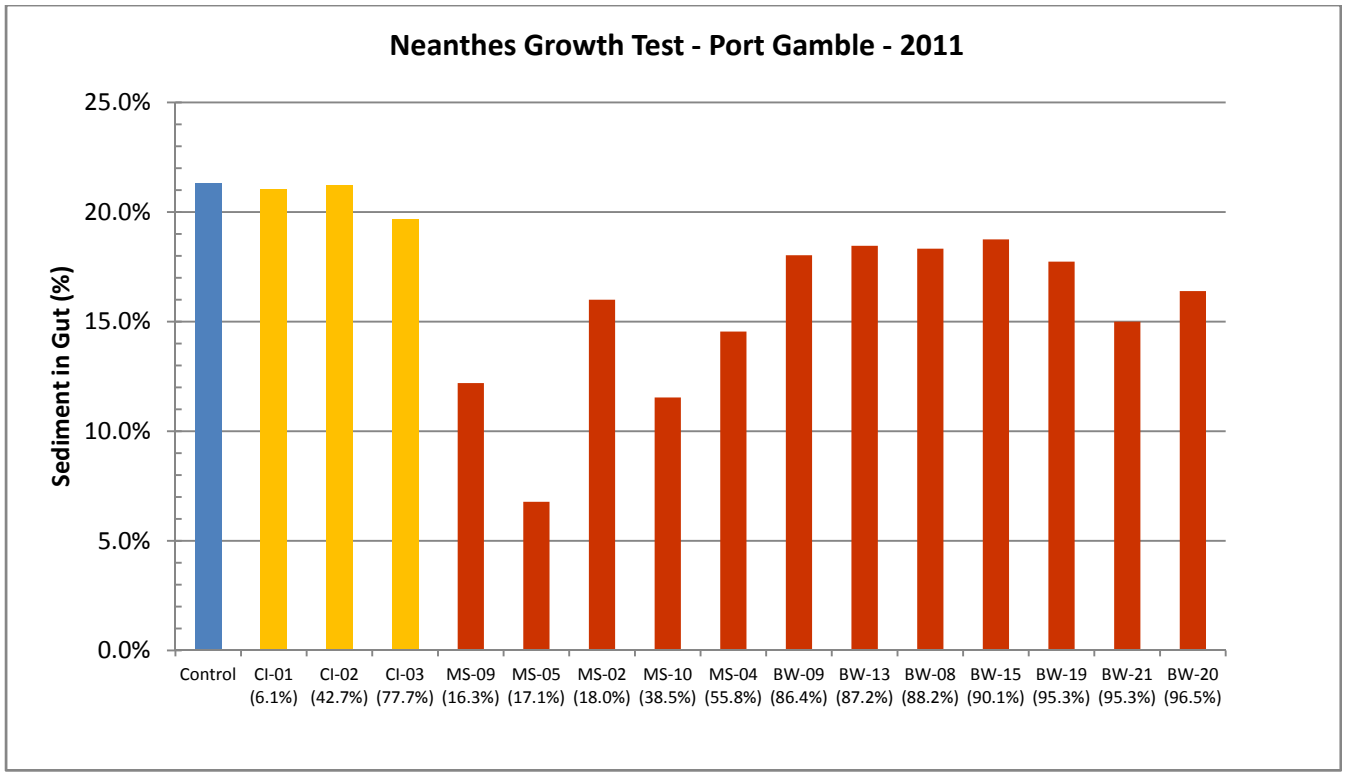


2c) Grays Harbor O&M 2012 – comparative sediment in gut



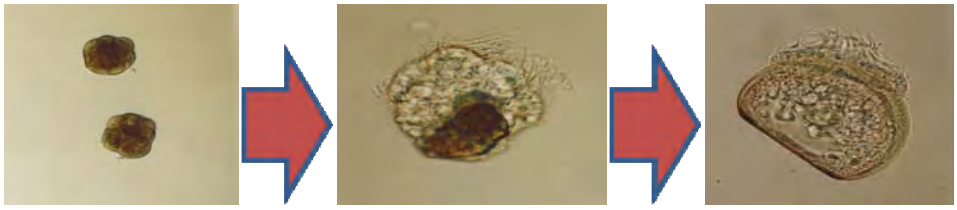


2d) Duwamish O&M 2011 – comparative sediment in gut (17 DMMUs total)



2e) SMS-Port Gamble, RI – 2011 – comparative sediment in gut

B) DMMP / SMS Case Studies: Bivalve Larval Test (*Mytilus galloprovincialis*):



Early in test
Non-swimming larvae rest on bottom, early cell division

Approximately 12-24 hours
Swimming forms rise off of sediment, begin gut/shell development

Later in test
Swimming, normal D-larvae, feeding in water column

Comparative differences between PSEP protocol versus Resuspension protocol:

PSEP Control DMMP Average: 91.4 % (84.8 – 94.4%)

Resuspension DMMP Control Average: 95.2 % (86 – 99.7%)

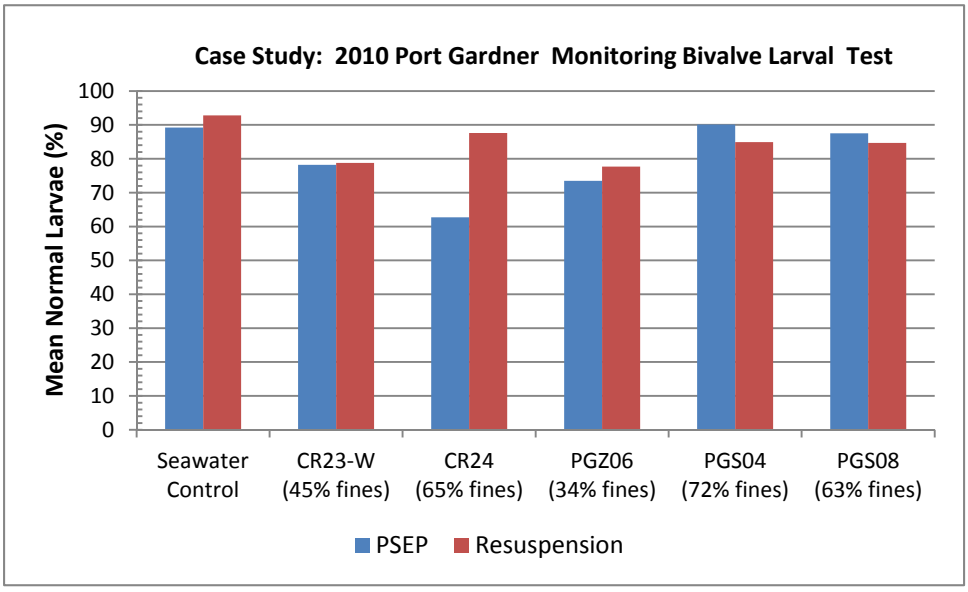
PSEP DMMP Reference Average: 82.6 % (62.7 – 92.4%)

Resuspension DMMP Reference Average: 83.0 % (78.8 – 87.6%)

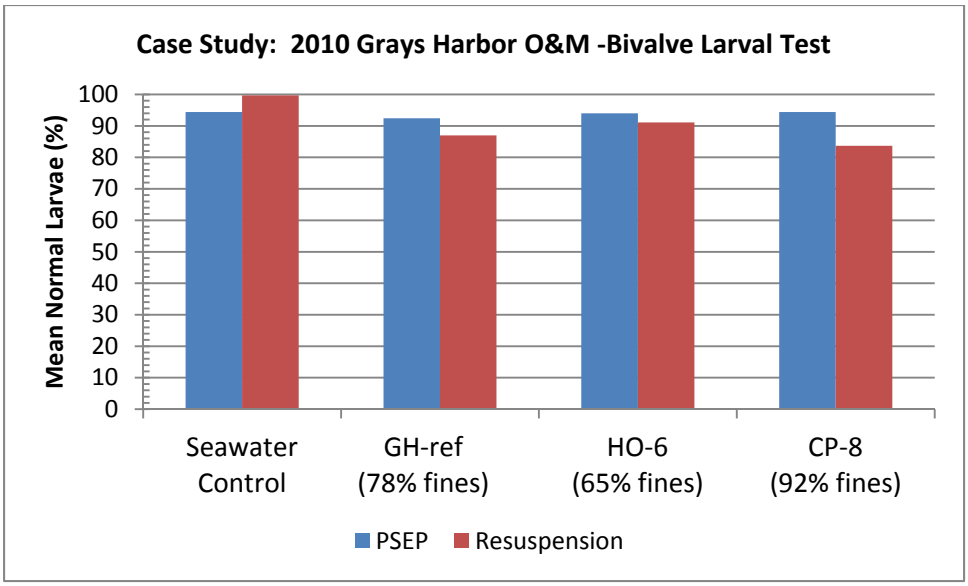
PSEP DMMP Treatment Average: 80.0 % (43 – 94.4%)

Resuspension DMMP Treatment Average: 77.1 % (30.9 – 98.6%)

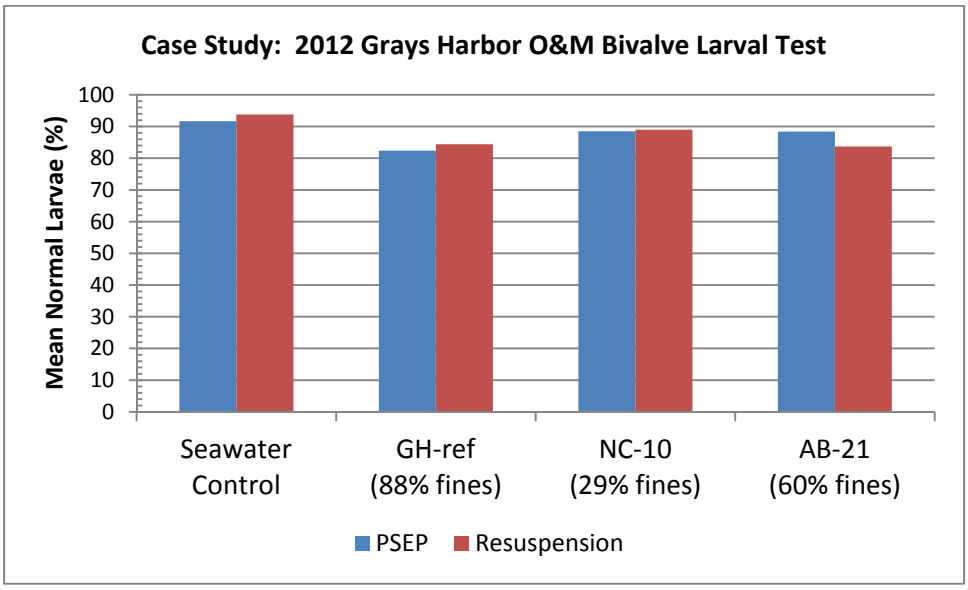
DMMP Case Studies: Bivalve Larval Test (Figures 3a-d):



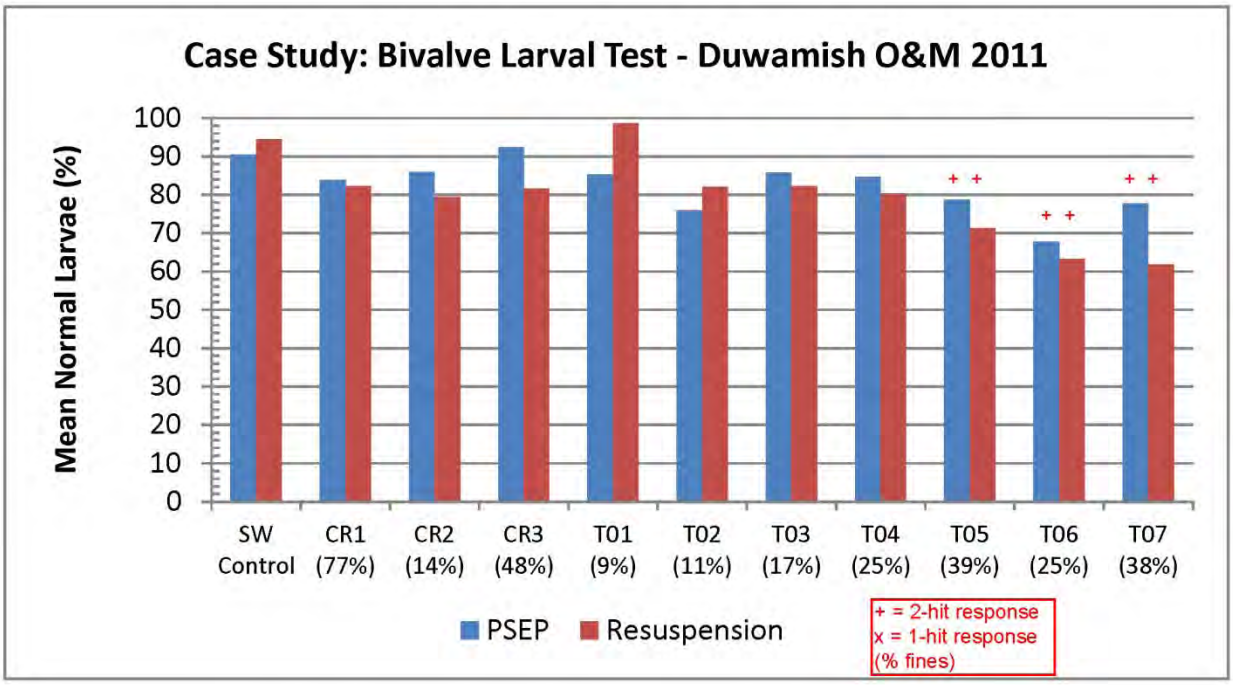
3a) **Port Gardner Disposal Site Monitoring – 2010 (No hits)**

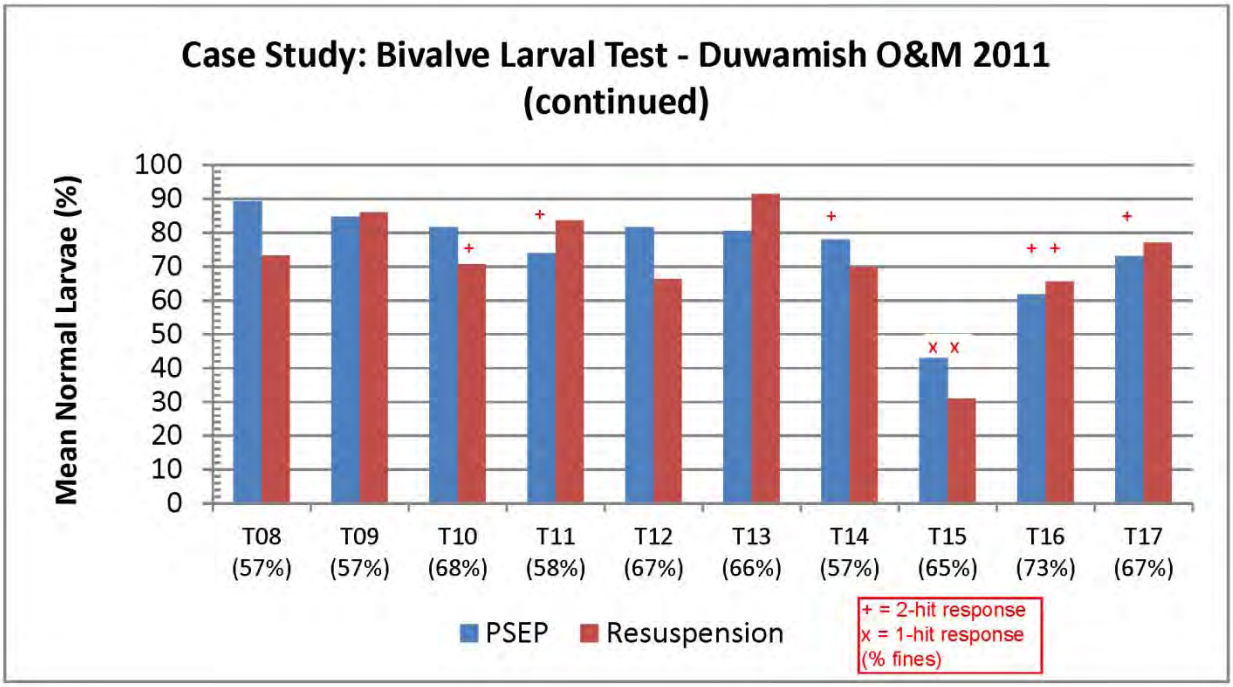


3b) Grays Harbor O&M Characterization – 2011 (No hits)

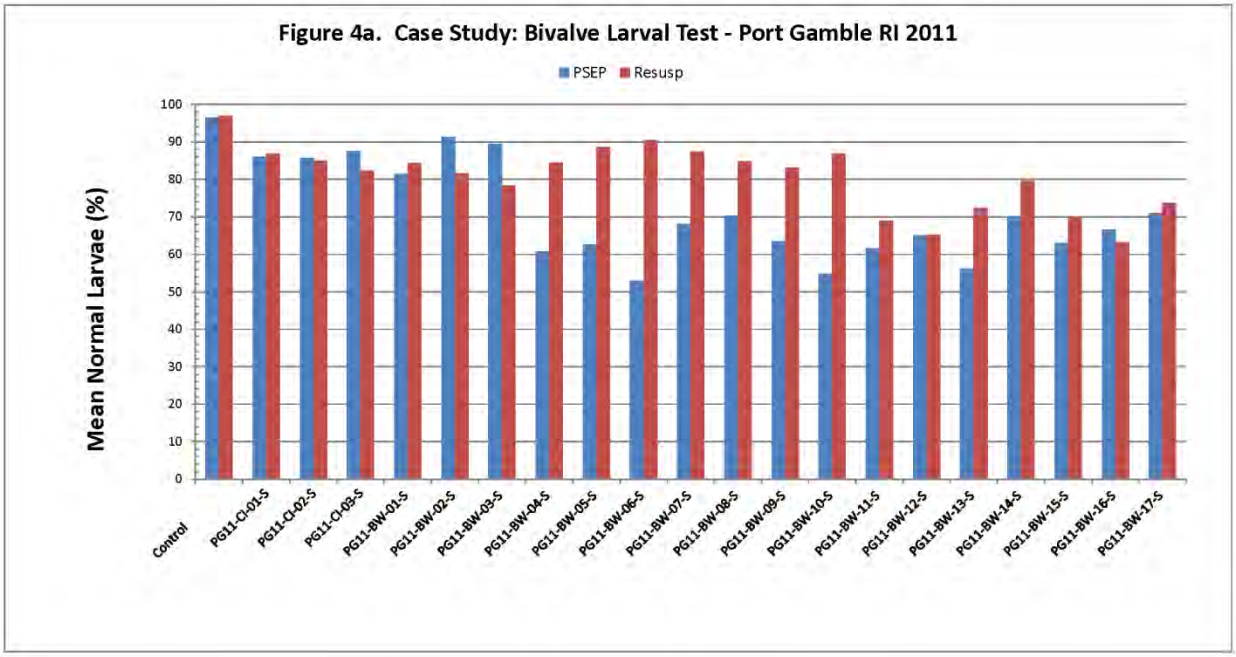


3c) Grays Harbor O&M Characterization – 2012 (No hits)





3d) Duwamish O&M Characterization – 2011 (2-hit responses observed for either PSEP and resuspension protocol did not change the overall bioassay interpretation relative to DMMP guidelines, as there were no other corroborating hits from other two bioassays (Amphipod and Neanthes). Only DMMU-15 failed based on 1-hit responses from both protocols.)



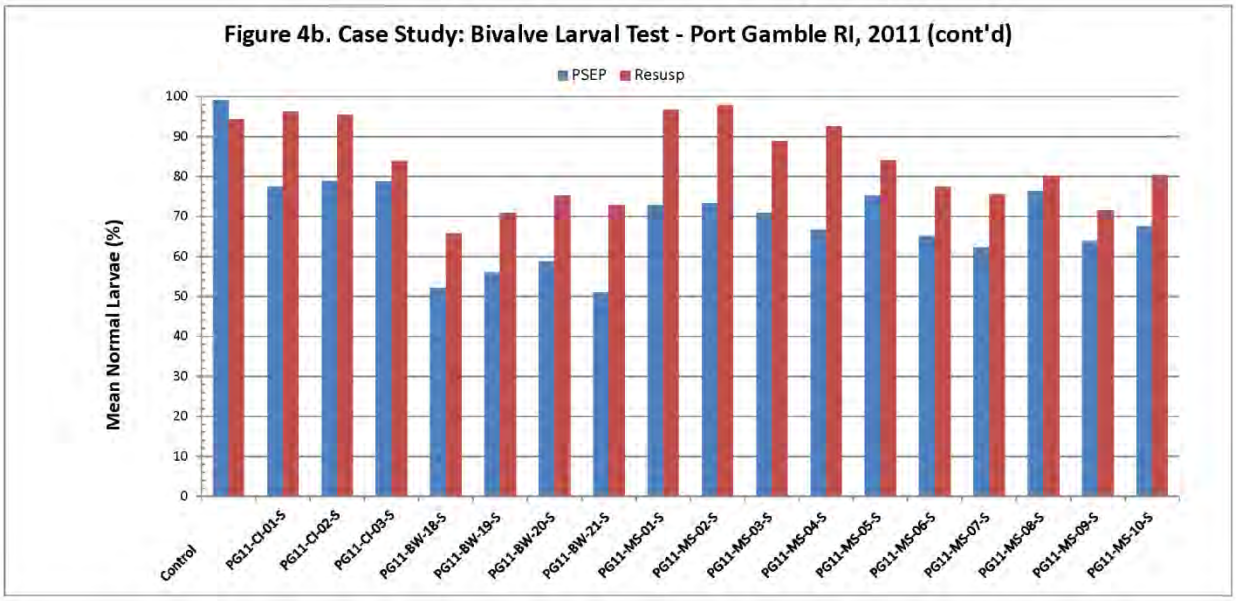


Figure 4a-b. SMS Case Study Port Gamble Remedial Investigation Study, 2011, comparing outcomes from PSEP and Resuspension protocols (See Table 2 for interpretation outcomes for testing results).

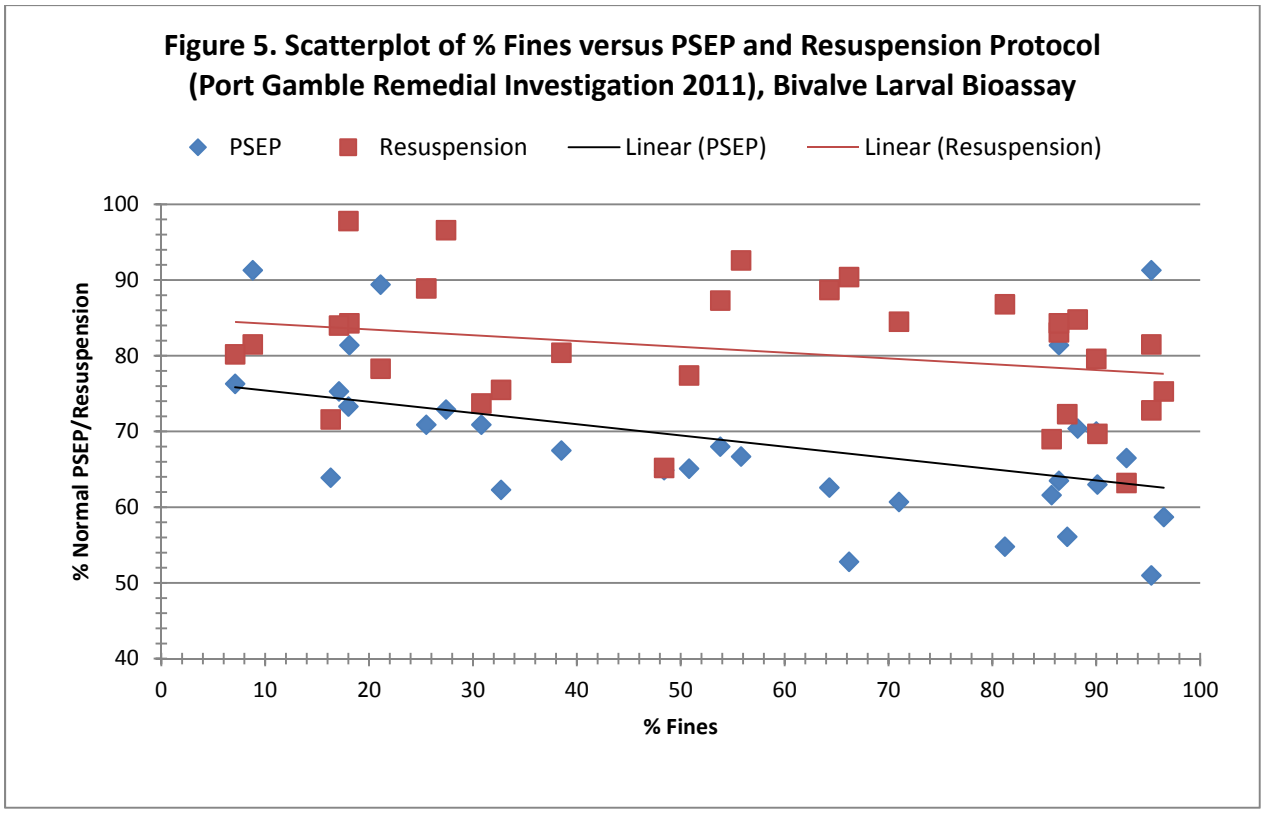


Figure 5. Scatterplot of % Fines versus PSEP and Resuspension Protocol (Port Gamble Remedial Investigation 2011), Bivalve Larval Bioassay
PSEP
Resuspension
Linear (PSEP)
Linear (Resuspension)
% Normal PSEP/Resuspension
100
90
80
70
60
50
40
0
10
20
30
40
50
60
70
80
90
100
% Fines

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Attachment 1.

A) *Neanthes* Growth Bioassay – Ash-Free Dry Weight (AFDW) Protocol

Ash-free dry weight represents the mass of biological tissues without the weight of inorganic materials in the gut of worms. At the end of the 20-day exposures:

1. Place all worms in pre-ashed (500^0C for 2 hours) in tared aluminum weigh boat;
2. Dry tissues for 24 hours at 60^0C;
3. Measure "dry weight";
4. Bake tissues in Muffle Furnace at 500^0C for 2 hours to remove all tissues;
5. Get Ashed Weight (Weight of all inorganic material); and,
6. Subtract ashed weight from dry weight

B) Bivalve-Larval Resuspension Termination Protocol-

The purpose of the larval resuspension method is to account for any larvae that may be buried in significant layers of sediment on the bottom. In reference or test sediments, the exclusion of larvae may result in reference failure or false positives. For resuspension, the bioassay is initiated and conducted up to termination in a manner similar to the PSEP method. As with the PSEP method, the test is terminated when greater than 95 percent of the embryos in the duplicate seawater control have reached the prodissoconch I stage (approximately 48-60 hours). Once this stage has been achieved in the control chambers, final water quality measurements are recorded and the test is terminated. The bioassay is terminated in the following manner.

1. With a perforated plunger, gently resuspend the contents of the test chamber. Mix for approximately 10 seconds or until the water, larvae, and settled sediment are resuspended in each container. Care should be taken to rinse the plunger between test chambers to prevent the transfer of larvae. Note the time that resuspension was initiated for the test.
2. Control and reference treatments should also be mixed at this time.
3. Allow at least 6 to 8 hours for the sediment to settle in the test chambers. Settling should be sufficient to allow for enumeration.
4. Once settling is complete, the test is terminated following the protocol presented in the PSEP method:
    a. carefully pour the water overlying the sediment into a clean 1-liter beaker;
    b. mix with a perforated plunger; and,

c. collect 10-mL aliquots of the well-mixed sample by calibrated pipette and place in 20-25 ml sealable shell or scintillation vials.
d. The contents of each vial are preserved with 0.5- 1mL of 5-percent buffered formalin.

DMMP CLARIFICATON PAPER

TRANSITION FROM DAIS TO EIM

Prepared by David Fox (U.S. Army Corps of Engineers) for the Dredged Material Management Program (DMMP) agencies.

INTRODUCTION

When the Puget Sound Dredged Disposal Analysis (PSDDA) program was implemented, the Corps of Engineers assumed responsibility for the development and maintenance of a database to store data from dredged material testing and disposal site monitoring (PSDDA, 1989). The Dredged Analysis Information System (DAIS) was created for this purpose. The system has evolved over time and is presently in the form of an Access database with a user interface developed using Microsoft Visual Basic 6. Data from over 300 dredging projects and monitoring events currently reside in DAIS, with over 200,000 individual chemistry and bioassay data records.

At the time of PSDDA implementation, the Department of Ecology had its own database, called SEDQUAL. The primary purpose of SEDQUAL was calculation of apparent effects thresholds (AETs), which were then used to establish sediment quality guidelines for use in the PSDDA program. SEDQUAL has since evolved into the Environmental Information Management (EIM) system, which has become the primary repository of many types of environmental data at the Department of Ecology.

Through the years, the Corps developed and maintained within its database system the capability of exporting data from DAIS into the input format required by Ecology's database – first SEDQUAL, and now EIM. This export capability is currently accomplished using Visual Basic code.

PROBLEM IDENTIFICATION

Many changes have occurred since the time DAIS was first envisioned and developed. Together these changes have created conditions under which it is no longer practical or necessary to maintain DAIS as a stand-alone repository for data from dredged material testing and disposal site monitoring. These changes are discussed in the following paragraphs.

In 2007, the Corps of Engineers switched from an information technology model in which each district maintained its own cadre of IT professionals, to a national contract (ACE-IT) under which district-managed services were discontinued. On a practical basis, this has meant that local programmers are no longer available to update the DAIS database and user interface.

The software that the DAIS user interface is based on (Visual Basic 6) is no longer supported by Microsoft. It is becoming increasingly difficult to maintain this older generation of software.

Upgrading to the current version of Visual Basic would require IT resources that are no longer available in Seattle District. It would also likely be costly due to the evolution of Visual Basic to the Microsoft .NET environment.

DAIS does not have the capability of accepting electronic data deliverables (EDDs) from laboratory information management systems (LIMS). Instead, data are entered manually using the DAIS user interface. This is a laborious and costly process. DAIS data input is funded by the Corps' Navigation Section for maintenance dredging of federal navigation projects, and by the Corps' Regulatory Branch for dredging projects regulated under Section 404 of the Clean Water Act. That funding, especially for regulatory projects, is becoming increasingly difficult to obtain. For the past several years, data entry for regulatory projects has had to wait until the end of the fiscal year to see if any year-end funding would be available for this effort. When funding is not available, DAIS data entry can be delayed for two years or more. This means that data export to EIM is also delayed.

Maintenance of the same data in two separate databases is redundant, and costly from a taxpayer perspective. During the early days of SEDQUAL, maintenance of two systems could be justified, as the two systems had largely independent functions. But with the evolution of SEDQUAL into EIM, the distinction between the two systems has blurred.

PROPOSED DMMP DATA MANAGEMENT STRATEGY

DMMP will transition from DAIS to EIM as a chemical and bioassay data repository in DY 2013. Once the transition has occurred, project proponents will be required to submit data for dredging projects to the Dredged Material Management Office (DMMO) in EIM format.

A number of procedural and data management issues will need to be resolved to complete this transition. First, while Ecology does have gatekeepers that ensure that data are in the proper format for import into EIM, these gatekeepers are not intimately familiar with DMMP and are therefore not equipped to identify problems with the data itself. A quality assurance process will need to be established to ensure the accuracy and completeness of the data submittals. Second, EIM does not capture some data that are essential for DMMP including, for example, the suitability determination for each dredged material management unit (DMMU), volumes associated with DMMUs, and the final disposition of dredged material. Critical data elements such as these will need to be identified and maintained outside of EIM. Finally, guidelines will need to be developed to help consultants and labs make this transition.

REFERENCES

PSDDA, 1989. *Management Plan Report, Unconfined Open-Water Disposal of Dredged Material, Phase II*, Prepared by the Puget Sound Dredged Disposal Analysis agencies: U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington State Department of Ecology, Washington State Department of Natural Resources, 1989.

CLARIFICATION PAPER

INTEGRATION OF DIOXIN DATA INTO RANKING DETERMINATIONS FOR PUGET SOUND DREDGING PROJECTS

Prepared by DMMP Agency Staff

INTRODUCTION

The DMMP agencies use a ranking process to represent a "best professional judgment" (BPJ) of concern or potential risk for any given dredging project. The project rank determines the maximal volume that can be represented by a single field sample and the number of DMMUs for a project. The ranking system is based on two factors:

(1) The available information on chemical and biological-response characteristics of the sediments.

(2) The number, kinds, and proximity of chemical sources (existing and historical).

For those dredging projects with sufficient historical data, the assigned ranking is based on the available chemical and biological data for project sediments. For those projects lacking sufficient historical data, the number, kinds and proximity of chemical sources are the major factors driving the assigned rank.

For the past 24 years, the existing ranking process has been based on the standard list of contaminants of concern (COCs) not including dioxins/furans. Twenty-five years of disposal site monitoring at the PSDDA non-dispersive sites have confirmed the utility of this ranking approach and the dredged material evaluation procedures in general; sediment concentrations of these COCs are consistently below SL levels at on-site and perimeter sample stations.

In December 2010 the DMMP agencies began implementing the new interim dioxin guidelines for Puget Sound, which set a site management objective of 4 pptr TEQ for the non-dispersive disposal sites. In order to meet the goal, projects must have a volume weighted average of 4 pptr TEQ or less, with no single DMMU having a concentration greater than 10 pptr TEQ. Disposal of material with more than 10 pptr TEQ or not meeting the volume weighted average of 4 pptr TEQ is subject to DMMP BPJ based on such things as the frequency of disposal site use and sequencing of dredged material disposal. The new interim dioxin guidelines also include updated reason-to-believe guidance; in urban areas, there must be existing dioxin data that supports exclusion of dioxins as a CoC, which has resulted in dioxin testing for almost all projects in urban embayments.

PROBLEM IDENTIFICATION

While the new interim guidance addresses where to test and what is allowed at the disposal site, it does not address how existing dioxin concentrations would affect project ranking. Such guidance is needed, particularly for areas that would be lower-ranked under the current ranking guidelines, but where dioxin concentrations may be elevated. In these cases, a lower rank based on existing chemistry data other than dioxins may support a low sampling density, but the lower density sampling may not provide sufficient information for appropriate project management with regard to dioxins. By considering dioxins in decisions regarding DMMU number and density, the DMMP agencies hope to both ensure appropriate characterization of material being taken to the PSDDA disposal sites, and to provide project proponents with useful information for sediment management of material that is not suitable for in-water disposal. In the latter case, lower volume DMMUs may allow more material to pass if the elevated dioxins are restricted in their distribution. In addition, lower volume DMMUs would support a higher-resolution evaluation for anti-degradation purposes, which may allow smaller areas to be targeted for active control of degraded surface sediment.

The DMMP agencies evaluated the ramifications of integrating dioxin data into ranking determinations through development of an algorithm based on the 4/10 guidelines. The algorithm resulted in ranks similar to existing ranks for most projects, but would have resulted in a significant increase in the number of DMMUs for a small number of projects. Such an increase in the number of DMMUs might not be warranted over the entire area of a project if elevated dioxin concentrations have limited distribution. For example, a marina with elevated dioxin levels associated with an active cleanup in one area might have background levels of dioxin in other nearby areas. Best professional judgment (BPJ) would be used to increase the sampling density of sediments near the cleanup area rather than throughout the marina.

PROPOSED ACTION/MODIFICATION

The DMMP proposes to use BPJ to determine ranking relative to dioxin rather than including dioxin in the standardized ranking approach used with other COCs. Where dioxins are either known or suspected to be present, existing sediment dioxin data from the project and vicinity as well as source information will be used to design a sampling density appropriate for the project.

REFERENCES

New Interim Dioxin Guidelines for Puget Sound - effective December 6, 2010.
http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=DMMO&pagename=Dioxin_Work_Group

USE OF PRACTICAL QUANTITATION LIMITS (PQLs) TO ESTABLISH CLEANUP STANDARDS FOR CONTAMINATED SEDIMENT SITES UNDER THE SEDIMENT MANAGEMENT STANDARDS (SMS)

SMS ISSUE PAPER
Sediment Management Annual Review Meeting, May 2, 2012

Prepared by Teresa Michelsen and Chance Asher (Washington Department of Ecology, Toxics Cleanup Program)

INTRODUCTION

This issue paper describes challenges associated with developing cleanup standards based on practical quantitation limits (PQLs), existing rules and guidance, a proposed approach for developing cleanup standards based on PQLs, and analytical considerations for remedial investigations at sediment sites.

Human health risk-based cleanup standards based on the seafood ingestion pathway are frequently below both natural background concentrations as defined in the Model Toxics Control Act (MTCA) Cleanup Regulation (Chapter 173-340 WAC) and PQLs. This is particularly true for carcinogenic chemicals detected even in nonanthropogenically impacted areas of Puget Sound and other parts of the state, including dioxins/furans, PCB congeners, carcinogenic PAHs, mercury, and arsenic. With increasing emphasis on protection of human health for sediment cleanup, it is likely this will be an issue at the majority of sediment cleanup sites contaminated with bioaccumulative chemicals.

The MTCA rule requires that cleanup standards be established at concentrations that are the highest of 1) the risk-based concentration (this would be the lowest risk based concentration for protection of both ecological and human health), 2) natural background, and 3) the PQL. The Sediment Management Standards (SMS) rule (Chapter 173-204 WAC) is silent on the use of cleanup standards based on PQLs. Therefore, the MTCA requirements apply because it is the more specific rule on this issue. Under the MTCA rule, the PQL is defined as follows (WAC 173-340-200):

> *… the lowest concentration that can be reliably measured within specified limits of precision, accuracy, representativeness, completeness, and comparability during routine laboratory operating conditions, using department approved methods.*

The SMS rule is currently under revision to address the issues of human and ecological risk from bioaccumulatives and how to incorporate natural background concentrations and PQLs when establishing cleanup standards. Supporting guidance is being developed on assessing human health risk and calculating background for sediment cleanup to support these rule revisions. This issue paper provides guidance on using the third element, PQLs, to develop cleanup standards.

Nothing in this guidance is intended to limit the selection of individual laboratories or PQLs during remedial investigations for purposes of analysis, quality assurance, and data interpretation based on site-specific conditions. The following guidance applies only to the development of cleanup standards based on PQLs.

DRAFT

PROBLEM STATEMENT

The following issues have arisen in using PQLs to develop cleanup standards at sediment sites:

- **Terminology.** Various laboratories, programs, guidance documents, and methods have different terminology for similar concepts. Conversely, the same term may not be used for the same thing in all contexts. Notwithstanding the MTCA rule definition above, this continues to be a challenge when working with PQLs. In general, there is a lower limit at which a chemical may be detected, and a higher limit at which a chemical concentration may be quantified. This higher limit may be termed the PQL or Limit of Quantitation (LOQ). There may also be method-specified reporting limits (MRLs), which may or may not be similar in concept to a PQL. Finally, these values may be 1) sample-specific, 2) "typical" values for the method that can be achieved by a specific laboratory, or 3) contract-required limits such under EPA's Contract Laboratory Program (CLP). Thus, identifying the specific value closest to that defined by rule can be a challenge.

- **Selecting PQLs for Use in Establishing Cleanup Standards.** Ecology maintains a list of accredited laboratories for each analytical procedure. However, these laboratories may not all have the same PQLs, even if they are all using the same terminology, for a given analyte. Ecology must select among this range of available PQLs in developing a cleanup standard, and that selection may affect 1) the protectiveness of the cleanup standard for that site, and 2) how many laboratories will have PQLs below that standard and thus can participate in future monitoring at that site. Ecology will also consider the capacity and potential cost of the few laboratories that can meet very low PQLs, as well as marketplace impacts, should low PQL-based standards be selected.

- **Recency.** Analytical methods change over time and PQLs may decline, which affects a number of aspects of the process. First, it is important that Ecology have recent information on PQLs prior to selecting a PQL-based cleanup standard for a sediment site. Second, because the PQL-based standard would in this case represent a risk level that is higher than that mandated by rule, the site manager must carefully consider what may happen if the PQL changes in the future and whether there is another alternative that could be chosen. Unlike most other cleanup standards, the permanence of the remedy could ultimately be called into question.

- **Remedial Investigation Data Reporting.** Despite the likely increased use of PQL-based cleanup standards for sediment sites in the future, Ecology wishes to re-emphasize its long-standing policy of requiring all remedial investigation data between the MDL and the PQL to be reported at face value and J-qualified. Ecology staff have noticed a recent trend in which many laboratories are reporting all data between the MDL and the PQL as undetected at the PQL. This limits the ability of site managers and contractors to perform needed evaluations of data that are frequently at these very low levels, including comparisons to natural background distributions, calculation of TEQs and human health risk evaluations, chemical fingerprinting, and trend analyses. As we deal more with natural background and human health evaluations for carcinogenic chemicals, concentrations of chemicals at these levels will become increasingly important to decision-making at sediment sites.

  Ecology believes that while these concentrations may be J-qualified and more uncertain than concentrations above the PQL, using the J-qualified data in these evaluations is preferable to substitution methods with even less statistical validity. In addition, simply knowing whether a

chemical is present at all (at the MDL) is valuable information that is lost when all concentrations are qualified as undetected at the PQL. This may inform us, for example, as to whether a more specialized analytical method is needed in a subsequent round of analyses. All of these uses are considered exploratory and deliberative in nature, as opposed to setting a cleanup standard, which necessitates use of a more accurate, precise, and achievable value such as the PQL.

EXISTING RULES AND GUIDANCE

Both the SMS and MTCA rules include provisions for situations where the calculated cleanup levels for protection of human health are below 1) natural background as defined in the MTCA rule or 2) non-anthropogenically affected background as defined in the SMS rule. Specifically:

- The SMS rule states that "…the existing sediment chemical and biological quality shall be identified on an area-wide basis as determined by the department, and used in place of the sediment quality standards of WAC 173-204-320(6).

- The MTCA rule specifies that "the cleanup level shall be established at a concentration equal to the practical quantitation limit or natural background concentration, whichever is higher" (WAC 173-340-700).

The SMS rule does not currently provide specific requirements or directives for addressing situations where human health risk-based or background levels are at concentrations that cannot be reliably quantified; therefore, the procedures set forth in MTCA are applicable to sediment sites.

The MTCA rule also requires that, where the PQL is used as a cleanup level, it must meet the more stringent of the following conditions (WAC 173-340-707(2)(a) and (b)):

- The PQL is no greater than ten times the method detection limit (MDL).

- The PQL is no greater than that established by the U.S. EPA and used to establish requirements in 40 CFR 136, 40 CFS 141-143, or 40 CFR 260-270.

The MTCA rule further requires that sites where the cleanup level was set at the PQL shall undergo periodic reviews, and that the availability of improved analytical techniques should be considered during the periodic review (WAC 173-340-707 (4)).

PROPOSED APPROACH

Ecology proposes to take the following approach to identifying, selecting, and applying PQL-based cleanup standards at sediment cleanup sites under the SMS:

- **Definitions.** The PQL will continue to be defined as in the MTCA rule, which is not currently open for revision. When conducting surveys of laboratories, Ecology will take care to understand the various levels the laboratory may be using and how they relate to the rule definition. In general, Ecology is seeking to identify the lowest level at which each laboratory can reliably quantify the

chemical concentration on a method-specific basis, as distinguished from either a contract-required reporting limit or a sample-specific quantification limit.

- **Identifying PQLs in Current Use.** To identify the commercially available range of PQLs from which PQL based cleanup standards will be derived, Ecology will periodically survey Ecology-accredited laboratories for a chemical or chemicals of interest. Information on all available analytical methods will be requested. Ecology will specify that method-specific MDLs and PQLs should be provided that represent what the laboratory can actually and routinely achieve using each method that it runs for that chemical.

- **Programmatic Approach for Developing PQL-Based Cleanup Standards.** On a program-wide basis, Ecology will review the available PQLs and identify a representative value from the distribution of PQLs that is reasonably achievable and reliably attainable by most accredited laboratories using appropriate analytical methods. Ecology may choose not to include particularly high PQLs (e.g., that represent EPA CLP contract-required reporting limits) or particularly low PQLs (e.g., that only a few specialty or research labs can achieve) in the distribution. For chemicals that are identified program-wide to have high human health or ecological risks at natural background or PQL concentrations, a more sensitive commercially available method may be used to establish the distribution of PQLs. To select a specific PQL-based cleanup standard, a central tendency value such as a median or mean of the distribution will be used and rounded to one significant digit. As required by MTCA, this value will be no more than 10 times the MDL and no higher than the EPA CLP. Ecology will make each chemical-specific evaluation available through the Sampling and Analysis Plan Appendix or the Sediment Management Annual Review Meeting. In general, analytical PQLs should be reviewed every 3-5 years to ensure that they are still accurate and that cleanup standards derived from them are still appropriate.

- **Site-Specific Approach for Selecting a PQL-Based Cleanup Standard or a Cleanup Standard below the PQL.** PQL-based cleanup standards, as with other cleanup standards, are selected at the end of the RI process, and do not necessarily reflect the PQLs used during the RI for analytical purposes. Site managers may require site-specific PQLs during the remedial investigation for the purposes of laboratory selection, data analysis, quality assurance, and data evaluation. Such analytical PQLs may be higher or lower than the PQL-based cleanup standard, depending on the conceptual site model and other site-specific considerations.

  There may be circumstances in which a site manager needs to select a site-specific PQL-based cleanup standard that is different from the programmatic PQL-based standard, for example:

  - If a new method or improvement to a method comes into widespread commercial use.
  - If the existing programmatic PQL-based cleanup standard for a chemical is more than 3-5 years old.
  - If a PQL-based cleanup standard has not been developed for a chemical of concern at the site.
  - The conditions in WAC 173-340-830(2)(e) apply.

  In these cases, the programmatic PQL-based cleanup standards may need to be updated or established and the site manager will work with the program to update the PQL-based cleanup

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standard needed for the site using the process above (or a simplified version of it for one or a few chemicals).

In addition, a site manager may wish to set a cleanup standard below the PQL on a site-specific basis if it would provide greater finality or protectiveness (e.g., based on human health risk, protection of ESA species, or natural background). This can be accomplished in one of two ways:

- Ecology and the liable party may negotiate a cleanup standard between the MDL and the PQL based on natural background or environmental/human health risk.

- A cleanup action may be selected that would achieve any reasonably foreseeable cleanup standard (e.g., dredging to native sediments).

Site managers should carefully consider the implications of selecting a PQL-based cleanup standard, including the possibility that the PQL may fall over time to below natural background or risk-based levels. An understanding of how decisions or actions could change if this occurs during the periodic reviews would be important to reach in cooperation with the PLP(s) prior to finalizing the Cleanup Action Plan.

- **Comparison of Natural Background or Risk-Based Concentration to PQLs.** In determining whether the cleanup standard should be based on PQLs under MTCA/SMS, the site manager will determine whether the risk-based concentration and/or natural background concentration is below the programmatic PQL. These comparisons will be based on bright-line values rather than distributions, e.g., the statistic representing natural background that would be selected as the cleanup standard is compared directly to the PQL-based cleanup standard to determine which is higher.

- **Remedial Investigation Data Reporting.** Ecology will continue to require that all data collected as part of the RI/FS process be reported at face value to the sample-specific detection limit, appropriately qualified. Data falling between the detection limit and the quantification limit (however defined) may not be U-qualified.

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