SEDIMENT MANAGEMENT
ANNUAL REVIEW MEETING MINUTES

May 8, 2001

FINAL

Prepared for:

U.S. Army Corps of Engineers
Seattle District
4735 East Marginal Way South
Seattle, Washington 98124-2255

Prepared by:

Science Applications International Corporation
Environmental Sciences Division
18706 North Creek Parkway, Suite 110
Bothell, Washington 98011

TABLE OF CONTENTS

SEDIMENT MANAGEMENT ANNUAL REVIEW MEETING MINUTES

The Cooperative Sediment Management Program (CSMP) held its annual review of dredging/disposal and sediment management issues on May 8, 2001. This Sediment Management Annual Review Meeting (SMARM) was hosted by the Washington State Department of Ecology (Ecology) and facilitated by the United States Army Corps of Engineers. It was held at St. Martin's College in Lacey, Washington. The SMARM encompassed both the Dredged Material Management Program (DMMP) annual review meeting and the Washington State Department of Ecology's Sediment Management Standards (SMS) annual review process. The DMMP is an interagency cooperative program for dredged material management that began with the Puget Sound Dredged Disposal Analysis Program (PSDDA) and has expanded to other regions of Washington State. The DMMP agencies include the U.S. Army Corps of Engineers (USACE), Seattle District; U.S. Environmental Protection Agency (EPA), Region 10; the Washington Department of Natural Resources (DNR); and Washington State Department of Ecology (Ecology). The meeting agenda is provided as Attachment 1, and Attachment 2 is the list of attendees.

MORNING SESSION

Introduction And Overview

1. Diane Parks, Deputy Chief, Operations Division, USACE, Seattle District - 9:00 am
Welcome, Opening Remarks

Diane Parks welcomed everyone to the 13th annual review meeting, gave opening remarks, and stated the following ground rules:

a. If you want to ask a question, stand up and say your name and affiliation.
b. Please wait to ask questions until the talk is over.

Diane Parks then introduced Nancy McKay as the opening speaker. Ms. McKay currently serves as the Chair for the Puget Sound Water Quality Action Team (PSWQAT). She is also a member of Governor Gary Locke's Natural Resources Cabinet, and serves on the science and policy advisory committee for the National Estuary Program. She has previously worked in the fields of land use for Washington cities and counties, juvenile justice, election law, education, international relations, and mental health.

2. Nancy McKay, Chair of PSWQAT - 9:15 am
Opening Speaker

Nancy McKay thanked everyone for his/her contribution to environmental health. She explained that sediment management, cleanup, and other sediment related issues have become prevalent at national meetings. The Pacific Northwest has been in a leadership position in this field. Congress

SEDIMENT MANAGEMENT
ANNUAL REVIEW MEETING MINUTES

May 8, 2001

FINAL

Prepared for:

U.S. Army Corps of Engineers
Seattle District
4735 East Marginal Way South
Seattle, Washington 98124-2255

Prepared by:

Science Applications International Corporation
Environmental Sciences Division
18706 North Creek Parkway, Suite 110
Bothell, Washington 98011

is finally taking interest in sediment management issues. The hope was that this would mean increased funding for sediment management.

Ms. McKay stated that increased funding for cleanup and research is needed. Sediment contamination has been one of the most serious problems in Puget Sound - an estimated 5000 acres of contaminated sediments needs to be cleaned up. Some of the hotspots have been affecting fish and marine mammals. The listing of salmon has promoted urgency as fish health may be compromised. The Puget Sound Estuary Program (PSEP) was originally formed, in part as a response to public outcry, to create management standards and disposal guidelines.

Bellingham Bay was discussed as the pilot study site for cleanup. The Bellingham Bay Interagency Work Group has reached an agreement and has finally moved from the planning and EIS phases to cleanup. Ms. McKay hoped the Bellingham pilot study would serve as a model for what would be done in other areas of Puget Sound and the Northwest. She indicated that we need to make progress on cleanup of other sites, and it has taken longer than she (and others) would like.

Through the Multi-user Disposal Sites (MUDS) program, the feasibility of treating contaminated sediments has been researched. There has been an increasing interest in treating the sediments, rendering them harmless, and doing something useful with them. Ms. McKay then mentioned a DNR workshop on treatment that occurred previously, and that there was generally a strong interest in treatment issues.

Ms. McKay explained that cleanup has occurred through navigation dredging and the Superfund program, but she would like to see this coupled with habitat restoration. There needs to be increased talk between the Superfund program and those working on navigation dredging. The Habitat Conservation and Restoration Act was passed by Congress, and if funded, should provide millions of dollars for habitat restoration around the nation. However, funding was still needed. She was hopeful that contaminated sediment cleanup would be part of that program. The passing of the Water Resources Development Act may provide more money for cleanup.

For upcoming cleanup projects, the following issues were identified to be important:

1. Treatment - learn more about technologies, options, and funding.
2. Explore public/private partnerships - public agencies working together and coordinating with the private sector.
3. Sediment standards have been in place - keep them up to date and make sure they protect human health and freshwater, as well as marine waters.
4. Continue to focus on source control - it is important not to recontaminate. Continue to look at storm water runoff control. How can we keep toxins out of our waters?
5. Monitoring is crucial. We need to know where we have been in order to know where we are going. Policy makers need to have an idea of what works in order to make decisions. Do Confined Aquatic Disposal Sites (CADS) work? Do treatment and capping work, and for how long? Monitoring should be built into any cleanup approach.

6. Adaptive Management - we need good monitoring to do a good job in making management decisions.
7. Fund raising to support work is crucial. We need to go to legislature to get the support to make things happen.
8. Integrate issue of sediment quality into other processes (e.g., watershed planning rarely had addressed sediment contaminant issues). Integration is needed between watershed planning, restoration, and sediment contamination.
9. People involved in Superfund cleanup work need to improve communication with those making decisions about navigation dredging.

Ms. McKay went on to point out that the cooperative sediment management program in the Puget Sound has had a difficult 3-4 years. Ms. McKay stated that the interagency DMMP, which developed from the PSDDA process, has been a good model. Something similar to that should be created for managing contaminated sediments. She suggested that a group of state and federal officials with a good advisory group consisting of local governments, tribes and interested parties should be established to keep track of what decisions have been made, what the best policies are for cleanup, what kind of research should be promoted, what types of interagency coordination can be looked into, what types of private/public partnerships can be developed, and how the work may be funded. All these issues need to be addressed. Ms. McKay intended to get this active and running in the next few months, and she indicated that she would love input from everyone. On a final note, Ms. McKay stressed the need for a bay-wide approach to sediment work; to look at the area larger than the site itself.

In conclusion, Ms. McKay thanked everyone again for the work that they have done. She said that the people at this meeting were the unsung heroines and heroes. Many people have not been aware of sediment contamination issues. Many others have been concerned about this issue and would like to see more progress. Ms. McKay was looking forward to working with everyone in the future on these critical issues.

3. Ms. Diane Parks - 9:30 am

Diane Parks next introduced the panel members for the SMARM meeting: Jim Pendowski, Ecology; Loren Stern, DNR; Sally Marquis, EPA; and David Kendall, USACE. She then talked about the objectives for the meeting, and reviewed the agenda. Ms. Parks again asked that anyone who would like to submit a comment should give it to the panel in written form. The comment would then be included in the final agenda. Ms. Parks announced that an interagency post SMARM meeting on June 7th, 2001 would address issues for agency consideration. She also encouraged everyone to add his/her name to the DMMP mailing list.

Ovrhd 1-1. Sediment Management Annual Review Meeting
Ovrhd 1-2. 2001 SMARM
Ovrhd 1-3. Meeting Objective and Purpose
Ovrhd 1-4. Meeting Objective and Purpose, Cont.
Ovrhd 1-5. Agency Summary Reports

Ovrhd 1-6. Agency Summary Reports, Cont.
Ovrhd 1-7. DMMP/SMS Presentations
Ovrhd 1-8. DMMP/SMS Presentations, Cont.
Ovrhd 1-9. Public Issue Papers/Discussion
Ovrhd 1-10. Topical Presentations/Lessons Learned
Ovrhd 1-11. Summary and Closing

Agency Summary Reports

4. Lauran Cole-Warner, USACE - 9:36 am
Summary of DMMP Testing Activities

Lauran Cole-Warner welcomed everyone to the meeting, and explained that she would be reviewing DMMP testing activities for this and last year, and briefly listed what other agencies would be discussing during the SMARM meeting. She indicated that the biennial review report on dredging activities would be prepared this summer, following the end of Dredging Year (DY) 2001. Once completed, the biennial review report would be posted on the DMMO website.

For DY 2000, which included projects conducted from June 16, 1999 to June 15, 2000, 91% of the sediment tested was suitable and authorized for open water disposal. However, only 4 of 9 projects passed screening levels for all material. Three of the 9 projects conducted bioaccumulation testing (contaminants tested included tributyltin [TBT], dichlorodiphenyltrichloroethane [DDT], and polychlorinated biphenyls [PCBs]). Most of the projects conducted during DY 2000 were either very large or quite small. Among the largest projects were the East Waterway and Puget Sound Naval Shipyard (and associated PitCAD). Dredging has been completed for the East Waterway Stage I, and testing has been completed for Stage II. For the Puget Sound Naval Shipyard, the Navy created a Confined Aquatic Disposal (CAD) site to contain material from navigation and Superfund dredging.

For DY 2001 (June 2000-2001), there have been 8 suitability determinations to date. Most of the failures for this dredging year occurred within the Hylebos Waterway, which was one of the largest projects conducted during DY 2001. This was also the only project for which bioaccumulation testing was conducted. Within the Hylebos, there were some cleaner sediments that had the potential to not be considered among the Superfund materials. The DMMP agencies were able to define which of the Hylebos Waterway sediments were not suitable for open-water disposal. The Grays Harbor O&M project also included extensive dredging. Sediments slated for dredging in this project were determined to be clean.

Ms. Cole-Warner then listed on-going dredging projects within Washington (refer to overhead for specific projects), and issues being addressed by the DMMP. The largest pending project was the Port of Tacoma Pierce County Terminal Expansion project, which would involve dredging 2.1 million cubic yards of material. Issues being addressed by the DMMP included *Eohaustorius estuarius* clay sensitivity testing (Navy sponsored), the definition of dredged material, beneficial use issues, site monitoring, and the Endangered Species Act (ESA). With respect to dredged material beneficial uses, the Bellingham log pond project was constructed, but

the Jetty Island project was not constructed, primarily due to ESA issues. Disposal site monitoring at the Elliott Bay site included additional testing to address ESA issues (e.g., impacts to salmon).

Ms. Cole-Warner concluded her discussion by listing the DMMO website where documents could be downloaded: http://www.nws.usace.army.mil/dmmo/homepage.htm

Ovrhd 2-1. DMMP Program Accomplishments
Ovrhd 2-2. Overview of Agency Reports
Ovrhd 2-3. Dredging Year 2000
Ovrhd 2-4. Dredging Year 2000, Cont.
Ovrhd 2-5. Dredging Year 2001
Ovrhd 2-6. Dredging Year 2001, Cont.
Ovrhd 2-7. Ongoing Projects
Ovrhd 2-8. Big Issues
Ovrhd 2-9. Website for More DMMP Information

5. Robert Brenner, DNR - 9:50 am
2000 Full Monitoring at the PSDDA Elliott Bay Disposal Site

Robert Brenner gave a presentation summarizing the results of the full monitoring at the PSDDA Elliott Bay disposal site, which occurred during June and July, 2000. Dr. Brenner first discussed the background and objectives of the site monitoring at the Elliott Bay site (refer to overheads for specific details). In addition to the standard objectives of the site monitoring, confirmatory testing was also conducted to address concerns related to the listing of Puget Sound Chinook salmon and bull trout as threatened under the ESA. He reviewed the PSDDA monitoring framework and associated monitoring tools, displayed figures showing the site boundaries and various sampling locations, and described modifications incorporated into the 2000 monitoring program. These modifications included 45-day bioaccumulation testing at one benchmark station and one composite of onsite stations; P450 RGS cell line assay for relative amounts of dioxin and dioxin like compounds conducted to address concerns about ESA listings; high-resolution GCMS PCB analysis; butyltins analysis (not a chemical of concern during the 1990 and 1992 monitoring); and *Molpadia* tissue collection and analysis at 2 of 3 transect stations (insufficient *Molpadia* were available at these locations during previous surveys to conduct tissue analyses). In addition, site-center coordinates were moved approximately 90 meters south to ensure confinement within the site perimeter.

Dr. Brenner then discussed the results of the monitoring survey. He showed figures that compared baseline and post-disposal chemistry results at the onsite zone station during the various monitoring surveys conducted at the site. With the exception of mercury during the 1988 baseline survey, all metals were detected below screening levels during all surveys at this station (EBZ01). Organic compounds were also below screening levels at EBZ01 during most surveys, except the baseline survey (and total DDTs during the 1990 monitoring).

For the 2000 monitoring, the SVPS survey results indicated that the dredged material remained within the perimeter of the site. Areas in which the sediments exhibited less bioturbation were

within the center of the disposal site and in perimeter areas where rocky outcrop areas were present. Prism penetration was deeper in unconsolidated bioturbated sediments. There were some screening level exceedances during the 2000 monitoring. These included 4 samples that exhibited screening level exceedances for mercury, one of which exceeded the SMS criterion. The screening level for total PCBs was also exceeded in 4 samples from 2 stations, two of which also exceeded the SMS criterion. Tributyltin screening levels were exceeded in 9 bulk sediment samples and one porewater sample. There were no other metals or organics exceedances.

No organic compounds were detected in the *Molpadia* tissue samples, and metals were detected at low concentrations within these samples. The bioaccumulation test tissue analyses showed some contaminants that were significantly higher than the reference in both species tested, although none were at levels that posed significantly higher human health risks.

One-hit failures were observed in the amphipod and sediment larval tests for EBZ01, although results were not corroborated by the *Neanthes* and Microtox tests, chemistry results at this station, retests that were conducted, and results for other site stations. The conclusion was that the failures were most likely due to the high clay content observed at this station. Therefore, benchmark stations were not tested. Benthic infauna results indicated that the abundance of major taxa were not significantly different among the three transect stations and the most numerically abundant species during the 1988 benchmark survey and 1992 monitoring survey was unchanged in 2000. Fewer crustaceans were observed in the 2000 survey than during the 1988 and 1992 surveys.

Robert Brenner then discussed the data evaluation results according to the monitoring framework questions and hypotheses. The survey found that dredged material remained onsite and biological effects conditions were not exceeded at the site due to dredged material disposal. It was not possible to fully evaluate whether unacceptable adverse effects to offsite biological resources occurred due to disposal activities, because there were no baseline or previous monitoring tissue data available.

Ovrhd 3-1. 2000 Full Monitoring at the PSDDA Elliott Bay Disposal Site
Ovrhd 3-2. Background
Ovrhd 3-3. Objectives
Ovrhd 3-4. PSDDA Monitoring Framework
Ovrhd 3-5. Presentation Agenda
Ovrhd 3-6. 2000 Elliott Bay SVPS Survey Sampling Grid.
Ovrhd 3-7. Chemical and Biological Sampling Stations
Ovrhd 3-8. PSDDA Monitoring Tools
Ovrhd 3-9. Modifications to the 2000 Monitoring Program
Ovrhd 3-10. Modifications to the 2000 Monitoring Program, Cont.
Ovrhd 3-11. Comparative Predisposal Baseline and Postdisposal Chemistry (Metals)
Ovrhd 3-12. Comparative Predisposal Baseline and Postdisposal Chemistry (Organics)
Ovrhd 3-13. Findings
Ovrhd 3-14. Sediment Vertical Profile Systems
Ovrhd 3-15. Dredged Material Footprint
Ovrhd 3-16. SVPS Mean Prism Penetration

Ovrhd 3-17. Redox Potential Discontinuity (RPD) Depths
Ovrhd 3-18. Sediment Chemistry
Ovrhd 3-19. Tissue Chemistry
Ovrhd 3-20. Sediment Bioassays
Ovrhd 3-21. Sediment Bioassays, Cont.
Ovrhd 3-22. Benthic Infauna
Ovrhd 3-23. Tissue Analyses
Ovrhd 3-24. Data Evaluation: Question 1, Hypothesis 1
Ovrhd 3-25. Data Evaluation, Question 1, Hypothesis 2
Ovrhd 3-26. Data Evaluation, Question 2, Hypotheses 3 and 4
Ovrhd 3-27. Data Evaluation, Question 3, Hypotheses 5 and 6
Ovrhd 3-28. Any Questions?

Discussion and Public Comment

John Wegrzyn, Oregon Department of Environmental Quality asked Robert Brenner what the agencies would do if an insufficient volume of tissue could be obtained to analyze tissues for chemical contaminants. Would they look at something else, or make assessments to determine why sufficient volumes of tissues could not be collected?

Robert Brenner replied that during previous surveys at the Elliott Bay disposal site, they were not able to obtain sufficient volumes of tissues for chemical testing. Therefore, the *Molpadia* tissue data from this survey would be used as baseline data for future monitoring at the site.

David Kendall, USACE, added that in the past the site was more contaminated, and they were unable to find the larger organisms to conduct tissue analyses. The fact that larger organisms such as *Molpadia* are now being found at two of the transect stations suggests that sediment quality has improved over the 12 years of site monitoring, and that some benthic recovery has apparently occurred in the area.

Jeff Steevens, USACE, asked Robert Brenner how it was determined that levels of contaminants observed in tissues in the 45-day bioaccumulation test were not a risk to human health.

Robert Brenner indicated that since he was new to the program, he could not answer the question at this time and would need to check into it.

Tom Gries, Ecology, added that the report was in draft form and conclusions were still being discussed.

6. Jim Pendowski, Ecology - 10:10 am
Cooperative Sediment Management Program

Jim Pendowski, manager of Ecology's Toxics Cleanup Program, spoke about the Cooperative Sediment Management Program (CSMP) and how its success has been dependant on the ability

of multiple agencies to coordinate and cooperate with all parties involved. To date the PSDDA/DMMP program has been a success, and Ecology remains committed to the program and to renewing, refining, and re-invigorating the relationships and policies. He then discussed what could be done to enable the CSMP to accomplish its goals with respect to cleanup, remediation, and habitat restoration.

One suggestion was to refine policy focus. Mr. Pendowski suggested that the new administration at DNR gave an opportunity to re-establish or redefine relationships with DNR and other agencies, review existing policies, and possibly establish new policies. The past 3 to 4 years have been good for addressing cleanup activity effectiveness and remediation, and perhaps the program could focus more on habitat restoration.

Another suggestion was to acknowledge the changed status of work in Bellingham Bay and the lessons learned from the project. The Bellingham Bay experiment is in its implementation phase and cleanup has begun. The question is where do we go from here and how do we clean Puget Sound on a bay-by-bay basis.

Mr. Pendowski also emphasized the need to focus on the near and long term future of MUDS. The program is at a critical juncture and decisions need to be made about a number of issues. He spoke of opportunities for new focused agenda (e.g., treatment), and addressing policy issues between all parties and agencies involved.

Mr. Pendowski's final suggestion was to remain flexible on new projects. There are projects that involve critical economic interests, multiple interests and parties, and both cleanup and dredging, which are different from typical projects addressed in the past. In addition, cleanup of sediments has been increasingly involved in freshwater environments. The program needs to address freshwater in addition to marine waters. There are complex issues in eastern Washington involving freshwater sediment cleanup (e.g., Lake Roosevelt basin, Spokane River, and Columbia River dredging issues).

Mr. Pendowski then introduced Roger Dovel, who gave the second half of the presentation.

Ovrhd 4-1. Cooperative Sediment Management Program
Ovrhd 4-2. Cooperative Sediment Management Program Participants
Ovrhd 4-3. Cooperative Sediment Management Program, Cont.
Ovrhd 4-4. MUDS Project
Ovrhd 4-5. Cooperative Sediment Management Program

7. Roger Dovel, Ecology
Summary of SMS Cleanup Activities

Roger Dovel, the unit leader for the toxics cleanup group at Ecology, introduced himself and indicated that he would be discussing the progress and status of SMS cleanup activities throughout the state. The sediment cleanup status report has been completed and includes 112 marine sites and 22 freshwater sites. The northwest regional office worked on the Bellingham Bay pilot agreement, and an in-situ treatment project is in place. The CAD has been completed

at PSNS, and a draft monitoring plan is in place. The southwest regional office had progressed in Commencement Bay sediment cleanups, where sediment is being removed for disposal. Lower Duwamish River cleanup is also progressing. He indicated that Ecology felt good about the agency cooperation in these programs.

Mr. Dovel indicated that there were issues with respect to freshwater cleanup that needed to be addressed. Cleanup efforts in Spokane must address fish consumption advisories for the Spokane River. For Lake Roosevelt, both Ecology and tribes were doing sediment characterizations. Lake Union cleanup projects were being addressed on a site-by-site basis by EPA. There are also a number of proposed development sites requiring attention within Lake Washington. A draft for freshwater guidance is in preparation, and Brett Betts at Ecology is the point of contact for this document.

With respect to sediment source control, the 2002 303d Sediment Policy is open to public comment (see overhead for website address for a copy of the policy). Other source control issues addressed have been sediment total maximum daily loads (TMDLs) in Bellingham Bay and the Duwamish River, stormwater general permits for which sediment impacts are an integral part, and National Pollutant Discharge Elimination System (NPDES) permit technical support.

Mr. Dovel indicated that the Sediment Sampling and Analysis Plan Appendix (SAPA), which provides guidance on development of sediment sampling and analysis plans to comply with sediment management standards, is under revision. Issues being addressed included analytical method and recovery limit updates, and reconciling technical inconsistencies between SMS and DMMP programs. The update is expected to be posted on Ecology's website later this year. Mr. Dovel listed various websites where SAPA/PSEP protocols and SMARM clarification and issue papers could be obtained (refer to overhead for details). Although the version of SAPA that was under revision remains on their website, the 1997 PSEP protocols and SMARM papers are most up to date.

With respect to human health issues, Mr. Dovel indicated that selection of exposure parameter values for the fish consumption pathway is one of the current focus areas. Other focus areas included analysis of "reference area" PCB concentrations, and correlation between English sole tissue and sediment PCB levels.

Mr. Dovel announced that Revision 4 of the Sediment Quality Information System (SEDQUAL) database program would be available this month. He briefly mentioned some of the revisions and indicated that Martin Payne would be demonstrating the new version during the SMARM meeting.

Ovrhd 5-1. Sediment Management Standards Program
Ovrhd 5-2. Sediment Cleanup Activities
Ovrhd 5-3. Sediment Cleanup Activities, Cont.
Ovrhd 5-4. Sediment Source Control
Ovrhd 5-5. Sediment Sampling and Analysis Plan Appendix (SAPA)
Ovrhd 5-6. Public Access to Guidance
Ovrhd 5-7. SMU Human Health Issues: Current Focus Areas

Ovrhd 5-8. Sediment Quality Information System (SEDQUAL)

8. Sally Marquis, EPA - 10:30 am
EPA National/Regional Activities

Sally Marquis gave an impromptu presentation on EPA national and regional activities in place of John Malek who was delayed. She spoke of a national water programs managers meeting in Washington D.C. she attended for which one of the topics was integration. This topic has caught the interest of senior EPA managers in Washington D.C. who are recognizing the need for integration, and she was pleased that integration was now being supported at the highest level. Discussions at the meeting included barriers to working well in an integrated manner. They spoke about Superfund, drinking water, water quality standards, TMDLs, and wetlands, and what barriers kept them from working well together. One important barrier to integration and cooperation identified is data management: database systems have not been well integrated. They discussed the need to find ways on how to complement the various systems and allow for interchange among them. It would be a significant effort to improve data cooperation and management. Bill Diamond, who heads the drinking waters program nationwide, articulated the benefits and need to start working in an integrated mode. They are now embracing integration between agencies, tribes, and private parties.

Ms. Marquis' impression of the current political climate was that there was nationwide optimism about Governor Whitman as EPA administrator. There has been a high level of interest and support from her. Ms. Marquis also met the designee deputy administrator, Linda Fisher. She described her as very enthusiastic, and very experienced with Superfund work. She had worked with EPA for a while, but worked for Monsanto for the last 8 years. She came back to EPA because of her devotion to environmental protection. The administrator positions at the national level were currently being filled, and she expected the Region 10 new administrator will likely be designated in the late summer/early fall, at the earliest, after the national level administrator positions have been filled.

DMMP/SMS Presentations: Issue Papers And Status Reports

9. Diane Parks, USACE - 10:58 am

After the morning break, Diane Parks reviewed the presentations for the next session. This session included the DMMP and SMS issue papers and status reports. She then introduced John Malek, who gave the first presentation on dispersive site guideline revisions.

10. John Malek, EPA - 11:00 am
Dispersive Site Guideline Revisions

John Malek briefly spoke about the presentation he was to give earlier, summarizing EPA national and regional activities. He stated that the national and regional activities had not changed significantly since his presentation at the SMARM last year. One could review last years' minutes for a general sense of EPA's activities over the past couple of years.

Mr. Malek then discussed the issue paper on dispersive site guideline revisions. He first gave a history of disposal site management and site guidelines. The standard was not to allow unacceptable adverse impacts at a disposal site. The guidelines were based on measurable site conditions, and the focus was on chemical and biological testing, and physical site monitoring. The PSDDA Phase I sites established were non-dispersive sites. Since the dredged material would remain on-site at these locations, it would be possible to monitor potential long-term impacts at these sites. Additional sites were established during Phase II of the PSDDA program. These included three dispersive sites where disposed dredged material would not remain onsite. Dispersion of material was expected to reduce the concentration of chemicals associated with the dredged material discharged at the site, and thus lessen the potential for adverse biological effects at the site. Due to the difficulties in monitoring disposal effects at these dispersive sites, and verifying the fate of the material, the dispersive site guidelines were more restrictive for the biological tests. Chemical and biological monitoring at the sites was not required, although limited physical monitoring of the dispersive sites was planned to verify that disposed material eroded and did not accumulate.

Monitoring of the non-dispersive disposal sites has occurred over the 13 years of PSDDA/DMMP disposal site management. The monitoring data was reviewed to assess whether unacceptable adverse impacts had occurred at the sites over time. The expectation was that if no unacceptable adverse impacts were occurring at the nondispersive sites, then there were likely no unacceptable adverse impacts at the dispersive sites. The results of the review showed that the types of impacts that were predicted did occur, and the types of impacts that were not expected did not occur. The DMMP agencies judged that no unacceptable adverse impacts have occurred at the nondispersive disposal sites as a result of dredged material disposal. Bathymetry monitoring at the Rosario Strait dispersive site showed that there was no mounding of material onsite. Based on this information and the fact that material going to nondispersive sites is judged to be clean, the DMMP intended to unify the bioassay interpretive guidelines for all open-water disposal sites. The new bioassay interpretive guideline would be identical to the present nondispersive guidelines.

11. Steve Babcock, USACE - 11:09 am
MUDS Study Update

Steve Babcock gave an update on the progress of the MUDS (Multi User Confined Disposal Site(s)) project, and discussed in particular the MUDS feasibility study. He first reviewed the purpose and background of the study, which was designed to address the regional need for management of contaminated Puget Sound sediments (i.e., dredged sediments that are unsuitable for open-water disposal or for beneficial use). The study focused on siting a confined disposal and/or treatment facility to manage the contaminated sediments. The need for a MUDS facility was identified in the late 1980s, and would require a cooperative effort among a number of agencies. In 1997, the USACE and the state of Washington (Ecology, DNR, PSWQAT) agreed to share the cost to perform a feasibility study. The EPA, Washington Public Ports Association (WPPA), and U.S. Fish and Wildlife Service (USFWS) were cooperating agencies involved in the study.

Mr. Babcock then reviewed the current status of the study. The study scope included a Programmatic EIS, a siting phase, a site-specific phase, and a feasibility report/EIS that would be submitted to Congress. The programmatic NEPA/SEPA EIS was completed in 1999. The EIS identified a need for the program, demonstrated the feasibility of conceptual design alternatives, described environmental impacts, and provided a foundation for siting a MUDS facility. The EIS concluded that there was a need for the MUDS facility and that the No Action alternative was unacceptable. Sediment treatment appeared to be more promising as technology has advanced. They found that all alternatives resulted in some trade-offs.

Mr. Babcock indicated that the first MUDS facility would involve a partnership between public and private sectors, and treatment would likely become part of the solution. The siting phase, which was initiated in April 2000, looked at management options, the siting process, the feasibility of a treatment facility, and public participation. The management options addressed who should own and operate a MUDS facility. The facility siting process involved development of siting criteria, identification of candidate zones within Puget Sound, and screening and ranking sites within identified zones. The public participation element focused on looking at strategies for public involvement, and may include fact sheets, website, video, and an external advisory committee. In order to assess the feasibility of a sediment treatment facility, the most promising technologies were examined.

The next steps, issues and challenges will shape the scope and schedule for completion of the site-specific phase. Funding from Congress has a completion date assigned to it. A public entity must be identified, which is best suited to own and operate a MUDS facility and act as the lead project proponent. The state attorney general is looking at statutory authorities and whether the existing statutory authority is adequate. The ports, DNR, and counties may be suitable for operating a MUDS facility. One question is whether there are any viable private sector "volunteers" that would be willing to facilitate a MUDS facility. There has been interest from some entities, but no formal offers to date. There has been much discussion about this, and it may greatly influence how a solution is presented. They are looking at the possibility of a site donation. In addition, sediment treatment technologies are mostly proprietary. The siting criteria needs to be finalized and they need to focus on the public process and treatment options, and determine how to best select the treatment technology and a treatment vendor. Mr. Babcock indicated that the project has moved at glacial speed, but has moved faster in the past few months.

Mr. Babcock concluded his discussion by giving credit to the various participants in the MUDS program, including the interagency study team and various consultants involved in preparation of the programmatic EIS and siting-phase work (refer to overheads for specifics).

Ovrhd 6-1. Puget Sound Multi-user Disposal Site Feasibility Study
Ovrhd 6-2. Project Study Purpose
Ovrhd 6-3. Background
Ovrhd 6-4. Current Status – Feasibility Cost Share Agreement
Ovrhd 6-5. Current Status – Programmatic EIS Goals
Ovrhd 6-6. Current Status – Programmatic EIS
Ovrhd 6-7. Decisions

Ovrhd 6-8. Current Status – Siting Phase
Ovrhd 6-9. Current Status – Siting Phase Studies: Management Options
Ovrhd 6-10. Current Status – Siting Phase Studies: Facility Siting Process
Ovrhd 6-11. Current Status – Siting Phase Studies: Public Participation Strategy
Ovrhd 6-12. Current Status – Siting Phase Studies: Feasibility of Treatment Facility
Ovrhd 6-13. Next Steps – Issues and Challenges
Ovrhd 6-14. Nest Steps – Issues and Challenges, cont.
Ovrhd 6-15. Interagency Study Team
Ovrhd 6-16. Consultant Assistance – Programmatic EIS
Ovrhd 6-17. Consultant Assistance – Siting Phase

12. Pam Elardo, Ecology - 11:31 am
Bellingham Bay Contaminated Sediment TMDL Development

Pam Elardo gave a presentation on the total maximum daily load (TMDL) development for Bellingham Bay contaminated sediments. She defined the TMDL acronym, and indicated that TMDLs were established in Section 303d of the Clean Water Act. Bellingham Bay was included on the 303d list for contaminated sediments. Many people have wondered why sediments were included on a water quality list. Ms. Elardo indicated that this was basically because water quality standards were connected to sediment standards by reference, and sediment management standards were approved under the Clean Water Act (CWA). Her approach for the TMDL development was to answer the question of how sediments could be addressed in the Clean Water Act context. There are Model Toxics Control Act (MTCA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup standards, water quality standards, and in the state of Washington, SMS. A large part of the work has been determining how to translate between all of the policies. Ecology and EPA have collaborated on TMDL efforts. Bellingham Bay was chosen for the TMDL development because the bay is well studied with information available that could possibly be reworked and used for development of TMDLs, the CSMP has been involved in Bellingham Bay issues and the pilot study work, and there have been extensive source control reviews for this area.

For Bellingham Bay, there are currently 36 parameters (organics, PAHs, some metals) listed as impaired on the 303d list (in comparison to approximately 220 contaminants in the Duwamish/Elliott Bay). The first step was to compare what the Section 303d list showed to what more recent data has indicated. They found that were only 4 or 5 parameters that were still of concern, and the rest could be removed from the 303d list. They would not need to develop a TMDL for those parameters eliminated. There were extensive source control evaluations and in the case of Bellingham Bay, the ongoing sources were not impacting the sediment to the extent they would expect the contamination to be a problem (this may not be the case for other places such as the Duwamish). They found that water quality and cleanup activities could be tied together, and storm water NPDES permits could be linked with TMDL. Ms. Elardo added a note concerning implementation: one of the main criteria for the TMDLs to be approved by the EPA was that there must be a reasonable assurance that activities would occur. Through the cleanup order and the NPDES permits (has associated law enforcement capabilities) a reasonable assurance was provided.

Ms. Elardo indicated that the public review draft for this work would be available the following month. She asked that anyone who was interested in a copy of the draft report to give her a card. The draft may also be posted on Ecology's website.

Discussion and Public Comment

Martha Burke, City of Seattle, asked if Pam Elardo could talk more about the source control study, and wondered how they determined there was not a problem.

Pam Elardo replied that data results for solids samples taken from catch basins were placed within a simple spreadsheet model to determine if contaminant concentrations in the bottom of the catch basins were similar to concentrations of particulates leaving the outfall. The assumption was that the concentration in the catch basin equaled the concentration coming out of the outfall. They also used flow data and made some major conservative assumptions about the particulates coming out of the outfall. This approach did not provide a good model they would transfer to other areas, but was useful as a good conservative screening method.

Ms. Burke asked if the conclusion was that there was no contribution from ongoing sources to sediment contamination.

Ms. Elardo responded that the conclusion was that if there was contamination it would be very minimal, and it would not cause problems for remediation.

Jeff Stern, King County, commented that he understood that the Georgia Pacific outfall had a TMDL standard, but that none of the storm water sites did. He wondered if a storm water outfall failed the exceedance criteria and therefore would receive a waste load allocation, what would be the process for identifying the problem, and what would the storm water contributors have to do?

Ms. Elardo responded that the Georgia Pacific did not get a TMDL, but did get a waste load allocation in Bellingham Bay (maximum discharge). She added that they have not yet dealt with that type of complexity. She indicated that there was a process to look at sediment impact zones for source control, through the SMS process, but that it has not yet been tested. Through some near field modeling exercises, they may be able to answer the question in the future.

13. Ted Benson, DNR - 11:42 am
Multibeam Bathymetric Surveys in Puget Sound

Ted Benson discussed the results of multibeam bathymetric surveys conducted in Commencement Bay, Elliott Bay, and the Puyallup River delta. He stated that a more thorough presentation on the survey results was scheduled to occur on May 14th in the NOAA Sand Point Auditorium (a handout with information on the time and contacts for this presentation was available at the SMARM). The surveys developed from work arranged by Lt. E.J. van den Ameele of NOAA, and James Gardner of the USGS. The earthquake that occurred on February

28, 2001 gave them an opportunity to work with the national ocean survey, which was preparing to do bathymetric work in Alaska. The decision was made to also look at deltas including the Elliott Bay Duwamish River delta, the Commencement Bay Puyallup River delta, and Nisqually Reach to see if there were any interesting earthquake associated features. Mr. Benson indicated that there would likely be Pt. Townsend survey data at the full presentation (May 14th). The bathymetric surveys were conducted aboard the NOAA survey vessel *Rainier*.

Mr. Benson first showed pictures of the survey vessel and equipment used to conduct the survey, including a simple graphic of the multibeam system. He indicated that the data presented was raw data and there likely were some errors. The figures displaying the multibeam survey results showed a 3-meter (m) resolution image with 5 times vertical exaggeration. He then showed a 3-m resolution image of the Puyallup River delta and pointed out where there were gaps in the overlay of data. For comparison, he also displayed an image of the Puyallup River delta developed from earlier surveys conducted from 1972 to 1982. The resolution was 30-m for the older bathymetric survey systems. Mr. Benson displayed two more images of this area created from the multibeam survey system data, and pointed out areas where slumping occurred near the old disposal site used before the Commencement Bay PSDDA site was established. He also pointed out another area where slumping of 400 acres of intertidal sediments occurred in 1896. A channel associated with the Hylebos Waterway was also apparent. In a 1-m resolution image of the Puyallup Delta, there were also features that may represent expulsion pits from freshwater seeps. He suggested that one question that arose from this was as to whether these areas were a PCB source. In addition, there was a line apparent that might be a head scarp from a possible slide or slumping that was developing.

Mr. Benson next displayed an image of the Duwamish Delta in which the Elliott Bay PSDDA disposal site was apparent. Similar to the Puyallup Delta, he showed images developed from data collected from 1941 to 1999 at 30-m resolution and an image of the same area at 3-m resolution developed from the multibeam bathymetric survey data. Spikes in the multibeam system images represented spurious returns, while pits represented areas where there were no returns. Mr. Benson commented that within Seattle Harbor, using small craft for surveying, they were able to scan in as little as 6 feet of water.

In another image of Elliott Bay, an old failure was visible as was slumping (failure) that occurred in 1985 off the west slope of Duwamish Head. This 1985 failure may have been associated with trenching for an sewer outfall in this area. Mr. Benson displayed a 2-m resolution image of the west slope off Duwamish Head in which he identified the sewer outfalls, the trenching over the slope, and the slump area which was 160 m long, 300 m wide, and 14 m deep. Another image showed the old failure slump area, the Elliott Bay disposal site, and a trench that was present near the original disposal site. He indicated that the PSDDA site was moved further south to prevent dredged material from entering the trench and from subsequently being carried down the slope of the trench.

Mr. Benson also showed a 20 cm resolution image of an expulsion pit, near which anchor drags on the bottom were visible. The final image was of the Nisqually Delta where sand waves and scour from tidal fluxes could be discerned. Mr. Benson concluded his presentation by reiterating that there would be a more detailed presentation at NOAA the following Monday. Points of

contact for the presentation at NOAA are John Boettner with DNR and Guy Gelfenbaum at USGS.

Ovrhd 7-1. High-Resolution Multibeam Bathymetric Surveys
Ovrhd 7-2. Figure Showing Sites Surveyed
Ovrhd 7-3. Photo of NOAA Survey Vessel
Ovrhd 7-4. Photo of Reson 8101 Transducer Used in Survey
Ovrhd 7-5. Figure of Multibeam from Vessel
Ovrhd 7-6. Image of Puyallup Delta: 3-m Resolution
Ovrhd 7-7. Image of Puyallup Delta Showing Dump Site
Ovrhd 7-8. Image of Puyallup Delta Showing Expulsion Pits, Head Scarp, Slumping
Ovrhd 7-9. Image Showing Commencement Bay Disposal Site
Ovrhd 7-10. Image of Possible Expulsion Pits and Head Scarp at 1-m Resolution
Ovrhd 7-11. Image of Duwamish Delta
Ovrhd 7-12. Image of Seattle Waterfront: 30-m Resolution
Ovrhd 7-13. Image of Seattle Waterfront: 3-m Resolution
Ovrhd 7-14. Image of Seattle Harbor
Ovrhd 7-15. Image of Elliott Bay Showing Old Failure and 1985 Failure
Ovrhd 7-16. Image of West Slope of Duwamish Head
Ovrhd 7-17. Image of PSDDA Disposal Site in Elliott Bay and Old Failure Area
Ovrhd 7-18. Image of an Expulsion Pit
Ovrhd 7-19. Image of Nisqually Delta

Discussion and Public Comment

An attendee asked why the depth was so exaggerated (5 times vertical exaggeration) in the images.

Ted Benson responded that the exaggeration made it easier to discern the various features (e.g., slumping, trenches, expulsion pits)

Doug Hotchkiss, Port of Seattle, pointed out an area in one image near the old failure that likely represented the fill from Denny Way that was dumped in Elliott Bay off of Pier 66.

Pete Rude, Landau Associates, asked if there was any evidence of slumping resulting from 2001 earthquake.

Ted Benson responded that there was no evidence of slumping associated with the earthquake. However, they only conducted surveys in 4 areas: the Duwamish delta, Puyallup delta, Nisqually Reach, and in Port Townsend Bay.

14. Stephanie Stirling, USACE - 11:58 am
Summary Overview of DMMP Clarification Papers and Status Reports

Stephanie Stirling gave a brief overview of the various DMMP clarification papers and status reports that would not be presented at the SMARM. She listed the various clarification papers and status reports, and indicated that they were available on the DMMO website.

One clarification paper dealt with reporting sediment quality for SMS compliance. There has been some confusion as to how to submit data to Ecology. It was decided that all data should be submitted in SEDQUAL format, with the exception of dredged material data submitted to the USACE in Dredged Analysis Information System (DAIS) format, since data in the DAIS program is readily transferred to the SEDQUAL format. A second clarification paper discussed the chemical analysis of archived sediment samples. The paper concluded that the dissolved fraction must be analyzed (if the sample has separated, it must be remixed), and that samples must not be decanted prior to chemical analysis. Another clarification paper concluded that a water-only LC_{50} must be run using the same bioassay test organisms if the data is used by DMMP agencies to consider ammonia toxicity in the project bioassays. Without the ammonia LC_{50} data, the agencies would not be able to assess ammonia as a non-treatment effect. A fourth clarification paper gave additional Z-sample guidance. Historically, Z-samples were only collected and archived in high ranked situations. These samples will be collected in all situations, and analysis of these samples will occur if the overlying DMMU is determined to be unsuitable for open-water disposal. The results of this analysis must meet SQS or additional testing may be required. The last clarification paper discussed dealt with the quality of post-dredge surfaces. There has been a revision to the language of the 1998 Evaluation Procedures Technical Appendix (EPTA), and there will be a requirement to comply with the SMS rule.

With respect to status reports, Ms. Stirling briefly described the status of the bioaccumulation chemicals of concern list (BCOC) and beneficial uses developments. She indicated that in 1999 there was a general weight-of-evidence approach to look at the bioaccumulation data. The bioaccumulation workgroup has been working with Striplin Environmental Associates to assess data, search ERED (Environmental Residue Effects Database) for residue effects data, compile information on availability of analytical methods, and complete the weight-of-evidence table. The next workgroup meeting will hopefully occur in August/September 2001.

Ms. Stirling then briefly reviewed the status report on beneficial uses. She stated that there have been increased challenges due to various issues, including ESA issues. A draft manual is being revised and updated, and is expected to be out soon for review. There are still issues that need to be resolved. In addition, national and technical guidance will be available in the revised USACE Engineering Manual when revisions are completed. An EPA policy document is expected to be out soon as well. The National Dredging Team also had a workshop to discuss beneficial uses.

Ms. Stirling concluded her overview by encouraging the audience to review and submit comments on the various clarification papers and status reports that are available on the DMMO website. Final papers will eventually be posted on the website.

Ovrhd 8-1. Clarification Papers and Status Reports
Ovrhd 8-2. Clarification Papers
Ovrhd 8-3. Status Reports
Ovrhd 8-4. Reporting Sediment Quality for SMS Compliance

Ovrhd 8-5. Chemical Analysis of Archived Sediment Samples
Ovrhd 8-6. Reporting Ammonia LC_{50} for Larval and Amphipod Bioassays
Ovrhd 8-7. Z-Sample Guidance and Post-Dredge Monitoring
Ovrhd 8-8. Quality of Post-Dredge Sediment Surfaces
Ovrhd 8-9. Status Report – BCOC List
Ovrhd 8-10. Status Report – Beneficial Uses
Ovrhd 8-11. The Rest of the Story

Discussion and Public Comment

Teresa Michelsen, Avocet Consulting, asked if running an ammonia positive control was preferred over purging and other measures to reduce ammonia from the sample.

Lauran Cole-Warner responded that purging is still an option. However, if you want to suggest that the bioassay results were affected by ammonia, then an ammonia positive control is needed to support that contention.

John Hicks, Columbia Analytical Services, asked if the Z-sample would still be archived or if it would have to be analyzed right away due to certain required holding times.

David Kendall responded that with respect to archiving, the general concern was about the holding times for chemicals like mercury (e.g., 28 days). He indicated that archiving would still occur and that it was accepted that there would be some holding time exceedances allowable under best-professional-judgement.

Mike Johns, Windward Environmental, mentioned that the EPTA language suggests that the sediment surface following dredging should not be worse than before dredging. The clarification paper on the DMMP Z-sample analysis guidance and post-dredge monitoring policy seemed to be a shift in policy from non-degradation to meeting specific standards, rather than a clarification. He wondered if this should really be addressed through another process since it appeared to be a shift in policy, rather than being addressed through a clarification paper.

Tom Gries, Ecology, indicated that this issue arose when the drafting the clarification paper, but stated that he believed the actual language in the paper did not reflect a fundamental shift in policy. The condition of material left after dredging should not be worse than before dredging, and the hope is that it will be better than predredging. With respect to how DMMP can include standards that were not promulgated at the time EPTA (Evaluation Procedures Technical Appendix) was written, Mr. Gries indicated that the clarification specifies SMS as a standard. He added that there could be sediments left behind that are worse than those dredged, but would still be considered acceptable because the sediments met SMS.

Dr. Johns reiterated that this still seemed like a policy shift to him rather than a clarification since the EPTA language clearly indicated a non-degradation intent.

John Malek responded that it was not necessarily a policy shift. They did not have standards when the EPTA was developed. They had always intended to develop standards, and when developed would incorporate them. In this respect, his feeling was that it was not really a shift in policy, but simply a clarification. He added that Dr. Johns' comment was good, and that they still did not have straight answers among the agencies concerning this.

Doug Hotchkiss, Port of Seattle, commented that there had previously been considerable discussion on navigation dredging vs. cleanup dredging. The philosophy was to not get in the way of existing navigation projects, but if one proceeded with a navigation-dredging project, exposed sediments should not be worse than existing sediments. There was some significant discussion that had to do with navigation vs. cleanup, and whether or not cleanup should be required before a navigation project commenced.

AFTERNOON SESSION

Public Issue Papers And Discussion

15. Diane Parks, USACE - 1:20 pm

Diane Parks began the afternoon session by stating that she noticed on the sign-up sheet that there were a number of visitors from out of state, and asked if they would introduce themselves and mention their interests. She thanked them for coming to the SMARM meeting. Those who introduced themselves included Clare Jaeger of USACE, Alaska District, Laura Inouye of USACE, Vicksburg, Jeff Steevens of USACE, WES, and Mike Rosen, Oregon Department of Environmental Quality. Ms. Parks then listed public issue paper presentations, and introduced Peter Havens, EFA Northwest, who gave the first presentation for the session.

16. Peter Havens, EFA Northwest - 1:30pm

Sediment Cleanup/MCON Integration Dredging and CAD Disposal

Peter Havens discussed the successful integration of programs at the Bremerton Naval Complex, including a CERCLA cleanup project, dredging project, and CAD construction. The integration of these programs saved approximately 9 million dollars. Mr. Havens was in charge of the environmental planning and permitting for the Clean Water Act (CWA), and Jai Jeffrey managed the CERCLA work. The Bremerton Naval Complex consists of a maintenance shipyard with drydocks located on the eastern side of the complex, and NAVSTA Bremerton located on the western side. The naval complex homeports a nuclear aircraft carrier among a number of other Navy vessels.

The site investigation for the CERCLA remediation program identified PCBs as the driver of the cleanup in Operable Unit B (marine site). One option for cleanup was to remove the contaminated sediments through active remediation (i.e., dredging). There are also plans to upgrade homeports within the Pacific fleet, and a NEPA EIS has been completed for naval

facility development (the EIS did not cover how the facility would be cleaned up). For the Puget Sound Naval Shipyard at Bremerton, the development involved navigation dredging and pier construction. Therefore, there were concurrent actions at the complex that involved a number of issues including CWA, ESA, CERCLA, and NEPA issues. They began to look at the economy of these programs, how to control construction contractors, and how to find ways to integrate the various programs. The program integration would be a challenge, since no regulatory procedure for this existed.

Compliance focus for these programs included CERCLA, CWA, Coastal Zone Management Act (CZMA), ESA, and submerged lands ownership. The CERCLA program involved consensus based decision making with durability. For the CWA, there existed a clear procedure for obtaining permits for navigation dredging. The CZMA involved regulations for shoreline development, and mitigation was evaluated through the ESA and CWA. The mitigation involved fisheries and habitat tribal interests. With respect to submerged lands ownership, close coordination with DNR was necessary.

The integrated program was intensive and involved a significant amount of coordination. A basic plan that met the U.S. Navy interest was initially adopted and presented to the regulatory agencies. They established CERCLA workshop groups that discussed the plans, met with agency managers to explain the importance of the programs and the benefits of integrating the two programs, and discussed their efforts with consultants in the area that had experience with similar projects. They always requested comments and suggestions and ended up modifying the plan.

Mr. Havens showed a diagram of the final plan of action. It involved cleanup, navigation dredging, suitability determinations, impact assessment and mitigation, ESA, and other regulations. The goal was to comply with existing regulations. One important milestone was to first determine the volumes of dredged material that would be managed and in what manner material would be handled. The unifying theme of the whole program was sediment management. Once the volume of sediment was determined they were able to proceed with the plan.

The program involved much mediation and compromise. DNR requested an existing conditions review for Sinclair Inlet, and they went beyond the boundaries of the project. This effort was helpful in showing the Navy's desire to work with the tribes and agencies to find solutions. A CERCLA workgroup was established and workshops conducted. The ESA consultation focused on fisheries, which were a major impact assessment issue. A CAD site was developed, which would be appropriate for CERCLA cleanup sediments and unsuitable dredged material from the navigation dredging project. The CAD would be capped with clean navigation dredged material. An agreement with the tribes and agencies was made with respect to CZMA compliance.

The Navy designated a program manager (Neil Bass) to keep the project going. The navigation dredging program and CVN homeport MCON construction project were well funded with a backup plan in place. The plan allowed for disposal of all material at an upland site. Therefore, they had funding in place to cover a worst-case financial scenario. The coordination of this work

and CERCLA work provided opportunities for alternative low cost disposal sites, and the consensus development nature allowed them to make durable decisions.

Mr. Havens stated that when they began working on this program in 1998, they were excited that they might be able to combine the cleanup and navigation dredging programs. Their conclusions are that with a lot of coordination, this type of work can be accomplished.

Ovrhd 9-1. Sediment Cleanup/MCON Integration, Dredging and CAD Disposal
Ovrhd 9-2. Project Location
Ovrhd 9-3. MCONs
Ovrhd 9-4. Figure 1. Site Location Map of the Bremerton Naval Complex.
Ovrhd 9-5. National Environmental Policy Act
Ovrhd 9-6. Installation Restoration
Ovrhd 9-7. Concurrent actions
Ovrhd 9-8. Regulatory Requirements
Ovrhd 9-9. CERCLA
Ovrhd 9-10. Clean Water Act
Ovrhd 9-11. Other Regulations
Ovrhd 9-12. Coordination/Integration
Ovrhd 9-13. Strategy
Ovrhd 9-14. Plan of Action
Ovrhd 9-15. Mediation and Compromise
Ovrhd 9-16. Plow Ahead to Completion
Ovrhd 9-17. Conclusion
Ovrhd 9-18. Questions?

Discussion and Public Comment

Martha Burke asked Mr. Havens what his role was in the program. She asked whether he handled the permitting or whether Jai Jeffery did that work.

Peter Havens responded that he was the environmental planner who managed the dredging work and facilities development program, including permitting. Jai Jeffery was the engineer and remedial project manager for the CERCLA program. He indicated that the CERCLA program differed from the permits and construction side of the program. He added that Puget Sound is primo in terms of regulatory coordination. He was in awe of the teamwork, and ideas and solutions not previously thought possible.

Pat Romberg, King County, stated that he heard that risk assessment was initially used in the project decision framework, and wondered how much that ended up driving the decisions.

Peter Havens responded that since Jai Jeffery ran the CERCLA program he knew the details, and the question may best be addressed to Mr. Jeffery. He suggested contacting Mr. Jeffery. He added that they did attempt to develop the sediment management

program in that direction, but they were unable to develop a strong effort to complete the program. The found more benefit to following the existing CERCLA and CWA process.

Lon Kissinger, Ecology, who worked on this project, added that the approach adopted was a background approach versus a risk-based approach. They decided that if background levels were higher than risk-based levels, then the Navy would be required to clean to risk-based levels. If risk-based levels were higher than background, then the Navy was doing a more stringent cleanup by going towards background levels.

17. Mike Johns, Windward Environmental, and David Powell, ProFishent - 2:00 pm
Assessment of the Immunocompetence Endpoint in Juvenile Chinook Salmon Following Exposure to Dietary PCB's at Environmentally Relevant Concentrations

Mike Johns gave an introduction to the series of studies performed on dietary exposure and outmigrating Chinook salmon. The studies involved a collaboration of sponsors, and were conducted by Windward Environmental and ProFishent at Battelle's laboratory in Sequim, Washington. The studies looked at the effect of size on immune response, and the effects of PCB dietary exposure on growth and immunocompetence. He said that they were also initiating studies on PAH effects on growth and immunocompetence. Dr. Johns stated the data from this study would contribute to a base of data on potential impacts of toxic chemicals on outmigrating salmon. The results of the study could be used for decision making. These studies complement the lower Duwamish Waterway remedial investigation, and could be used for risk assessment and the ESA habitat matrix analysis, and could be used in natural resource damage causation evaluation and injury determination.

He mentioned that additional information on the studies is available on their website address: www.windwardenv.com/duwamish. He added that the results of the study are being submitted to a peer-reviewed journal, and that all relevant information will be available once the report is accepted. They could not provide the overheads for the SMARM minutes due to journal requirements.

He then introduced David Powell of ProFishent who described the studies and the results.

18. David Powell, ProFishent - 2:10 pm

David Powell, who described himself as a fish immunologist who has focused on fish immunity and toxicology, discussed the experiments conducted on PCBs and immunocompetence. The focus was on Aroclor 1254, which is comprised of a mixture of polychlorinated planar molecules that are very stable. Fish were first fed PCB-spiked food for 28-days. Part I of the experiment involved challenging these fish with bacteria in freshwater, using a bacterium (*Vibrio anguillarum*) that causes stress-mediated disease. Part II involved vaccinating fish that were fed PCB-spiked food and then challenging them with the bacteria (*Vibrio*). The fish were exposed to a range of PCB concentrations, and Dr. Powell displayed a graph showing the PCB concentrations used in the test. The range was from 460 to 18,000 ppb, and the control levels were the levels that came in commercial feeds (approximately 55 ppb). His next overhead showed the PCB body burdens after 28 days of feeding. The body burdens showed low uptake

in the low dose groups, and high uptake in the high dose groups. The control body burden levels were about what would be expected using commercial feeds.

Dr. Powell then described the study designs showing a schematic of tanks and replicate challenge tanks. There were 50 fish in each of 5 replicate challenge tanks, and the fish used were about 7 months old. The experimental design of the first test (Challenge 1) involved examining unvaccinated juvenile Chinook salmon in a number of treatments to get a sense of their natural immunity. The treatments included unchallenged controls, challenged controls, and challenged fish exposed to low, mid, and high levels of PCBs. The second test involved studying vaccinated fish exposed to the same PCB levels and bacteria. Treatments for this test group included unchallenged controls (served as an indicator of water quality and background effects), challenged unvaccinated controls, challenged vaccinated controls, and challenged vaccinated juvenile salmon exposed to low and high levels of PCBs.

Part of the design of the experiment was to determine if there were any trends in the weights of the juvenile salmon fed varying levels of PCBs. The results of these tests indicated no significant difference in the weights of the fish for the first test. They looked at unvaccinated fish and found no trends. The weight of the fish tended to be about 15 grams. They then looked at the length of the fish (fork length) to see if there were any trends in size. They found no significant trends in fork lengths between the controls and PCB challenges. The fork lengths were all fairly consistent for each group. There was also no depression or reduction in feeding with the experiments (i.e., fish had no problem with respect to palatability as PCB levels were increased). A graph of the weight and length relationship (coefficient of condition = k) of the juvenile salmon fed various levels of PCBs showed no declines in the index with PCB exposure. Another graph depicted the cumulative percent mortality of unvaccinated challenged fish (Challenge 1 results). The mortality began on Day 4, increased rapidly, and then leveled off. All treatment groups followed the same line. There was apparently a high variation in mortality among replicates in a given treatment group. An analysis of variance (ANOVA) test resulted in a high p-value, and the F-critical value was 3.2. This indicated no significant difference among treatments.

Another aspect of their study included looking at bacteria growing in the kidneys of the fish that died. Agar plates were used to grow bacterial colonies from bacteria taken from the kidneys. An antibody test was then used to determine if the bacteria was *Vibrio*. They found that all the bacteria were *Vibrio* through the antibody test. However, some of the background mortality of fish used in Challenge 2 came down with a disease from a common pathogen found in salmon (*Aeromonas salmonicida*). Handling could precipitate its release. This could be passed on through mucus, and could have been passed on in nets used to handle the fish. This made data interpretation difficult.

Dr. Powell described the procedure for vaccinating the fish against *Vibrio anguillarium.* This involved vaccination by immersion. The fish were placed in a net, dipped into the vaccine for 30 seconds (a very dilute vaccine), and then placed back in a tank for 3 weeks. They believed that some of the fish taken from the hatchery for the tests had a low level of *Aeromonas salmonicida* in the population. When they vaccinated the fish, they may have transferred the bacteria among the fish.

He then displayed a graph of the cumulative mortality with non-specific (non-*Vibrio*) related mortalities excluded. They found when non-specific mortalities were excluded from the analysis, that there was no difference from the vaccinated controls in the response of vaccinated fish to the dose of PCBs in the low and high ranges. According to the test results, PCBs did not appear to influence susceptibility to *Vibrio* following vaccination. However, for unvaccinated fish they found a similar cumulative mortality curve to that displayed earlier for Challenge 1. If non-*Vibrio* related mortalities were included in the cumulative mortality, there was substantial mortality, but there was not significant difference among treatment groups due to high variability. The non-specific mortalities made interpretation of the results difficult. They were working with fish grown from eggs in the laboratory to try and eliminate the problem and were planning to rerun the tests once this issue was resolved.

Another aspect studied was plasma sodium levels in the juvenile fish to see if they tolerated saltwater. After submerging the fish in saltwater for 24 hrs, blood samples taken revealed that the juvenile fish had a hard time eliminating salt at the beginning of the test. At this time, the fish appeared to be undergoing smoltification, which is indicative of maturation of the fish (the ability to eliminate saltwater). During this time, the fish tend to be more susceptible to stress, which could have been one other reason for the non-specific mortality.

Mr. Powell concluded his presentation by summarizing the results. Dietary exposure to PCBs did not effect fish growth as measured by weight or length at the start of the initial challenge and at vaccination prior to Challenge 2, their innate immune system was apparently unimpaired by PCB, and PCB exposure had no significant effect on non-vaccinated resistance to *Vibrio anguillarum*. Salmon did appear to be resistant to *Vibrio anguillarum* following vaccination; however, non-*Vibrio* related mortality complicated the interpretation of the results. Non-*Vibrio* infections made data interpretation difficult. Further testing would be necessary to determine if there are dietary effects of PCBs on growth or immunocompetence of juvenile salmon.

Discussion and Public Comment

Teresa Michelsen commented that the first part of the study seemed fairly clean, but that the second part had problems. She wondered how the vaccination part of the study represented real life – how it related to actual fish in environment.

David Powell responded that it represented the immune system in action. They knew that fish in the wild acquire immunity to diseases they encounter. The fish become naturally resistant to *Vibrio* sp. through exposure over time and through immune system development. They wanted to see how PCBs would affect the fishes' ability to respond to such a disease in the wild. The presumption was that PCBs at high levels might reduce resistance to *Vibrio*. He agreed that it was a laboratory exposure, so it was not quite like what would occur in the wild.

Lon Kissinger, Ecology, asked if the immune response the vaccine generated was an antibody-based one, and if so, would the study have any ramifications for cell-mediated immunity in salmon. He also commented that feeding salmon unweathered Aroclor 1254

is different than what the salmon would be exposed to in the natural environment as PCBs transfer through the food chain. He wondered if feeding them unweathered PCBs would generate something that is meaningful in an environmental exposure context.

Dr. Powell replied that the high PCB dose meant that tremendous levels of each of the congeners were in there, and the important compounds would be present in high enough levels so that after weathering, they would still be present at the same levels. He agreed that it was complicated. He added that PCBs are stable, and weathering would not remove the important congeners.

Mike Johns added that the fish were analyzed for total Aroclor PCBs, as well as the congeners. They also had data on PCB congener analysis that showed there has been a basically good match for 3,4,5-congeners (congeners with chlorine), the more toxic congeners, in laboratory fish and the fish in the field. There was a very good match between exposures to fish in the laboratory and the field.

An individual in the audience asked what the relevance of the overall study was given that *Vibrio* is more marine or brackish?

Dr. Powell answered that *Vibrio* was chosen because it has been well studied; they could prove that fish had not been exposed to it in the hatchery; and *Vibrio* has been a model organism for how fish respond to stress. They could have used other species, but it was difficult to separate out other variables. This species of bacteria also provided the best model for repeatability.

Dr. Johns stated that the literature is not strong on whether PCBs are immunodepressants in fish. Within the dietary range they looked at, they did not see effects. They expected to see some effect in the higher levels of PCBs.

Another individual asked in what journal this study would be published.

Dr. Powell replied that this study would be published in the SETAC journal.

19. John Hicks, Columbia Analytical Services - 2:33 pm
Ultra Low-Level PCB-Aroclor Analysis A Tool to Monitor Sediment Loading

John Hicks indicated that Columbia Analytical Services (CAS) developed an ultra low-level PCB-Aroclor analysis method when approached by clients who were concerned about discharge water contaminating sediments. There have been increasing requirements to achieve lower and lower detection limits for Aroclors and PCB congeners due to water quality and sediment loading concerns. There have been limitations to achieving these low detection limits.

Looking at this from a holistic standpoint, there have been two ways to achieve very low levels: 1) put more sample into the instrument, or 2) fine tune the resolution of the equipment (increase the sensitivity of the detector). There have been very few advances in the analysis methods for PCBs. PCB Aroclors and congeners have been generally analyzed using gas

chromatography/electron capture detection (GC/ECD) following EPA method 8082. High resolution GCMS has also been used.

CAS laboratories wanted to approach sample volume issues related to achieving low detection limits and make the collection and analyses more cost effective. In the case of discharge water, 2-3 L are collected and extracted with a continuous liquid-liquid extractor method (Manchester Method). For sediment, an accelerated solvent extractor is used to extract the sample. After water or sediment sample extract has been concentrated to a small volume, it is cleaned with Gel Permeation Chromatography (GPC) followed by large-volume silica gel column cleanup. These cleanup methods remove some PCB-interfering pesticides (e.g., non-heavily chlorinated compounds) and other non-target interferences. A sulfuric acid treatment is used to remove biogenic interferences. This sulfuric acid treatment has been important for analysis of raw sewage samples. One problem is that the sulfur can interfere with the quantitation of Aroclors, and therefore, when the sulfuric acid treatment is used, it is followed by cleanup with elemental mercury, which precipitates the sulfur. Following cleanup, a pressure programmable high volume injector (HVI), which can inject up to 100 μL of sample extract, is used to inject the sample into the gas chromatograph. These procedures have allowed CAS to achieve low detection limits. If samples are reasonably clean, they can achieve reporting limits of 5 ppt (ng/L) for water. They are currently achieving reporting limits of 50 ppt for raw sewage samples, 20 ppt in aggressively treated samples, and 2 ppb for tissue and sediment. Actual detection limits are lower. Anything measured between the detection limit and reporting limit is a "J" qualified estimate.

Users of these data have been able to do mass balancing of effluent of PCB coming out of their pipes. For control measures in a PCB plume or storm water system, they may be able to discern differences that have an impact on sediment loading. This ultra low-level analysis has also been useful for potentially responsible parties (PRPs) when allocation of responsibility occurs.

Mr. Hicks concluded his discussion by talking about the lessons learned using this analysis technique. One lesson was that laboratory cleanliness was critical. It is very difficult to measure ultra-trace level organics. Their ultra-low level analyses have been set up in a manner similar to those that run dioxin analyses, in an ultra-trace organics extraction facility. He indicated that it is easy to have contamination occur when working with detection levels of 5 ppt. They have found they need to separate out some of the critical glassware used for these analyses and use disposable glassware when appropriate. Some clients have even invested in buying their own set of glassware for their samples.

Another lesson learned was that if a sample is highly contaminated, they would not be able to see ultra-low levels of some of the PCB Aroclors or congeners. Despite all of the cleanup methods used, there still can be matrix interferences. They found that this technique is best used by the most experienced analysts. Detection limits at the 5 ppt level are problematic and chromatograms are very complex. Columbia Analytical Services has been performing this procedure regularly and the analysts are experienced.

Discussion and Public Comment

Kathy Bragdon-Cook, Ecology, asked John Hicks whether when CAS reports a value as undetected, they report the method detection limit or the practical quantification limit (PQL). She also asked how CAS would qualify a value that is in between the method detection limit and PQL.

John Hicks responded that every client requests something different, and they try to determine that contractually. Some clients want them to report to the lowest level they can see, even if it must be qualified, while others want something that is more statistically valid.

Kathy Bragdon-Cook asked again about the qualifiers used.

John Hick's replied that if the concentration is between the detection limit and reporting limit (or PQL), the results are considered an estimate and results are qualified with a "J". This allows people to do what they want with it. He added that some databases strip out all qualifiers.

Lawrence McCrone, Exponent, asked if John Hick's would comment on considerations for sampling and sample handling procedures. He wondered what procedures should be followed so that samples are not compromised.

John Hicks indicated that most clients use an Isco glass lined sampler and collect the composite samples through teflon tubing when sampling discharges. He stated that some people have used a grab sample approach, and others have used special tubing and collected the water in benthos bottles. They had one set of samples arrive that had been collected in a PVC bucket, which likely compromised the samples. With respect to sample handling, there really were no sample handling differences from standard protocols. He recommended using fresh gloves in between stations and using all standard decontamination protocols for the sampling equipment.

Tom Gries wondered what the variability between replicates had been for these analyses.

John Hicks indicated that the data has been tight (relatively low variability). He said the results were not as reproducible with raw sewage samples, but most effluent waters data have been very reproducible. Quality control results have met EPA Method 8082 analysis requirements. He stated that CAS has focused on making sure blanks are clean all the way through the analyses. With respect to spikes, they have been spiking at 30-40 ppt, which is really low.

Lon Kissinger asked John Hicks how much it would cost to run these analyses.

John Hicks told him that it would cost approximately $250 per water or sediment sample.

Topical Presentations/Lessons Learned

20. Diane Parks, USACE - 2:58 pm

Following the afternoon break, Diane Parks reviewed the next set of presentations. These included topical presentations and discussions of lessons learned on these projects. She then introduced Karen Keeley of the EPA who gave the first presentation.

21. Karen Keeley, EPA - 3:00 pm

Ketchikan Pulp Company CERCLA Remediation

Karen Keeley spoke about the Superfund sediment remediation conducted for the Ketchikan Pulp Company CERCLA site, located in Ketchikan, Alaska. She displayed a photo of the site in Ward Cove. The site was typical for Alaska, with steep rocky slopes, and included little intertidal areas but extensive subtidal areas. The Ketchikan Pulp Company was a dissolving sulfite pulp mill. The pulp mill was in operation from 1954-1997. It is now owned by another company (Gateway Forest Products). For a number of years, there was no wastewater treatment and pulp residue was discharged into the cove. The historical pulp residue releases resulted in sediments comprised of black anoxic material mixed with pulp residue. Ammonia, hydrogen sulfide, 4-methylphenol, which are natural degradation products of organic matter and wood material, were identified as the major problem chemicals. The contamination caused by the discharge resulted in sediment toxicity to benthic organisms.

The EPA issued a record of decision for the site, which designated 80 acres of bottom sediments within Ward Cove for sediment cleanup. The sediments were identified as being at risk for worms, clams, and other benthic organisms, although no human health or wildlife concerns were identified. The objectives of the cleanup were to reduce sediment toxicity and improve the health of the benthic community. The selected remedy was thin layer placement, which involved capping the material with a thin layer (6-12 inches) of clean sediment. They recommended dredging the sediment in the berth areas, and natural recovery where a cap could not be placed (e.g., too deep, too soft, too steep, or too many logs present). Because of material that had settled, sediments in this area were very soft, were high in organic content, and had abundant wood material. Near the outfall, there were up to 18 feet of black sediments overlaying rock or shale and native sediments. These black sediments were also present in the deep-water areas.

The remedial action (RA) was finished in 4 months. The RA involved thin layer placement over 27 acres, and dredging 12,000 cy of material over 4 acres. The thin layer placement was not designed as an isolation cap. The purpose was to provide sand for animals to begin colonization. As part of the remedial action, they tried to define site-specific standards to use to verify capping success (this included lateral coverage and thickness of the cap). There were 15 acceptance areas, which were unique 1- to 3-acre areas established for long-term monitoring. All areas capped were to have a minimum of 6 inches of material, and sand needed to be placed down over 80% of each of the acceptance areas.

Ms. Keeley stated that for the cleanup, they defined the best type of equipment and methods for placement of the cap material. They identified acceptance areas and set up a design test in a

small pilot section (1/3-acre area) for each acceptance area. If the placement design was successful for that area, they would continue with that design for the rest of the acceptance area. They found they had such success with their placement methods that they were able to abandon this practice as they continued with the cleanup.

In order to determine that acceptance area performance standards were met, the contractor performing the work was required to track the sand volume and show that it covered the bottom adequately. They used STFATE to optimize distance from bottom for release, but later determined that they could do a surface release. In order ensure that the placement method worked, they performed post-placement sampling using a van Veen grab sampler. The placement was considered successful if the surface sediment sampled contained ≥ 40% sand in 80% of samples (similar to background and reference stations in the area). No more than 20% of the samples could have less than 13% sand. They found that most of the post-placement samples collected had 90-100% sand.

Ms. Keeley indicated that they used a modified material-handling bucket, which would consistently pick up 5.5 cubic yards of material at a time, and this repeatedly enabled them to place a 6-12 inch layer of sand on the bottom. Cap material was slowly released from barges near the surface of the water. They ran into some problems anchoring work barges due to the water depth in some areas, and therefore needed to set up anchor lines.

A computer system was set up on the barge for navigation and positioning. The program, WinOPS Dredge Positioning Software, interfaced with DGPS for real time positioning. They used the program to divide acceptance areas into sections (trapezoids or rectangular shaped sections). Within the program, the barge, bucket swing, and drop space was shown. They could tell the volume of the sediment released, and where they were placing the material in real time. Tracking the volumes and placement in real time was important because they were concerned that if too much sand was placed in a given area, the sand would sink into the soft sediments. After placement, they sampled the material with a van Veen grab and wet-sieved the sediment in the field to ensure that it was sand and that the proper volume was placed. They found sand in all samples.

Ms. Keeley stated that the thin layer placement was 100% successful. They found that they were able to place 40-80 cy of material per hour. The process was slow at first and improved as the contractor became familiar with the WinOPS program. Thin layer placement was just as successful in deep waters as in the shallow waters, and had even better production rates. This disproved preconceived notions that they would not be able to cap the sediments in the deeper waters. Areas up to 120 feet deep were capped successfully. They also had no problems monitoring the cap success. Low currents, great weather, anchoring systems which were more efficient than the use of spuds, the WinOPS program, and the fact that the deeper cap areas were more linear and had less boat traffic contributed to the success of the thin layer placement.

Initially, mounding was proposed in some very soft areas. Concerned that sand would sink, in areas with bedrock under the soft contaminated sediments, heavy rocks were proposed as a foundation for mounds of sand. However, capping was so successful that this was not required.

Ms. Keeley also indicated that they performed a lot of water quality monitoring. Water quality monitoring performed was consistent with EPA's WQC (water quality certification), and included turbidity, dissolved oxygen, salinity, and pH measurements. They found few exceedances, and those that did occur were related to pipes coming off of the barge. Water quality monitoring was very expensive, but the data were very important.

One of the lessons learned in this remedial action process was that they were not able to predict capping success using classic engineering tests. Sediments had a higher bearing strength than predicted by engineering tests. Ms. Keeley suggested that a better test was needed to predict the success of capping soft sediments. Other considerations included analyzing the placement method ahead of time (e.g., where they would anchor barges), performing design tests during the start of the remedial action, buying good uniform sand for precision capping, and performing water quality monitoring closer to the activity, among a number of other considerations (refer to overheads for more information).

Ms. Keeley concluded the discussion by talking about some of the costs for the remedial action. It cost $4 million dollars for the work plan through construction completion.

Ovrhd 10-1. EPA Superfund Sediment Remediation
Ovrhd 10-2. Photo of Superfund Site in Ward Cove
Ovrhd 10-3. Site History
Ovrhd 10-4. Photo of Site and Ketchikan Pulp Company Mill
Ovrhd 10-5. The Problem
Ovrhd 10-6. EPA Record of Decision
Ovrhd 10-7. Aerial View of Superfund Site
Ovrhd 10-8. Remedial Action Objectives
Ovrhd 10-9. Selected Remedy
Ovrhd 10-10. Unique Aspects of Sediments
Ovrhd 10-11. Remedial Action
Ovrhd 10-12. Thin Layer Placement: ROD and RD
Ovrhd 10-13. Thin Layer Placement: Standard
Ovrhd 10-14. Acceptance Areas
Ovrhd 10-15. Acceptance Areas within Remediation Area
Ovrhd 10-16. Acceptance Areas Design Tests
Ovrhd 10-17. Figure of Acceptance Areas and Design Test Areas
Ovrhd 10-18. Acceptance Areas Performance Standards
Ovrhd 10-19. Acceptance Areas Performance Standards, Cont.
Ovrhd 10-20. Photo of 25,000 Cubic Yards of Sand Used for Capping
Ovrhd 10-21. Photo Showing Cap Material Being Loaded onto Barges
Ovrhd 10-22. Photo of Material Handling Bucket
Ovrhd 10-23. Photo Showing Slow Release of Material at Water Surface
Ovrhd 10-24. Photo Showing Slow Release of Material at Water Surface, Cont.
Ovrhd 10-25. WinOPs Dredge Positioning Software
Ovrhd 10-26. WinOps Program Display
Ovrhd 10-27. WinOps Program Display Showing Completed Acceptance Areas
Ovrhd 10-28. Photo of Grab Sampling and Wet-Sieving

Ovrhd 10-29. Photo of Grab Sampler Contents: Sand
Ovrhd 10-30. Thin Layer Placement
Ovrhd 10-31. Thin Layer Placement Deep Water
Ovrhd 10-32. Mounding Proposed, But Not Performed
Ovrhd 10-33. Water Quality Monitoring Approach
Ovrhd 10-34. Water Quality Monitoring Results
Ovrhd 10-35. Lessons Learned
Ovrhd 10-36. Other Considerations
Ovrhd 10-37. Other Considerations, Cont.
Ovrhd 10-38. Remedial Action Costs

Discussion and Public Comment

Patt O'Flaherty, CH2M Hill, asked how long it took to cover an acceptance area.

Karen Keeley responded that it took 2-3 days on average (capping for the entire project took 28 days).

An individual asked what the expected long-term fate of sand over rocks would be. He also asked Ms. Keeley what the reason was for the dissolved oxygen water quality violations.

Ms. Keeley stated that the dissolved oxygen violations occurred in the deeper waters in the cove away from where activity was occurring, and may have been unrelated to the placement activity. There were a number of other potential factors that could have contributed to the violations. With respect to long-term fate of the cap, it appeared to be staying in place. They would be starting long-term monitoring of the cap in a couple of years.

Russ McMillan, Ecology, wondered if they were looking at the biological community and sediment porewater quality in the long-term monitoring.

Karen Keeley responded that they were monitoring the benthic community. They would be looking at sediment toxicity, but she did not believe they were going to be looking at the sediment porewater.

Mr. McMillan asked if there would be long-term monitoring in areas left alone for natural recovery.

Ms. Keeley responded that there would be monitoring in both actively remediated areas and natural recovery areas. There was a recognition that recovery may take many years.

Mr. McMillan also asked if there were any predictions for how long it would take for recovery to occur.

Ms. Keeley replied that case studies suggested that it could take up to 8 years for recovery to occur in actively remediated areas, and for some chemicals it could take 20 years. Therefore, one should expect 8-20 years for natural recovery.

Joe Germano, Germano and Associates, indicated that he was confused about one of Karen Keeley's statements during her presentation. The cap was placed due to the risk to the benthic community from exposure to ammonia, sulfide, and 4-methylphenol. Yet, the cap was not engineered to isolate the contaminants. He was not clear as to why that was done.

Karen Keeley responded that with new sand the benthic community would initially not be exposed to the sediments, and they did not expect concentrations that may move through sand to be at a level that would cause toxicity to the benthic organisms.

Joe Germano asked if they would be including non-capped areas in the long-term monitoring to evaluate whether it is worth actually placing a cap or not.

Karen Keeley responded that they would be looking at non-capped areas for comparison purposes.

Martha Burke noted that some areas were dredged and other areas were not. She wondered what determined which areas would be dredged.

Karen Keeley responded that some areas were dredged for navigation reasons (i.e., to allow for boats to reach the main dock). They combined this dredging work with the cleanup process so that the new owner would not have to obtain a separate permit.

Martha Burke asked if they felt it was not worth dredging the other areas or removing logs.

Karen Keeley stated that it was too expensive to dredge everything. There was too much sediment, large logs, and other debris to remove to make dredging economical, given the risks to the community. There also was not a suitable disposal site to handle the material.

An individual asked where the material that was dredged was disposed.

Ms. Keeley responded that KPC had a landfill that was going to be closed and had a capacity of approximately 15,000 cubic yards of material. It went into their landfill.

Jeff Steevens asked what they used to dredge the material.

Ms. Keeley indicated that a digging bucket and environmental bucket were used. The environment bucket was a type of bucket that does not dig, but simply shuts. This was used in some areas, but when they got into areas in which the material was more cohesive, they switched to the digging bucket.

Another individual asked if there were any steep slope issues.

Ms. Keeley responded that they did not cap sediments if the slope was steeper than 40%.

22. Tracy Collier, NMFS - 3:45 pm
NMFS White paper overviews

Tracy Collier gave an overview of a number of National Marine Fisheries Service (NMFS), Environmental Conservation Division (ECD) white papers. He indicated that these papers represent best professional judgment on levels of toxic contaminants associated with adverse biological effects in marine and anadromous fish of the Pacific Northwest. Laboratory and field data were used to estimate thresholds for contaminants where adverse effects were first observed. The papers were an assessment of current literature and field data, and had been extensively peer-reviewed and submitted for publication. The papers were available at the following website address: http://research.nwfsc.noaa.gov/ec/ecotox/Publications/whitepapers.html

There were different approaches for determining thresholds for different toxicants. For PCBs, direct effects on outmigrating juvenile salmon were used to determine thresholds. Indirect effects on salmon through direct effects on benthic prey organism were used to develop thresholds for TBTs. Thresholds for adverse effects of polycyclic aromatic hydrocarbons (PAHs) on English sole were based on direct exposure of these fish to PAH contaminated sediments. The PAH thresholds were based on field data, whereas the TBT and PCB thresholds were based on laboratory studies. Exposure to multiple contaminants was an issue for the PAH studies.

Mr. Collier stated that these papers did not recommend sediment cleanup levels, although the tissue and sediment levels could be used to determine "not likely to adversely effect levels" (NLAA). The papers did not represent the final answer, but represented their current assessment. Further research would improve the strength of the recommendations. In addition, the papers were not policy guidelines from NMFS, but should be regarded as a scientific paper to support policy decisions and development.

Mr. Collier first summarized the PCB white paper. The approach for this analysis involved looking at data from 15 independent laboratory studies to link tissue concentrations to biological effects. Field data were used to extrapolate from tissue to sediment levels. The tissue residue effect and sediment effect thresholds were 2.4 µg/g lipid and 225 ng/g dry weight, respectively. The tissue threshold was site independent, but for the sediment effects threshold site-specific criteria were important and could change the threshold value. Therefore, the sediment effects threshold may not directly apply to other systems; whereas, the tissue reside effect threshold had greater certainty.

The selection criteria for PCB studies to include in their review for determining PCB thresholds were that a) fish species had to be salmonid; b) data had to be from controlled laboratory studies; c) there had to be a biological response in one or more treatments, which was statistically different from the control; d) dietary exposure had to be involved and tissue concentrations

reported; e) the life stage of the fish was important (juvenile fish); and f) the fish could only have been exposed to PCBs.

Mr. Collier showed a graph that plotted the cumulative distribution of studies showing lower effect residue (LOER) values for salmonids. They chose the 10^{th} percentile to be conservative with ESA salmonids. Effects levels for all studies were highly variable.

In order to determine the biota-sediment accumulation factor (BSAF) approach, they looked at a series of studies done on salmonids (included hatchery and wild fish). They looked at PCBs in tissues of fish in the hatchery vs. downstream to determine any differences, and which fish exhibited the highest tissue concentrations. Studies showed that fish from Duwamish River had concentrations of 1000 ng/g in tissues as they transit through the estuary. Slip 4 fish had highest levels (4000 ng/g). Taking BSAFs derived from the above assessment of sediment and tissue contamination, they could show how sediment guidelines could change with site-specific data. In addition, a range of values is important to consider when looking at ESA species. There was high variability in PCB accumulation in some of these habitats.

The approach for deriving threshold PAH values involved looking at English sole tissue data from several years of monitoring along the west coast (national benthic surveillance project). Tissue residue analyses were not really useful, since PAHs do not accumulate in fish tissues. The thresholds were based on real world exposure vs. laboratory studies. Liver disease was the primary effects endpoint, and reproductive dysfunction and DNA problems were all used as corroboration of threshold values. The PAH sediment effects threshold was determined to be 1000 ng/g dry weight. This analysis had strong applicability in Essential Fish Habitat (EFH) groundfish consultations. However, these may be stopped in the near future. EFH is undergoing assessment under the new Bush administration. The future of EFH consultation is uncertain.

Dr. Collier displayed linear regression results for biological effects due to PAHs in sediments. The linear regression was segmented. There were doses where there was no effect with increasing sediment contamination (or dose), and then a threshold would be reached in which there was a definite increase with dose. They also looked at DNA adducts (genotoxic exposure can be looked at with this method) as a response to PAHs levels. The DNA adduct damage was thought to be the beginning of liver disease in English sole. In addition, they looked at reproductive endpoints including gonadal growth, spawning inhibition, infertile eggs, etc. They found that at total PAH levels of 1000 ppb in sediments, they would begin to see problems such as increases in the types of liver lesions. Mr. Collier displayed a figure showing the relationship of PAHs to liver lesions using a segmented regression analysis. At levels of "x" ppb in the sediment, one could predict "y" percent of English sole that would have various types of liver damage. The threshold was 1000 ppb. This regression was also done for reproductive problems. Reproductive systems appeared to be less sensitive than the liver to PAH. A threshold value of 5000 ppb was determined when considering reproductive endpoints.

The TBT white paper involved reviewing and analyzing a large data set on adverse effects. The threshold was determined through indirect effects on salmon based on direct effects on benthic invertebrate prey. They found that some sublethal effects would occur at low levels of exposures. The tissue residue effect threshold was established as 3 μg/g dry weight, and the

sediment effects threshold was established as 120 ng/g dry weight. The EPA and NMFS agreed that 3 µg/kg would be the tissue trigger level for some applications such as CERCLA and salmonid ESA applications.

Discussion and Public Comment

Damon Morris, ThermoRetec, noted that they looked at total PAHs in the study. He asked Mr. Collier if given the fact that there is variable toxicity in the PAH individual compounds, if they looked at normalizing the data to different PAH compounds such as benzoid-pyrene equivalent compounds or anything similar.

Tracy Collier responded that they looked at total PAHs only. He added that the PAH compounds included in their totals may be different from what others may include. The analysis endpoints were not necessarily tied into carcinogenic effects.

Teresa Michelsen wondered why fish observed in the lower reaches of the rivers sometimes exhibited lower levels of PCBs in their tissues than those in the higher reaches, when one might expect that as fish migrate down the river, they are exposed to PCBs along the way and potentially accumulate more contaminants.

Tracy Collier responded that we need to know how these fish utilize their habitats. Data suggest that some of these habitats may be used differently. One cannot assume the fish are moving continuously downstream, and as they continue downstream they accumulate more contaminants. Fish may have gone straight to Kellogg Island, or remained in one place and then moved. There is not a continuous gradient downstream.

Mike Johns commented that as they collect fish at the mouth of the East or West Waterway, at the terminus of the Duwamish, they should have fish with tissue residues representing their entire exposure. Therefore, if Tracy Collier is correct, one should find fish with high tissue concentrations and others with low levels.

Tracy Collier agreed that salmon leaving the Duwamish may exhibit varying levels in tissues, depending on how long they remained in certain places and how heterogenous the sediment contamination was.

Mike Johns asked whether whole body values were used, or if the stomach content was removed.

Tracy Collier responded that the stomach content was removed first.

23. Tom Gries, Ecology - 4:20 pm
Feasibility of Sediment Treatment in Puget Sound

Prior to his presentation on the feasibility of sediment treatment, Tom Gries announced that Ecology was demonstrating the newest revision to the SEDQUAL database at the SMARM. He mentioned that it would be publicly available in 2 weeks. Those interested should leave their

business card with Martin Payne. Anyone interested in a copy of the report on the feasibility of sediment treatment in Puget Sound should contact Mr. Gries.

Mr. Gries indicated that as part of the MUDS project, work was performed under contract with Ecology by many team members to further examine the feasibility of sediment treatment. Mr. Gries first gave an outline of his presentation and talked about the early findings and decisions made concerning sediment treatment. The EPA Region 2 (east coast) led the effort to develop sediment treatment technologies. Several categories of technologies were promising, and bench and pilot testing was underway. One issue was that a treatment needed to be cost effective. Other key issues included whether there were markets for sale of end products from the treatment process. Another issue was the need for a reliable supply of sediment. The volumes that drove treatment interest back east was from navigation material. Within the Pacific Northwest, most of the contaminated material requiring treatment was from cleanup activities, which generally is more sporadically available. It was also not always clear how much of the sediments should be treated, and if the product was topsoil, how clean does it need to be to be sold?

Some of the leading technology categories and end products resulting from treatment included soil washing methods using physical and chemical treatments to remove contaminants from sediment particles. The end product would be sediment that can yield topsoil. Stabilization technology could result in construction fill. Thermal treatment could result in cement, gravel, glass products, and electric power as byproducts. Bioremediation could yield topsoil or fill.

Early findings and decisions concerning a MUDS facility were that the first MUDS facility should provide the capacity for sediment treatment. They also determined that the treatment facility would involve a partnership of both public and private sectors. The Study Team would identify candidate sites for MUDS facilities.

Mr. Gries then talked about the evaluation of treatment technologies. They came up with a process for evaluating technologies, which involved establishing criteria for evaluating treatment technologies. Ratings of treatments were based in part on a survey mailed to independent contractors and their responses. Evaluation of the treatment technologies included looking at the cost (e.g., tipping fees), marketability of products, effectiveness of treatment, flexibility of the process, relevant business information, and public acceptability. Through this evaluation process, four technologies/vendors were selected for further study. These included BEM Systems (chemical stabilization process resulting in fill), Biogenesis/Weston (soil washing), Cement-Lock (thermal treatment), and Global Plasma Systems (thermal treatment).

Mr. Gries indicated that there were many categories of challenges with respect to the feasibility of sediment treatment. Among these are reliable contaminated sediment supply, environmental impacts associated with byproducts, markets for end products, liability, economic viability, and others. Solutions to providing a reliable supply of sediment are using alternative materials, temporarily stockpiling/storing contaminated sediments, coordinating sediment cleanup actions, and creating a legislative guarantee of adequate sediment volume. With respect to regional markets for end products, there are potential markets for topsoil, cement, and glass products, but

little or no market for construction fill. The Study Team recommended conducting a detailed market analysis for end product marketability.

Mr. Gries stated that since the treatment technology had not yet been chosen, it was difficult to assess the environmental impacts since these could vary with the specific technology. He commented that legal analysis indicated a minimal risk of liability from future environmental contamination associated with manufactured products. With respect to economic viability and funding, they put a spreadsheet together that assessed profitability. They looked at private enterprise and a number of public/private partnership scenarios, and found that public sector land lease was the most profitable. They also looked at a number of funding options for financing a full scale MUDS treatment facility. One benefit derived from having the private sector build the facility would be that costs would be competitive. A private company might own and operate a facility and be assisted by public agency that owns the land on which the facility is built.

Recommendations for next steps include deciding which public entity will lead the future development of a MUDS (e.g., DNR, port district, PSDDA, or county). The agency that takes the lead would evaluate alternatives, evaluate "volunteer" sites for a MUDS treatment facility, and would need to continue with public outreach and siting activities. Mr. Gries concluded his presentation by stating that most treatment technologies were good and could work in this region, but that we would need political will, public acceptance, and few cost-competitive alternatives in order to develop a regional capacity for treatment of contaminated sediments.

Ovrhd 11-1. Feasibility of Sediment Treatment in Puget Sound
Ovrhd 11-2. Outline of Presentation
Ovrhd 11-3. Early Findings and Decisions
Ovrhd 11-4. Early Findings and Decisions, Cont.
Ovrhd 11-5. Early Findings and Decisions, Cont.
Ovrhd 11-6. Evaluation of Treatment Technologies
Ovrhd 11-7. Evaluation of Treatment Technologies, Cont.
Ovrhd 11-8. Evaluation of Treatment Technologies, Cont.
Ovrhd 11-9. Challenges and Solutions
Ovrhd 11-10. Reliable Supply of Contaminated Sediment
Ovrhd 11-11. Regional Markets for End Products
Ovrhd 11-12. Environmental Impacts/Product Liability
Ovrhd 11-13. Economic Viability and Funding
Ovrhd 11-14. Break-Even Tipping Feels by Management Alternative and Land Value
Ovrhd 11-15. Other Challenges and Solutions
Ovrhd 11-16. Needs and Next Steps
Ovrhd 11-17. Needs and Next Steps, Cont.
Ovrhd 11-18. Acknowledgements

Discussion and Public Comment

Lawrence McCrone asked about the feasibility of treatment of varying types of contamination and physical content of the sediments (e.g., grain size). He wondered how they worked that into the feasibility assessment.

Tom Gries answered that when they sent out surveys to the vendors, the vendors were given average concentrations of contaminants in Puget Sound sediments that required cleanup, as well as grain size characteristics. None of the vendors indicated that they would have a problem with differences in sediment parameters. He commented that pretreatment might be necessary for some of the processes, which could increase the cost. However, they asked vendors for a cost per cubic yard for the entire treatment process.

Lawrence McCrone commented that if the vendors were given an average for the parameters in Puget Sound, there is a lot of range around the averages.

Mr. Gries agreed. The vendors were not only given averages, but maximums, minimums, medians, and more.

Martha Burke asked if anyone had stepped up to the plate politically on treatment of sediments.

Tom Gries responded he thought that they would know in the next few months. He was curious as well.

Doug Hotchkiss, Port of Seattle, wondered if Tom Wakeman of New York got anyone to bite on his privatization proposal. He had spoken with him about the concern of having a sufficient quantity of sediments to keep a treatment plant going. Mr. Wakeman told him that once their pilot studies were complete, he began to look for a private party to build a facility. No one was interested unless there was even more public assistance.

Tom Gries responded that he did not know the full answer, but a facility for a 250,000 cy demonstration was expected to be in operation this year. He commented that the east coast has better markets for topsoil, and had established standards for types of topsoil. Although the east coast is leading in treatment technologies, he felt they have a long way to go before they have a full-scale operation going.

Mr. Hotchkiss added that vendors talked about how they could perform the treatment, and were interested when a lot of public funds were involved for the pilot studies, but when it came down to actually getting a facility in operation beyond the pilot study phase, no one stepped up.

Mr. Gries indicated that he had heard that as well, but did not know the full answer to that.

An individual asked if the vendors indicated how much land would be required for a treatment facility.

Mr. Gries responded that generally 5-15 acres (maximum of 60 acres) would be necessary, depending on the type of facility. The maximum of 60 acres involved a facility that would have enough storage space to ensure a reliable flow of material.

Allison Hiltner, EPA, mentioned that the push toward treatment was related to DNR's strong position that there should be no contaminated sediments disposed on state aquatic lands. There is a new administration with DNR and she wondered if those involved in the MUDS program knew if DNR was going to continue with this position or if there may be a shift in their position.

Mr. Gries responded that Ecology is still working with DNR on other alternatives such as in-water disposal. It was clear that treatment was still the direction that most agencies were interested in pursuing. How DNR views aquatic disposal is still evolving. The cost associated with aquatic disposal may not have been fully evaluated in the past. He felt that if a team of economists conducted a thorough analysis, they might come up with somewhat different estimates.

Martha Burke stated that she heard that the cost for upland disposal had decreased.

Tom Gries indicated that they are now evaluating the costs. Three years ago, the costs for upland disposal looked too high. This could inhibit cleanups, and they would need to do something new. Within the last couple of months, at least one regional landfill was claiming lower costs. They were revisiting that. It may buy more time. They were also looking at long-term cost agreements.

Tammy Allen, DNR, commented about the evolution of policy for aquatic lands. They will continue to prioritize to take the pressure off aquatic lands, and continue to look for other alternatives such as treatment.

Summary and Closing

24. Diane Parks, USACE
Closing Remarks

Diane Parks addressed the audience and stated that if anyone had other issues they wanted the DMMP agencies to consider, they should submit written comments. Comments on DMMP issues needed to be submitted by June 5, 2001, and comments for SMS issues needed to be submitted by June 30, 2001 for consideration. She asked if anyone had any issues they would like to bring up during the current meeting before she closed the meeting. Since there were no additional issues raised, Ms. Parks thanked the presenters, those keeping the minutes and operating the video, and others involved in running the meeting. She thanked everyone for attending, and adjourned the meeting.

ATTACHMENT 1

Agenda

Sediment Management Annual Review Meeting
Date: May 8, 2001
Location: Saint Martin's College Auditorium
Final Agenda

Registration, coffee ---------- 8:30 - 9:00

Welcome, Opening Remarks, (Diane Parks, U.S. Army Corps of Engineers) --------- 9:00 - 9:15

Opening Speaker (Nancy McKay, Chair, PSWQAT[1]) ---------- 9:15 - 9:45

Agency Summary Reports ---------- 9:45 -11:00

- Corps (Summary of DMMP Testing Activities, Lauran Cole-Warner, Corps)
- DNR (Summary of DMMP Disposal and Monitoring Activities, Robert Brenner, DNR)
- Ecology (Summary of SMS Cleanup Activities, Roger Dovel, Ecology Introduction, Jim Pendowski, Ecology)
- EPA (Summary of National/Regional Activities, Sally Marquis, EPA)

Questions and Answers (on any of the above topics)

Break ---------- 11:00 -11:15

DMMP/SMS Presentations ---------- 11:15 -12:15

- Issue Paper: Dispersive Site Guideline Revisions (John Malek, EPA)
- Status Report: MUDS Study Update (Steve Babcock, Corps)
- Status Report: Bellingham Bay TMDL Development (Pam Elardo, Ecology)
- Multibeam Bathymetric Surveys in Puget Sound (Ted Benson, DNR)
- Summary Overview of DMMP Clarification Papers (Stephanie Stirling, Corps)

Questions and Answers (on any of the above papers)

Lunch ---------- 12:15 - 1:30

Public Issue Papers and Discussion ---------- 1:30 - 2:45

- Sediment Cleanup/MCON Integration Dredging and CAD Disposal (Peter Havens, USN)
- Assessment of the immunocompetence endpoint in juvenile chinook salmon following exposure to dietary PCBs at environmentally relevant concentrations (Mike Johns, Windward Environmental and David Powell, Profishent, Inc.)
- Ultra-low level PCB analysis technique for water and sediments (John Hicks, Columbia Analytical Services)

Questions and Answers (on any of the above papers)

Break ---------- 2:45 - 3:00

Topical Presentations/Lessons Learned ---------- 3:00 - 4:45

- Ketchikan Pulp Company CERCLA remediation (Karen Keeley, EPA)

[1] Puget Sound Water Quality Action Team

- NMFS White Paper Overviews, PAHs, TBT, PCBs (Tracy Collier, NMFS)
- Feasibility of Sediment Treatment in Puget Sound (Tom Gries, Ecology)

Questions and Answers (on any of the above papers)

Summary and Closing of SMARM 2001 ---------- 4:45 - 5:00

Adjourn ---------- 5:00

ATTACHMENT 2

List of Attendees

NAME	AGENCY	STREET ADDRESS	CITY	STATE	ZIP CODE	E-MAIL
Karen Bergmann	AMEC Earth & Enviro.	5009 Pacific Hwy East, Suite 2	Fife	WA	98424	klbergmann@aees.com
Dave Mitchell	Analytical Resources, Inc.	333 - 9th Avenue North	Seattle	WA	98109	dave@arilabs.com
Teresa Michelsen	Avocet Consulting	15907 - 76th Place NE	Kenmore	WA	98011	teresa@avocetconsulting.com
Betsy Barrows	Battelle	1529 West Sequim Bay Road	Sequim	WA	98382	es.barrows@pnl.gov
Meg Pinza	Battelle	1529 West Sequim Bay Road	Sequim	WA	98382	meg.pinza@pnl.gov
Doug Holsten	CH2M Hill	P.O. Box 91500	Bellevue	WA	98009	dholsten@ch2m.com
Patt O'Flaherty	CH2M Hill	P.O. Box 91500	Bellevue	WA	98009	poflaher@ch2m.com
Jennie Goldberg	City of Seattle – SCL		Seattle	WA		jennie.goldberg@ci.seattle.wa.us
Martha Burke	City of Seattle – SPU		Seattle	WA		martha.burke@ci.seattle.wa.us
John Hicks	Columbia Analytical Services	19916 - 5th Avenue South	DesMoines	WA	98148	jhicks@caslab.com
John Bower	DNR	P.O. Box 47000	Olympia	WA	98504-7000	john.bower@wadnr.gov
Loren Stern	DNR	P.O. Box 47000	Olympia	WA	98504-7000	loren.stern@wadnr.gov
Robert Brenner	DNR	P.O. Box 47000	Olympia	WA	98504-7000	robert.brenner@wadnr.gov
Ann Bailey	EcoChem					abailey@ecochem.net
Brad Helland	Ecology /TCP-NWRO	P.O. Box 47600	Olympia	WA	98504-7600	bhel461@ecy.wa.gov
Gail Colburn	Ecology /TCP-NWRO	P.O. Box 47600	Olympia	WA	98504-7600	gcol461@ecy.wa.gov
Grant Yang	Ecology /TCP-NWRO	P.O. Box 47600	Olympia	WA	98504-7600	gyan461@ecy.wa.gov
Pam Elardo	Ecology /TCP-NWRO	P.O. Box 47600	Olympia	WA	98504-7600	pam.elardo@metrokc.gov
Rick Thomas	Ecology /TCP-NWRO	P.O. Box 47600	Olympia	WA	98504-7600	rick461@ecy.wa.gov
Brenden McFarland	Ecology/SEA Program	P.O. Box 47600	Olympia	WA	98504-7600	bmcf461@ecy.wa.gov
Jim Pendowski	Ecology/TCP-HQ	P.O. Box 47600	Olympia	WA	98504-7600	jpen461@ecy.wa.gov
Tim Nord	Ecology/TCP-HQ	P.O. Box 47600	Olympia	WA	98504-7600	tnor461@ecy.wa.gov
Martin Payne	Ecology/TCP-ICU	P.O. Box 47600	Olympia	WA	98504-7600	mpay461@ecy.wa.gov
Brett Betts	Ecology/TCP-SMU	P.O. Box 47600	Olympia	WA	98504-7600	bbet461@ecy.wa.gov
Kathy Bragdon-Cook	Ecology/TCP-SMU	P.O. Box 47600	Olympia	WA	98504-7600	kbco461@ecy.wa.gov
Lon Kissinger	Ecology/TCP-SMU	P.O. Box 47600	Olympia	WA	98504-7600	lkis461@ecy.wa.gov
Lynn Gooding	Ecology/TCP-SMU	P.O. Box 47600	Olympia	WA	98504-7600	lgoo461@ecy.wa.gov
Roger Dovel	Ecology/TCP-SMU	P.O. Box 47600	Olympia	WA	98504-7600	rdov461@ecy.wa.gov
Sharon R. Brown	Ecology/TCP-SMU	P.O. Box 47600	Olympia	WA	98504-7600	sbro461@ecy.wa.gov
Tom Gries	Ecology/TCP-SMU	P.O. Box 47600	Olympia	WA	98504-7600	tgri461@ecy.wa.gov
Russ McMillan	Ecology/TCP-SWRO	P.O. Box 47600	Olympia	WA	98504-7600	rmcm461@ecy.wa.gov
Nora Jewett	Ecology/Water Quality Program	P.O. Box 47600	Olympia	WA	98504-7600	njew461@ecy.wa.gov
Dave Kulman	EPA Region 10	1200 6th Avenue	Seattle	WA	98101	kulmandavid@epa.gov
John Malek	EPA Region 10	1200 6th Avenue	Seattle	WA	98101	malek.john@epa.gov

NAME	AGENCY	STREET ADDRESS	CITY	STATE	ZIP CODE	E-MAIL
Justine Barton	EPA Region 10	1200 6th Avenue	Seattle	WA	98101	barton.justine@epa.gov
Karen Keeley	EPA Region 10	1200 6th Avenue	Seattle	WA	98101	keeley.karen@epa.gov
Otto Moosburner	EPA Region 10	1200 6th Avenue	Seattle	WA	98101	moosburner.otto@epa.gov
Sally Marquis	EPA Region 10	1200 6th Avenue	Seattle	WA	98101	marquis.sally@epa.gov
Allison Hiltner	EPA-Region 10 Superfund	1200 6th Avenue	Seattle	WA	98101	hiltner.allison@epa.gov
Andrea Brauner	EVS Environment Consultants	195 Pemberton	N. Vancouver	BC, Canada	V7P 2R4	abrauner@evsenvironment.com
Jennifer Stewart	EVS Environment Consultants	195 Pemberton	N. Vancouver	BC, Canada	V7P 2R4	jstewart@evsenvironment.com
Lorraine Read	EVS Environment Consultants	200 West Mercer Street, Ste 403	Seattle	WA	98119	lorrainer@evs-eco.com
Lawrence McCrone	Exponent	15375 SE 30th Place	Bellevue	WA	98007	mccronel@exponent.com
Steve Remiers	Floyd and Snider	83 South King Street, Ste 614	Seattle	WA	98104	
Gary Braun	Foster Wheeler Environmental	12100 NE 195th St, Ste 200	Bothell	WA	98011	gbraun@fwenc.com
Jennifer Hawkins	Foster Wheeler Environmental	12100 NE 195th St, Ste 200	Bothell	WA	98011	jhawkins@fwenc.com
Sally Fisher	GeoEngineers	1101 Fawcett Suite 208	Tacoma	WA	98402	sfisher@geoengineers.com
Joe Germano	Germano & Associates	12100 SE 46th Place	Bellevue	WA	98001	germano@ix.netcom.com
Jim Phipps	Grays Harbor College	1620 Edward P. Smith Drive	Aberdeen	WA	98520	toninjim@techline.com
Roger McGinnis	Hart Crowser	1910 Fairview Avenue East	Seattle	WA	98102	roger.mcginnis@hartcrowser.com
Taku Fuji	Hart Crowser	5 Center Pointe Drive, Ste 240	Lake Oswego	OR		ttf@hartcrowser.com
Lincoln Loehr	Heller Ehrman White & McAuliffe	6100 Columbia Center	Seattle	WA	98104-7098	lloehr@hewm.com
Rob Zisette	Herrera Environmental Consultants	2200 Sixth Avenue, #601	Seattle	WA	98121	rzisette@herrerainc.com
Allan Chartrand	Jones and Stokes	2820 Northup Way, Ste 100	Bellevue	WA	98004	allanch@jsonet.com
Jeff Stern	King County	201 South Jackson Street	Seattle	WA	98104-3855	jeff.stern@metrokc.gov
Pat Romberg	King County	201 South Jackson Street	Seattle	WA	98104-3855	pat.romberg@metrokc.gov
Pete Rude	Landau Associates	130 - 2nd Ave South	Edmonds	WA	98020	pdrude@landauinc.com
Tim Hammermeister	Landau Associates	130 - 2nd Avenue South	Edmonds	WA	98020	thammer@landauinc.com
Peter Havens	U.S. Navy	19917 - 7th Avenue NE	Poulsbo	WA	98370-7570	havenspw@efanw.navfac.navy.mil
Lyndal Johnson	NMFS, NW Fisheries Science Center	2725 Montlake Place East	Seattle	WA	98112	lyndal.l.johnson@noaa.gov
Dan Delinger	North Creek Analytical	11720 North Creek Pkwy N, Ste 400	Bothell	WA	98011-8223	ddelinger@ncalabs.com
Lee Carfioli	North Creek Analytical	11720 North Creek Pkwy N, Ste 400	Bothell	WA	98011-8223	lcarfioli@ncalabs.com
John Wegrzyn	Oregon DEQ	2020 SW 4th Avenue	Portland	OR	97201	wegrzyn.john@deg.state.or.us
Mike Rosen	Oregon DEQ	2020 SW 4th Avenue	Portland	OR	97202	rosen.mike@deq.state.or.us
Linda Logan	Parametrix	5808 Lake WA Boulevard NE	Bellevue	WA	98033	logan@parametrix.com
Jerry Ramsden	Parsons Brinckerhoff	421 SW 6th Ave, Ste 1350	Portland	OR	97204	ramsden@pbworld.com
Clifford Whitmus	Pentec Environmental	120 Third Ave South, Ste 110	Edmonds	WA	98020-8411	cliff@pentecenv.com
Rob Gilmour	Pentec Environmental	120 Third Ave South, Ste 110	Edmonds	WA	98020-8411	rob.gilmour@pentec.com

NAME	AGENCY	STREET ADDRESS	CITY	STATE	ZIP CODE	E-MAIL
Pete Stoltz	PI Engineering					petes@piengr.com
Doug Hotchkiss	Port of Seattle	P.O. Box 1209	Seattle	WA	98111	hotchkiss.d@portseattle.com
Konrad Liegel	Preston, Gates, Ellis	701 – 5th Avenue	Seattle	WA	98104-7078	konradl@prestongates.com
David Powell	ProFishent, Inc.	17806 NE 26th Street	Redmond	WA	98052	davidp@profishent.com
Rick Sheats	S&S Environmental	7865 NE Day Road West	Bainbridge Is.	WA	98110	richard@ssea-restore.com
Brynie Kaplan	SAIC	18706 North Creek Pkwy, Ste 110	Bothell	WA	98011	k.brynie.kaplan@saic.com
Lisa E. Roach	SAIC	18706 North Creek Pkwy, Ste 110	Bothell	WA	98011	lisa.e.roach@saic.com
John Webb	SSEA	7865 NE Day Road West	Bainbridge Is.	WA	98110	bill@ssea-restore.com
Pete Striplin	Striplin Environmental Associates	15111 - 8th Avenues SW, Ste 303	Seattle	WA	98166	pstriplin@striplin.com
Sandy Browning	Striplin Environmental Associates	222 Kenyon Street NW	Olympia	WA	98502	sbrowning@striplin.com
Bruce W. Rummel	Taylor Associates	7104 Greenwood Avenue N	Seattle	WA	98103	bwrummel@taylorassoc.net
Damon Morris	ThermoRetec	1011 SW Klickitat Way, Suite 207	Seattle	WA	98134	dmorris@thermoretec.com
Kris Fabian	URS Corporation	1501 – 4th Avenue	Seattle	WA	98101	kris_fabian@urscorp.com
Clare Jaeger	USACE - Alaska District	P.O. Box 898	Anchorage	AK	99508-0898	clare.l.jaeger@poa02.usace.army.mil
David Kendall	USACE -Seattle District	P.O. Box 3755	Seattle	WA	98124	david.r.kendall@nws.usace.army.mil
Stephanie Stirling	USACE -Seattle District	P.O. Box 3755	Seattle	WA	98124	stephanie.k.stirling@nws.usace.army.mil
Diane Parks	USACE -Seattle District	P.O. Box 3755	Seattle	WA	98124	diane.e.parks@nws.usace.army.mil
Lauran Warner	USACE -Seattle District	P.O. Box 3755	Seattle	WA	98124	lauran.c.warner@usace.army.mil
Steve Babcock	USACE -Seattle District	P.O. Box 3755	Seattle	WA	98124	steven.d.babcock@usace.army.mil
Laura Inouye	USACE-EROC	3909 Halls Ferry	Vicksburg	MS	39180	inouyel@wes.army.mil
Laura Hamilton	USACE-Portland District	P.O. Box 2946	Portland	OR	97208-2946	laura.j.hamilton@usace.army.mil
Mark Siipola	USACE-Portland District	P.O. Box 2946	Portland	OR	97208-2946	mark.p.siipola@usace.army.mil
Tim Sherman	USACE-Portland Dist.	P.O. Box 2946	Portland	OR	97208-2946	timothy.j.sherman@usace.army.mil
Jeff Steevens	USACE-WES	3909 Halls Ferry	Vicksburg	MS	39180	steevej@wes.army.mil
Genevieve Pisarski	WA State Senate					pisarski_ge@leg.wa.gov
Mike Johns	Windward Environmental	200 West Mercer Street, Ste 401	Seattle	WA	98119	mikej@windwardenv.com
Scott Shotwell	Windward Environmental	200 West Mercer Street, Ste 401	Seattle	WA	98119	scotts@windwardenv.com

APPENDIX A

Post-SMARM Comments and Responses

DMMP Post-SMARM Response to Port of Seattle letter (Doug Hotchkiss and Tom Newlon).

Comment: "The Z-sample Clarification appears to go far beyond merely clarifying current practice. Rather, it appears to be setting a fundamentally new – and inappropriate – policy affecting the interplay between the DMMP and SMS programs. Whereas the DMMP program is primarily intended to address dredging and the SMS program to address discharges and cleanups, the Clarification creates confusion in the application of the two programs.

We concur with the paper's objective of clarifying the rationale for collecting and analyzing Z-samples. We disagree, however, with the paper'' apparent conclusion that more than compliance with Washington's anti-degradation policy is required.

Dredging projects that results in a cleaner aquatic environment and equal or better habitat functions and values comply with the SMS Rule. The Legislature clarified the state's policy on this issue when it addressed whether mitigation is required for dredging projects that result in a cleaner aquatic environment and equal or better habitat functions and values and concluded that mitigation is not required in such situations. RCW 77.55.260 (1997). Accordingly, consistent with the Legislature's direction, the sole rationale for DMMP Z-sample collection and analysis should be to ensure compliance with the anti-degradation policy, ie., to ensure that the post-dredge surface is cleaner than the pre-dredge surface and provides equal or better habitat functions and values. To the extent that Ecology believes further sediment cleanup is required after dredging is complete, they have the option of independently pursuing implementation of a sediment cleanup action, not impeding dredging through the piggybacking of opportunistic cleanup requirements on otherwise beneficial dredging projects."

Response (David Kendall and Tom Gries): The purpose of the Z-sample clarification paper is update current DMMP guidance and ***not*** to establish "a fundamentally new – and inappropriate – policy affecting the interplay between the DMMP and SMS programs". However, the draft clarification paper has been revised slightly to address the Port's concerns.

The original PSDDA-EPTA guidance predated the implementation of the Sediment Management Standards, but this guidance clearly anticipated that "appropriate Sediment Management Standards" would be promulgated and implemented in the future by the State of Washington. The Z-sampling paper provides general clarification of when Z-samples must be collected, when they must be archived, when they must be analyzed, and the analytical requirements that allow the agencies, especially Ecology, to evaluate compliance with the State's "antidegradation" policy (see the Clarification Paper "Quality of post-dredge sediment surfaces", SMARM 2001). The chemical and biological quality of newly exposed sediment surfaces must only be equal to or better than predredge conditions and may not need to meet specific SMS criteria. However, Z-samples must be collected to adequately characterize the newly exposed surfaces and analytical detection limits must be low enough to allow evaluation of compliance with the antidegradation policy.

The DMMP evaluation process does not force applicants to do a voluntary cleanup action. However, Ecology does consider compliance with the antidegradation policy during its Section 404/401 review before issuing a water quality certification.

APPENDIX B

SMARM Issue Papers, Clarification Papers, and Status Reports

Clarification Papers:

1. Quality of post-dredge sediment surfaces (DMMP)
2. Claifications to the DMMP z-sample analysis guidance and/or post-dredge monitoring policy (DMMP)
3. Chemical analysis of archived sediment samples (DMMP/SMS)
4. Reporting sediment quality for compliance with the SMS Rule (173-204 WAC) (SMS)
5. Reporting ammonia LC_{50} data for larval and amphipod bioassays (DMMP)

Issue Paper:

1. Uniform application of disposal guidelines to all Puget Sound open-water disposal sites (DMMP)[1]

Status Reports:

1. Beneficial use of dredged material (DMMP)
2. Puget Sound Multi-User Disposal Site (MUDS) Project

[1] The DMMP agencies will delay implementation of this issue paper until additional coordination has taken place with the resource agencies and affected Indian Tribes.

DMMP CLARIFICATION PAPER

QUALITY OF POST-DREDGE SEDIMENT SURFACES

Prepared by Thomas H. Gries (Washington Department of Ecology) for the Dredged Material Management Program (DMMP) agencies.

INTRODUCTION

One of the objectives established in the original Puget Sound Dredged Disposal Analysis (PSDDA) program was that the sediment surface exposed by dredging must meet acceptable sediment quality guidelines. For most dredging projects, the Evaluation Procedures Technical Appendix (EPTA) defined acceptable post-dredge sediment quality as chemical contamination below the maximum level guidelines (MLs) or as meeting appropriate State sediment quality standards ***(1)***. EPTA envisioned such standards in 1988, but they had not yet been promulgated.

In 1991, Washington State adopted a Sediment Management Standards (SMS) rule that contains both narrative and numeric sediment quality standards or SQS ***(2)***. Part I of the rule contains general information on authorities, purpose, applicability and administrative policies. The rule establishes "standards for the quality of surface sediments" in Part III. It also provides sediment source control standards in Part IV and sediment cleanup standards in Part V. The latter addresses minimum acceptable standards for sediment quality subsequent to cleanup actions.

PROBLEM IDENTIFICATION

Experience with several recent projects has resulted in the need to better define what is considered acceptable sediment quality for surfaces that remain after completing navigation or cleanup dredging projects. One project is known to have post-dredge surface sediment quality that exceeds DMMP MLs, DMMP biological guidelines, SMS chemical and/or SMS biological standards. A different project is believed to have unacceptable sediment quality at a depth that will become exposed by the dredging that is planned.

Unfortunately, it is not completely clear in either of the cases cited above which post-dredge surfaces comply with the DMMP guidance found in EPTA or the SMS rule. There are at least two reasons for this uncertainty. First, the language in EPTA does not define what is acceptable post-dredge sediment quality in terms of biological effects, e.g., observed toxicity or bioaccumulation. This appears to be inconsistent with other DMMP guidelines and SMS standards. Second, opinions differ regarding post-dredge surface sediment quality that fully complies with the SMS rule.

PROPOSED DMMP CLARIFICATION

The DMMP agencies propose the following revisions to the guidance on acceptable post-dredge sediment quality found in EPTA. The original text is preserved in Italics, while deletions appear in strikeout font and additions in bold.

2.3 New Sediment Surface Exposed by Dredging. Dredging operations can alter the condition of the surface sediments in the dredging area by exposing new sediments to direct contact with biota and the water column. Because the exposed surfaces may result in greater surface sediment chemical concentrations than existed before dredging, this aspect of dredging must be considered in project planning, review and decision-making.

A variety of options were considered for sampling of material that might be left following a dredging operation. EPWG specified that the new exposed surfaces be sampled to a depth of 1 ft below overdepth, and that the composited sample be archived. Chemical analyses of this material would only be required of the dredger if the sediment above the exposed surface indicated potentially elevated chemical concentrations.

Several options for disposition of, and responsibility for, material that might be left following a dredging operation were discussed. Resolution of this issue was as follows, with three separate cases considered:

1. Material with unacceptable chemical concentrations may be present adjacent to a dredged area, but in an area that is not proposed to be dredged. In such cases, the dredger has no requirement under the PSDDA program to address the fate of the sediment in the adjacent area.

*2. The dredging operation may result in exposure of sediment that has ~~higher~~ **elevated** chemical concentrations**, greater toxicity, more bioaccumulation or higher risk** than the material that was dredged. ~~The concentrations of chemicals in the exposed sediment could:~~ **The following three scenarios are possible:***

~~*a.be less than the chemical ML for unconfined, open water disposal;*~~

~~*b.exceed the chemical ML for unconfined, open water disposal, but not the in situ sediment standard for chemical concentrations (i.e., a chemical guideline requiring evaluation of potential remedial action; such a guideline has not yet been established; or*~~

~~*c.exceed the in situ sediment standard for chemical concentration as well as the chemical ML for unconfined, open water disposal.*~~

~~*The dredger must overdredge or cap the exposed sediment if chemical concentrations in the sediment exceed the ML for unconfined open-water disposal (see section II-8.2 and table II-11.1). Dredging that causes surface chemical concentrations to exceed this level is unacceptable.*~~

a.The post-dredge surface sediment exceeds no DMMP chemical or biological

guidelines and no SMS chemical or biological criteria or standards. In this case, the dredger has no requirement under the dredging program concerning the fate of the exposed sediments.

b. The post-dredge surface sediment quality exceeds the chemical or biological SQS and/or minimum cleanup levels (MCUL). In this case, the dredger is not in compliance with the antidegradation policy in the SMS rule (WAC 173-204-120) and the dredger will be required by the SMS to 1) evaluate the impacts to beneficial resources, 2) apply for a sediment impact zone, and/or 3) determine the technical feasibility, cost and net environmental effects of overdredging and/or capping the new sediment surface. Henceforth, the DMMP supports the antidegradation policy contained in the SMS rule by also managing "sediment quality so as to protect existing beneficial uses and move towards attainment of designated beneficial uses". This means that post-dredge surface sediment should be closer to meeting the chemical and biological SQS than the pre-dredge surface sediment.

c. The post-dredge surface sediment exceeds one or more DMMP MLs or biological guidelines for unconfined open-water disposal. In this case, the dredging causes the post-dredge surface sediment quality to exceed acceptable DMMP guidelines and the dredger must overdredge and/or cap the exposed sediment (see section II-8.2 and table II-11.1).

3. *The dredging operation may leave material that contains lower chemical concentrations**, less toxicity, less bioaccumulation and less associated risk** than was initially present. In this case, the dredger has no requirement under the dredging program concerning the fate of the exposed sediments. ~~However, there may be other regulatory programs that request or require additional dredging in this, and other cases. For example, the dredger may be determined to be responsible for discharge of the chemicals of concern and be required under a State or Federal regulation to conduct additional dredging as a remedial measure.~~ **However, while the post-dredge surface sediment may meet the intent of the antidegradation and designated use policies of the SMS rule (Section 120), additional dredging and/or capping of the exposed sediment may still be required by the SMS as part of an agreed cleanup or source control actions if post-dredge surface sediment quality still exceeds SMS chemical or biological sediment quality criteria or standards.***

REFERENCES

1. EPTA, 1988. Evaluation Procedures Technical Appendix. Prepared by the Corps of Engineers in cooperation with the Environmental Protection Agency, Region 10, and the Washington State Departments of Ecology and Natural Resources.

2. Sediment Management Standards, 1991. 173-204 Washington Administrative Code. Washington Department of Ecology, revised 1995.

DMMP CLARIFICATION PAPER

CLARIFICATIONS TO THE DMMP Z-SAMPLE ANALYSIS GUIDANCE AND/OR POST DREDGE MONITORING POLICY

Prepared by David R. Kendall (U.S. Army Corps of Engineers) for the DMMP agencies.

INTRODUCTION

During sediment characterization, the Dredged Material Management Program (DMMP) requires the collection and archiving of a sample (Z-sample) of the top one-foot of material extending beyond the proposed project dredging depth. This sample reflects the new surface sediment quality that would be exposed following dredging (EPTA, 1988, page I-14; Phase I MPR, 1988, page A-12; and Phase II MPR, page 5-34; Grays Harbor and Willapa Bay Dredged Material Users Manual, pages 57-58[1]).

In practice, over the past twelve years of implementation, z-samples were only required for projects in high ranked areas, or in dredging areas where there was a concern for groundwater contamination. The initial guidance stipulated a tiered testing process, whereby archived Z-samples would only be analyzed if there was a "reason-to-believe" that the underlying sediments reflecting the new surface following dredging might be contaminated (e.g., if the immediately overlying sediments were unsuitable for aquatic disposal). During the early years of the Puget Sound Dredged Disposal Analysis (PSDDA) program implementation, most dredging projects were generally initiated in areas with better sediment quality, whereas during the last five years more dredging projects are being initiated in or adjacent to CERCLA or MTCA cleanup areas.
.

PROBLEM IDENTIFICATION

Recent characterization activities in the Blair Waterway (Pierce County Terminal Expansion Project) and East Waterway (Corps/Port of Seattle project; near the mouth of the Duwamish Waterway) have highlighted the need to clarify the rationale for the collection and analysis of z-samples for projects in areas with complex surface and subsurface chemical contamination.

Proposed dredging in the Blair Waterway, a low ranked project, found unexpectedly high levels of subsurface contamination (PCB's and DDT). In the Corps/Port of Seattle construction project in the East Waterway (Stages I and II), subsurface contamination generally was lower than existing surface contamination, but still showed chemical

[1] Z-sample collection and analysis requirements are being added to the PSDDA Users Manual and will be posted prior to the 2001 SMARM.

contamination which exceeded the SQS and in some cases the Cleanup Screening Level (CSL).

A portion of the East Waterway project (Stage I) was dredged in 2000. Z-samples were collected but not analyzed as part of the initial Stage I East Waterway dredging project characterization. Because no Z-samples were analyzed, the predredge sediment quality of the Z-sample layer (new surface) was not known prior to dredging. Subsequent monitoring conducted by the Port of Seattle to assess postdredge sediment quality showed that the newly exposed surface was contaminated (exceeding the chemistry and/or bioassay interpretation CSL) in many areas. Further characterization of these areas will be required to clarify whether contamination is due to recontamination of the surface from the dredging operation, an extension of the contaminated sediment layer below the characterized sediments, or a combination of the two.

Lastly, sediments characterized from the Stage II East Waterway proposed dredging area but not yet dredged, also showed a similar pattern of increasing surface to subsurface contamination at some locations. At one location the Z-sample was analyzed and showed a Hg concentration exceeding the surface concentration (Figure 1). Thus, complex surface and subsurface sediment contamination issues identified from this project and others briefly described above have highlighted the need to clarify Z-sample collection and analysis requirements of the DMMP.

The clarification below will ensure that the DMMP agencies, especially Ecology, will be able to evaluate the postdredge sediment surface for compliance with Washington State's "anti-degradation" policy[2].

PROPOSED CLARIFICATION

The DMMP agencies propose the following clarification to the Z-sample collection and analysis guidance.

1. Z-samples will be collected and archived for every core sampling location for all projects in areas ranked from low to high, unless there is recent sediment quality data (e.g., within recency guideline specifications) to verify that contaminants are restricted to the surficial sediment layer (< 4 feet, or less than the depth cut plus overdredge proposed for dredging) of the sediments proposed for dredging.

2. If a surface dredged material management unit (DMMU) is found to be contaminated (e.g., unsuitable for unconfined-open-water disposal), and the underlying DMMU either is contaminated also or has not been adequately characterized, then archived Z-samples must be analyzed to verify the sediment quality of the Z-horizon.

[2] The new postdredge sediment surface can not be more contaminated than the existing predredge surface.

3. Z-sample analyses will initially consist of sediment conventional and chemical analyses. If the results of these analyses indicate exceedances of SMS-SQS or CSL chemicals of concern within the Z-sample horizon, the dredging applicant may be required to remobilize and resample those given Z-sample locations in order to perform required biological testing (bioassays and/or bioaccumulation testing). The evaluation standard for interpreting the Z-sample sediment quality data will be the Sediment Management Standards "Sediment Quality Standard".

4. The postdredged sediment surface (top 10 cm) may be subject to sediment quality evaluation at the discretion of the DMMP and/or SMS programs for any project where either overlying surface or subsurface DMMU's were found to be unsuitable for unconfined open-water disposal.

REFERENCES

EPTA, 1988. Evaluation Procedures Technical Appendix. Prepared by the Corps of Engineers in cooperation with the Environmental Protection Agency, Region 10, and the Washington State Departments of Ecology and Natural Resources.

GHWBUM[3], 1995. Dredged Material Evaluation Procedures and Disposal Site Management Manual: Grays Harbor and Willapa Bay, Washington. Prepared by the Corps of Engineers in cooperation with the Environmental Protection Agency, Region 10, and the Washington State Departments of Ecology and Natural Resources.

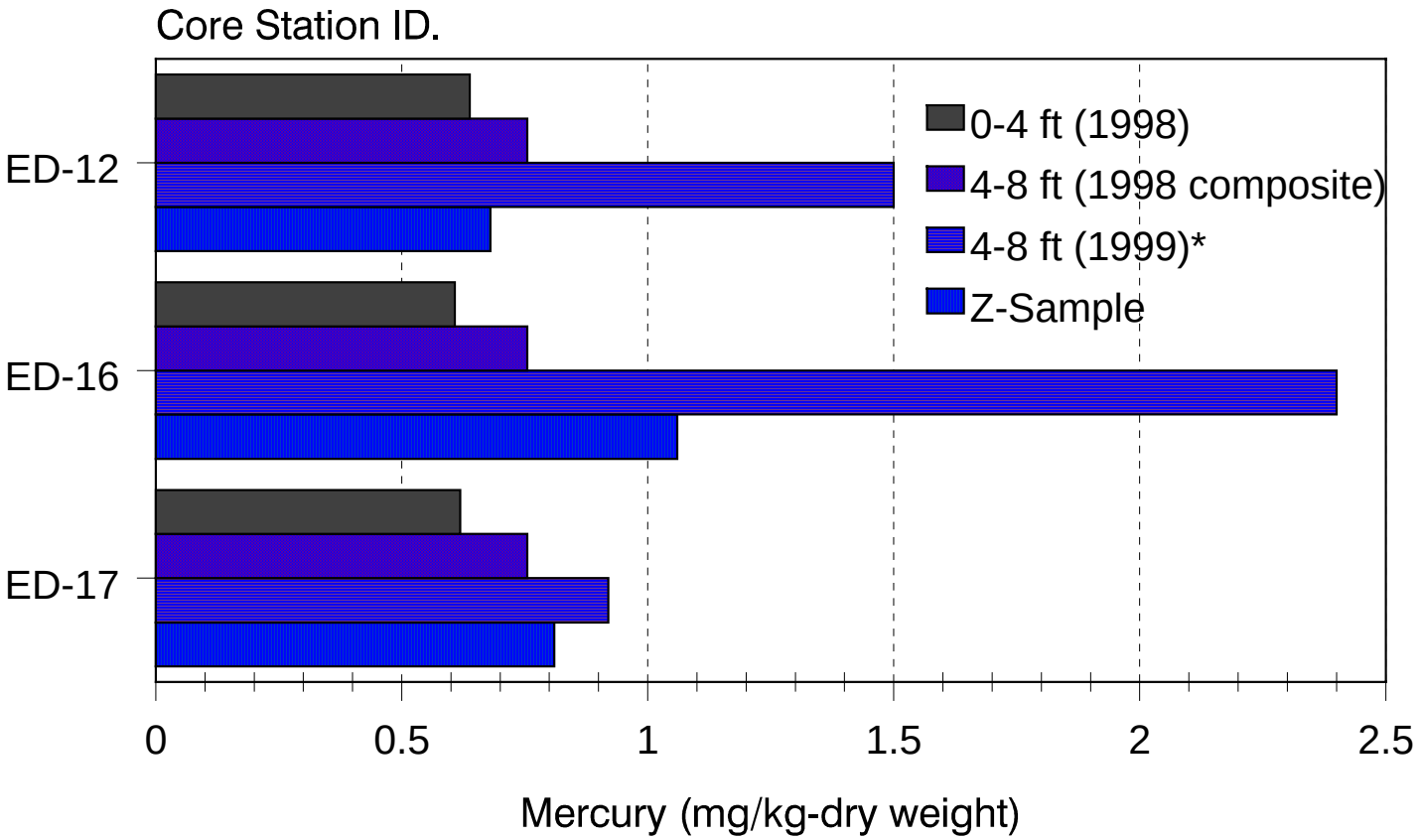
MPR, 1988. Puget Sound Dredged Disposal Analysis (PSDDA) Management Plan Report, Unconfined Open-Water Disposal of Dredged Material, Phase I (Central Puget Sound). Prepared by the Corps of Engineers in cooperation with the Environmental Protection Agency, Region 10, and the Washington State Departments of Ecology and Natural Resources.

MPR, 1989. Puget Sound Dredged Disposal Analysis (PSDDA) Management Plan Report, Unconfined Open-Water Disposal of Dredged Material, Phase II (North and South Puget Sound). Prepared by the Corps of Engineers in cooperation with the Environmental Protection Agency, Region 10, and the Washington State Departments of Ecology and Natural Resources.

[3] GHWBUM = Grays Harbor, Willapa Bay Dredged Material Users Manual.

Figure 1. East Waterway Project (Stage II)

Surface/Subsurface Mercury Comparisions



*1998 Subsurface composited D7 resampled in 1999 and reanalyzed as individual uncomposited samples.

DMMP/SMS CLARIFICATION PAPER

CHEMICAL ANALYSIS OF ARCHIVED SEDIMENT SAMPLES

Prepared by Brett Betts and Kathy Bragdon-Cook (Washington Department of Ecology) for Ecology and the DMMP agencies.

INTRODUCTION

An environmental laboratory in the Puget Sound region recently sought guidance from the Department of Ecology on appropriate handling of archived sediment samples. The main question involved whether or not to decant any overlying water from the sample container prior to chemical analysis. The lab claimed that this is an acceptable option under the current PSEP Protocols and Guidelines.

PROBLEM IDENTIFICATION

Under the most recent PSEP Protocols and Guidelines, environmental laboratories may elect to decant any overlying water that may accumulates at the top of an archived sample *prior to chemical analysis.* The protocols state, "It is extremely important that the sample be clearly defined prior to starting the analysis. In general, current references recommend that excess or overlaying water in a sample be decanted prior to subsampling (EPA, 1987; EPA, 1994; EPA, 1995). For some projects, the concentration of analytes in the interstitial water associated with the solid phase may be of interest (e.g., oiled sediments). **Decanting, centrifugation and discarding this water may bias the results**. If concentrations in the whole sample (i.e., including interstitial water are of interest, the decanted water should be extracted as a liquid sample and the resulting extract combined with the sediment extract (EPA, 1987). Alternatively, the overlaying water in the sample can be mixed into the sediment prior to subsampling. The desired procedure should be specified in the project planning document to ensure the generation of data appropriate to project goals. If samples are decanted, this should be reported with the final data and the percent solids should be determined on a decanted sample." (*Organics Chapter, 5.3.2 Sediment*, 4/97) As noted in the protocols, this practice clearly leads to an unwarranted loss of contaminants from the original sample and yields inaccurate results. While it is true that most sediment contaminants tend to adsorb to particles, a significant fraction of the total sample contaminants may occur in the interstitial or porewater.

PROPOSED CLARIFICATION

To accurately represent the chemical concentrations originally present in the sample when collected, prior to being archived, the dissolved fraction must also be analyzed as described above. Samples archived at 4^{o} Celsius must not be decanted prior to chemical analysis.

REFERENCES

PSEP, 1997 Recommended Guidelines For Measuring Organic Compounds in Puget Sound Water, Sediment and Tissue Samples

SEDQUAL CLARIFICATION PAPER

REPORTING SEDIMENT QUALITY FOR COMPIANCE WITH THE SMS RULE (173-204 WAC)

Prepared by Thomas H. Gries (Washington Department of Ecology) for the DMMP agencies and Ecology.

INTRODUCTION

The original PSDDA agencies cooperatively developed SEDQUAL as a database not only to house navigation dredging project data, but also one that would include ambient sediment quality and disposal site monitoring data, sediment quality data from cleanup sites and source control projects, special scientific studies, etc. In addition, SEDQUAL was intentionally designed not only to be a data repository but also an application that included specific, portable and flexible analytical capabilities. Some of these analytical tools enable the agencies to a) calculate new, or revise old sediment quality guidelines/criteria, b) compare site chemistry to existing guidelines/criteria, c) statistically evaluate biological test results, d) evaluate and map the extent of known or suspected contaminated sediment sites. Using this database and accompanying analytical tools enables the agencies to make informed decisions on appropriate sampling analysis plans, cleanup site boundaries, establish 303d listed water bodies, and management alternatives for contaminated sediment, etc.

PROBLEM IDENTIFICATION

Over the 12+ year history of its use and development, SEDQUAL has evolved into what is arguably one the most robust information management tools in the country used for evaluating sediment quality and making related regulatory decisions. Ecology, the agency responsible for maintaining this database and application, with funding from the U.S. Environmental Protection Agency, has made every effort to make submittal of data in SEDQUAL format a straightforward process. Data entry templates are readily available on Ecology's web site and staff have periodically offered training workshops on the use of SEDQUAL. Yet submittal of sediment quality in format easily reviewed in SEDQUAL continues to be problematic.

It is common practice for individual dredging project proponents or liable parties to contract with consulting firms that have developed their own proprietary databases and/or applications. Having the consulting firm enter data into their own system as well as into SEDQUAL adds cost. However, is it tremendously burdensome and costly from the taxpayers perspective for the regulated community to continue to provide sediment quality data to Ecology in a myriad of different formats. Furthermore, the sediment quality data submitted in these different formats is almost always incomplete. These factors lead to a very resource intensive effort (e.g., more than an entire week) for highly trained technical staff to review and enter sediment quality data for just one fairly typical project.

One potential solution to this problem has been for Ecology to require all environmental data to be submitted in an agency-wide standard format ("Environmental Information Management" system). This is arguably an appropriate goal that has been or is being effectively implemented for some of Ecology's programs. However, the EIM database has been designed to neither house all the data needed to make informed sediment management decisions nor provide

practically any of the current capabilities of SEDQUAL required for effective implementation of the SMS rule.

Ecology and the other agencies involved in the umbrella Cooperative Sediment Management Program should work to ensure sediment quality information is readily available and analyzed for multiple purposes. The following are possible approaches to address this need:

- Ecology, with the support from other CSMP agencies, insists that all sediment quality data be submitted in SEDQUAL format, with accompanying hard copy source data and quality assurance reports
- Ecology could develop its EIM system further to fully meet the needs of sediment management decision-makers
- A different regulatory agency, with greater dedicated resources, could assume the responsibility of maintaining SEDQUAL
- Ecology or a different regulatory agency could develop an alternative or "next generation" SEDQUAL
- Other

PROPOSED CLARIFICATIONS

Ecology has required submittal of sediment quality data into SEDQUAL prior to this clarification. Since development of the EIM system, there has been confusion as to the appropriate format in which to submit sediment quality data. However, because Ecology must make timely and informed sediment management decisions with increasingly limited resources, the agency can no longer accept alternative data formats. Ecology will not approve subsequent SAPS for sites involving navigation, cleanup or source control projects unless the previously collected data upon which the SAPS have been based were provided to Ecology in SEDQUAL format. The agency will no longer make decisions on cleanup site boundaries, etc. unless it is able to analyze the pertinent sediment quality data using the only comprehensive sediment management database and analytical application available that is not nonproprietary - SEDQUAL.

A few reasonable exceptions to this clarification follow. In the case of navigation projects evaluated under DMMP guidelines, proponents may provide the sediment quality to the Corps in DAIS format because the Corps maintains a convenient and accurate program that translates sediment quality data into SEDQUAL format. In the case of projects involving collection of natural resource damage assessment data that cannot be entered into SEDQUAL at this time, Ecology will accept sediment quality information in SEDQUAL format only. Associated NRDA data may be submitted in any format agreeable to all parties involved.

DMMP CLARIFICATION PAPER

REPORTING AMMONIA LC_{50} DATA FOR LARVAL AND AMPHIPOD BIOASSAYS

Prepared by Lauran Cole Warner (U.S. Army Corps of Engineers) for the DMMP agencies

INTRODUCTION

Bioassays are used by the DMMP program to assess toxic and chronic sublethal effects of sediments proposed for dredging and open-water disposal. A suite of three bioassays is presently used: the 20-day juvenile infaunal growth test (with *Neanthes arenaceodentata*), the 10-day amphipod acute mortality test (with *Rhepoxynius abronius*, *Ampelisca abdita*, or *Eohaustorius estuarius)*, and the sediment echinoderm or bivalve[5] larval test.

Ammonia toxicity is a potential non-treatment factor that may affect the results of the larval and amphipod bioassays (Fox 1993). A clarification for ammonia monitoring for the *Neanthes* biomass test was instituted in 1993 (Fox 1993), but there has been no guidance for the larval and amphipod bioassays beyond that found in published protocols (PSEP 1995; USEPA 1994).

Bioassays from some recent projects--particularly those from sediments with high organic fractions (such as wood waste) have shown somewhat elevated ammonia levels. Though reported ammonia levels have never reached published LC_{50} values, there is always a possibility that relative sensitivity of the animals can vary with season, population, or other factors (PSEP 1995). This clarification is intended to provide the needed information for the DMMP agencies to assess the role of ammonia on any expressed toxicity in the larval and amphipod bioassays.

PROBLEM IDENTIFICATION

Presently, laboratories are required to report ammonia levels at test initiation and completion. Both overlying and porewater levels are measured for the amphipod bioassay, and overlying water ammonia levels for the larval bioassay. If ammonia is not a potential contaminant of concern,[6] aeration and/or purging are used to reduce ammonia levels when it is initially present at toxicologically important levels (EPA 1994).

---

[5] Typically, *Dendraster excentricus* is the recommended echinoderm species and *Mytilus galloprovincialis* is the recommended bivalve species for the sediment larval test. However, echinoderms *Stronglyocentrotus droebachiensis* and S*. purpuratus* or bivalve *Crassostrea gigas* may be substituted with DMMP coordination.

[6] In some cases, ammonia can interfere with bioassay results, providing stress to the test animals that is not related to stress caused by the chemicals of concern, (e.g. anoxic sediments with elevated TOC). In other cases, the effects of ammonia are considered important to the toxicity of the sediment, and are a contaminant of concern (e.g., wood waste).

Despite following appropriate protocols, there have been cases where bioassay results have still shown evidence of ammonia toxicity. Sensitivity to ammonia may also covary with toxicity of other compounds, and thus increased mortality can be an accurate measure of the toxicity of test sediments. Without direct evidence to the contrary, the agencies cannot assume that ammonia toxicity is a primary component of any observed toxic responses if reported levels are below published levels of concern.

PROPOSED CLARIFICATION

The DMMP agencies are instituting the following clarification to guidance on larval and amphipod bioassays:

Project proponents may elect to run a water-only ammonia LC_{50} experiment to quantify the sensitivity of the amphipod or larval population being used to ammonia levels occurring in the test sediment. Tests must be run on animals collected and delivered at the same time and place as the test animals, and be run concurrently with the bioassays. The agencies will use information from the water-only tests to consider whether ammonia is contributing to or largely responsible for the observed toxicity in a given test. Test methods and guidelines for interpreting LC_{50} data should be arranged in consultation with the DMMP agencies prior to the initiation of any testing. Appropriate steps to reduce ammonia levels in the test sediments would still be required (see URL: http://www.epa.gov/ostwater/library/sediment/dredgepanel.pdf and/or http://www.wa.gov/puget_sound/Publications/protocols/protocol.html).

Ammonia LC_{50} tests will not be appropriate for many bioassays. Elevated ammonia levels can be expected primarily from very deep sediments or those with substantial amounts of organics such as wood waste. However, ammonia LC_{50} data will be required to support any contentions that ammonia, and not other chemicals of concern, was the primary cause of any expressed toxicity in the larval or amphipod bioassays.

REFERENCES

Fox, David. 1993**.** Clarification on the *Neanthes* 20-day bioassay - requirements for ammonia/sulfides monitoring and initial weight. Presented at the 5th PSDDA Annual Review Meeting, June 1993.

PSEP. 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound sediments. In: Puget Sound Protocols and Guidelines, Puget Sound Estuary Program. Final report by PTI Environmental Services for US Environmental Protection Agency, Region 10, Seattle, WA.

SAIC. 1992. Role of ammonia in toxicity tests used in evaluation of dredged material. Prepared for EPA, Naragansett, Rhode Island under EPA contract No. 68-C1-005, Work Assignment 13, Task 3 (SAIC Project No. 2263).

USEPA. 1994. Methods for assessing the toxicity of sediment-associated contaminants with estuarine and marine amphipods. Environmental Protection Agency Office of Research and Development, June 1994.

DMMP ISSUE PAPER

UNIFORM APPLICATION OF DISPOSAL GUIDELINES TO ALL PUGET SOUND OPEN-WATER DISPOSAL SITES

Prepared by John Malek (U.S. Environmental Protection Agency) for the DMMP agencies

INTRODUCTION/BACKGROUND

In 1988, the Puget Sound Dredged Disposal Analysis (PSDDA) program began managing dredged material. Beginning that year, PSDDA identified three disposal sites in central Puget Sound, implemented state-of-the-science evaluation procedures for testing, defined and implemented disposal site management, and required program accountability which included management of program-generated information and annual program review. In 1989, phase II of PSDDA was completed which expanded the program to north and south Puget Sound and identified five additional sites in those locations. Initially scoped to manage cleaner dredged sediments discharged at the eight PSDDA-approved sites in Puget Sound, in 1994 the program was renamed the Dredged Material Management Program (DMMP) and its scope expanded to address management of all dredged material in the State of Washington as part of the Cooperative Sediment Management Program (CSMP). Management of the eight PSDDA sites continues to form an important core mission for the DMMP. Site use and management remain fundamentally tied to the original PSDDA documents, as modified over the years by Issue and Clarification papers formalized by the agencies through the annual review process.

The intent of PSDDA was to provide publicly acceptable guidelines that were environmentally safe and cost effective, thereby improving consistency and predictability in the dredged material management and regulatory processes. The federal and state agencies that comprised the PSDDA program determined that a regional program offered a much greater opportunity for environmental protection than had case-by-case decision-making.

ISSUE STATEMENT

Comprehensive dredged material evaluation procedures governing sampling, testing, and test interpretation (disposal guidelines) were developed to ensure that conditions at disposal sites are consistent with site management objectives (EPTA, 1988). Disposal guidelines were linked to objective and measurable site conditions that reflected the “no unacceptable, adverse effect” standard of §404 of the Clean Water Act. Over the years, material found to be suitable for unconfined, open-water disposal has come to be regarded as “clean.” PSDDA recognized that dredged material testing and test interpretation was and would continue to rapidly evolve. Accordingly, provision was made for annual assessment of data obtained through regulatory actions on specific dredging projects, as well as information gained from environmental monitoring of disposal sites after they have been in use. Those assessments and review were to provide the basis for appropriate revisions to the PSDDA program.

Similarly objective criteria were developed by the agencies and employed to locate dredged material disposal sites. All disposal sites identified in the phase I area were located in nondispersive environments where bottom currents are very low. Nondispersive sites were preferred locations as such sites could be easily monitored since the discharged material would tend to stay on site. Nondispersive sites were also considered to represent the potential worst-case effects situation as the build-up of discharged sediments would alter bottom bathymetry, structure, and concentrate chemical contaminants associated with the sediments placed there.

Hence the importance PSDDA placed on site monitoring. Unacceptable adverse impacts could be identified and controlled via monitoring, thereby providing accountability and public acceptability. [PSDDA's evaluation procedures were viewed as "experimental" at the time.]

In the phase II areas, it was not possible to locate all disposal sites in nondispersive environments. Three of the five phase II sites (Rosario Strait, Port Townsend, and Port Angeles) were located in very high current or dispersive environments where dredged material would be swept away within several tidal cycles. Dispersion of the material would quickly reduce the concentration of chemicals associated with the dredged material discharged at the sites, thereby further reducing the potential for adverse biological effects. The worst-case assumption predicted that over time, dispersed materials would tend to settle out at different locations, and could potentially achieve similar chemical levels at those remote locations. The testing protocols required by PSDDA were judged to be appropriate to that worst-case scenerio. However, dispersive site monitoring and consequent modification of disposal practices is much more difficult, costly, and of low utility since the material was predicted to not remain onsite long enough that monitoring could detect changes. Consequently, and solely due to the difficulties in verifying the materials' fate and effects, PSDDA decided that a more restrictive disposal guideline would be used for the dispersive sites, hence, nondispersive and dispersive guidelines were created. The following passage from the phase II EIS is illustrative:

> *The PSDDA agencies consider the dispersive disposal guidelines highly protective of environmental values[7]; accordingly, neither chemical nor biological monitoring of the sites is required. (This contrasts with the nondispersive sites, where monitoring will be accomplished). However, limited physical monitoring of dispersive sites is planned to verify predictions that the disposed material erodes and does not accumulate*. (NEPA/SEPA-II, 1989; page 2-63)

Monitoring of the nondispersive sites was expected to provide verification of the effectiveness of the newly implemented evaluation procedures.

Over the fifteen years of PSDDA—now DMMP—management, monitoring of the nondispersive sites has occurred and those data presented to the public as formal reports and

[7] Defined by either all sediment chemistry quantitated at or below DMMP screening levels, or Tier III bioassay tests all pass the dispersive interpretative guidelines, which are established at Site Condition I, where " no adverse effects" are expected on-site/offsite due to sediment quality (e.g., no sublethal or acute toxicity). This differs from the non-dispersive Site Condition II bioassay interpretative guidelines, which allow "minor adverse effects on-site, no adverse effects offsite.

presentations at the annual review meetings. The environmental protectiveness and effectiveness of the evaluation procedures used for dredged material management, and which form the basis of the State of Washington's Sediment Management Standards (SMS), is judged to be verified. The judgment of the DMMP agencies is that the discharges of dredged material at the nondispersive sites have caused no unacceptable adverse effects. Discharges at the Elliott Bay, Commencement Bay, and Bellingham Bay sites have contributed to measurable improvements in site chemistry since their selection in 1988 and 1989. Physical monitoring of the dispersive sites during this time has confirmed the prediction that dredged material placed at the sites does not result in significant mounding onsite. Dispersion of the placed material offsite would not result in any accumulation of those sediments at any location that would approach the volumes or levels associated with the nondispersive sites.

PROPOSED ACTION

The DMMP intends to unify the bioassay disposal interpretive guidelines (Table 1) for all DMMP unconfined, open-water sites as a single regulatory standard that would be identical to the present nondispersive guidelines. As explained above, the nondispersive interpretive guidelines are fully compliant with the requirements of the Clean Water Act. Changes to the DMMP chemical guidelines in 1999 brought the SLs into substantive agreement with the State's Sediment Quality Standards (SQS) chemical numbers. The interpretive criteria for biological tests for unconfined, open-water disposal suitability at the nondispersive sites (DMMP) and the regulatory limit for the SMS have always been in substantive agreement. Future collaboration by the DMMP and SMS is anticipated in developing or refining chemical, biological, and bioaccumulation tests and interpretations for use in managing sediments under the CSMP. Owing to the different administrative procedures in formalizing changes to the DMMP guidelines v. the SMS, it may require some years until the requirements for the two programs are identical.

REFERENCES

PSDDA. 1988. *Management Plan Report - Phase I* (MPR) U.S. Army Corps of Engineers - Seattle District; U.S. Environmental Protection Agency - Region X; Washington State Department of Natural Resources; Washington State Department of Ecology.

PSDDA. 1988. *Final Environmental Impact Statement: Unconfined Open-Water Disposal for Dredged Material (Central Puget Sound)*. (NEPA/SEPA). U.S. Army Corps of Engineers - Seattle District; U.S. Environmental Protection Agency - Region X; Washington State Department of Natural Resources; Washington State Department of Ecology.

PSDDA. 1988. *Evaluation Procedures Technical Appendix - Phase I* (EPTA). U.S. Army Corps of Engineers - Seattle District; U.S. Environmental Protection Agency - Region X; Washington State Department of Natural Resources; Washington State Department of Ecology.

PSDDA. 1989. *Management Plan Report - Phase II* (MPR- II). U.S. Army Corps of Engineers - Seattle District; U.S. Environmental Protection Agency - Region X; Washington State Department of Natural Resources; Washington State Department of Ecology.

PSDDA. 1989. *Disposal Site Selection Technical Appendix - Phase II* (DSSTA-II). U.S. Army Corps of Engineers - Seattle District; U.S. Environmental Protection Agency - Region X; Washington State Department of Natural Resources; Washington State Department of Ecology.

PSDDA. 1989. *Final Environmental Impact Statement: Unconfined Open-Water Disposal for Dredged Material (North and South Puget Sound)*. (NEPA/SEPA-II). U.S. Army Corps of Engineers - Seattle District; U.S. Environmental Protection Agency - Region X; Washington State Department of Natural Resources; Washington State Department of Ecology.

DMMP BIOASSAY PERFORMANCE STANDARDS AND EVALUATION GUIDELINES

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

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

Status Report

Beneficial Use of Dredged Material

Prepared by Stephanie Stirling, US Army Corps of Engineers, Seattle District, and Justine Barton, US EPA, Region 10, for the DMMP agencies.

Regional beneficial use of dredged material is facing increased challenges. Issues of scheduling and cost, always problematic, have become even more so. Increased coordination of projects required by the Endangered Species Act adds uncertainty to the timing of both dredging and beneficial use projects. The DMMP agencies want to continue and encourage the use of dredged material for environmental benefit.

Attached to this status report is a table titled *"Sources of Corps Dredged Material for Beneficial Use Projects"* (last revised 4/01). This table is updated annually and describes Seattle District Corps of Engineers operations and maintenance dredging projects, including the project, amount of material, sediment grain-size, any testing data, and the point-of-contact. It is hoped that this information will aid project proponents in assessing the availability and suitability of dredged material for beneficial use.

Regional Perspective

A draft regional beneficial use manual has been distributed for DMMP agency comment this spring. In 1997 a work group created the original draft. Three of the four DMMP agencies commented on it at that time, but it was never finalized nor distributed for public comment. The DMMP agencies plan to reinvigorate this effort and finalize the manual in 2001. The manual and Seattle District dredging project table (mentioned above) will be updated and made available on the Seattle District DMMO web page: http://www.nws.usace.army.mil/dmmo/homepage.htm

National Perspective

The Corps Waterways Experiment Station (WES) continues to provide technical and policy guidance related to Beneficial Use at their web sites. Dredging Research Tech Notes and Bulletins are available at:
http://www.wes.army.mil/el/dots
http://www.wes.army.mil/el/dots/doer

In January 2001, the National Dredging Team (NDT) (made up of representatives from EPA, Corps, NOAA, USFWS and Department of Transportation) held a meeting to gather input from over 200 representatives of environmental groups, ports, dredging industry and agency staff members. Several "breakout" sessions were held to gather information for the NDT on issues of national and regional concern regarding beneficial use. These sessions identified policy, process, funding, and communication issues that hamper the effective beneficial use of dredged material. The following items were identified by work group participants as priorities for the NDT:

Policy

- Develop a national vision that establishes beneficial use of dredged material as a national priority
- Clarify and/or modify the Federal Standard
- Clarify the status of dredged material to more readily enable its use for beneficial purposes
- The Corps should alter economic evaluation requirements to allow for additional economic benefits categories

- Consider using permit/mitigation process participation in BU objectives
- Cost share agreements to allow local partners to be valued as partners and share in project decisions
- Institutionalize the dissemination of information pertaining to technological improvements
- States develop a unified position supported by all of the subunits of state government

Process

- Streamline the Corps planning process required for special authority programs
- Site-specific stakeholder teams should be responsible for developing preferred BU options
- Plan for the long-term (both at the project level and at the policy level) to increase efficiency and decrease costs

Funding

- Funding increases are mandatory
- Develop funding incentives to encourage more local partners to participate
- Create a demand and establish a market for BU end products
- Increase finding for research and development demonstration projects as a way of testing the technology and measuring the costs and benefits
- Increase funding options for BU

Communications

- Institutionalize the concept that dredged material is a valuable resource
- Communicate pertinent information to the public concerning demonstrated successes in BU
- Foster effective communication among and between stakeholders
- Build coalitions of stakeholders to plan and implement BU objectives

Status Report

Puget Sound Multi-user Disposal Site (MUDS) Project

Prepared by Steven Babcock, U.S. Army Corps of Engineers, Seattle District, for the DMMP agencies

Introduction

The MUDS project is examining the feasibility of providing a common, cost-effective and environmentally sound location for the management of contaminated marine sediment dredged from Puget Sound. A MUDS could involve disposal and/or treatment of contaminated sediments that require dredging but are unsuitable for unconfined open-water disposal at existing PSDDA sites or for beneficial uses.

Problem Identification

The need for a multi-user disposal site (MUDS) for contaminated marine sediments from Puget Sound was first recognized in the mid-1980s. The 1987 *Puget Sound Water Quality Management Plan* [1] identified the need to study the feasibility and potential demand for multi-user confined disposal sites in Puget Sound. In 1994, the Cooperative Sediment Management Program agencies recommended that studying the feasibility of a MUDS facility in Puget Sound should be a regional priority. [2] In 1997, the Corps of Engineers, Washington Departments of Ecology and Natural Resources, Puget Sound Water Quality Action Team, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and Washington Public Ports Association, formed an interagency team (the MUDS study team) to evaluate the feasibility of a such a project. [3]

Status of Work

The current study scope includes the following elements: programmatic phase; siting phase; site-specific phase; and submittal of a feasibility report and NEPA/SEPA EIS to decision-makers, including Congress and the State Legislature.

The programmatic phase was completed in October 1999 with release of a final programmatic NEPA/SEPA EIS. [4] The programmatic EIS evaluates the environmental impacts of developing one or more multi-user confined disposal or treatment facilities for contaminated sediments. The EIS also included a cost analysis of available disposal alternatives. No preferred alternative was recommended. However, the programmatic EIS will serve to facilitate development of any site-specific confined disposal or treatment EIS that might follow. We confirmed the following during the programmatic phase:

- Regional capacity is needed to manage contaminated sediments. The need has been well documented.
- All disposal alternatives are technically feasible.
- Sediment treatment is very promising and should be fully integrated into the MUDS planning process.
- All MUDS alternatives result in significant trade-offs.
- "No action" – i.e., business as usual – is not an acceptable alternative.

The siting phase was initiated in April 2000 and has the following four elements:

- Management options report – Report nearing completion.
- Facility siting process – Draft screening and evaluative criteria have been developed and are being refined and readied for public comment and subsequent application.
- Feasibility of large-scale facility for treatment of contaminated sediments – Report completed in March 2001. [5] Study results will be discussed at the SMARM in a separate presentation.
- Public participation strategy – Strategy has been completed and is ready to be implemented in conjunction with the site-specific phase of the MUDS project. It also included establishing an External Advisory Committee (EAC). The EAC provided independent review and comment on the development of the four siting phase elements.

A number of issues and activities – all of which will shape the scope and schedule for completion of the site-specific phase of the MUDS project – are currently being addressed by the MUDS agencies. These include the following:

- Which state entity is best suited to own and operate a multi-user disposal site?
- Is existing statutory authority adequate to perform all such functions?
- What level of financial resources will be necessary to implement a MUDS project?
- Are there viable private sector "volunteer" opportunities that can facilitate establishment of a MUDS facility? Such opportunities include both facility siting and sediment treatment.
- How best to ultimately select a treatment technology and vendor. DNR is leading a further analysis of contaminated sediment treatment alternatives, in conjunction with the Bellingham Bay Pilot project.

[1] Puget Sound Water Quality Authority, *Puget Sound Water Quality Management Plan* (1987).
[2] An Interagency/Intergovernmental Agreement between the Washington Departments of Ecology and Natural Resources, Puget Sound Water Quality Authority, U.S. Environmental Protection Agency, and U.S. Army Corps of Engineers, May 2, 1994.
[3] *Agreement Between the Department of the Army and the State of Washington for the Puget Sound Confined Disposal Site Study, Washington*, July 1, 1997.
[4] U.S. Army Corps of Engineers, Washington Department of Natural Resources, Washington Department of Ecology, *Puget Sound Confined Disposal Site Study: Programmatic Environmental Impact Statement* (October 1999).
[5] Science Applications International Corporation, *Feasibility of a Large-scale Facility for Treatment of Contaminated Sediments in Puget Sound*. Prepared for Washington State Department of Ecology (March 23, 2001).

APPENDIX C

SMARM Overheads

SEDIMENT MANAGEMENT ANNUAL REVIEW MEETING

May 8, 2001

Ovrhd 1-1. Sediment Management Annual Review Meeting.

2001 SMARM

- Jointly Sponsored by the Dredged Material Management Program and the SMS Program
- Moderated by the Corps of Engineers (Lead DMMP agency)
- Hosted by Washington State Department of Ecology

Ovrhd 1-2. 2001 SMARM.

MEETING OBJECTIVES AND PURPOSE

- Obtain public input on proposed changes to the Dredged Material Management Program (DMMP) Management Plans per Clarification Papers posted on the Corps/Dredged Material Management Office's Homepage: www.nws.usace.army.mil/dmmo/homepage.htm
- Discuss disposal site management actions and changes.

Ovrhd 1-3. Meeting Objectives and Purpose.

MEETING OBJECTIVES AND PURPOSE (continued)

- Obtain public input on proposed changes to the Dredged Material.
- Presentation and discussion of Public Issue Papers.
- Comments and discussion on Status Reports of ongoing actions of DMMP and SMS Program.

Ovrhd 1-4. Meeting Objectives and Purpose, Cont.

Agency Summary Reports:

- DMMP Program Activities Update (Lauran Cole-Warner, Corps)
- DMMP Monitoring Activities Update (Robert Brenner, DNR)

Ovrhd 1-6. Agency Summary Reports, Cont.

Agency Summary Reports: (continued)

- Summary of SMS Cleanup Activities (Roger Dovel, Ecology)
- Summary of National/Regional Activites (John Malek, EPA)

Ovrhd 1-6. Agency Summary Reports, Cont.

DMMP/SMS Presentations

- Dispersive Site Guideline Revisions: Issue Paper (John Malek, EPA)
- Bellingham Bay Demonstration Pilot Project Status (Jim Pendowski, Ecology)
- Multiuser Confined DisposalSite (MUDS) Study Update (Steve Babcock, Corps)

Ovrhd 1-7. DMMP/SMS Presentations.

DMMP/SMS Presentations (continued)

- Multibeam bathymetric surveys in Puget Sound (Ted Benson, DNR)
- Summary Overview of DMMP Clarification Papers, (Stephanie Stirling, Corps)

Ovrhd 1-8. DMMP/SMS Presentations, Cont.

Public Issue Papers/Discussion

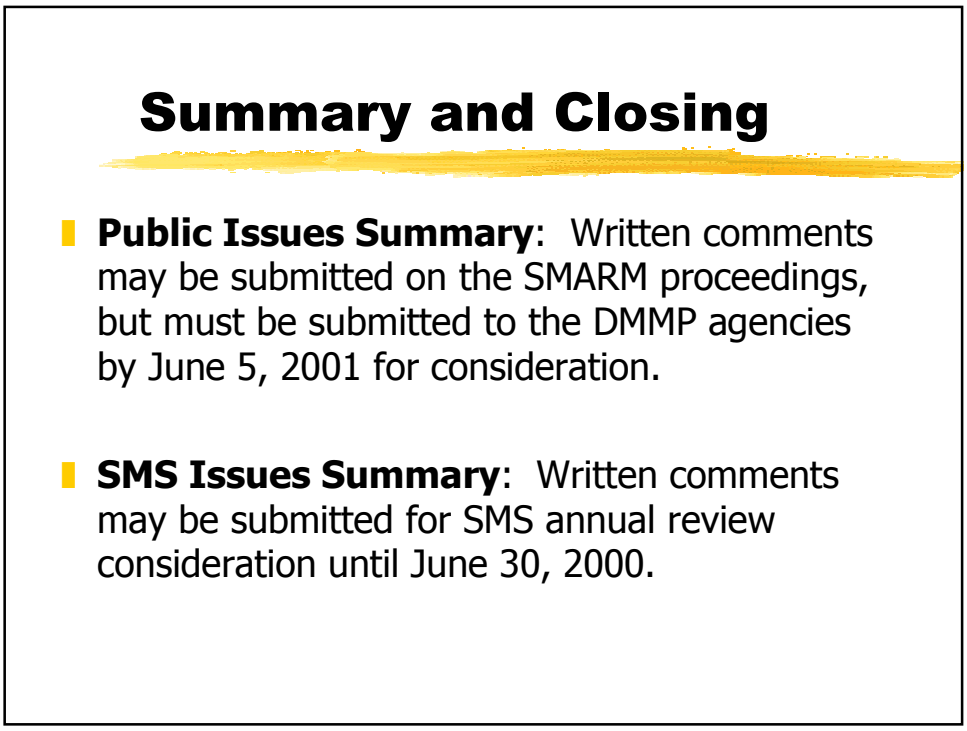
- Sediment Cleanup/MCON Integration Dredging and CAD Disposal (Peter Havens, USN)
- Assessment of the immunocompetence endpoint in juvenile chinook salmon following exposure to dietary PCBs at environmentally relevant concentrations (Mike Johns and David Powel)
- Ultra-low level PCB analysis technique: water and sediments (John Hicks)

Ovrhd 1-9. Public Issue Papers/Discussion.

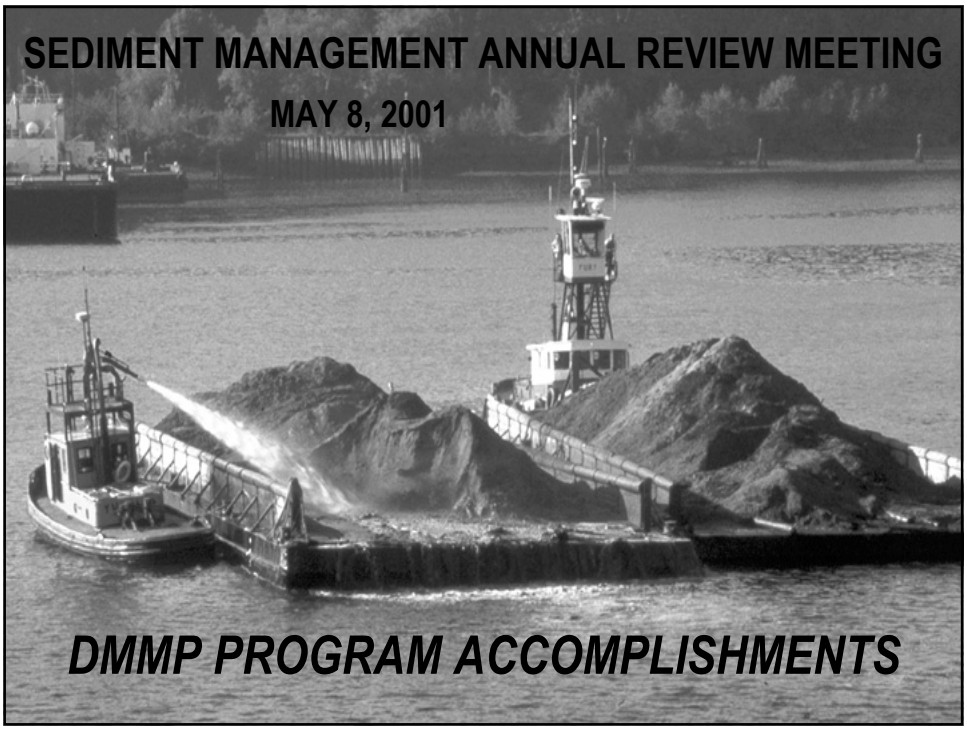
Topical Presentations / Lessons Learned

- Ketchikan Pulp Company CERCLA remediation (Karen Keeley, EPA)
- Eagle Harbor CERCLA activites (Ken Marcy, EPA)
- NMFS White Paper Overviews, PAHs, TBT, PCBs (Tracy Collier, NMFS)
- Feasibility of Sediment Treatment in Puget Sound (Tom Gries, Ecology)

Ovrhd 1-10. Topical Presentations/Lessons Learned.



Ovrhd 1-11. Summary and Closing.



Ovrhd 2-1. DMMP Program Accomplishments.

Overview of Agency Reports

- Corps: testing activities, big projects and issues
- DNR: disposal site management
- Ecology: SMS clean-up activities
- EPA: national overview
- Issue, Clarification and Status papers

Ovrhd 2-2. Overview of Agency Reports.

Dredging Year 2000

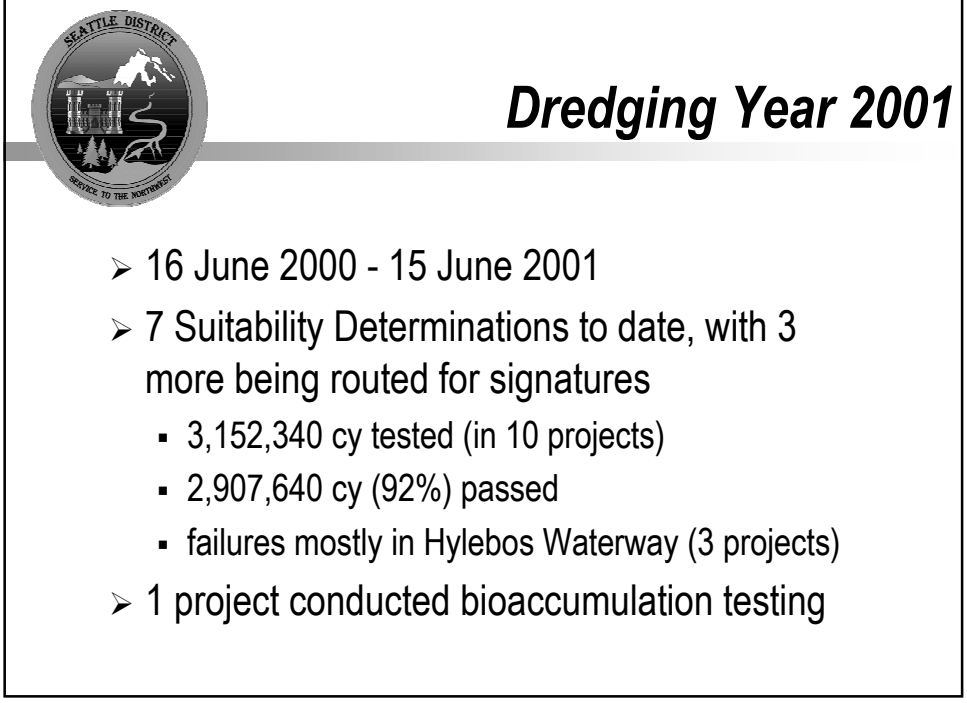
- 16 June 1999 - 15 June 2000
- 9 Suitability Determinations
  - 3,075,099 cy tested
  - 2,784,986 cy (91%) passed
  - only 4 projects passed ALL material
- 3 projects conducted bioaccumulation testing

Ovrhd 2-3. Dredging Year 2000.

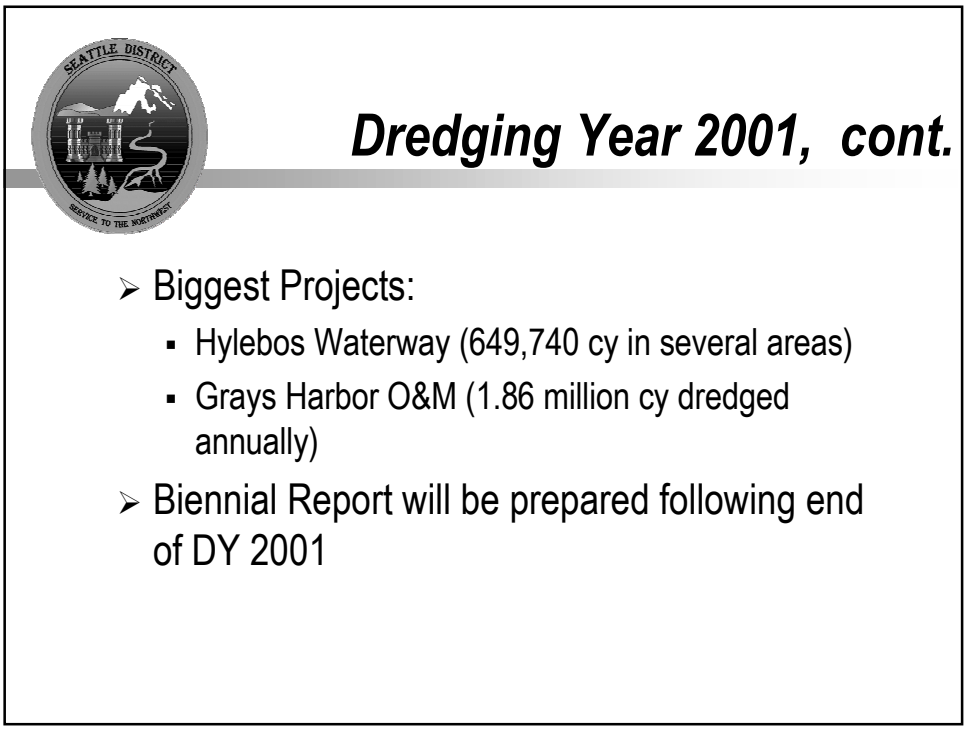
Dredging Year 2000, cont.

- Most projects either quite big (>400,000 cy) or small (<20,000 cy)
- Biggest projects
  - Puget Sound Naval Shipyard and Pit CAD, for a total of 1,268,050 cy
  - East Waterway Stage II - 618,120 cy

Ovrhd 2-4. Dredging Year 2000, Cont.



Ovrhd 2-5. Dredging Year 2001.



Ovrhd 2-6. Dredging Year 2001, Cont.

Ongoing Projects

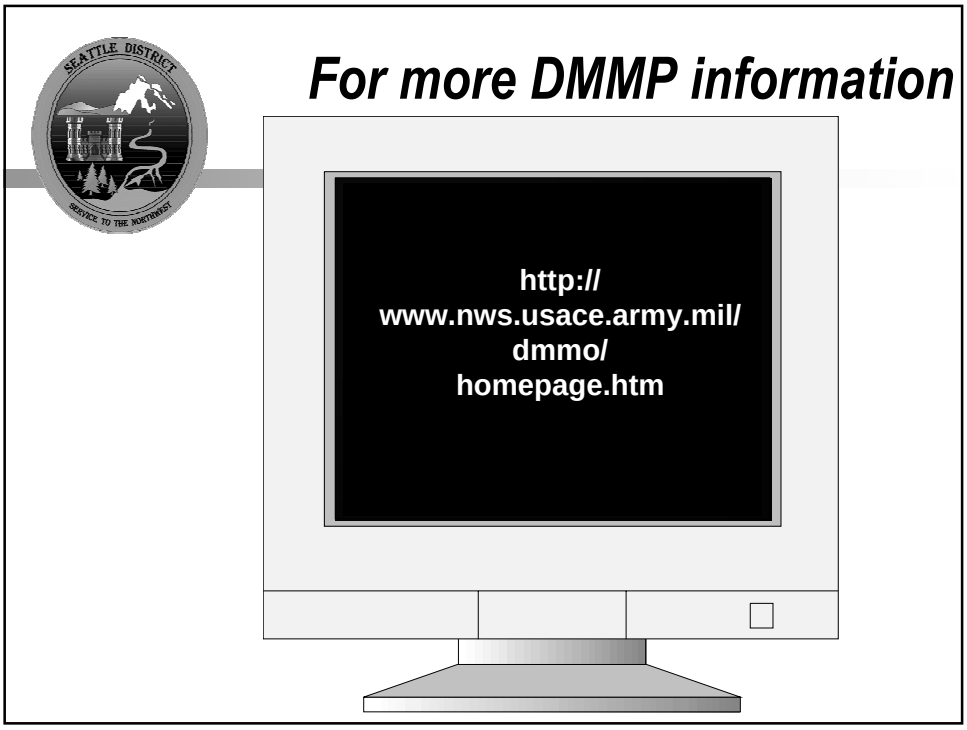
- Projects from many parts of Washington, e.g.:
  - Bay Center (Willapa)
  - Port of Everett 12th St. Marina
  - Oak Harbor
  - La Conner Marina
- Biggest pending project:
  - Pierce County Terminal Expansion, Port of Tacoma
  - 2.1 million cy

Ovrhd 2-7. Ongoing Projects.

Big Issues

- *Eohaustorius* clay sensitivity
- Beneficial uses
  - Bellingham log pond
  - Jetty Island
- Definition of dredged material
- Site monitoring and ESA

Ovrhd 2-8. Big Issues.



Ovrhd 2-9. Website for More DMMP Information.

2000 Full Monitoring at the PSDDA Elliott Bay Disposal Site

Robert J Brenner

Ovrhd 3-1. 2000 Full Monitoring at the PSDDA Elliott Bay Disposal Site.

Background

- Prior monitoring includes partial event in 1991 and full event in 1992
- Eighth monitoring event in Puget Sound since establishment of the non-dispersive sites by PSDDA - Conducted by SAIC
- 414,794 yd^3 of dredged material disposed of in 1999
- Sampling Operations June 2 - July 11 Y2K

Ovrhd 3-2. Background.

Objectives

- Ensure disposal complies with 404(b)(1) guidelines
- Verify PSDDA predictions on site conditions
- Provide site monitoring information
- Contribute data for review of PSDDA dredging and disposal site evaluation process
- Provide confirmatory testing addressing concerns related to listing of Puget Sound Chinook and Bull Trout as threatened under ESA (1973)

Ovrhd 3-3. Objectives.

PSDDA Monitoring Framework

3 Main Questions:

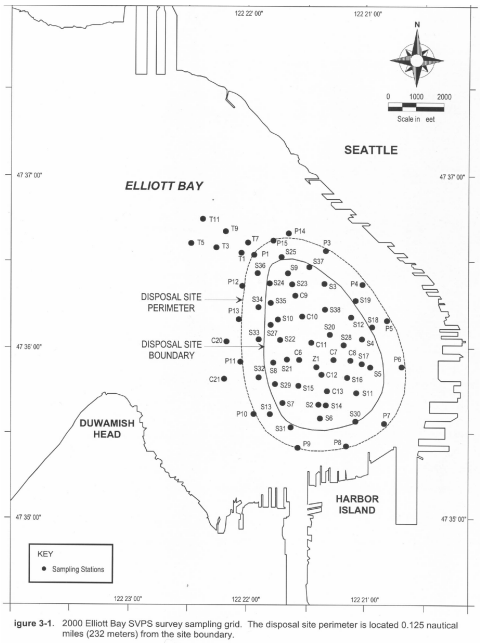
1. Does dredged material remain onsite?
   - Sediment Vertical Profile System
   - Sediment Chemistry
2. Have biological effects conditions been exceeded?
   - Sediment Chemistry
   - Sediment Bioassays
3. Any adverse effects to offsite biological resources?
   - Tissue Chemistry
   - Infaunal Community Structure

Ovrhd 3-4. PSDDA Monitoring Framework.

Presentation Agenda

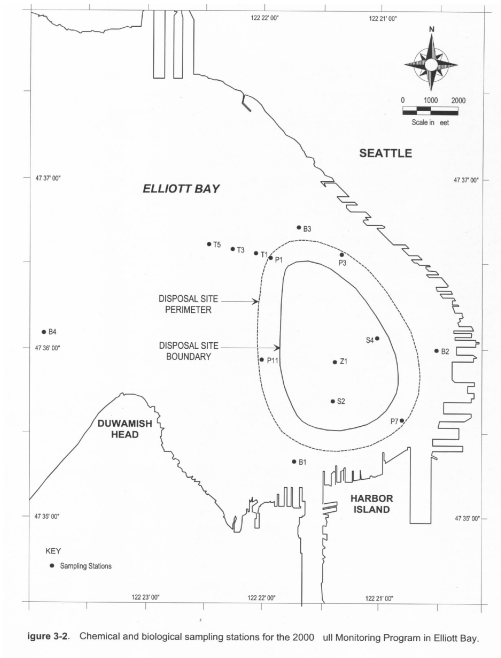
- PSDDA Monitoring Tools
- Modifications to Monitoring Approach
- 2000 Findings
- 2000 Evaluations

Ovrhd 3-5. Presentation Agenda.



igure 3-1. 2000 Elliott Bay SVPS survey sampling grid. The disposal site perimeter is located 0.125 nautical miles (232 meters) from the site boundary.

Ovrhd 3-6. 2000 Elliott Bay SVPS Survey Sampling Grid.



igure 3-2. Chemical and biological sampling stations for the 2000 ull Monitoring Program in Elliott Bay.

Ovrhd 3-7. Chemical and Biological Sampling Stations.

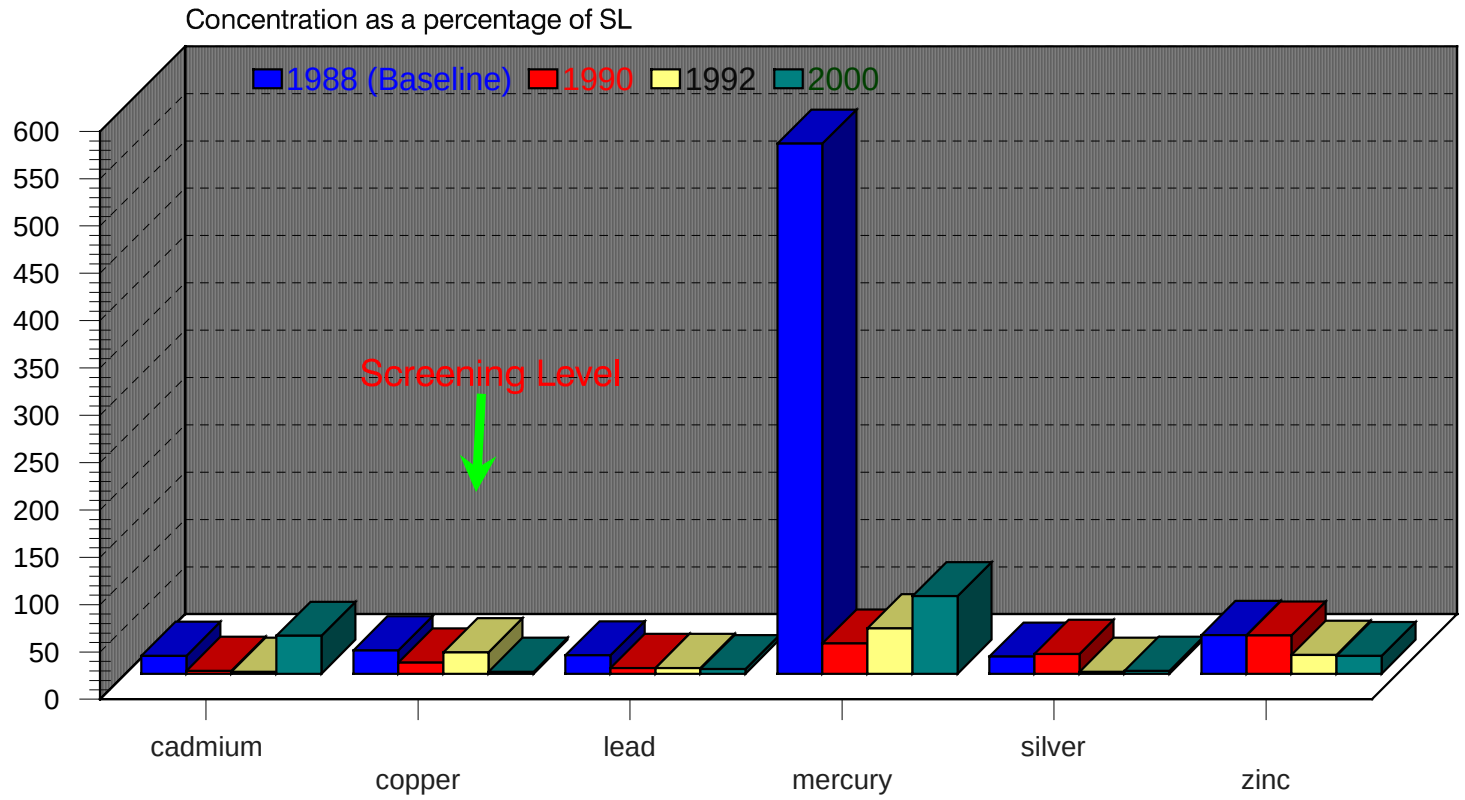
PSDDA Monitoring Tools

Station Type	SVPS	Sediment Chemistry	Benthic Infauna	Bioassays	Tissue Chemistry
Zone (Z)	*	*		*	
Site (S)	*	*		*	
Perimeter (P)	*	*			
Transect (T)	*		*		*
Benchmark (B)		*A	*A	*A	*A
Cross (C)	*				
Reference (R)				*	

Ovrhd 3-8. PSDDA Monitoring Tools.

Comparative Predisposal Baseline and Postdisposal Chemistry*

Onsite Station EBZO1



Comparative metal concentrations detected at Elliott Bay onsite station (EBZ01)

*results expressed as a percentage of the screening level (SL).

Modifications to the 2000 Monitoring Program

- *Molpadia* tissue collection and analysis
  - Sufficient volume for body-burden analysis collected @ 2 of 3 transect stations
- 45 d bioaccumulation testing
  - Using *Macoma* and *Nephtys* @ 1 benchmark station and one composite of onsite stations
- P450 RGS cell line assay
  - Screening assay for relative amt of dioxin and dioxin-like compounds
  - Address concerns about ESA listings

Ovrhd 3-9. Modifications to the 2000 Monitoring Program.

- Hi-Res GCMS PCB analysis
  - Correlate WES (ACE Waterways Experiment Station) cell line assay results w/ concentrations of coplanar PCBs in tissues
- Butyltins analysis
  - Not a chemical of concern in 1990 and 1992
  - Incorporated for onsite, perimeter, and benchmark stations
  - Bulk and interstitial water analysis
- Site-Center coordinates
  - Moved ~90m south to ensure confinement w/in site perimeter

Ovrhd 3-10. Modifications to the 2000 Monitoring Program, Cont.

Findings

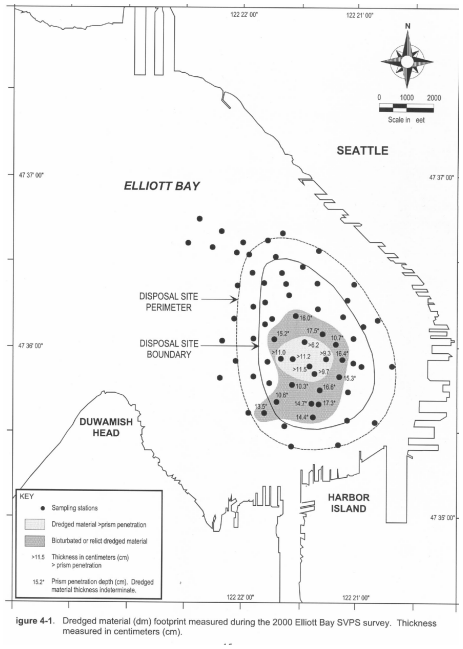
- SVPS
- Site Chemistry
- Site Bioassays
- Benthic Infauna
- Tissue Analyses

Ovrhd 3-13. Findings.

Sediment Vertical Profile System

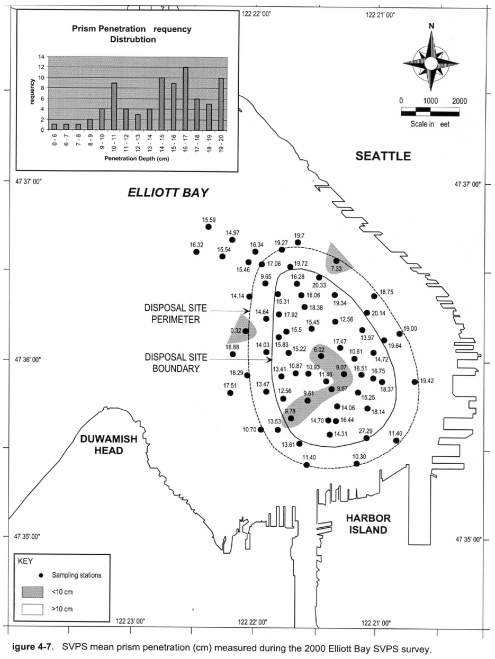
- Survey of stations
- Dredged material vs. ambient sediment
- Effect of dredged materials on other measurements
  - Grain size
  - RPD
  - Successional Stages
- Overall impressions of site conditions

Ovrhd 3-14. Sediment Vertical Profile System.



igure 4-1. Dredged material (dm) footprint measured during the 2000 Elliott Bay SVPS survey. Thickness measured in centimeters (cm).

Ovrhd 3-15. Dredged Material Footprint.



igure 4-7. SVPS mean prism penetration (cm) measured during the 2000 Elliott Bay SVPS survey.

Ovrhd 3-16. SVPS Mean Prism Penetration.

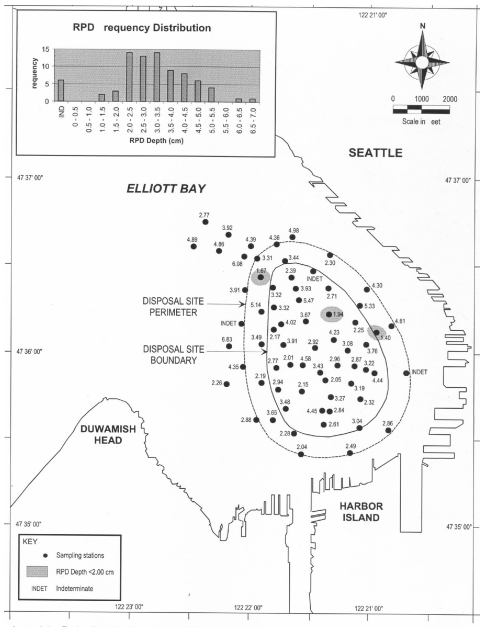


Figure 4-8. Redox Potential Discontinuity (RPD) depths (cm) measured during the 2000 Elliott Bay SVPS survey.

Ovrhd 3-17. Redox Potential Discontinuity (RPD) Depths.

Sediment Chemistry

Conventionals:

- TOC, NH_3, and TVS slightly higher onsite than in 1992
- Sulfides slightly higher onsite, perimeter, and benchmark

Metals:

- 4 samples > SL for Hg, one of which > SMS criterion
- No other SL or SMS levels exceeded for remaining metals

Organic Compounds:

- Total PCBs > SL in 4 samples @ 2 stations, 2 > SMS
- Bulk TBT > SL in 9 samples, 1 porewater TBT > SL

No exceedances of SL or SMS criteria for PAHs

No other organic chemical exceedances

Ovrhd 3-18. Sediment Chemistry.

Tissue Chemistry

- Samples tested in triplicate from *Molpadia* at 2 of 3 transect stations
- Analyzed for metals, semi-volatile organics, pesticides/PCBs, and butyltin compounds.

- No organic compounds found in any of the samples
- Metals detected in all replicates at low concentrations

Ovrhd 3-19. Tissue Chemistry.

Sediment Bioassays

- Amphipod test used *Eohaustorius estuarius*, sediment larval test used *Dendraster excentricus*
- Toxic response for amphipod test at station EBZ01
  - One-hit failure according to PSDDA sediment characterization standards
- Toxic response in sediment larval test @ EBZ01
  - One-hit failure
- 20 d *Neanthes* mean growth test
  - Mortality not observed, no growth rate exceedances
- Saline Microtox® test
  - Passed for all onsite test sediments

Ovrhd 3-20. Sediment Bioassays.

Why the 2 one-hit failures?

High clay content in recently deposited materials likely contributed to toxic response, supported by results of retesting

No testing of Benchmark samples:

- Above reason
- Toxic response not supported by chemical analysis
- Not corroborated by *Neanthes* or Microtox results
- No toxicity was observed at the 2 other onsite stations

Ovrhd 3-21. Sediment Bioassays, Cont.

Benthic Infauna

- Total abundance of major taxa not significantly different among the 3 transect stations
- Similar trends in mean number of taxa and diversity were observed, though not statistically significant
- The most numerically abundant species in 1988 Benchmark station study and 1992 monitoring survey was unchanged in 2000 (bivalve *Axinopsida serricata*)

Ovrhd 3-22. Benthic Infauna.

Tissue Analyses

45 d bioaccumulation tests using *Macoma* and *Nephtys* exposed to reference and benchmark sediments.

Macoma nasuta - bivalve

Ag, Cu, Pb, Sb, Zn, Hg, and TBT significantly higher than reference

None posed significantly higher human health risks

Nephtys caecoides - polychaete

Pb and Hg significantly higher than reference

None posed significantly higher human health risks

Ovrhd 3-23. Tissue Analyses.

Data Evaluation

- Question 1: Does dredged material remain onsite?
  - Hypothesis 1: Dredged material remained within site boundaries.
    - Dredged materials remain w/in site perimeter
    - Hypothesis not rejected

Ovrhd 3-24. Data Evaluation: Question 1, Hypothesis 1.

- Hypothesis 2: Chemical conc. at offsite stations don't increase over time due to dredged material disposal
  - 2 exceedances of state SQS at perimeter stations (Total PCBs @ EBP07 as TOC @ EBP07-1,2)
    - Total PCBs decreased from 1992
  - No other chemical exceedances measured
  - Global Maximum Likelihood suggest slope not different from zero @ any perimeter station
  - Hypothesis is not rejected

Ovrhd 3-25. Data Evaluation, Question 1, Hypothesis 2.

- Question 2: Are biological effects conditions exceeded at site due to dredged material disposal?
  - Hypothesis 3: Sediment chemical conc. @ onsite stations don't exceed guidelines
    - No exceedances of ML measured
    - Hypothesis not rejected
  - Hypothesis 4: Sediment toxicity @ onsite stations does not exceed guidelines
    - High clay content, lack of chemical corroboration, etc…
    - Hypothesis not rejected

Ovrhd 3-26. Data Evaluation, Question 2, Hypotheses 3 and 4.

- Question 3: Are unacceptable adverse effects to offsite biological resources occurring due to disposal?
  - Hypothesis 5: No sig. increase in chemical body burden of benthic infauna down-current of disposal site
    - Can not be evaluated at this time
  - Hypothesis 6: No sig. decrease in dominant benthic infauna abundance down-current of disposal site.
    - Fewer crustaceans observed, dominant species haven't changed significantly
    - Further analysis may be required for Hypothesis 6

Ovrhd 3-27. Data Evaluation, Question 3, Hypotheses 5 and 6.

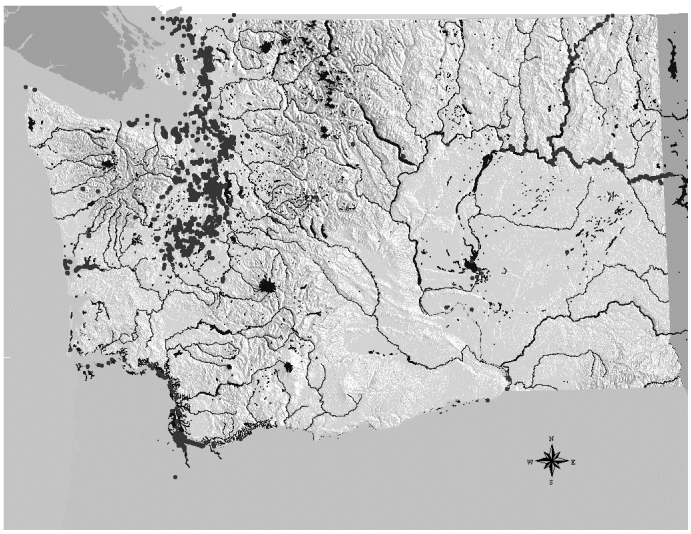
Any Questions?

- Keep in mind I've been in this position for 1 month so I have little historical knowledge!

Thank You

Ovrhd 3-28. Any Questions?

Cooperative Sediment Management Program



Department of Ecology
Sediment Management

Ovrhd 4-1. Cooperative Sediment Management Program.

Cooperative Sediment Management Program

CSMP Participants

- Department of Ecology
- U.S. Environmental Protection Agency
- Department of Natural Resources
- U.S. Army Corps of Engineers
- Puget Sound Water Quality Action Team
- (Department of Fish and Wildlife)
- (Department of Transportation)

Department of Ecology
Sediment Management

Ovrhd 4-2. Cooperative Sediment Management Program Participants.

Cooperative Sediment Management Program

- Refine Policy Focus
- Changed Status of Bellingham Bay Work
- Near and Long Term Future of MUDS
- Remain Flexible on New Projects

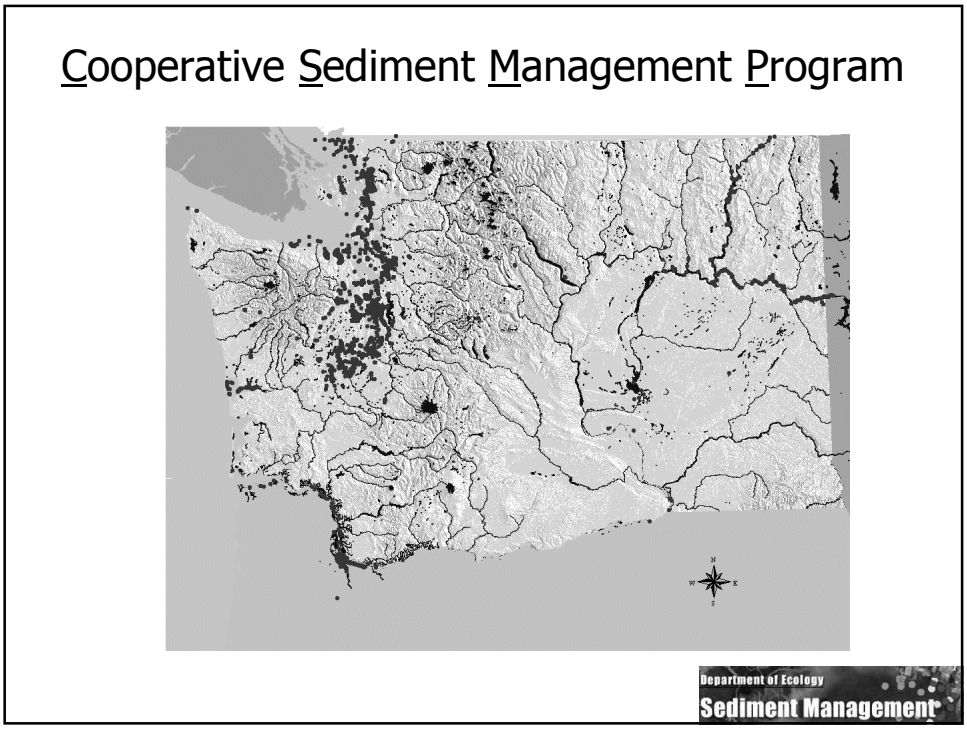
Department of Ecology
Sediment Management

Ovrhd 4-3. Cooperative Sediment Management Program, Cont.

MUDS Project

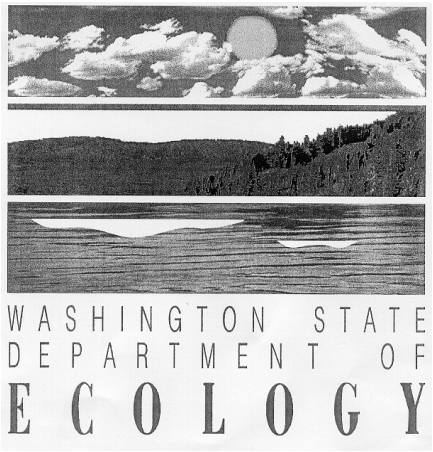
Department of Ecology
Sediment Management

Ovrhd 4-4. MUDS Project.



Ovrhd 4-5. Cooperative Sediment Management Program.

Sediment Management Standards Programs



Department of Ecology
Sediment Management

Ovrhd 5-1. Sediment Management Standards Program.

Sediment Cleanup Activities

- Ecology made progress on sediment cleanups throughout state
- 2001 Sediment Cleanup Status Report has been completed
- Bellingham Bay Pilot Agreement
- Puget Sound Naval Shipyard

Department of Ecology
Sediment Management

Ovrhd 5-2. Sediment Cleanup Activities.

Sediment Cleanup Activities

- Lower Duwamish River cleanup progressing
- Commencement Bay sediment cleanups progressing
- Freshwater sediment cleanup sites

Department of Ecology
Sediment Management

Ovrhd 5-3. Sediment Cleanup Activities, Cont.

Sediment Source Control

- 2002 303(d) Sediment Policy
  - www.ecy.wa.gov/programs/wq/303d/2002/index-2002.html
- Sediment TMDLs
  - Bellingham Bay
  - Duwamish River
- Phase I - Stormwater General Permits
  - Snohomish, King, Pierce, Clark Counties
  - Seattle, Tacoma; Dept of Transportation
- NPDES Permit Technical Support

Department of Ecology
Sediment Management

Ovrhd 5-4. Sediment Source Control.

Sediment Sampling and Analysis Plan Appendix (SAPA)

- Guidance on development of sediment sampling and analysis plans to comply with the Sediment Management Standards, Chapter 173-204 WAC
- SAPA currently under revision
  - Analytical method / recovery limits updates
  - Reconciling technical inconsistencies between SMS and DMMP programs

Department of Ecology
Sediment Management

Ovrhd 5-5. Sediment Sampling and Analysis Plan Appendix (SAPA).

PUBLIC ACCESS TO GUIDANCE

SAPA / PSEP Protocols
SMARM Clarification & Issue Papers

- http://www.ecy.wa.gov/programs/tcp/smu/sapa/sapa.htm
- http://www.wa.gov/puget_sound/Publications/protocols/protocol.html
- http://www.nws.usace.army.mil/dmmo/homepage.htm

Department of Ecology
Sediment Management

Ovrhd 5-6. Public Access to Guidance.

SMU Human Health Issues
Current Focus Areas

- Selection of exposure parameter values for the fish consumption pathway (in conjunction with EPA)
- Analysis of "reference area" PCB concentrations
- Correlation between English Sole tissue and sediment PCB levels (in conjunction with WA Department of Fish and Wildlife)

Department of Ecology
Sediment Management

Ovrhd 5-7. SMU Human Health Issues: Current Focus Areas.

Sediment Quality Information System (SEDQUAL)

- Revision 4 of SEDQUAL will be mailed in May 2001
- R4 has refinements to chemical and bioassay comparison tools
- R4 includes internal mapping tool and interactive HELP Module
- Martin Payne demonstrating R4 today

Department of Ecology
Sediment Management

Ovrhd 5-8. Sediment Quality Information System (SEDQUAL).

Puget Sound Multiuser Disposal Site Feasibility Study

"MUDS -- Siting a confined disposal and/or treatment facility within a regional framework "

May 8, 2001 - Steve Babcock

U.S. Army Corps of Engineers

Ovrhd 6-1. Puget Sound Multiuser Disposal Site Feasibility Study.

Project Study Purpose

- **To address the regional need for a common, cost-effective, and environmentally sound solution to the management of contaminated Puget Sound marine sediments** -- sediments that require dredging but are unsuitable for open-water disposal or for beneficial uses.

Ovrhd 6-2. Project Study Purpose.

Background

- **Need perceived in late-1980s/early-1990s**
  - ⇒ 1987 Puget Sound Water Quality Mgmt Plan
  - ⇒ 1989 PSDDA program
  - ⇒ 1991 Ecology framework studies
- **Feasibility study agreement in 1997**
  - ⇒ Corps of Engineers -- cost share sponsor
  - ⇒ State of Washington -- cost share sponsor
  - ⇒ EPA, WPPA, USFWS -- cooperating agencies

Ovrhd 6-3. Background.

Current Status - Feasibility Cost Share Agreement

Elements of the current study scope

- Programmatic EIS
- Siting Phase
- Site-specific phase
- Feasibility Report/EIS to Congress

Ovrhd 6-4. Current Status - Feasibility Cost Share Agreement.

Current Status - Programmatic EIS

Goals:

- To reaffirm need for disposal capacity
- To demonstrate feasibility of conceptual design alternatives
- To describe environmental impacts
- To provide a foundation for site-specific evaluations and plan selection

Ovrhd 6-5. Current Status - Programmatic EIS Goals.

Current Status - Programmatic EIS

Programmatic EIS completed October 1999

⇒ Regional capacity is needed

⇒All disposal alternatives are feasible

⇒ Sediment treatment is very promising

⇒ All MUDS alternatives result in trade-offs

⇒ "No Action" is not acceptable

Ovrhd 6-6. Current Status - Programmatic EIS.

Decisions

The first MUDS facility to be established will:

- Involve a partnership between the public and private sectors
- Likely include capacity to treat contaminated sediment

Ovrhd 6-7. Decisions.

Current Status - Siting Phase

Siting Phase was initiated in April 2000 and has four elements:

⇒ Management options -- Nearing completion

⇒ Facility siting process -- draft screening and evaluative criteria

⇒ Feasibility of treatment facility -- Completed

⇒ Public participation strategy -- Developed; (Includes an External Advisory Committee)

Ovrhd 6-8. Current Status - Siting Phase.

Current Status - Siting Phase Studies

Management Options

Who should own and operate a MUDS?

- Likely MUDS conceptual designs
- Evaluate owner/operator scenarios for each design
- Assess private sector interest
- Determine important barriers

Ovrhd 6-9. Current Status - Siting Phase Studies: Management Options.

Current Status - Siting Phase Studies

Facility Siting Process

- Develop publicly-acceptable site selection process and criteria
- Identify candidate zones
- May screen and rank sites within zones
- May select alternatives for site-specific EIS

Ovrhd 6-10. Current Status - Siting Phase Studies: Facility Siting Process.

Current Status - Siting Phase Studies

Public Participation Strategy

Which strategies and "tools" will get priority audiences involved?

- Flexible strategy and implementation plan
- "External Advisory Committee"
- Public information team
- Fact sheets, MUDS web site, video, etc.

Ovrhd 6-11. Current Status - Siting Phase Studies: Public Participation Strategy.

Current Status - Siting Phase Studies

Feasibility of a Contaminated Sediment Treatment Facility for Puget Sound

Which technologies are most promising?

- Stick around for Tom Gries' presentation at the 3:00 p.m. session today.

Ovrhd 6-12. Current Status - Siting Phase Studies: Feasibility of Treatment Facility.

Next Steps: Issues and Challenges

These will shape the scope and schedule for completion of the site-specific phase

- Which public entity is best suited to own and operate a MUDS? Who will be the lead project proponent?
- Is existing statutory authority adequate?

Ovrhd 6-13. Next Steps - Issues and Challenges.

Next Steps: Issues and Challenges

- Are there viable private sector "volunteers" that will step in to facilitate a MUDS?
  - ⇒Facility siting
  - ⇒Sediment treatment
- Finalize siting criteria
- How best to select a treatment technology and a treatment vendor

Ovrhd 6-14. Next Steps - Issues and Challenges, Cont.

Interagency Study Team

U.S. Army Corps of Engineers (sponsor)
(Steve Babcock, Steve Martin, Sandy Lemlich)

State of Washington (sponsor)

- **Dept. of Ecology** (Tom Gries)
- **Dept. of Natural Resources** (Tim Goodman)
- **Puget Sound WQ Action Team** (John Dohrmann)

Cooperating Agencies

- **Washington Public Ports Association** (Eric Johnson)
- **EPA - Region 10** (John Malek)
- **U.S. Fish and Wildlife Service** (Fred Seavey)

Ovrhd 6-15. Interagency Study Team.

Consultant Assistance

Programmatic EIS

- **Striplin Environmental Associates, Inc.**
  - **Anchor Environmental, LLC**
  - **Ogden Beeman Associates, Inc.**
  - **ECO Resource Group, Inc.**
  - **Enviroissues, Inc.**
  - **Marshall and Associates, Inc.**

U.S. Army Corps of Engineers Waterways Experiment Station (WES)

Ovrhd 6-16. Consultant Assistance - Programmatic EIS.

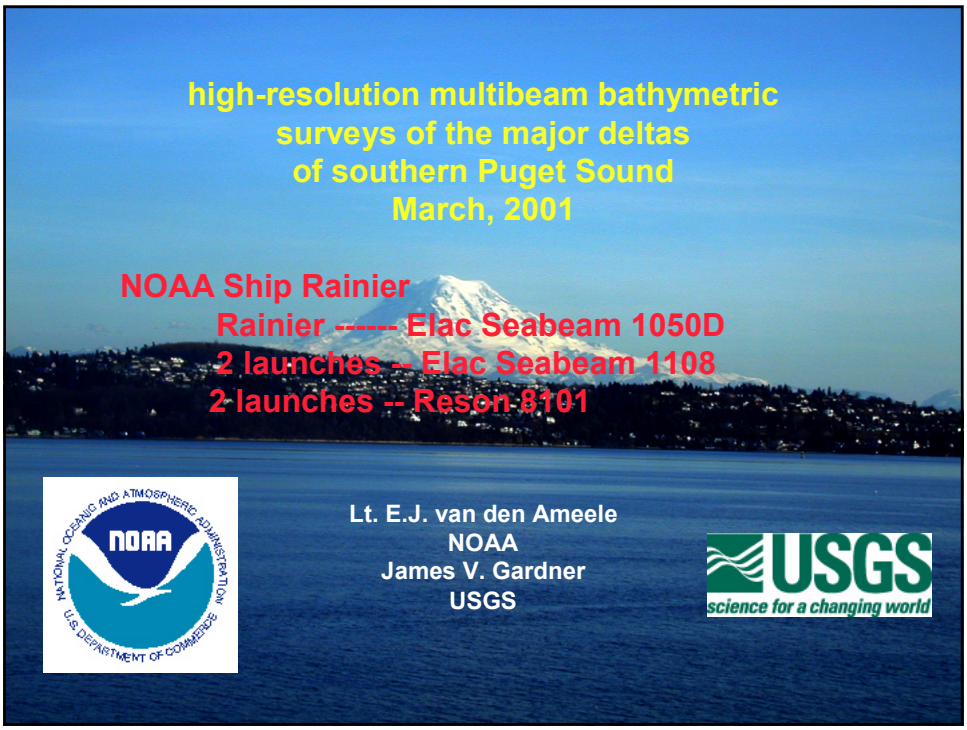
Consultant Assistance

Siting Phase

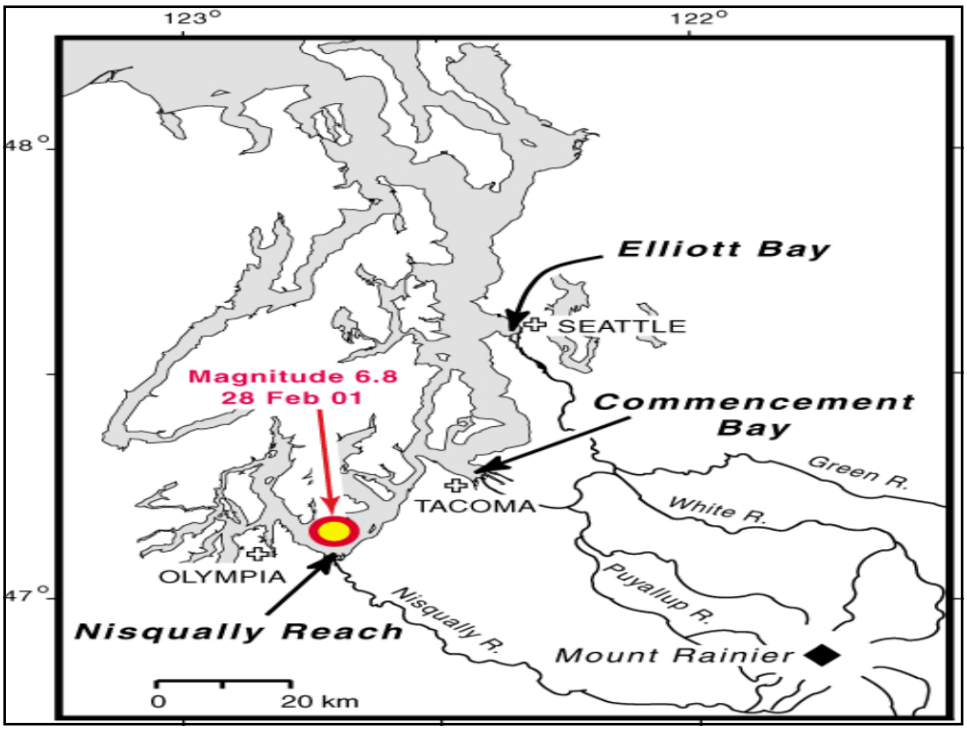
Science Applications International Corporation (SAIC)

- **ECO Resource Group, Inc.**
- **Enviroissues, Inc.**
- **Marten & Brown, LLP**
- **Battelle**

Ovrhd 6-17. Consultant Assistance - Siting Phase.

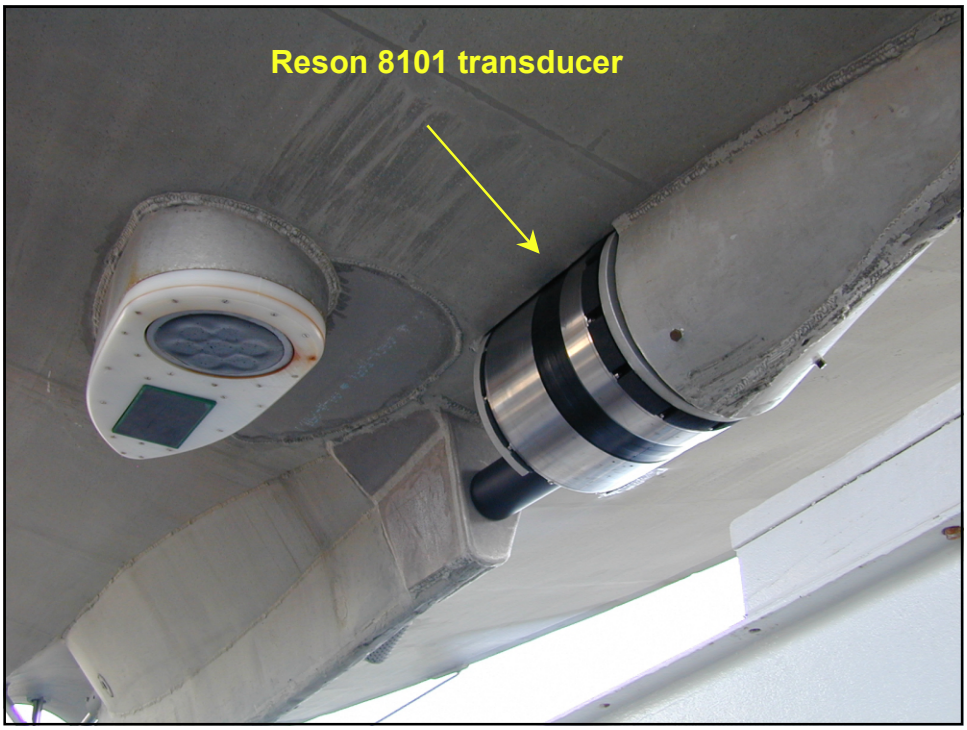


Ovrhd 7-1. High-Resolution Multibeam Bathymetric Surveys.

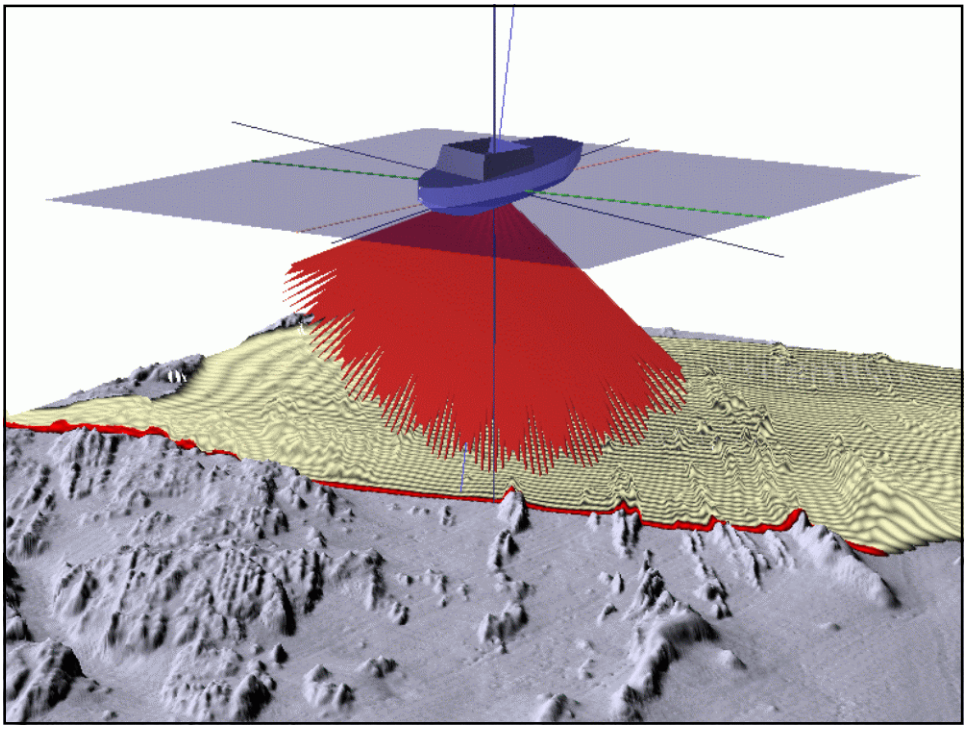


Ovrhd 7-2. Figure Showing Sites Surveyed.

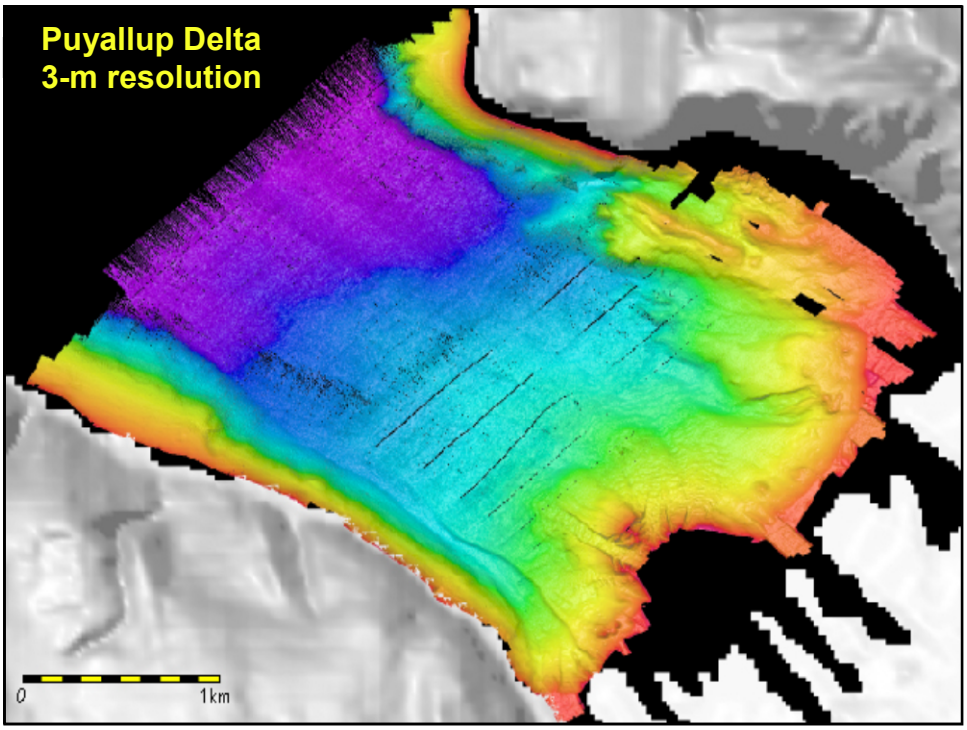
Ovrhd 7-3. Photo of NOAA Survey Vessel.



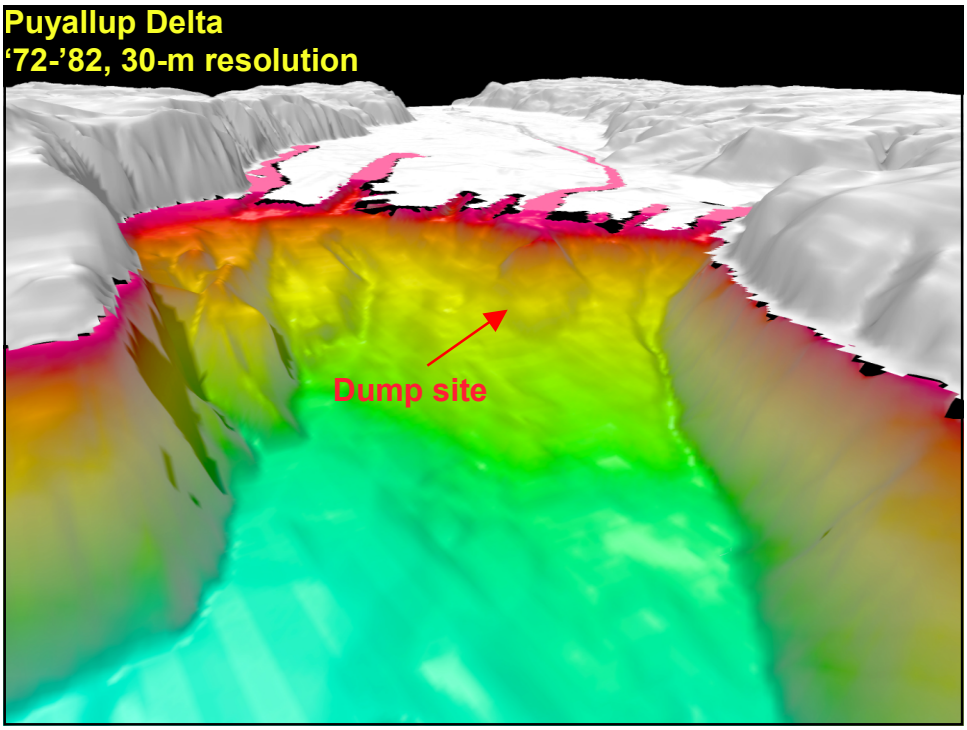
Ovrhd 7-4. Photo of Reson 8101 Transducer Used in Survey.



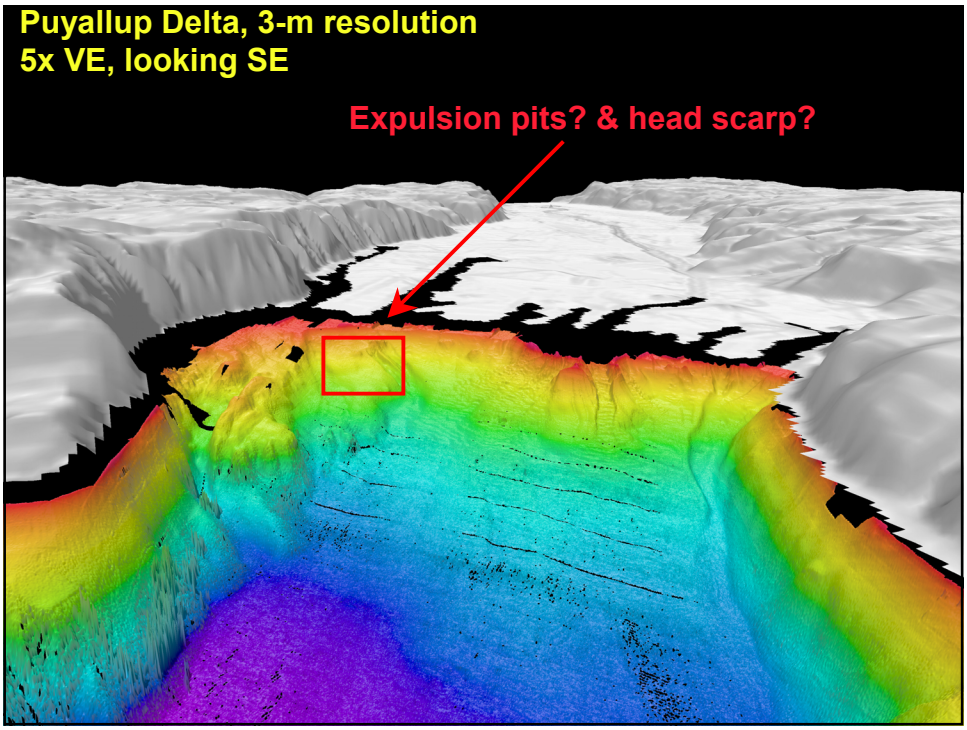
Ovrhd 7-5. Figure of Multi-Beam from Vessel.



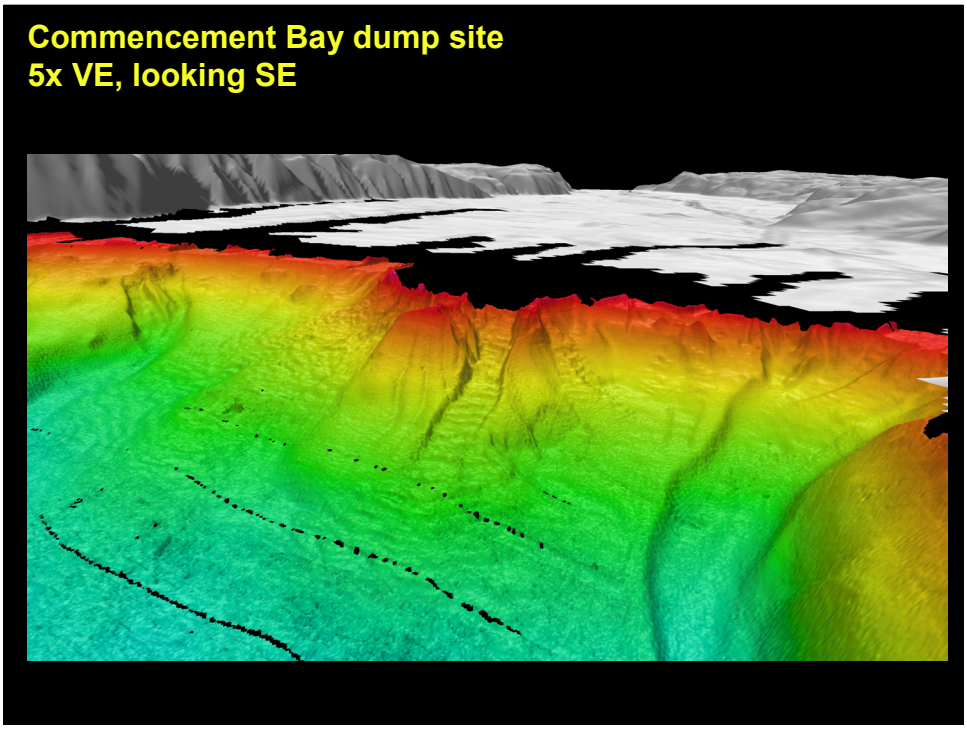
Ovrhd 7-6. Image of Puyallup Delta: 3-m Resolution.



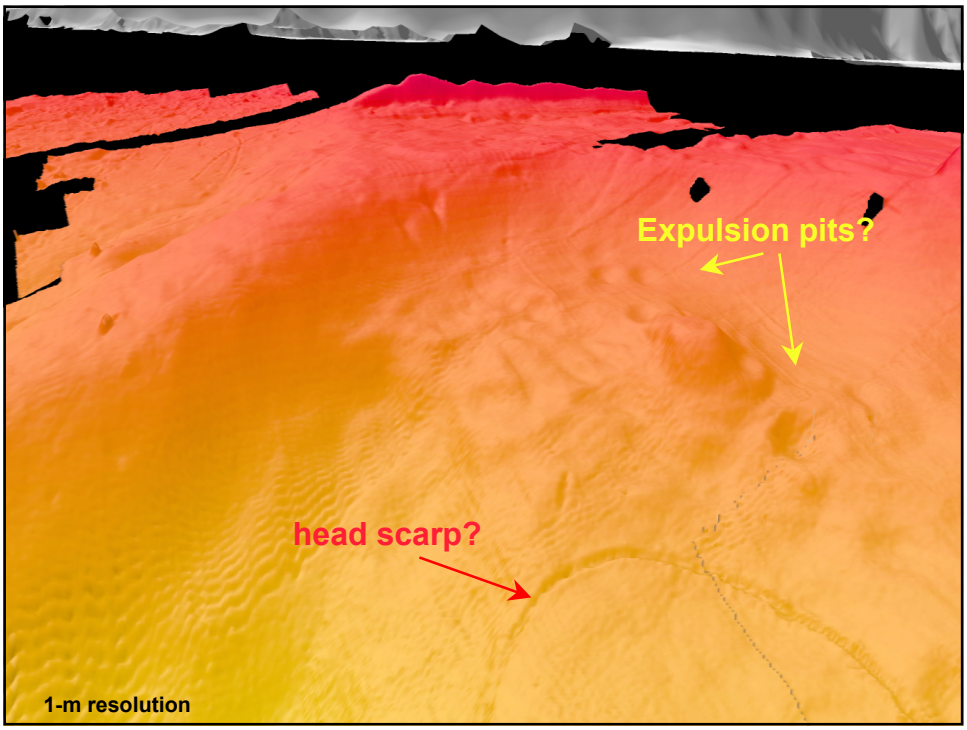
Ovrhd 7-7. Image of Puyallup Delta Showing Dump Site.



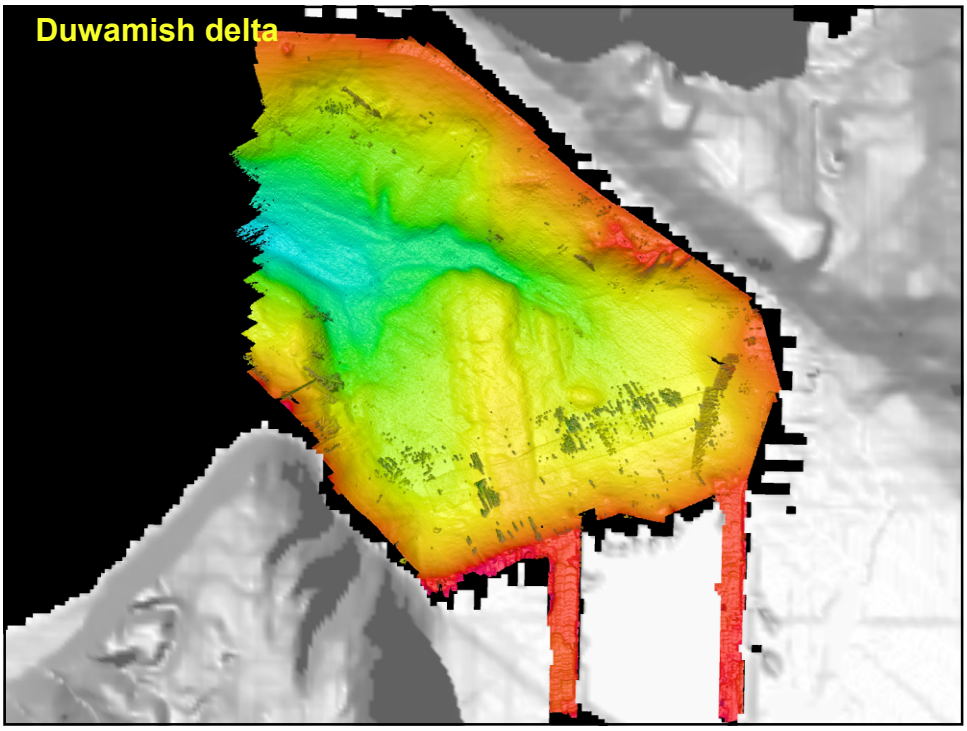
Ovrhd 7-8. Image of Puyallup Delta Showing Possible Expulsion Pits and Head Scarp.



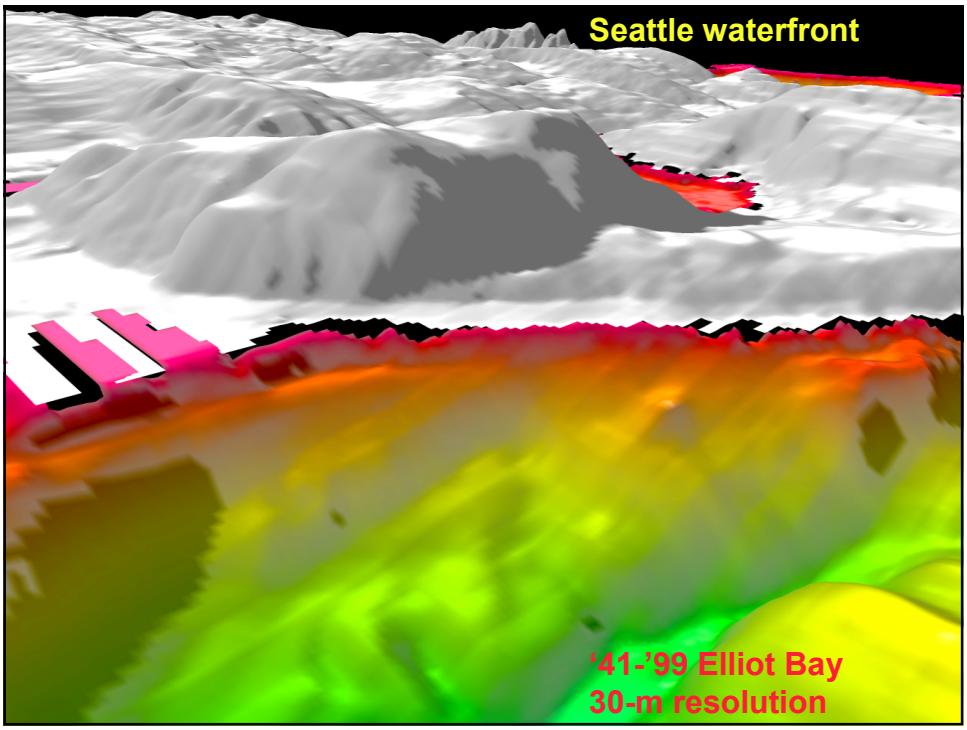
Ovrhd 7-9. Image Showing Commencement Bay Disposal Site.



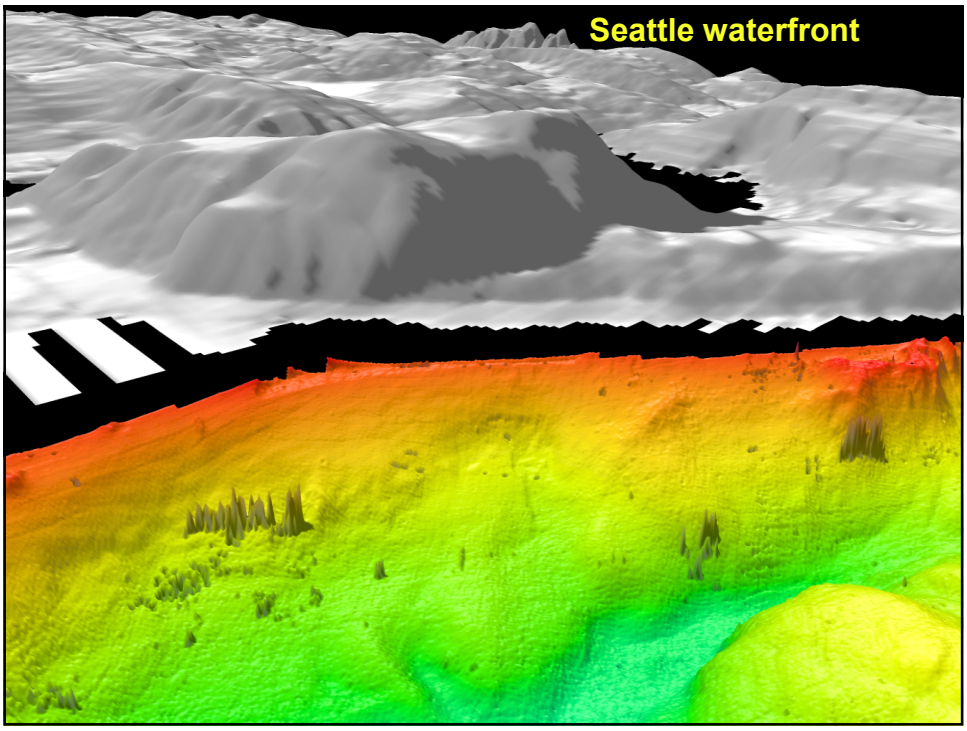
Ovrhd 7-10. Image of Possible Expulsion Pits and Head Scarp at 1-m Resolution.



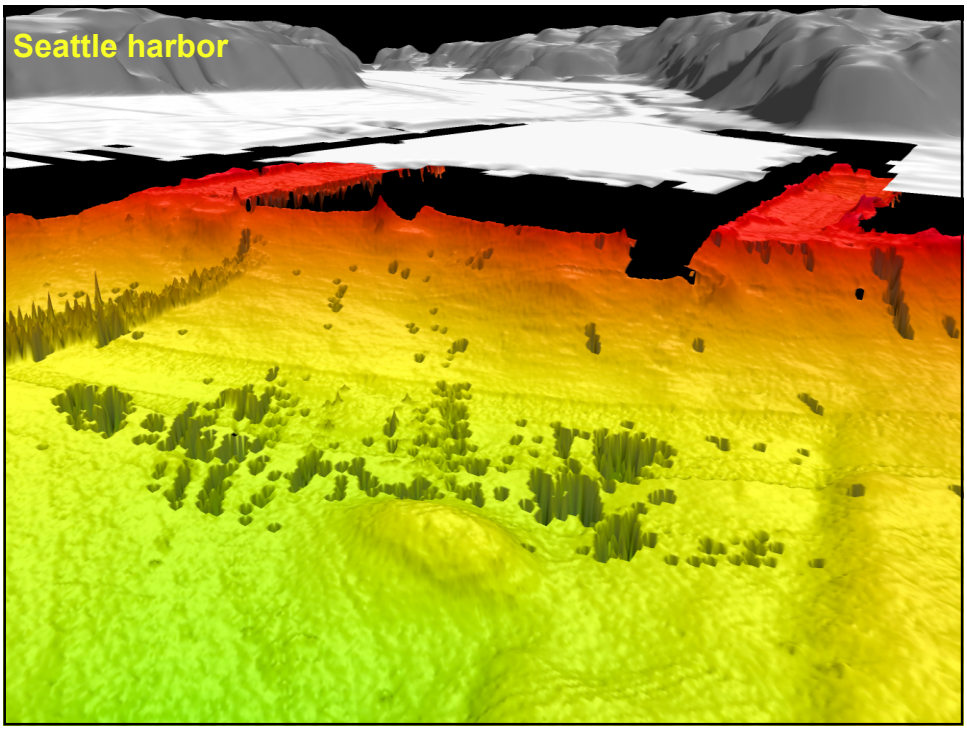
Ovrhd 7-11. Image of Duwamish Delta.



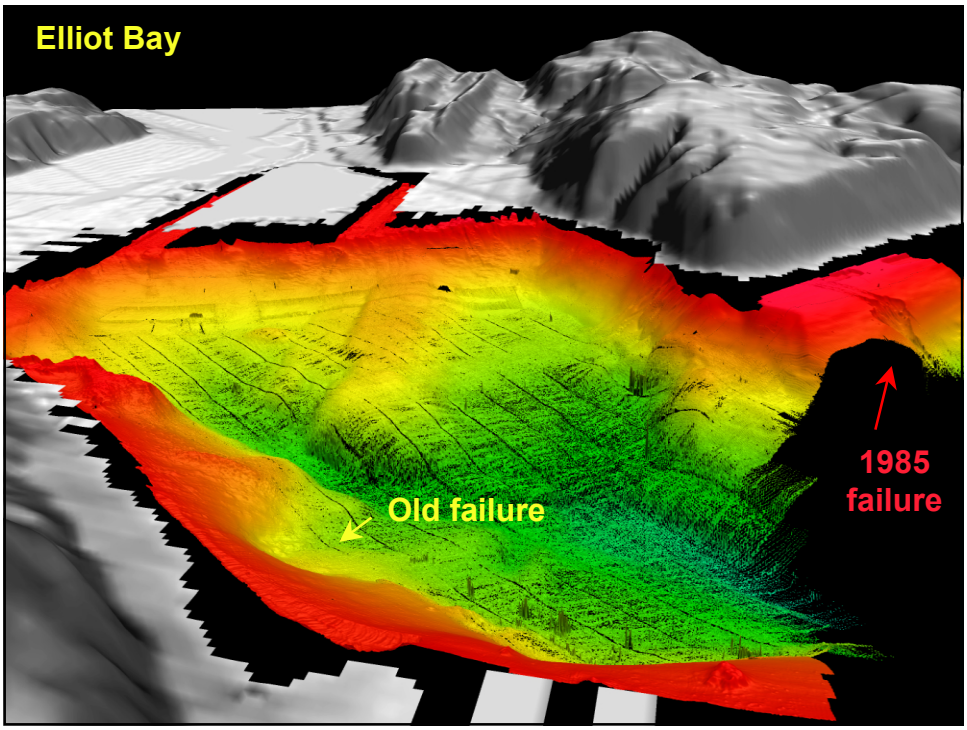
Ovrhd 7-12. Image of Seattle Waterfront: 30-m Resolution.



Ovrhd 7-13. Image of Seattle Waterfront.

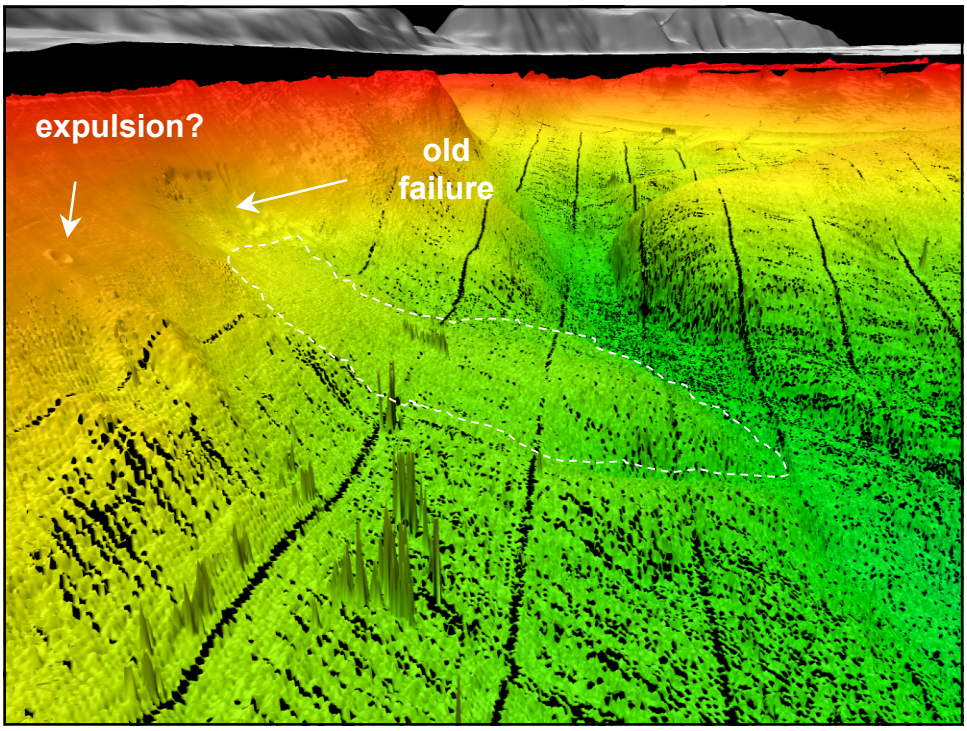


Ovrhd 7-14. Image of Seattle Harbor.

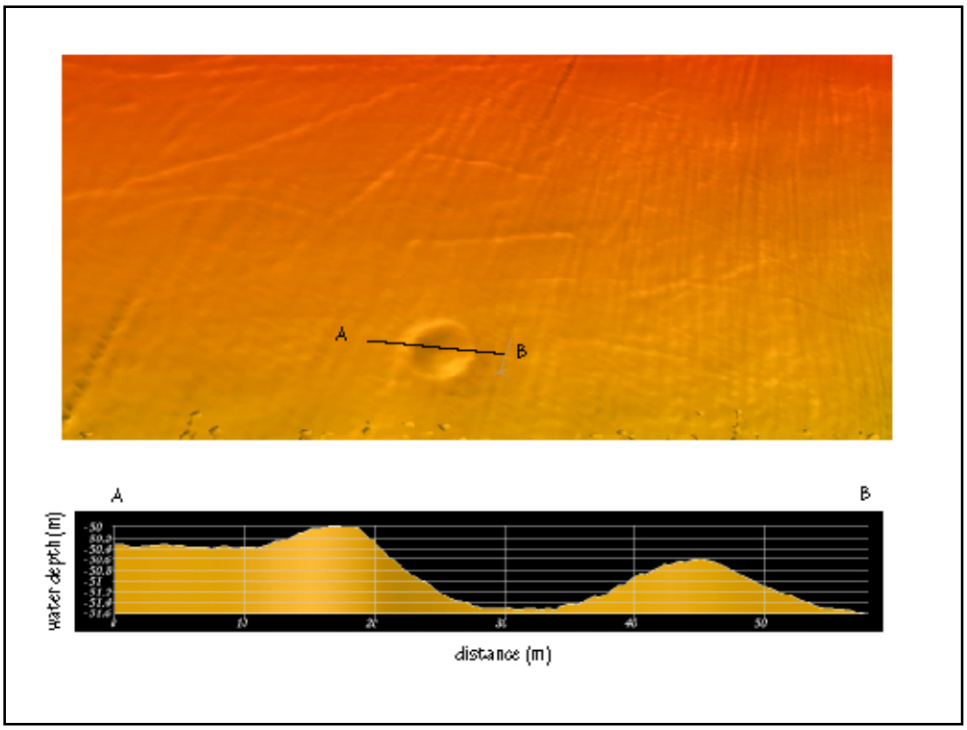


Ovrhd 7-15. Image of Elliott Bay Showing Old Failure and 1985 Failure.

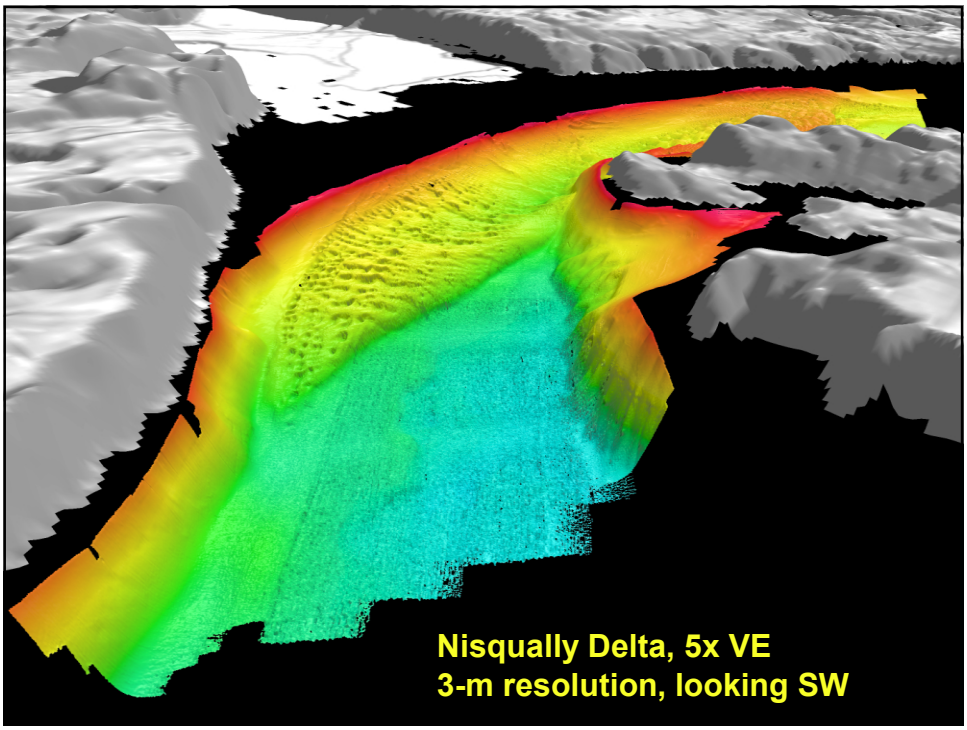
Ovrhd 7-16. Image of West Slope of Duwamish Head.



Ovrhd 7-17. Image of PSDDA Disposal Site Area in Elliott Bay.



Ovrhd 7-18. Image of an Expulsion Pit.



Ovrhd 7-19. Image of Nisqually Delta.

Clarification Papers
and Status Reports

SEDIMENT MANAGEMENT
ANNUAL REVIEW MEETING

May 8, 2001

Ovrhd 8-1. Clarification Papers and Status Reports.

Clarification Papers

- Reporting Sediment Quality for Compliance with the SMS Rule
- Chemical Analysis of Archived Sediment Samples
- Reporting Ammonia LC_{50} for Larval and Amphipod Bioassays
- Z-Sample Guidance Clarification
- Quality of Post-Dredge Sediment Surfaces

Ovrhd 8-2. Clarification Papers.

Status Reports

- Bioaccumulation Chemicals of Concern
- Beneficial Uses

Ovrhd 8-3. Status Reports.

Reporting Sediment Quality for SMS Compliance

- SEDQUAL goals
- Differing data formats cause problems
- Clarification: all data must be submitted in SEDQUAL format
- Exception: DAIS data readily transferable

Ovrhd 8-4. Reporting Sediment Quality for SMS Compliance.

Chemical Analysis of Archived Sediment Samples

- Dissolved fraction must be analyzed
- Archived samples must not be decanted prior to chemical analysis

Ovrhd 8-5. Chemical Analysis of Archived Sediment Samples.

Reporting Ammonia LC_{50} for Larval and Amphipod Bioassays

- Ammonia a potential non-treatment effect
  - aeration and/or purging when ammonia not CoC
- May covary with toxicity
- Water-only LC_{50} using same test organisms may be run
- Data will be used by DMMP agencies to consider ammonia toxicity in project bioassays

Ovrhd 8-6. Reporting Ammonia LC50 for Larval and Amphipod Bioassays.

Z-Sample Guidance and Post-Dredge Monitoring

- Z-samples will be collected and archived for every core sampling location for all projects - unless recent data says otherwise
- If overlying DMMU is unsuitable, Z-sample will be analyzed - conventionals and CoCs
- Must meet SQS or additional testing may be required (bioassay or bioaccumulation)

Ovrhd 8-7. Z-Sample Guidance and Post-Dredge Monitoring.

Quality of Post-Dredge Sediment Surfaces

- Revision of EPTA language
- Three scenarios
- Requirement to comply with SMS rule

Ovrhd 8-8. Quality of Post-Dredge Sediment Surfaces.

Status Report - BCOC List

- History -weight of evidence approach
- Striplin Environmental Associates Contract:
  - gathering data from existing databases
  - searching ERED for residue effects data
  - compiling info on availability of analytical methods
  - completion of weight of evidence table
- Next BWG Meeting - August 2001

Ovrhd 8-9. Status Report - BCOC List.

Status Report - Beneficial Uses

- Increasing challenges
- Draft regional manual being reviewed and updated
- National technical and policy guidance available - Corps Engineering Manual being revised
- National Dredging Team - work group issues

Ovrhd 8-10. Status Report - Beneficial Uses.

The Rest of the Story

- http://www.nws.usace.army.mil/dmmo/homepage.htm

Ovrhd 8-11. The Rest of the Story.

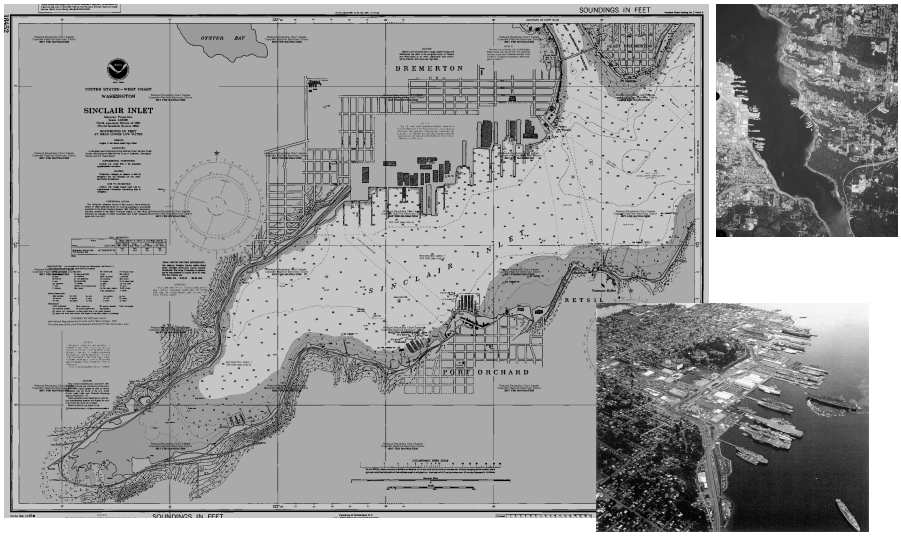
Sediment Cleanup/MCON Integration
Dredging and CAD Disposal

Bremerton Naval Complex
Bremerton, WA

Engineering Field Activity, Northwest
Jai Jeffery, Remedial Project Manager
Peter Havens, Environmental Planner

Ovrhd 9-1. Sediment Cleanup/MCON Integration, Dredging and CAD Disposal.

Project Location



Ovrhd 9-2. Project Location.

MCONs

- P-338 Dredging FY00
  - Berths at Piers B, D
  - Turning Basins
  - 281,000 m^3 (368,000 yd^3)
- P341, Pier D Expansion FY01
  - Demo Pier D
  - Construct New Pier, 1310 x 150 feet
  - Begin Construction DEC 00

Ovrhd 9-3. MCONs.

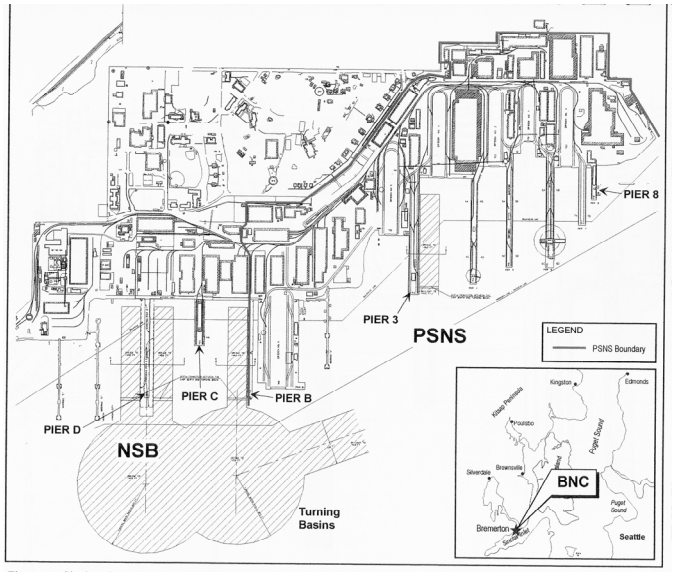
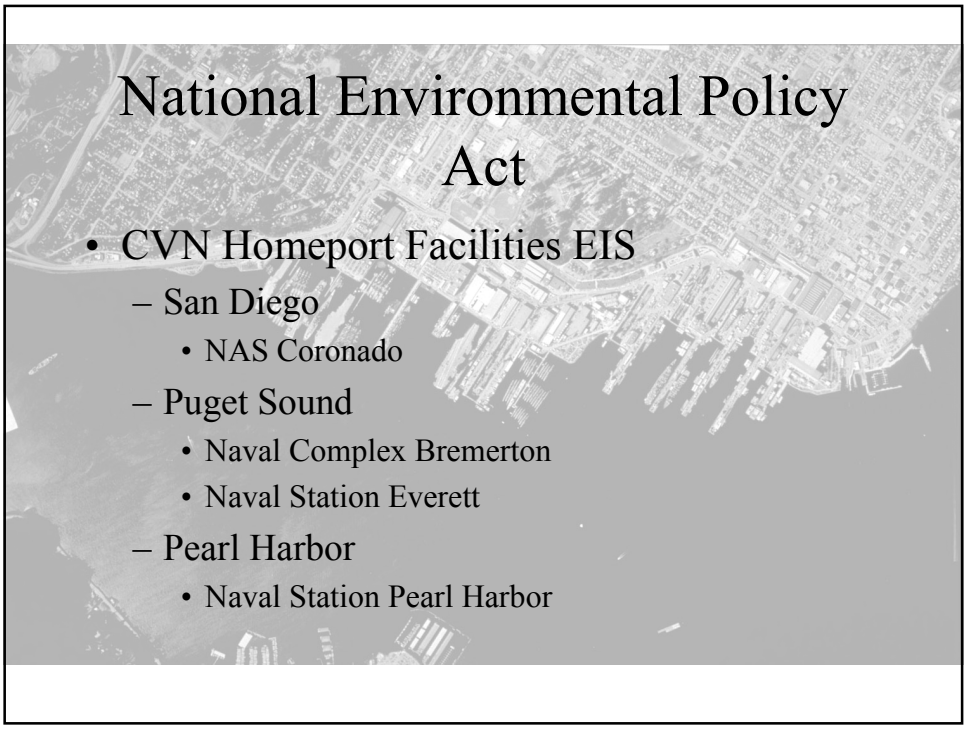
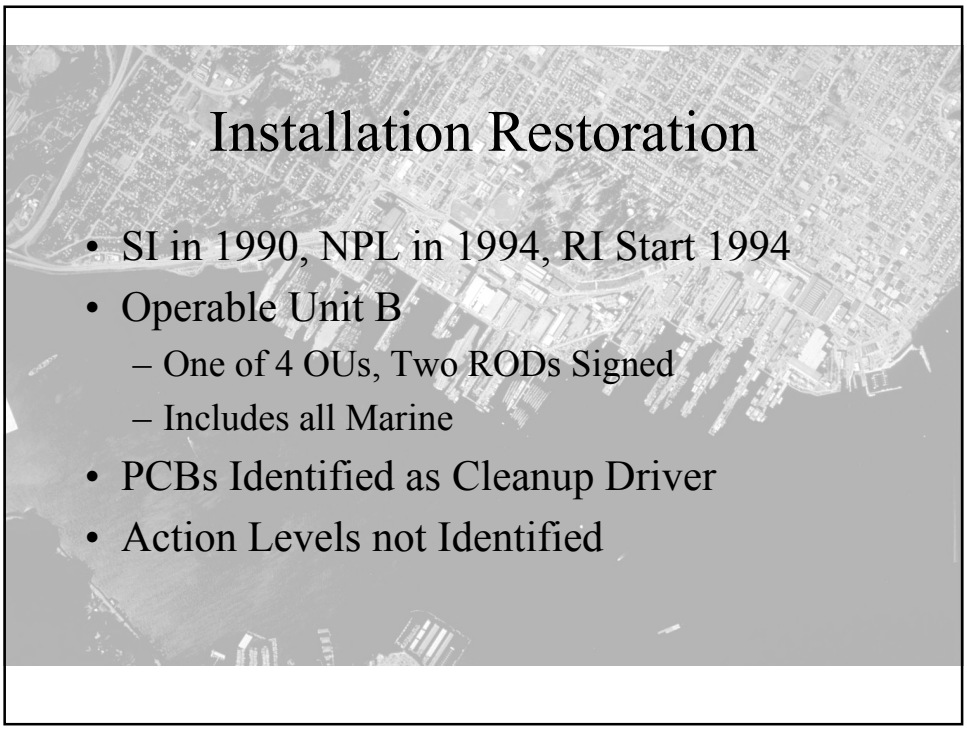


Figure 1. Site location map of the Bremerton Naval Complex (BNC), showing Naval Station Bremerton (NSB), Puget Sound Naval Shipyard (PSNS), Pier D, and proposed dredging areas.

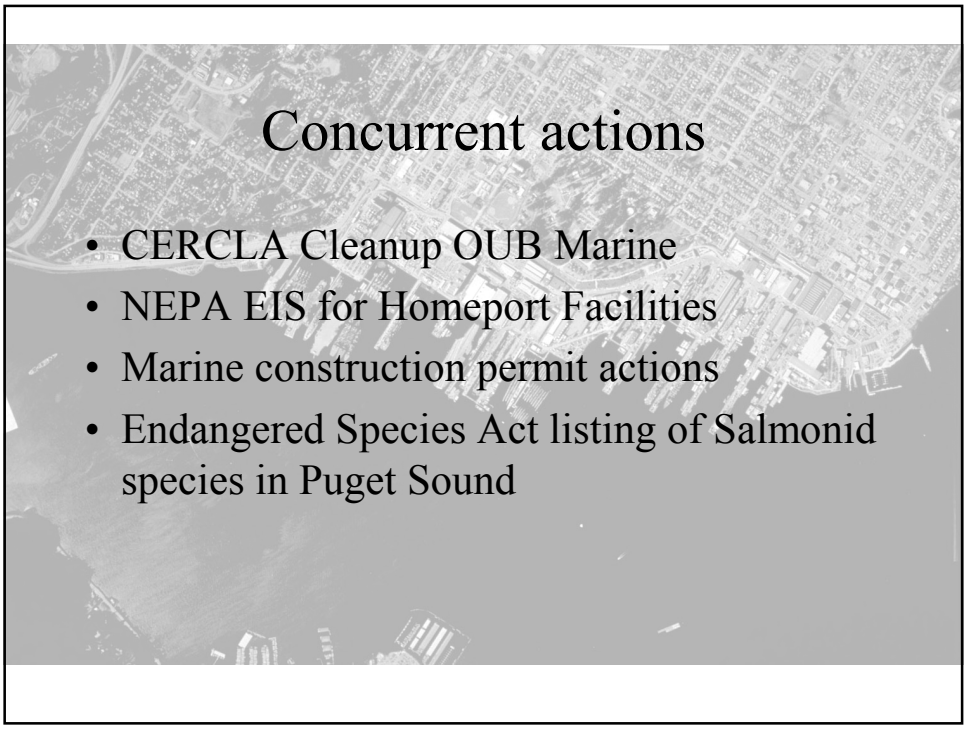
Ovrhd 9-4. Figure 1 - Site Location Map of the Bremerton Naval Complex.



Ovrhd 9-5. National Environmental Policy Act.

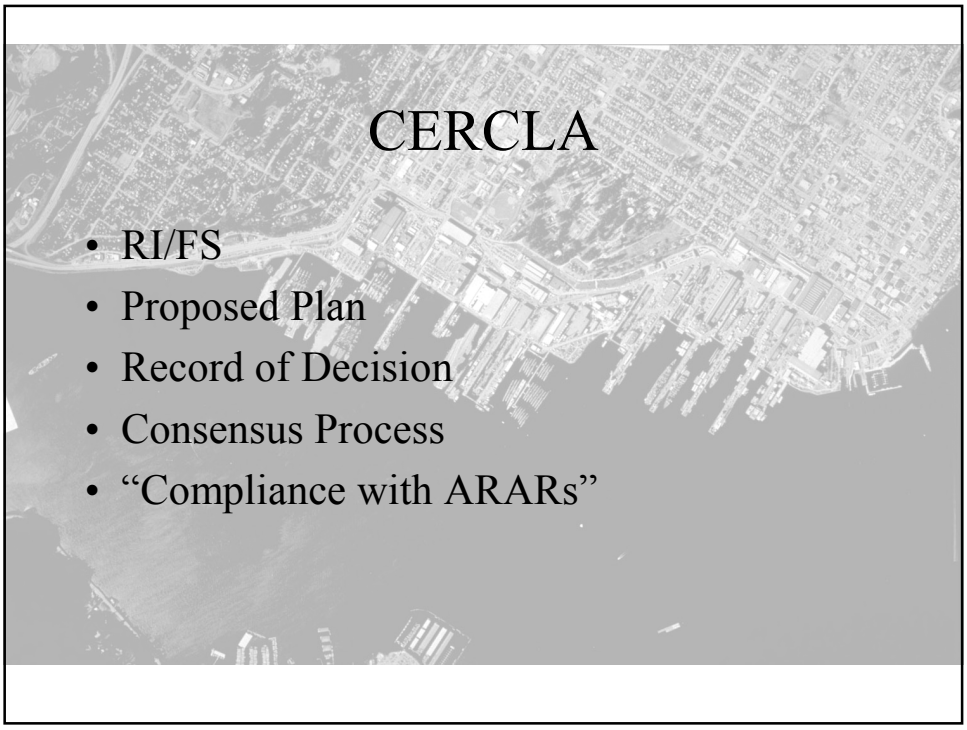


Ovrhd 9-6. Installation Restoration.

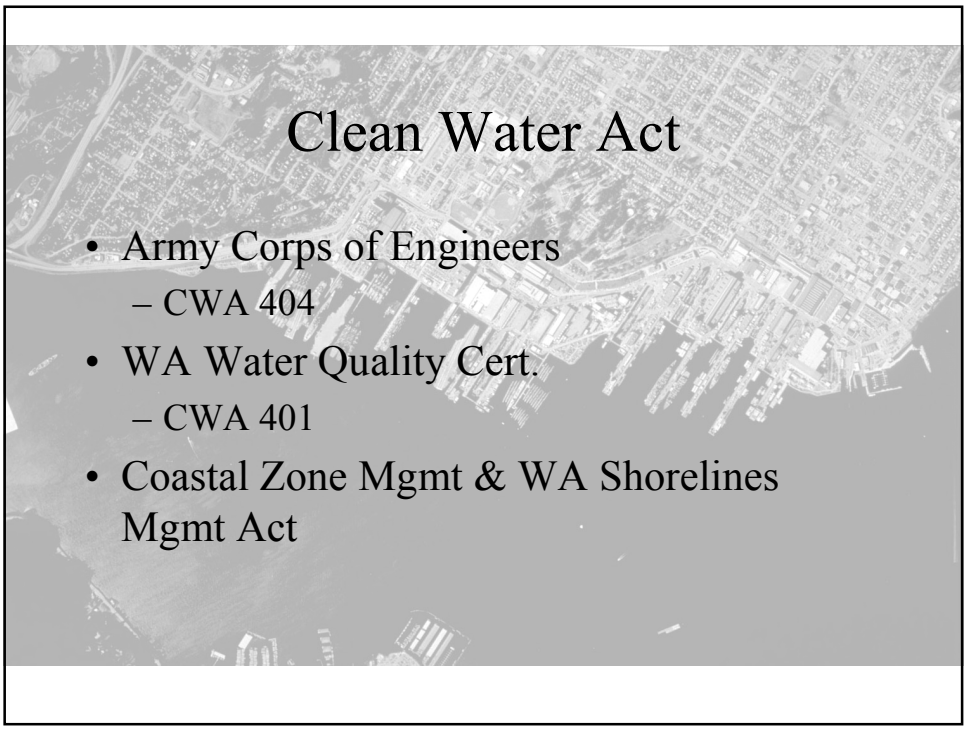


Ovrhd 9-7. Concurrent Actions.

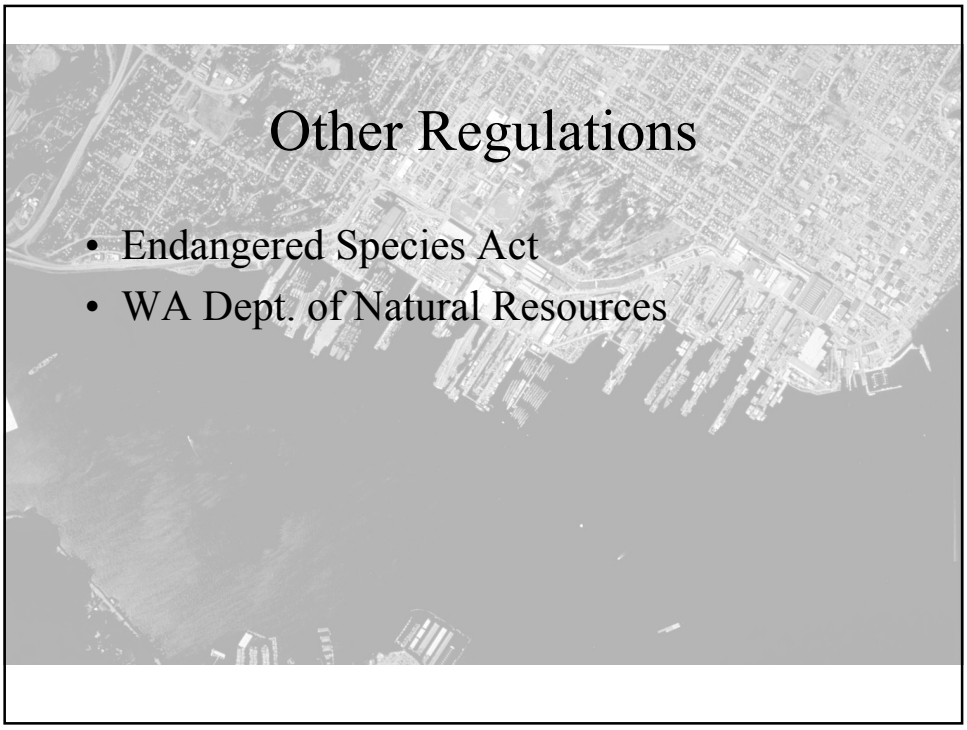
Ovrhd 9-8. Regulatory Requirements.



Ovrhd 9-9. CERCLA.



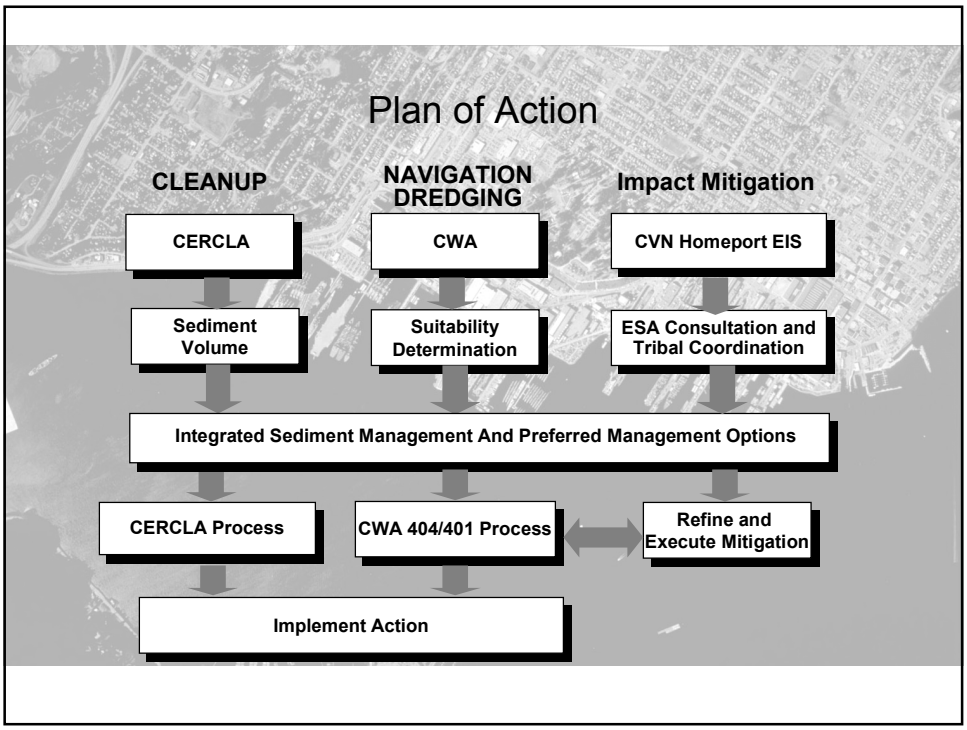
Ovrhd 9-10. Clean Water Act.



Ovrhd 9-11. Other Regulations.

Ovrhd 9-12. Coordination/Integration.

Ovrhd 9-13. Strategy.



Ovrhd 9-14. Plan of Action.

Ovrhd 9-15. Mediation and Compromise.

Ovrhd 9-16. Plow Ahead to Completion.

Conclusion

- It is possible to conduct dredging on a CERCLA site
- Single-point Program Management is crucial
- This integrated program resulted in:
  - $18.55 cy for dirty sediments
  - $7.19 cy for clean sediments

Ovrhd 9-17. Conclusion.

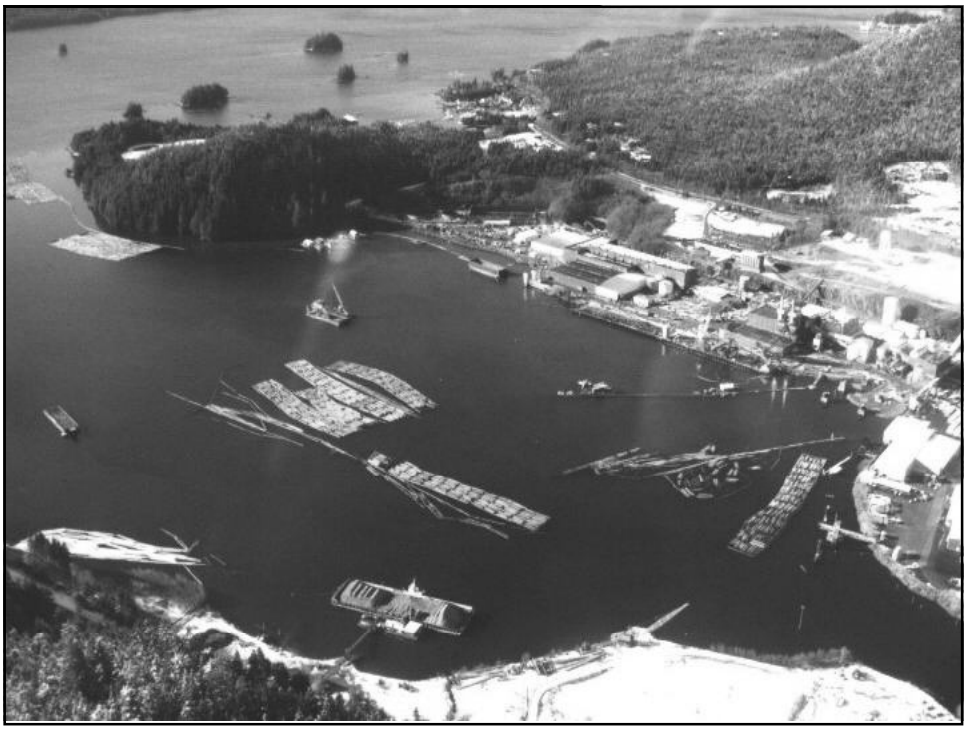
Ovrhd 9-18. Questions?

EPA Superfund Sediment Remediation

Ketchikan Pulp Company Site
Ketchikan, Alaska

Key Players: EPA, ACOE, KPC/LP, Exponent, FWENC, PND

Ovrhd 10-1. EPA Superfund Sediment Remediation.

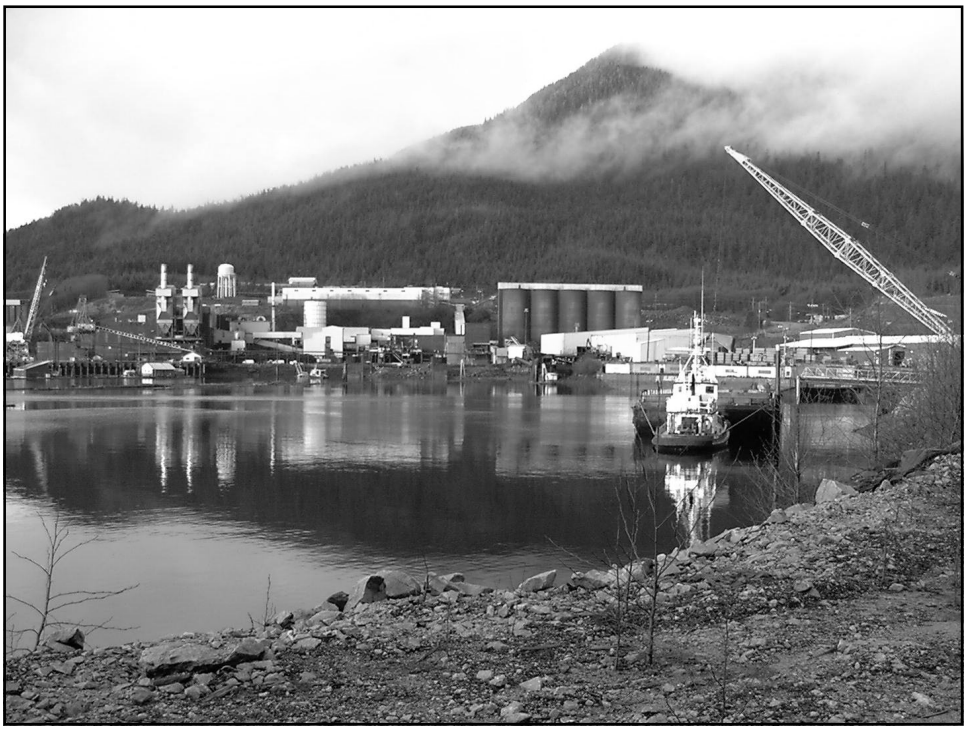


Ovrhd 10-2. Photo of Superfund Site in Ward Cove.

Site History

- Dissolving sulfite pulp mill since 1954
- Primary treatment installed 1971
- Secondary treatment installed 1980
- Discharged pulp effluent to Ward Cove until 1997
- Sold to Gateway Forest Products in 1999

Ovrhd 10-3. Site History.



Ovrhd 10-4. Photo of Site and Ketchikan Pulp Company Mill.

The Problem

- Historical releases caused accumulation of pulp residue on the bottom of Ward Cove
- Problem chemicals -- ammonia, hydrogen sulfide, and 4-methylphenol -- are natural degradation products of organic matter and wood material

Ovrhd 10-5. The Problem.

EPA Record of Decision

- Designated 80 acres of bottom sediments for remedial action
- Sediments posed a risk to benthic organisms
- No human health or wildlife concerns

Ovrhd 10-6. EPA Record of Decision.

Ovrhd 10-7. Aerial View of Superfund Site.

Remedial Action Objectives

- Reduce toxicity of sediments to benthic organisms
- Enhance recolonization of sediments to support a healthy benthic community

Ovrhd 10-8. Remedial Action Objectives.

Selected Remedy

- Dredging (berth areas)
- Thin layer placement of 6 to 12 inches sand
- Natural recovery where capping infeasible
  - Too steep (>40 percent slope)
  - Too soft (bearing strength less than 6 psf and organic material thickness more than 5 ft)
  - Too deep (>120 ft MLLW water depth)
  - Too many logs
- Long-term monitoring

Ovrhd 10-9. Selected Remedy.

Unique Aspects of Sediments

• Soft sediments	415 percent water content (avg) <3-100 psf
• High organics	20-40 percent TOC 1 to 12 percent TOC (native)
• Thick organics	1 to 18 ft
• Deep-water area	120 ft MLLW (max)

Ovrhd 10-10. Unique Aspects of Sediments.

Remedial Action

- Completed in 4 months (11/00-2/01)
- Dredged 12,000 cy sediment over 4 acres
- Thin layer placement over 27 acres

Ovrhd 10-11. Remedial Action.

Thin Layer Placement

- **ROD: "Placement of thin-layer cap (approx. 6- to 12-inches) of clean, sandy material where practicable."**
  - Amend surface sediments (not isolation cap)
- **RD: Defined site-specific standards to verify success of placement**
  - Lateral coverage *and* depth of coverage

Ovrhd 10-12. Thin Layer Placement: ROD and RD.

Thin Layer Placement

- Standard: Place a 6 to 12 inch sand cap over at least 80% of each of 15 acceptance areas *and verify compliance*
  - Calculate quantities placed
  - Track areal coverage of placement
  - Test sediments after capping

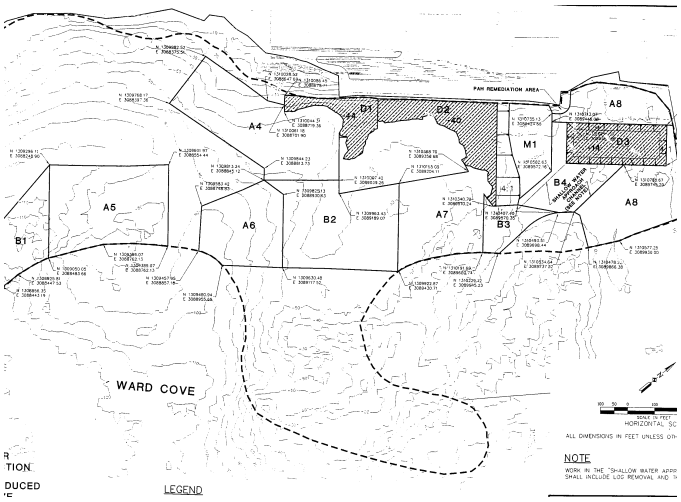
Ovrhd 10-13. Thin Layer Placement: Standard.

Acceptance Areas

- 15 acceptance areas (thin layer placement)
- Typically 1-3 acres per area
- Area boundaries determined by unique characteristics (water depth, sediment bearing strength, thickness of organics)

Ovrhd 10-14. Acceptance Areas.

Acceptance Areas within Remediation Area



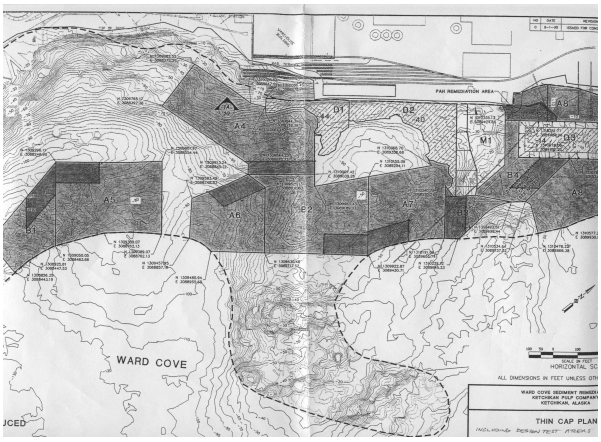
Ovrhd 10-15. Acceptance Areas within Remediation Area.

Acceptance Areas Design Tests

- Implemented during construction phase
- Performed design test in 1/3 acre of each acceptance area
- Established to develop capping placement methodology to meet performance standard in specific -acceptance area (later modified)

Ovrhd 10-16. Acceptance Areas Design Tests.

Acceptance Areas - Design Tests



Ovrhd 10-17. Figure of Acceptance Areas and Design Test Areas.

Acceptance Areas Performance Standards

- Tracked sand volume placed and adequacy of bottom coverage
  - Delivery Rate: Placed known volume in defined area to achieve 6- to 12-inch cap
  - Delivery Method: Used STFATE to optimize distance from bottom for release (RD: 15 ft off bottom; RA: modified to surface release)

Ovrhd 10-18. Acceptance Areas Performance Standards.

Acceptance Areas Performance Standards

- Tested surface sediment characteristics after capping
  - Rationale: Post-placement sand content similar to background (32 percent sand by weight)
  - *In situ* Testing: Surface sediment samples to 10 cm from 12 stations within each area
  - Standard: Surface sediment $\geq$ 40 percent sand in 80 percent of samples and no more than 20 percent of samples have less than 13 percent sand

Ovrhd 10-19. Acceptance Areas Performance Standards, Cont..

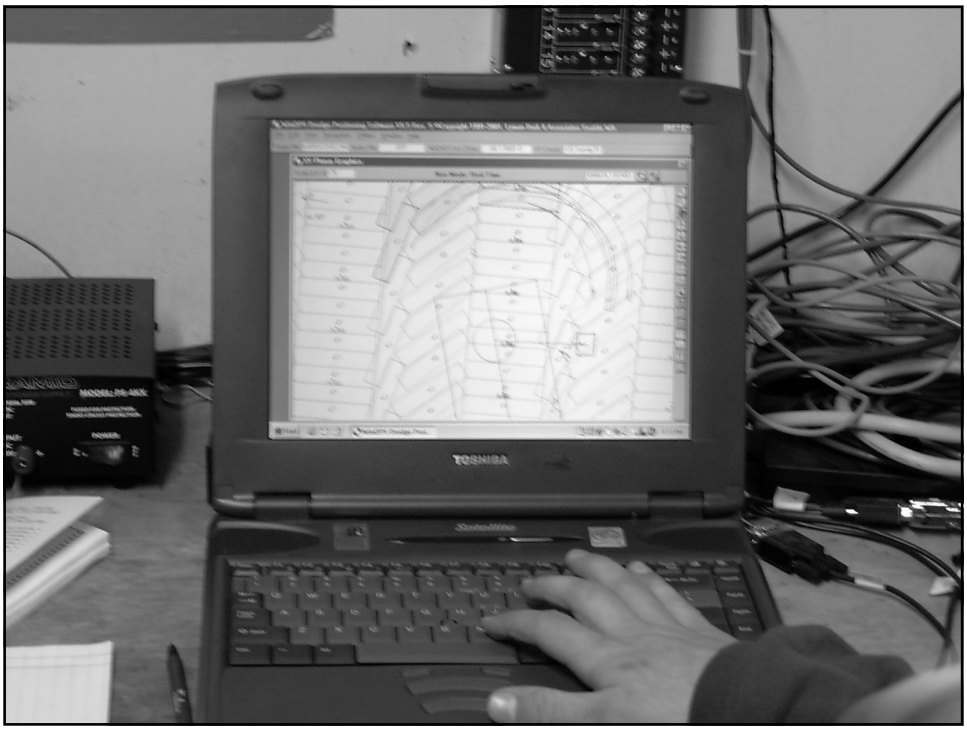
Ovrhd 10-20. Photo of 25,000 Cubic Yards of Sand Used for Capping.

Ovrhd 10-21. Photo of Cap Material.

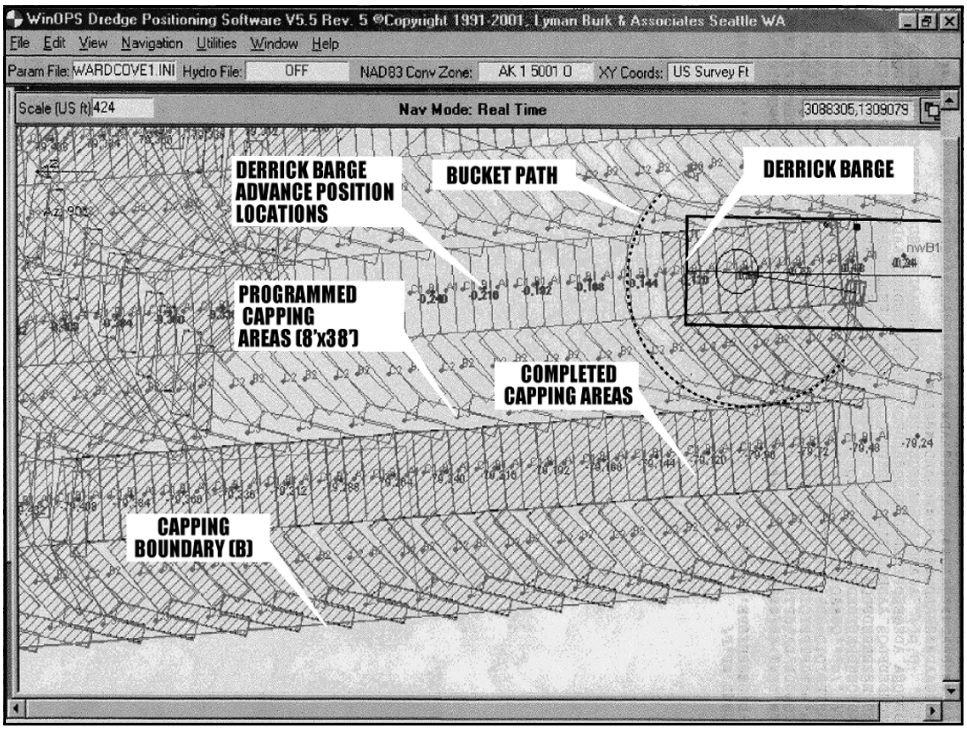
Ovrhd 10-22. Photo of Material Handling Bucket.

Ovrhd 10-23. Photo Showing Slow Release of Material at Water Surface.

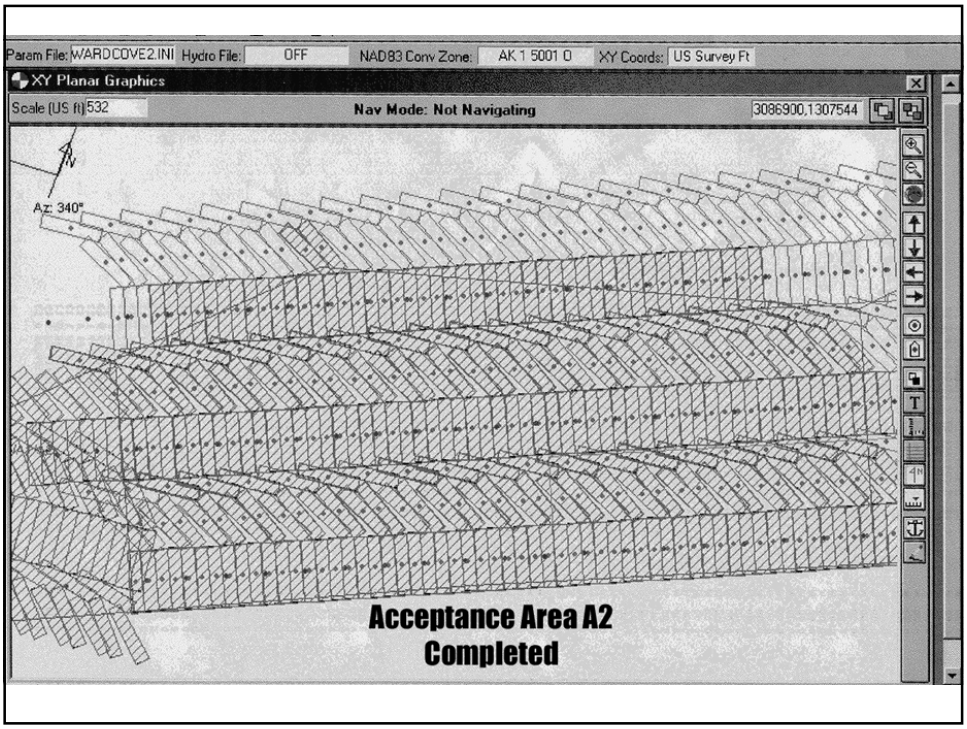
Ovrhd 10-24. Photo Showing Slow Release of Material at Water Surface, Cont.



Ovrhd 10-25. WinOPs Dredge Positioning Software.

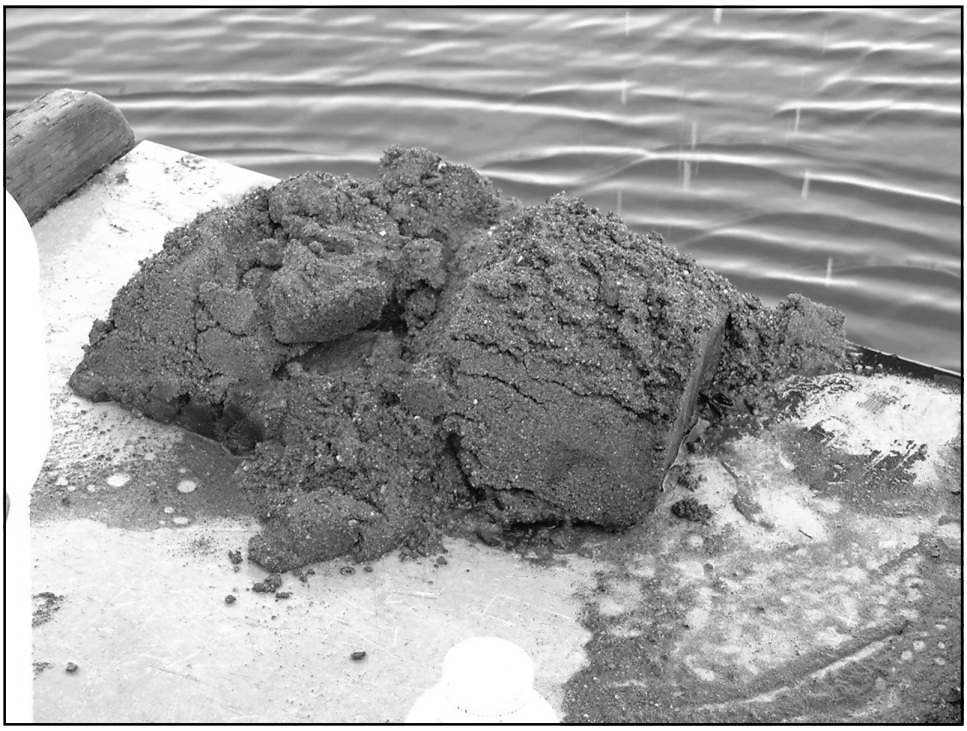


Ovrhd 10-26. WinOps Program Display.



Ovrhd 10-27. WinOps Program Display Showing Completed Acceptance Areas.

Ovrhd 10-28. Photo of Grab Sampling and Wet-Sieving.



Ovrhd 10-29. Photo of Grab Sampler Contents: Sand.

Thin Layer Placement

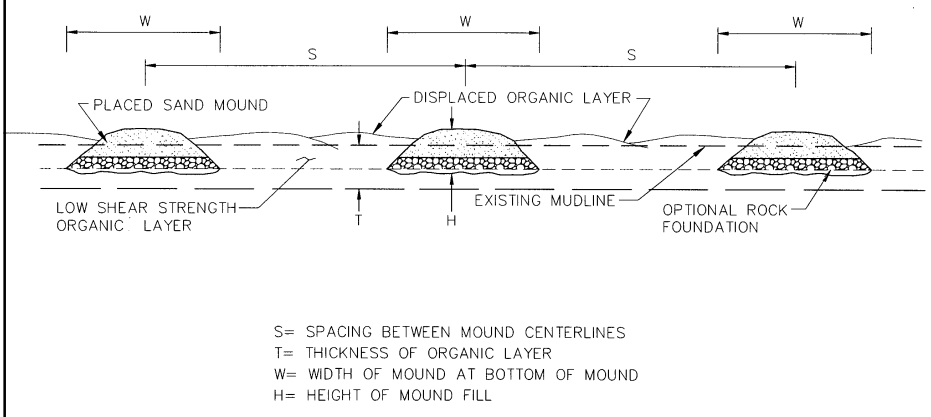
- 100% Success
- Beautiful Sand — 97% fine-medium sand
<3% fines
no clumping, consistent
- Material Placed — 23,000 cy sand
- Material Cost — $25/cy
- Production Rate — 40 - 80 cy/hr

Ovrhd 10-30. Thin Layer Placement.

Thin Layer Placement
Deep Water

- Successful in deeper waters (120 ft)
- Sediment placed on bed surface with precision
- Able to adequately monitor success of capping at depth
- Relative cost of capping and production rates were similar between shallow and deep areas
- Considerations: near-surface release (not bottom); low currents; anchor system more efficient than spuds; WINOPS; good weather; deeper cap areas shaped more linearly with less boat traffic.

Ovrhd 10-31. Thin Layer Placement Deep Water.



Mounding proposed, but not performed.

Ovrhd 10-32. Mounding Proposed, But Not Performed.

Water Quality Monitoring Approach

- Performed consistent with EPA's WQC
- Monitored log/debris removal, dredging, thin layer placement, dredged material offloading
- Short-term variance areas - 300 ft radially (dredging); entire Cove (capping)
- Sampled turbidity, DO, salinity, pH
- 4 times/day (1 hr before start, ebb, flood, 1 hr after end of activity); later 2 times/day

Ovrhd 10-33. Water Quality Monitoring Approach.

Water Quality Monitoring Results

- 236 monitoring events over 78 days in-water work
- Few transient exceedances of turbidity standard of 25 NTU
- Few instances where dissolved oxygen measured below 5 mg/L
- Cost: $70,000

Ovrhd 10-34. Water Quality Monitoring Results.

Lessons Learned

- Bottom Line: Sediments had higher bearing strength than predicted by classic engineering tests (shear strength, water content)
- Research Needs: Better test to predict success of capping soft sediments

Ovrhd 10-35. Lessons Learned.

Other Considerations

- Buy good sand for precision capping
- Analysis of placement method is key
- Modify STFATE for slow release near surface (rather than single dump off bottom)
- Perform method placement design tests during start of remedial action (rather than pilot test during FS or bench tests during RD)

Ovrhd 10-36. Other Considerations.

Other Considerations

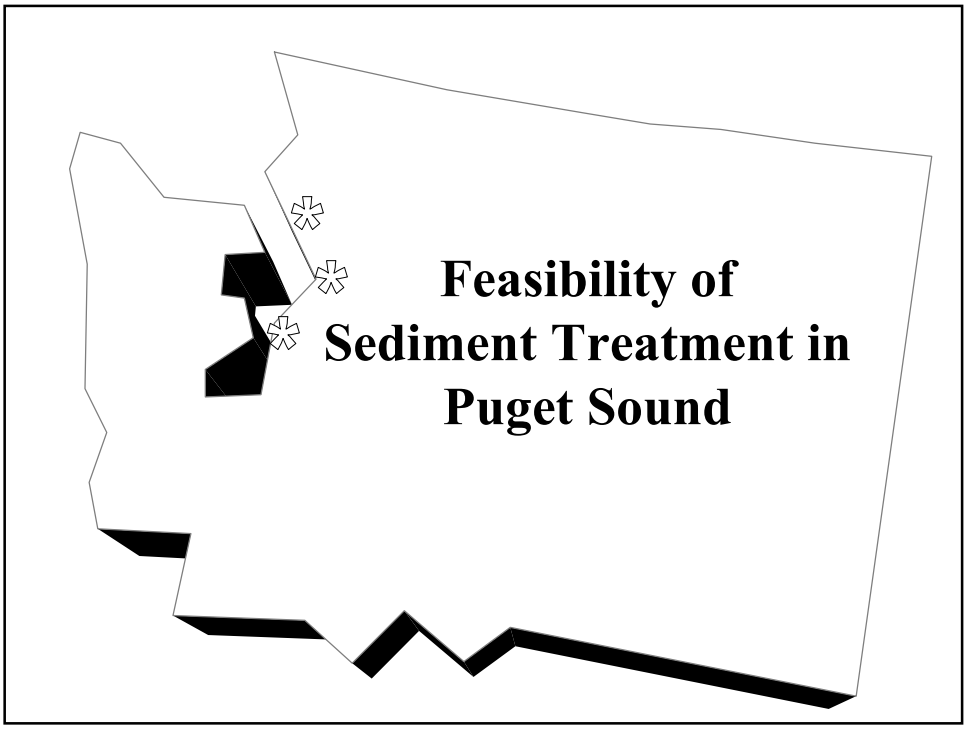
- Implement BMPs
- Water Quality - Collect data at certification boundary *and* 300 ft from capping activity
- Dredging - 1,500 cy sealed barges worked great; used 6-cy Cable Arm environmental bucket and 5-cy digging bucket
- Oversight approach - establish clear triggers/notification requirements to agency

Ovrhd 10-37. Other Considerations, Cont.

Remedial Action Costs

- $4 million (RA work plan through construction completion)
- $159/cy dredging (not disposal)
- $110/cy capping (approx. $96,000/acre)

Ovrhd 10-38. Remedial Action Costs.



Ovrhd 11-1. Feasibility of Sediment Treatment in Puget Sound.

Feasibility of Sediment Treatment

Outline of Presentation

- Early findings and decisions
- Evaluation of technologies
- Challenges and solutions
- Needs and next steps

Ovrhd 11-2. Outline of Presentation.

Feasibility of Sediment Treatment

Early Findings and Decisions

- East Coast (EPA Region 2) leads effort to develop sediment treatment technologies
  - Several categories of technologies promising
  - Bench and pilot testing underway
- Key issues include
  - Markets for sale of end products
  - Reliable supply of contaminated material
  - Clear requirements for extent of treatment

Ovrhd 11-3. Early Findings and Decisions.

Feasibility of Sediment Treatment

Early Findings and Decisions

Leading technology categories and end products

- "Soil washing" technology produce "top soil"
- Stabilization technologies yield construction fill
- Thermal treatment can produce cement, light weight aggregate, various glass products and electric power
- Bioremediation to yield top soil or fill

Ovrhd 11-4. Early Findings and Decisions, Cont.

Feasibility of Sediment Treatment

Early Findings and Decisions

- 'The first MUDS facility should provide capacity for sediment treatment, at least in part'
- 'A partnership of both public and private sectors should develop such a facility'
- 'The Study Team should identify candidate sites for MUDS facilities (but not rank them yet)'

Ovrhd 11-5. Early Findings and Decisions, Cont.

Feasibility of Sediment Treatment

Evaluation of treatment technologies

- Study Team and External Advisory Committee established 24 criteria in 6 weighted categories
- Seven treatment technologies rated by independent contractor based on responses to survey and other information gathered
- Four technologies selected for further study

Ovrhd 11-6. Evaluation of Treatment Technologies.

Feasibility of Sediment Treatment

Evaluation of treatment technologies

- Cost and marketability (6.3 weight factor)
- Performance (8.2)
- Facility/process characteristics (5.2)
- Flexibility (7.0)
- Relevant business information (4.4)
- Public acceptability/permittability (5.7)

Ovrhd 11-7. Evaluation of Treatment Technologies, Cont.

Feasibility of Sediment Treatment

Evaluation of treatment technologies

Selected the following treatment "vendors" for further evaluation

- BEM Systems
- Biogenesis/Weston
- Cement-Lock
- Global Plasma Systems

Ovrhd 11-8. Evaluation of Treatment Technologies, Cont.

Feasibility of Sediment Treatment

Challenges and Solutions

- Reliable supply of contaminated sediment
- Regional markets for end products
- Environmental impacts associated with bi-products and waste streams
- Liability associated with products
- Economic viability and funding
- Other

Ovrhd 11-9. Challenges and Solutions.

Feasibility of Sediment Treatment

Reliable supply of contaminated sediment

- Ability to use alternative materials
- Ability to temporarily stockpile/store CS
- Coordinated sediment cleanup actions, e.g.,
  - regulatory cooperation
  - advanced contracting
- Legislative "guarantee" of volume

Ovrhd 11-10. Reliable Supply of Contaminated Sediment.

Feasibility of Sediment Treatment

Regional markets for end products

- Conducted limited survey
- Indicated potential markets for top soil, cement, LWA and glass products
- Found little or no market for construction fill
- (Electric power not a bad bi-product)
- Recommended detailed market analysis

Ovrhd 11-11. Regional Markets for End Products.

Feasibility of Sediment Treatment

Environmental impacts/product liability

- Waste streams vary with specific technology
- Impacts potentially significant but …
  - Relatively less than impacts from disposal?
  - Permits intended to minimize impacts
- Legal analysis indicated minimal risk of liability from future environmental contamination associated with manufactured products

Ovrhd 11-12. Environmental Impacts/Product Liability.

Feasibility of Sediment Treatment

Economic viability and funding

- Spreadsheet assesses profitability of regional treatment technologies (@ 100,000 yards^3/year)
- Four public/private partnership scenarios viable for one technology, results may vary
- "Land lease" most profitable
- Various funding options for financing full scale MUDS treatment facility (and pilot projects)

Ovrhd 11-13. Economic Viability and Funding.

Feasibility of Sediment Treatment

Table 8. Break-Even Tipping Fees by Management Alternative and Land Value

Management Alternative	Low Land Value ($0.2 million/acre)	High Land Value ($1.1 million/acre)
Baseline	$11.20	$35.10
Turnkey	$3.30	$24.90
Privatization	$7.20	$29.90
Land Lease	$16.50	

Ovrhd 11-14. Break-Even Tipping Fees by Management Alternative and Land Value.

Feasibility of Sediment Treatment

"Other" Challenges and Solutions

- Siting - identification of suitable site(s)
- "Permittability" of treatment facility
- Acceptance by public and regulatory agencies/programs
- Competition with existing alternatives
- Timeliness

Ovrhd 11-15. Other Challenges and Solutions.

Feasibility of Sediment Treatment

Needs and Next Steps

- Decide which public entity will "lead" any future development of a MUDS, e.g., port district, DNR, "PSDDA" or a county
  - Re-evaluate existing alternatives, e.g., disposal at regional solid waste landfills
  - Evaluate "volunteer" sites for MUDS treatment facility
  - Continue siting & public participation activities?

Ovrhd 11-16. Needs and Next Steps.

Feasibility of Sediment Treatment

Needs and Next Steps

- For development of regional capacity for treatment of contaminated sediment to proceed need …
- Political will
- Public acceptance
- Few cost-competitive alternatives

Ovrhd 11-17. Needs and Next Steps, Cont.

Feasibility of Sediment Treatment

Acknowledgments

- MUDS agencies' Study Team members
  (noted in earlier presentation)
- Science Applications International Corp. (SAIC)
  Nancy Winters
- Battelle Pacific Northwest Laboratory
  (Jeff Ward)
- Martin and Brown
  (Jay Manning & Tanya Barnett)

Ovrhd 11-18. Acknowledgements.

APPENDIX D

Public Issue Papers and Topical Presentations

1. Ultra low-level PCB Analysis – a tool to monitor sediment loading
2. NMFS White Papers – Overview Summary

Columbia Analytical Services inc.

An Employee Owned Company

Ultra Low-level PCB-Aroclor Analysis
A Tool to Monitor Sediment Loading

John Hicks, Columbia Analytical Services, Inc. (CAS)

In response to requests from industrial clients and other regulated entities, CAS has developed a set of analytical techniques to identify and quantify Aroclors in discharge water. Requirements to achieve risk-based detection limits in discharges are being requested by regulators due to water quality and sediment loading concerns. While the primary reason for requesting low-level Aroclor analysis of outfalls is fish and human health protection, an important additional benefit is to know the point source loading of the sediment adjacent to and downriver of the outfall plume.

While other analysis options exist, PCB Aroclors and Congeners are generally analyzed using Gas Chromatography/Electron Capture Detection (GC/ECD) following EPA Method 8082. Typically, increased method sensitivity is achieved via two mechanisms: 1) hardware modifications and/or operating conditions of the instrumentation; 2) introduce more sample into the instrument by extracting more water or sediment and/or concentrating the sample extract. After a typical GC/ECD is optimized to obtain the greatest sensitivity possible, the next step is to enhance the sample preparation procedure. The primary objective is generally to devise a technique that results in an increased equivalent amount of sample to be introduced into the GC/ECD. When considering various options to increase sample on column, other factors need to be evaluated (e.g. concentration of interferences, concentration of analytical noise, concentration of background contamination, etc.). If non-target signal can be controlled, a true gain in signal:noise can be achieved.

A relatively large volume or mass of sample is solvent-extracted by the laboratory. After concentration of the sample extract to a small volume, the extract is subjected to Gel Permeation Chromatography (GPC) followed by a large-volume silica gel column cleanup to remove PCB-interfering pesticides and other non-target interferences. These cleanups are followed by concentrated sulfuric acid treatment to remove biogenic interferences. Further cleanup is performed using elemental mercury to precipitate sulfur, which interferes with the quantitation of Aroclors. Samples are injected into the gas chromatograph using a pressure-programmed High Volume Injector (HVI) that allows the injection of up to 100 µL of sample extract, which essentially results in further concentration of the sample in the instrument. This technique has been used successfully on discharge water, receiving water, sewage influents/effluents, sediment, and tissue. Aroclor reporting limits are 5 ng/L (ppt) for water, 2.0 µg/kg (ppb) for tissue and sediment. Experimentally derived detection limits are 2-5 times lower than the reporting limit, depending on the Aroclor.

End users of the low-level Aroclor outfall data have been able to correlate discharge total mass to sediment loading, particularly when PCB control measures have been implemented. These data have also been helpful to potentially responsible parties when allocation disputes occur.

Lessons learned:

- Laboratory cleanliness is critical to remove background/blank contamination. CAS/Kelso has segregated all ultra-low level analyses in an ultra-trace organics extraction facility. Much of the extraction and concentration glassware is disposable to prevent cross-contamination potential. Non-disposable glassware is washed, solvent rinsed, muffled, and solvent rinsed again prior to coming in contact with the field sample. Glassware designated for this analysis is segregated from other equipment used for routine applications. (Note: CAS/Kelso is currently working on a critical project where the client has purchased their own personal glassware to be used for ultra-trace analysis of their samples only.)

- Although extensive extract cleanups are performed, applications of this technique can still be limited by matrix.
- The use of this procedure is limited to experienced analytical chemists. CAS/Kelso uses a "panel" of experienced analysts on difficult samples requiring judgment calls.

CAS has been providing this service in support of investigations on three freshwater rivers in the Pacific Northwest and Alaska. Our clients have asked that their names be kept confidential due to pending regulatory actions in these rivers.

John Hicks
Senior Chemist
Columbia Analytical Services, Inc.
jhicks@caslab.com
(206) 824-8933

Preface for ECD White Papers

What are these papers?

These papers represent our best professional judgement on the levels of toxic contaminants which are associated with adverse biological effects in marine and anadromous fish of the Pacific Northwest.

We have used both laboratory and field data to estimate the thresholds for contaminants, in either tissues or in surficial sediments, where adverse effects are first evident.

These papers are an assessment of current literature and field data. There are several key uncertainties.

These papers have been extensively peer-reviewed, were given to the Northwest Regional Office in 2000 (Friedman and Landino), and have been submitted for publication, both in science journals, and as NOAA Technical Memoranda.

Currently available online at

http://research.nwfsc.noaa.gov/ec/ecotox/Publications/whitepapers.html

Collier, Meador, and Johnson. NOAA, NMFS, NWFSC
Presentation to SMARM, Lacey, WA 5/8/01

Different approaches for different toxicants

For polychlorinated biphenyls (PCBs), the thresholds for adverse effects in outmigrant juvenile salmon were determined, based on direct effects to PCB-exposed salmonids.

For tributyltins (TBTs), the thresholds for adverse effects of TBTs on juvenile salmon were determined, based on indirect effects (i.e. via effects of TBTs on benthic prey organisms).

For polycyclic aromatic hydrocarbons (PAHs), the thresholds for adverse effects of PAHs on resident flatfish (English sole) were determined, based on direct exposure of these fish to PAH-contaminated sediments in the field.

Whereas the approaches for PCBs and TBTs evaluate the effects of these compounds in the absence of other contaminants, the PAH white paper, based on field data, incorporates exposure to multiple contaminants.

What these papers ARE NOT

These papers do not recommend sediment cleanup levels. Rather, the tissue and sediment levels can be used to determine NLAA (not likely to adversely affect) levels.

These papers are not the final answer. Rather they represent our current assessment, and research focused on reducing key uncertainties would substantially improve the strength of these recommendations.

These papers are not policy guidelines from NMFS. Rather, they are science syntheses, from the science arm of NMFS, and are provided to the policy arm of NMFS to support informed policy decisions.

PCB White Paper Summary

An analysis in support of tissue and sediment based threshold concentrations of polychlorinated biphenyls to protect juvenile salmonids listed by the Endangered Species Act.

Ecotoxicology and Environmental Fish Health Program
Environmental Conservation Division, NWFSC

Goal: Provide a framework for determining the tissue and sediment concentrations of polychlorinated biphenyls (PCBs) to protect against adverse effects in listed salmonid species.

Approach:

- Laboratory studies from several researchers (15 independent studies) used to link tissue concentrations to biological effects (LOERs).

- Field data from Puget Sound (Duwamish River) used to extrapolate from tissue to sediment levels

Findings:

- Tissue residue effect threshold = **2.4 μg/g lipid** (site independent)

- Sediment effect threshold = **225 ng/g dry wt** (site specific data could change the value. For this analysis TOC = 1.5% BSAF = 0.16)). To protect 95% of individuals, this value would be **113 ppb**.

- Value can be recalculated, depending on
  1) lipid levels in fish (10% dry wt used to determine SET);
  2) total organic carbon (TOC) content of sediments (1.5% used);
  3) percentile of studies used to set threshold (10th percentile of all studies used)
  4) estimation of habitat utilization patterns (currently assuming no preference)
  5) site- or species-specific BSAF values

Implications:

- Tissue residue effect threshold is site independent and thus has greater certainty

- Sediment effects thresholds developed from one river system in Puget Sound, may not directly apply to other systems (i.e. site-specific inputs could change the sediment effect threshold).

Collier, Meador, and Johnson. NOAA, NMFS, NWFSC
Presentation to SMARM, Lacey, WA 5/8/01

PAH White Paper Summary

An analysis in support of a sediment threshold concentration for polycyclic aromatic hydrocarbons to protect estuarine and marine fish.

Ecotoxicology and Environmental Fish Health Program
Environmental Conservation Division, NWFSC

Goal: Determine sediment polynuclear aromatic hydrocarbons (PAH) concentrations at which biological injury of a sentinel species (English sole) is likely to occur.

Approach:

- Utilized field data from several years of monitoring along the west coast
- Based on real world exposure i.e. not laboratory studies
- No tissue residue calculations, as PAHs do not bioaccumulate in fish tissues
- Liver disease was primary effects endpoint, reproductive dysfunction and DNA damage data were used as corroboration of threshold values

Findings:

- PAH sediment effects threshold = **1000 ng/g** (ppb) dry weight

Implications:

- Minimal injury to English sole - tenuous direct applicability to salmon. Additional analysis needed to strengthen applicability to salmon
- Effect level is substantially lower than WA State Sediment Management Standards "no adverse effect" criteria, which are currently
  PAH ("heavy") = 12,000 ppb dry weight;
  PAH ("light") = 5200 ppb dry weight
- More stringent than Columbia River PAH guideline for salmon rearing habitat (2000 ppb dry weight)
- Has strong applicability to EFH groundfish consultations

Collier, Meador, and Johnson. NOAA, NMFS, NWFSC
Presentation to SMARM, Lacey, WA 5/8/01

TBT White Paper Summary

An analysis in support of a sediment quality value for tributyltin to protect prey species of juvenile salmonids listed by the Endangered Species Act.

Ecotoxicology and Environmental Fish Health Program
Environmental Conservation Division, NWFSC

Goal: Propose a sediment concentration of tributyltin (TBT) that would protect against severe effects on many, but not all, salmonid benthic prey species.

Approach:

- Utilized large dataset on adverse effects developed by USEPA and NMFS from chronic bioassays
- Bioaccumulation factors based on literature values (75th percentile)
- Direct effects on salmon expected to occur at higher sediment levels of TBT than in invertebrates

Findings:

- TBT tissue residue effect threshold = **3 μg/g** (ppm) dry weight
- TBT sediment effect threshold = **120 ng/g** (ppb) dry weight (6,000ng/g OC)
  TOC content = 2%; BSAF = 10

Implications:

- Some sublethal effects on benthic invertebrates will occur
- Sediment in several areas in Puget Sound exceed this level of exposure
- EPA and NMFS have agreed to 3 μg/g as a tissue trigger level for some applications, such as CERCLA, salmon ESA

Collier, Meador, and Johnson. NOAA, NMFS, NWFSC
Presentation to SMARM, Lacey, WA 5/8/01