PROCEEDINGS OF SCIENTIFIC AND POLICY WORKSHOPS TO INFORM THE COLUMBIA RIVER NEARSHORE BENEFICIAL USE PROJECT

MAY 2–3, 2005

PORTLAND STATE UNIVERSITY

CONVENED BY THE
INSTITUTE FOR NATURAL RESOURCES AT OREGON STATE UNIVERSITY
AND
THE LOWER COLUMBIA SOLUTIONS GROUP,
NATIONAL POLICY CONSENSUS CENTER, PORTLAND STATE UNIVERSITY

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EXECUTIVE SUMMARY

In recent years, depletion of sands in the nearshore environment along the northern Oregon and southwest Washington coasts has been documented. This erosion raises concerns about protection of economic and ecological resources in the area. The Columbia River Nearshore Beneficial Use Project was initiated by the Lower Columbia Solutions Group to engage public and private sector participants in a collaborative process to explore the use of lower Columbia River maintenance dredge material to address the depletion of natural sand volumes in the nearshore environment off the South Jetty of the Columbia River. The objective of the proposed supplementation of dredged sediments is for these sediments to rebuild the offshore sands in the project area and, over the long term, better protect the South Jetty from wave impacts.

To address scientific information needs articulated by the Nearshore Project group and share this information with decision-makers, the Institute for Natural Resources and the Lower Columbia Solutions Group convened joint workshops. The scientific workshop organized by the Institute for Natural Resources focused on scientific information about such topics as sediment migration, wave and current patterns, and biological communities in the area of interest. Discussions at the scientific workshop addressed issues such as areas of scientific agreement, research and monitoring needed to address scientific unknowns, and key indicators for assessing impacts of a nearshore beneficial use project. The science-policy workshop hosted by the Lower Columbia Solutions Group communicated findings from the scientific workshop to policymakers, resources practitioners, and interested stakeholders.

The workshops identified common themes regarding the Nearshore Project, issues requiring additional discussion or research, next steps, and important implications for the project, including:

- There is a consensus within the scientific and policy community that the problem of sand depletion in the Columbia littoral zone is real and needs to be addressed.

- One of the goals of the Columbia River Nearshore Beneficial Use Project has been to help provide long-term protection to the Columbia River jetties. However, the scientific community acknowledged that the ability to do this through deposition of dredged material remains an open question.

- As a first step, it is important to determine if "thin-layer" disposal of sand is feasible in the nearshore environment. This question will be addressed by the proposed 2005 limited demonstration project. Addressing this unknown is critical to obtaining support from some stakeholders for moving forward with the project.

- Currently, the Nearshore Project is envisioned to be a three-phase project. Phase I is a limited (i.e., approximately 30,000 cubic yards of sediment) demonstration project intended to evaluate the potential for thin-layer disposal. Phase II is a larger (i..e, approximately 150,000 cubic yards) demonstration project aimed at determining the degree and direction of sediment that is disposed and assessing biological impacts. Phase III is a full-scale (i.e., 1-2 million cubic yards per year) project that would restore sediment to the nearshore environment. It may, however, be necessary and/or desirable to have additional phases.

- Scientifically, there is still a question about sediment migration into and out of the proposed project area. In addition, more information is needed about wave and current patterns in the project area. To answer some basic questions about sediment movement in the area, the Project may require deposition of more than the 150,000 cubic yards which was previously envisioned for Phase II.

- Scientists question if it is possible to "gently fill in" the former shoals of the nearshore area without creating a "mound" that presents navigational hazards due to wave amplification. The project must use models to help determine this, and verify these models during early phases of the project. The model used to predict wave patterns should be the one that best incorporates the relevant physical processes in the proposed project area.

- From a biological perspective, there are no site-specific data on crab populations available for the proposed demonstration project area. Such site-specific information on distribution, abundance, and habitat quality is needed. In particular, it is important to know if this area is important from a reproduction or production standpoint (e.g., high abundances of female crabs), both of which have economic consequences to the fishery.

- Burial of Dungeness crab can lead to mortality, but at what thresholds and under which conditions this occurs is not clear. Studies show that younger crab may be more successful at digging out after burial. However, existing studies do not realistically mimic in-situ conditions. More research is needed on this topic.

- The Nearshore Project has the potential to enhance habitat for species such as Dungeness crab in areas that are currently of poor habitat suitability due to sediment erosion.

- The benthic community has patchy distribution in this area, and is adapted to the high-energy environment. The Nearshore Project should not have a long-term impact on the benthic community, particularly if clean sand of a similar size distribution to the native sediment is used. However, more information is needed about similarities between the dredge material to be disposed at the site and the native sediment that is present there.

- Four Endangered Species Act-listed fish species are found in the proposed demonstration project area, including large numbers of sub-yearling fall Chinook salmon. Because of the dynamic nature of the nearshore zone, fish populations inhabiting this area are largely adapted to these conditions. Studies show they are unlikely to be negatively affected by

sediment disposal, though some questions remain about impacts of turbidity on juvenile salmon.

- The innate variability of fish populations inhabiting the area will make monitoring and evaluation of disposal impacts difficult.

- Impacts to bird populations from the proposed project would be non-lethal in nature (i.e., altered foraging behavior, energy expenditure). ESA-listed marbled murrelets may be impacted if the project has a substantial negative effect on its benthic prey.

- Impacts from the Nearshore Project on marine mammals should be negligible.

- The *relative* impacts of different alternatives should be considered when evaluating impacts. For example, biological impacts to such species as Dungeness crab or salmon associated with the proposed demonstration project should be assessed relative to impacts from current dumping practices in the Mouth of the Columbia River region.

- The Nearshore Project is likely to be an iterative process, involving several steps that are designed based on information gained and lessons learned during previous phases of the project.

- A bi-state policy approach to sediment management is needed to develop a solution that is truly regional in scope. The Lower Columbia Solutions Group can help develop this regional approach, and communicate and collaborate with Pacific Northwest governors and the Congressional delegation to implement it.

This information will be used by the Nearshore Project group and its partner organizations to help increase understanding about the state of knowledge and uncertainty regarding the nearshore environment and to recommend effective policies and activities that will address concerns about resource protection in the area of interest.

OVERVIEW OF THE COLUMBIA RIVER NEARSHORE BENEFICIAL USE PROJECT AND ITS RELATIONSHIP WITH THE LOWER COLUMBIA SOLUTIONS GROUP

The Lower Columbia Solutions Group (LCSG), a collaborative group of federal, state, and local leaders, has engaged a project team to explore the use of lower Columbia River maintenance dredge material to stem the depletion of the natural sand volumes in the nearshore environment off of the South Jetty of the Columbia River.

Studies indicate that there has been a significant loss of offshore sediment to the mid-continental shelf and near shore region offshore from the Clatsop Plains, resulting in greater wave energy being focused on the south jetty and the ocean shore. The long-term objective of a proposed supplementation of dredged sediments would be to keep these sediments in the littoral zone, rebuild the offshore sands to prevent further erosion of historic habitat, and better protect the jetty from the impacts of waves coming from the southwest.

The project team has identified an iterative approach to accomplishing this objective that will involve at least two demonstration projects. *The purpose of these projects is to demonstrate and evaluate the technical feasibility, effectiveness, and environmental impacts of dispersal methods likely to be used in the longer-term efforts to mitigate the erosion of nearshore sands off the south jetty of the Columbia.*

- A small-scale (30,000 cubic yards) testing of the enhanced dumping method of dispersal, in summer 2005. The key objective of this study is to determine the feasibility of "thin-layer" dispersal of dredged sediments in the nearshore area.
- Subsequent demonstration, using larger volumes (150,000 cubic yards) to determine the degree and direction of migration of deposited sediments in the nearshore environment.
- Modeling and measurement of biological impacts and navigational safety (wave) impacts prior to any long-term, large-scale disposal of dredged sediments in the nearshore environment.

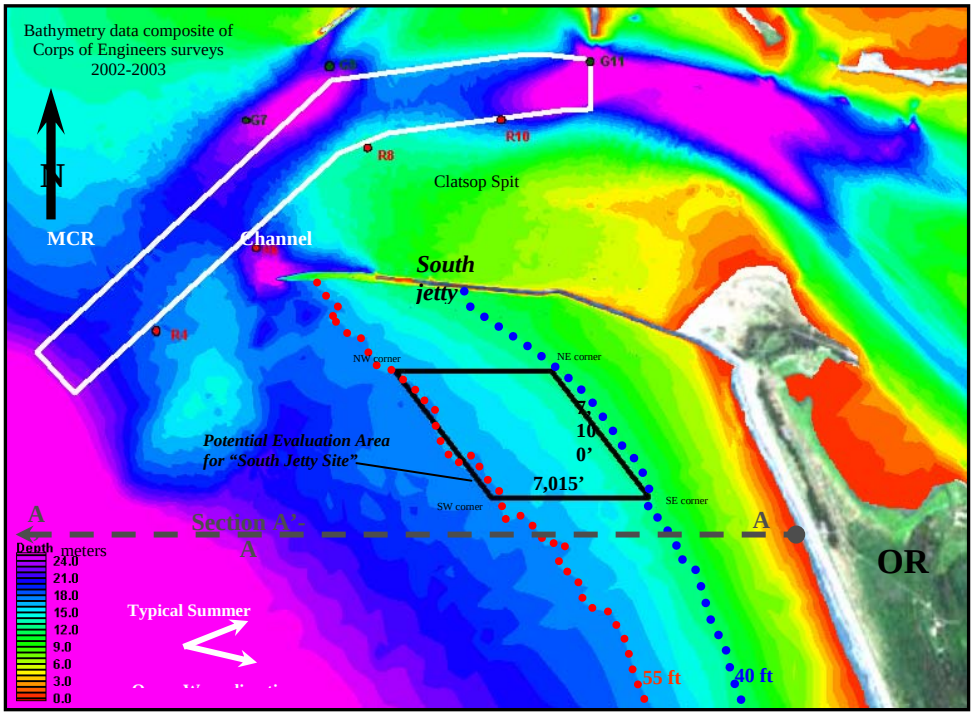

Figure 1. Location of proposed demonstration project.

The scientific community can play an important role in addressing the depletion of nearshore sands off the Oregon and Washington coasts and in answering a number of questions that have been raised about both the demonstrations and the long-term project:

1. Current and Migration Measurement
   If sand is placed in the nearshore, where will it go? An estimate of the rate and direction of sand migration in this nearshore environment is needed to know the degree to which the sand will build up and not simply migrate out to deeper water or move back into the shipping channel.

2. Navigational Safety
   For navigational considerations, it is important to understand both current wave patterns and wave-amplification impacts of a program to replenish the nearshore sands. There is not yet agreement on which wave amplification models will best serve the project.

3. Biological Impacts
   An assessment of the potential impacts from thin-layer disposal in the nearshore environment to both aquatic life and the benthic community is needed. What additional baseline information is needed to ensure proper post-placement evaluation? What actual methods should be used to monitor impacts to each biological community?

   Shellfish. Dungeness crab and razor clams are both abundant in the area, although razor clams are found closer in to shore. What are the natural conditions of the near-shore ocean bottom, and what rate of sediment accumulation can shellfish be expected to survive in this environment?

   Salmonids. What is the potential for turbidity to have impacts to juvenile salmon that may be in this area? What is the best way to evaluate the results of a demonstration project?

   Flatfish and other commercial/recreational fish species. What flatfish and other fish species are found in the area, and what concerns should we have about potential impact from this project?

   Benthic organisms. Smaller organisms living in the sediment of the nearshore environment, while likely acclimated to rapid changes in sediment from natural wave and current action, could be affected by accumulations of sediment. What is the best and most cost-effective way of measuring impacts to the benthic community?

   Marine birds and mammals. Marbled murrelets are found on the Clatsop Spit, though the Nearshore Project team understands they are not in the area when the dispersal is likely to be taking place. Brown Pelicans are in the area, and potential impacts on this species must be assessed. In addition, a number of marine mammal species have been observed in the general project area.

ROLE OF THE INSTITUTE FOR NATURAL RESOURCES

The Institute for Natural Resources (INR), based at Oregon State University, has been contracted by the Oregon Department of Land Conservation and Development's Ocean and Coastal Services Division to join the project team and provide scientific and technical support for the project. To address gaps in scientific information articulated by the Nearshore Project team, INR took the following steps:

1) Commissioned white papers from experts on topics of high importance to the Columbia Near-Shore Beneficial Use Project in order to supplement the existing literature review,
2) Convened a workshop that would synthesize information about the current state of scientific understanding, research and monitoring needs, and key indicators to assess impacts relevant to the Columbia Near-Shore Beneficial Use Project, and
3) Worked with the Lower Columbia Solutions Group (LCSG), which convened a subsequent workshop to facilitate dialogue between scientists and policymakers about the Nearshore Project and the regional sediment management.

Appendix 1 includes the agenda from the May 2, 2005 scientific workshop convened by INR. Appendix 2 lists the participants and observers who attended the 5/2 workshop. Appendix 3 provides the agenda from the May 3, 2005 science-policy workshop convened by LCSG. Appendices 1–3 are available online at http://inr.oregonstate.edu/columbia-river.html.

SCIENTIFIC WHITE PAPERS

INR commissioned six scientists with expertise in the following topic areas to author white papers:

- Sediment Migration and Wave and Current Patterns
- Dungeness Crab
- Benthic Infauna
- Marine Fishes
- Marine Birds
- Marine Mammals

These topics were identified by the Nearshore Project teams as issues of interest and concern as the group deliberates the feasibility of the nearshore demonstration project. Authors drafted preliminary versions of the white papers for presentation at the 5/2/05 scientific workshop. At the workshop and via personal communications with the authors, scientific peers provided feedback about the papers. Based on this feedback, the papers were revised and finalized. The final white papers are included in Appendix 4, which is accessible online at http://inr.oregonstate.edu/columbia_river_white_papers.html.

SUMMARY OF THE MAY 2, 2005 SCIENTIFIC WORKSHOP

Overview of the Workshop and Introduction to the Topic

Gail Achterman, INR Director, welcomed participants and observers to the workshop and noted the goal of the workshop: obtain input about the Nearshore Project from scientists representing diverse disciplines. Ms. Achterman highlighted the dual intent of the Nearshore Project, which is to determine if dredge disposal material can be placed in the nearshore environment south of the South Jetty of the Columbia River with the dual purpose of keeping sand in the littoral cell to rebuild offshore sands and reducing wave impacts to the jetty. Participants were charged with synthesizing information about the physical environment in the nearshore area off the Mouth of the Columbia River (MCR), overlaying biological information about species of concern, and helping to answer questions about design and monitoring for the project.

Framing the Issues from the Scientific Standpoint

On behalf of George Kaminsky from the Washington Department of Ecology who was scheduled to give a presentation, Dr. Giles Lesser of the U.S. Geological Survey presented an overview of erosion and sand depletion issues in the nearshore environment off MCR and along the northern Oregon and southwest Washington coasts. Key points made in the presentation include:

- The Columbia River littoral cell extends 165 km from north to south, with the Columbia River supplying most of the sand to the nearshore environment here. However, between the mid 1800s and present, the average sand supply from the Columbia River has decreased from 4.3 Mm^3/year to 1.4Mm^3/year. This reduction may be due primarily to Columbia River dams changing sediment flow downstream through a reduction of peak flows. The carrying capacity of the Columbia River has decreased by two-thirds since the dams were constructed.
- The construction of jetties has changed the dynamics of sand movement into the nearshore environment also. Before jetties were built, the rate of shoreline change in the littoral cell was low and consistent. In the first several decades after jetty construction, accretion spiked along the shore directly adjacent to MCR. However, in recent decades, the areas adjacent to MCR have been eroding rapidly in comparison with pre-jetty rates. The sand balance in the MCR region (taking into account dredging activities to maintain navigability of the shipping channel) is estimated to be -3.9 Mcy/year.
- The coasts and inner-shelf adjacent to the Columbia River are undergoing substantial chronic erosion. Where some of the sand is moving to remains an open question.

See http://www.inr.oregonstate.edu/download/lesser_kaminsky.pdf to review the Powerpoint slides from this presentation.

Framing the Issues from the Policy Standpoint

Steve Greenwood, facilitator of the Nearshore Project team, provided an overview presentation about the Columbia River Nearshore Beneficial Use Project. Key points made in the presentation include:

- The objective of the Project is to explore use of a nearshore dredge disposal site for maintenance dredge material from the Columbia River to mitigate erosion of nearshore sands off the South Jetty. If successful, the Project aims also to better protect the jetty from wave energy through the restoration of nearshore sand.
- The proposal demonstration project area is within 1 mile of the jetty in 40–70 feet of water. Phase I of the demonstration project, which is scheduled for summer 2005, will test the feasibility of thin-layer disposal of sediment to reduce impacts to the biological (and especially benthic) community.
- The Project was initiated as part of the Lower Columbia Solutions Group process, which is a bi-state, collaborative effort to look at dredged material management.
- The Project has proposed an idea for how to address the chronic erosion problem off Clatsop Plains. The team now needs scientific input to inform the project and identify gaps in information that affect Project design, monitoring, etc.

See http://www.inr.oregonstate.edu/download/greenwood.pdf to review the Powerpoint slides from this presentation.

White Paper Presentations and Discussion

Sediment Migration and Wave and Current Patterns

Dr. Daniel Cox and Dr. Tuba Özkan-Haller of Oregon State University gave a presentation about waves, currents, and sediment at the MCR based on observations and modeling. Key points made in the presentation include:

- The Columbia River jetties are built on spits, which are dynamic and unstable. Following construction of the jetties, accretion occurred. However, in the last several decades, erosion rates have increased dramatically, with Benson Beach eroding 2,000 feet since 1939.
- The Southwest Washington Coastal Erosion Study provides a geographically relevant and up-to-date assessment of the sediment-transport pathways in the area of interest. The net sediment transport patterns north of MCR are fairly consistent in a northerly direction. Sediment transport south of MCR is less consistent, with some movement observed in multiple directions (e.g., southerly, northerly, and inshore). Thus, the question of where sand placed in the demonstration project area would move remains an open one.
- The National Data Buoy Center offers a very reliable, long-term dataset for offshore waves and currents. Yet, comparable data for the nearshore environment are not available. This information is needed to develop a prediction of wave climate which then can be used to determine sediment movement.
- A study by the Army Corps of Engineers used short deployments to collect wave and current data at MCR. Data suggest that the change of seabed elevation can be fairly substantial even at offshore sites. The change is even more pronounced closer to shore, where wave heights and bottom currents increase.
- It is important to consider how incident surface gravity waves interact with both tidal- and wave-induced circulation to result in morphological changes to the seabed.

- A number of different process, including shoaling, refraction, and diffraction, occur in nature. Models, however, cannot take all of these processes into account when predicting how an area will respond to forces. For example, monochromatic wave models assume that the wave field is made up of one component, thus they provide a more conservative estimate of responses such as wave amplification. When selecting a predictive model, it is important to think about which processes are most prevalent.
- Point measurements are a good starting point for model validation, but synoptic measurements of a larger region are needed to differentiate the appropriateness of multiple models.

See http://www.inr.oregonstate.edu/download/cox_ozkan-haller.pdf to review the Powerpoint slides from this presentation.

Following the presentation, several questions were posed:

1) Are there seasonal differences in the magnitude and directional movement of sand, especially relevant to winter storms? The presenters responded that wave depth will have a major influence on this, and that interannual and decadal differences must be considered also.
2) Can the available body of literature about how to create berms to minimize refraction or diffraction be applied here? The presenters responded that the information is not directly transferable. While such information, along with models, can help deign the shape of a mound, a project such as this must be groundtruthed.

Dungeness Crab

Dr. Walter Pearson of the Pacific Northwest National Laboratory presented information about Dungeness crab that is relevant to the Nearshore Project. Key points made in the presentation include:

- Areas of scientific agreement include life history of Dungeness crab and distribution and abundance information (although site-specific data for the proposed demonstration project area is not available). In addition, scientists agree that the Columbia River estuary is incredibly important for crab production.
- Distribution and abundance of Dungeness in the ocean is variable by location and by depth. For example, Age 0+ crab are especially dominant at 40-feet depth relative to shallower depths. This is important because younger crab can move more readily than larger ones, and thereby can escape more readily.
- Issues associated with disposal that could negatively impact crab include surge (i.e., the dynamic collapse and spreading of sediment)—about which little is known—and burial. More information is needed about the potential for these processes to impact crabs. Existing studies have two shortcomings: 1) surge currents have not been simulated, and 2) the small containers used in laboratory tests do not allow an escape response.

- Before deciding the location of the demonstration project, the presence and abundance of crab should be assessed for a larger area, and hot spots for Dungeness should be avoided.
- A tiered monitoring approach highlights the need for more physical data about waves, currents, and sediment transport before delving into substantial data collection about the biological community.

See http://www.inr.oregonstate.edu/download/pearson.pdf to review the Powerpoint slides from this presentation.

Following the presentation, several questions were posed:

1) Crabs need sand, and vibracores are finding that the nearshore area is eroding down to mud? What depth of sand is needed? The presenter responded that crabs need 4 inches of sand for burial, and that they prefer sand to mud.
2) Is the project proposed to occur during a critical stage in the crab life cycle? The presenter responded that if the project occurs in September, most of the adult crabs (which are female) would be inshore and that one-quarter of these would be soft-shell.
3) How does the proposed enhanced dumping affect surge currents? The presenter responded that there would still be an effect, but that specific impacts would depend on disposal logistics such as how quickly the hopper doors are opened, adhesion of the dredge material, etc.
4) Are extreme perturbations to crab populations in the proposed demonstration project area important in the larger fishery context? The presenter responded that no research has been done in this area, so it is impossible to estimate specifics. However, given the size of the area proposed, which is small, the potential impact could be extrapolated from that and is expected to be low.

Benthic Infauna

Gary Braun of TetraTech EC, Inc. made a presentation about benthic infauna (including razor clams) that is relevant to the Nearshore Project. Key points from the presentation include:

- Benthic communities along the northern Oregon coast are similar to those found elsewhere in the Pacific Northwest. The community is dominated by species that are adapted to a highly dynamic environment. The community found south of the South Jetty has been consistent in terms of community composition over many years, especially when compared to MCR sites. This difference is likely due to differences in flow, nutrients, and other factors associated with the river. Variability in abundances of species is high regardless of location.
- While monitoring has been done in the past in the general project area, no site-specific analysis on the inshore monitoring stations has been completed. If there are particular species of interest to the Nearshore Project, these analyses could be completed.
- Ninety percent of the razor clam fishery in Oregon occurs along an 18-mile stretch of Clatsop Beach. This species is abundant on surf-pounded beaches, to which individuals settle in late summer.
- Regarding potential impacts of disposal, the scale and magnitude of sediment disposal may exceed that of natural occurrences. While potential impacts such as burial and smothering are often considered as decimating the entire benthic community, this may not in fact be the case. Such impacts would likely affect sedentary species more than burrowers.

- Research that assessed the effect of disposal at Experimental Site G in 25-30 meters of water found that after disposal (thickness of sediment disposed was 1.5 meters and material was slightly coarser than native sediment), species diversity and evenness was higher, but species abundances remained lower for 10 months following disposal.
- One study regarding potential impacts to razor clams suggests that sediment comprising 2.2% or more clays can negatively affect the species.
- Tiered monitoring would focus on obtaining additional information about the physical environment, then use a methodology such as Sediment Profile Imagery (SPI) to obtain biological information.

See http://www.inr.oregonstate.edu/download/braun.pdf to review the Powerpoint slides from this presentation.

Following the presentation, one question was posed:

1) Accretion episodes on an annual basis and extreme events associated with earthquakes occur and species survive. Will the disposal have an impact? The presenter responded that the difference is instantaneous placement of sediment.

Marine Fishes

Dr. William Pearcy, Professor Emeritus at Oregon State University, presented information about marine fishes that is relevant to the Nearshore Project. Key points made in the presentation include:

- From shore to 20-40 meters water depth, the substrate is almost entirely sand along the northern Oregon coast. Here, 11 species make up 95% of the research-trawl catches.
- Monitoring shows that there is a very complex situation in terms of what species are found where (i.e., spatial and temporal significance for species presence).
- A study of the impact of disposal on fishes showed that species diversity and size of fishes was significantly different at the disposal site, but the fish community recovered in 8 months. Long-term effects of 2 Mcy of disposed sediment could not be detected.
- Species that may be impacted the most include English sole and starry flounder, which come inshore to spawn. In addition, juveniles of these species are found inshore in summer months, suggesting that these waters are used as nursery areas. In addition, a number of salmonids are found in the proposed demonstration project area. Of greatest concern is the subyearling fall Chinook salmon. Potential effects on species such as shad and sturgeon should be considered also.
- Fish species inhabiting the area likely are adapted to this high-energy environment, suggesting that impacts would be minimal.

See http://www.inr.oregonstate.edu/download/pearcy.pdf to review the Powerpoint slides from this presentation.

Following the presentation, two questions were posed:

1) What about sand lance? The presenter responded that the species is abundant in estuary. However, they have not been abundant in nearshore samples, likely because they can escape the trawl net or burrow into the sand.

2) What are the potential effects of turbidity? The presenter responded that turbidity could affect all pelagic species. If the sand disposed is clean, turbidity should be low. Otherwise, turbidity could affect migration or even clog gills.

Marine Birds

Craig Strong of Crescent Coastal Research made a presentation about marine birds that is relevant to the Nearshore Project. Key points from the presentation include:

- A few species—specifically, common murre and surf scoter—dominated the observation taken during many surveys.
- Composition of the marine bird assemblage and ranking of species based on frequency of observations was consistent across surveys, regardless of the timing and water depth of the surveys. However, abundances observed during the surveys was not comparable.
- Several species have the potential to be affected by the proposed demonstration project. During a 6–8-week period in the summer (May–August), adult male and fledging common murres are at sea and flightless. The species could be susceptible to impacts during this time; however, it is expected that they would evade disturbance by swimming. Brown pelicans, which are listed under the Endangered Species Act, are abundant in the general project area in spring and summer. Both marbled murrelet (another ESA-listed species) and pigeon guillemot show preference for habitats directly adjacent to the jetties.
- Potential impacts to marine birds from the proposed demonstration project include 1) displacement, 2) turbidity effects on feeding, and 3) smothering of prey. The amount of turbidity depends on grain size and the percentage of fine sediment in the dredge material. Regarding turbidity, the possibility exists that turbidity actually could benefit marine birds by concealing them from prey, but this is not well studied. Little is known about the effect of prey smothering from dredge disposal. This impact could affect species such as pelagic cormorant, pigeon guillemot, scoters, and marbled murrelet.
- Proposed monitoring would include physical monitoring of such parameters as turbidity, and vessel- and shore-based surveys of marine birds.

See http://www.inr.oregonstate.edu/download/strong.pdf to review the Powerpoint slides from this presentation.

Following the presentation, two questions were posed:

1) Given the available information about sediment characteristics of the dredge material, is there a threshold in terms of grain size that raises concerns about impacts to seabirds? The presenter responded that the important issue is how long the sediment remains in the water column. In his opinion, an increase in turbidity during the course of just one day suggests a minor impact to birds. Access to turbidity data from the Army Corps of Engineers is desirable.
2) Is there a substantial amount of interannual variability in species abundances? The presenter responded that there is relatively low interannual variability in abundances measured during alongshore transects. In some years, large flights of alcids northward occur. Presumably, these birds are escaping effects of El Niño/Southern Oscillation to the ocean environment.

Marine Mammals

Jan Hodder of the University of Oregon's Oregon Institute of Marine Biology presented information about marine fishes that is relevant to the Nearshore Project. Key points made in the presentation include:

- The predominant pinniped species in the proposed demonstration project area are harbor seals and California and Steller sea lions. None of these species are found in abundance in the project area during late summer/early fall. Harbor seals are found in the Desdemona Sands portion of the Columbia River estuary and farther south along Tillamook Head. Both species of sea lions use the South Jetty as a haul out.
- Surveys of cetaceans in the general project area are limited (as is the case with pinnipeds also). Predominant cetaceans include gray whale and harbor porpoise, although these species typically are found farther offshore. There is no evidence of estuary feeding by these species, nor is the proposed project area known as a whale watching "hot spot" along the Oregon coast.
- Potential effects on marine mammals include 1) disturbance by vessel traffic and 2) turbidity effects on feeding behavior. These effects are expected to be minimal, though, because the energy spent relocating is negligible relative to normal movement patterns of these species. Regarding impacts on feeding behavior, some information is available about diets of harbor seals, while little is known about food preferences of both species of sea lions.
- Proposed monitoring would include assessing the disturbance of marine mammals hauled out on the South Jetty from the dredge. Presence/absence surveys of species are not useful because marine mammals very rarely are found in the project area.

See http://www.inr.oregonstate.edu/download/hodder.pdf to review the Powerpoint slides from this presentation.

Charge to Disciplinary Breakout Groups

Participants were divided into four disciplinary breakout groups:

- Sediment Migration and Wave and Current Patterns
- Dungeness Crab
- Benthic Infauna
- Marine Fishes, Birds, and Mammals

Gail Achterman described the charge to the breakout groups. The groups were asked to discuss the level of scientific agreement (and possibly scientific certainty) associated with information presented in the topical white papers and presentations, consider how this information can be used to inform decision-making (e.g., demonstration project design, regional sediment management, etc.), identify research and monitoring needs that will address information gaps, and suggest possible indicators that would determine positive or negative environmental thresholds associated with the demonstration project.

Presentation and Plenary Discussion of Breakout Group Findings

Sediment Migration and Wave and Current Patterns

The group expressed consensus that the long-term trend of nearshore erosion is a significant problem. They also agreed that the Project's objective of keeping sand in the littoral sand is a positive and worthwhile effort. The challenge is how to do this while minimizing wave amplification that could pose a navigational hazard. Because wave amplification is caused by mounding, models can help assess the potential for this problem.

Important questions:

1) What is the sediment flux through MCR? This information is important for considering the long-term sustainability not only of the demonstration project, but of regional sediment management.
2) What are the sediment dispersal paths and rates? For example, will the sediment move back into the channel, toward the beach, or offshore?
3) What is the grain size of the native sediment at the disposal site and of the dredge sediment that will be disposed?

Information gaps:

1) Publications and data from the Army Corps of Engineers can shed light on the sediment flux question.
2) While there is a considerable body of knowledge about what is happening at large scales of time and space, comparable information about such parameters as currents and sediment transport is not available for the proposed demonstration project site.
3) There is debate about how much sediment is needed for Phase II, the full-scale demonstration project. While some scientists said that 150,000 cy is sufficient, others said a larger volume of sand is needed to determine where the sand is moving and if it can have a beneficial effect.
4) Opportunities exist to learn from similar projects, such as the Ocean Beach dredge disposal monitoring that is being conducted by the U.S. Geological Survey and the California State University, Monterey Bay Sea Floor Mapping Lab during summer 2005.

Next steps needed to fill information gaps:

1) Characterize waves, currents, and sediment transport medium scales of space and time
2) Characterize bathymetry
3) Collect wave and current data to use for calibrating trusted models we trust
4) Use modeling and observations to provide guidance about what a reasonable volume of sediment is to start with
5) Obtain groundtruthing data
6) Analyze existing data reports from the Army Corps regarding sediment flux through MCR

Summary:

Physical monitoring and project design need to be an iterative process. First, data should be analyzed, and results from these analyses should inform design of demonstration project. The demonstration project is likely to be more than a three-step process. Instead, rather than scaling from 150,000 cy to 1 million cy of sediment, it likely makes more sense to take smaller steps and continue learning from these in a way that is useful in project design.

Dungeness Crab

Important questions and next steps needed to fill information gaps:

The group identified a number of important questions and associated research needs.

1) There is very little data available about crab use, crab habitat, etc. for the proposed demonstration project area. The following steps are needed: a) conduct a survey of the physical habitat and obtain a better understanding of physical features such as wave and current patterns in the area; b) if the habitat is found to be poor for crabs, subsequent disposal is acceptable OK; c) however, if the habitat is found to be good for crabs, a full analysis is needed (see below). Ideally, the physical habitat survey would be conducted before ANY disposal occurs at the site.
2) While no biological sampling is scheduled for the summer 2005 limited demonstration project, this is not a concern because of the small size of the project. However, for Phase 2, which proposes to dispose ~150,000 cy of sediment, the following steps are needed: a) distribution and abundance data and population structure data at and away from the proposed site; b) assessment of impacts such as surge currents and burial associated with the disposal event (burial is most important potential impact); c) a prediction of long-term effects from the demonstration project; d) assessment of the relative value of the site from the biological (e.g., reproduction and production) and economic (e.g., fisheries) standpoint as compared with other locations in the region and with existing disposal sites; e) Determination of the rate of crab recolonization; and f) assessment of long-term effects on catch rates or navigability at the site.
3) In order to assess impacts of burial, experiments are needed for various ages, sizes, and molt stages of crabs. These experiments will monitor behavior of crabs when exposed to differing degrees of burial.
4) It is important to acknowledge that studies conducted at one scale of disposal (e.g., 150,000 cy) may not enable prediction for another scale (e.g., 1 million cy).

Summary:

1) Filling the aforementioned information gaps is important to accurately identifying negative impacts and placing these impacts into perspective (e.g., relative to existing disposal sites) so that an analysis of impacts can be used to select the best policy option. Ultimately, the preferred policy option would accomplish project objectives while minimizing negative impacts by selecting the best alternative from a series of options. Key indicators include catch per unit effort using experimental fish and modified gear, and female crab abundance determined by surveys.

Benthic Infauna

Key points from white paper:

1) Distribution of benthic species is inherently patchy and variable.
2) The paper provides a good general characterization of species composing the community.
3) Benthos are adapted to a high-energy environment.
4) Some effect to the community is expected following disposal, but this will not necessarily have a long-term negative impact. The time frame of recovery is variable depending on project-specific details such as thickness of material disposed, timing, etc.
5) Measurement of the physical environment is important. The use of sediment profile imaging (SPI) is suggested as a proxy for the physical environment.

Important questions:

1) It is important to know the sediment characteristics of the material to be disposed and that at the disposal site. (According to the Army Corps of Engineers, the dredge sediment is 98.6% sand and 1.4% fines.) Can native sediment be differentiated from dredge material? Is the material being disposed similar to the native sediment?
2) Is thin-layer disposal possible?
3) Is there a more effective method and/or location for the proposed project that would retain sediment in the nearshore?
4) Regarding the benthic infauna, what is the baseline condition of the benthic condition? (Ideally, this would be assessed before the 2005 limited demonstration project.)
5) Also regarding infauna, does the benthos recover and over what time frame?
6) Will the project have an impact on razor clam populations? The potential impact will largely hinge on the demonstration site location (i.e., is it near production "hot spots" for the species) and the demonstration project design.

Additional information to inform the Nearshore Project process:

1) Ninety percent of razor clam fishery is along an 18-mile stretch of beach inshore of the project area.
2) Oregon Department of Fish and Wildlife (ODFW) has annual monitoring of razor clams underway that could help assess impacts to this species.
3) To minimize the impact, sediment disposed should be clean sand as similar to the native sediment as possible.
4) Additional disturbance from full-scale demonstration project (i.e., 150,000 cy) is unlikely to be severe because the community is adapted to a high-energy environment.
5) Regarding razor clam biology, most of the available information about spawning is anecdotal, and little to no information is available regarding the larval stage of this species.

Summary:

1) To maximize knowledge gained from the limited demonstration project in 2005, use SPI to assess the physical setting. Ideally, these surveys would be conducted before and after disposal, but if resources are limited, a post-disposal survey is critical. This information will enable learning from earlier phases before scaling up to a large-scale, long-term project. It also will assess the feasibility of thin-layer disposal.

2) Baseline conditions for razor clam populations should be documented. Benthic samples can be collected and archived for later analysis if resources are limited. Monitoring of razor clam populations by ODFW should continue. In addition to biological monitoring, ODFW could expand their surveys to measure slope and grain size on beaches with abundant razor clams.

Marine Fishes, Birds, and Mammals

Key points from the marine fishes white paper:

1) The white paper provides good information about distribution and abundance of species. A few species dominant the fish community in the general project area.
2) Both pelagic and demersal fish are important inhabitants of the nearshore environment.
3) A high amount of seasonal and spatial variability exists among fish populations here.
4) Pelagic species—especially subyearling Chinook salmon—are vulnerable to turbidity. Juvenile fish may be more vulnerable to such impacts because they spend more time close to shore.
5) Because demersal species exhibit more site fidelity, they may be vulnerable to impacts.
6) Bias of sampling gear may result in past surveys not catching all of the species that inhabit the area.
7) Impact assessment is very difficult because of the existing variability in fish populations.

Key points from the marine birds white paper:

1) The white paper includes good information about distribution and abundance, and useful suggestions for a monitoring plan. There is a low abundance of birds in the project area relative to other coastal areas in Oregon and Washington. A few species dominate the bird community.
2) There is high seasonal variability in bird populations.
3) Some species, such as common murres during flightless times, are more vulnerable than others.
4) Two Endangered Species Act-listed species inhabit the proposed project area, and these should be accounted for.

Key points from the marine mammals white paper:

1) Only a few mammal species are relevant to considering impacts of the proposed demonstration project. One species that must be considered is Steller sea lion, which is listed as threatened.
2) The likelihood of impact is low.
3) Marine mammals here already are exposed to vehicle traffic through MCR.

Important questions:

1) The scale of the proposed demonstration project, including the method of disposal and potential implications of this, was discussed at length by the breakout group. The group noted the importance of knowing if the sediments are contaminated, either by toxins or by fine sediment.
2) Sediment characterization of the dredge material by the Army Corps of Engineers shows that the composition is 98.6% sand and 1.4% fines. This would indicate that turbidity should

not be a major concern, but the group thinks it is important to consider and account for any potential impacts from turbidity. There may be a role for laboratory experiments to assess turbidity level and persistence.

3) Also, the group highlighted the need to consider the scale of interference relative to the scale of habitat use by these animals.
4) Funding is critical for needed studies/monitoring.
5) The impact of no action must be considered also.

Monitoring needed:

1) Regarding physical monitoring, sediment grabs can be taken for information about composition of native sediment.
2) Regarding biological monitoring, it is important to determine the metric that can be used for decision-making (e.g., reduction in population size, growth rate, abundance, etc.).
3) Monitoring recommendations for fish: a) Perform a power analysis to determine number of samples needed to document an effect; b) Flatfish are most feasible for monitoring because they are place-based and potentially vulnerable); and c) A new LIDAR technique is available that can show fish underwater. (NOAA and Oregon Sea Grant are funding LIDAR surveys along the Oregon coast in summer 2005.)
4) Recommendations for birds: a) Monitoring is feasible and has a reasonable likelihood of detecting impacts; and b) Seabird foraging may serve as a surrogate for monitoring schooling fish.
5) Recommendations for mammals: a) Limited monitoring of mammal presence could be integrated into seabirds monitoring; and b) Full-scale monitoring is not feasible given the large areas over which these species venture.

Summary:

1) The limited demonstration project that is proposed for summer 2005 will not assess biological impacts. While this may be acceptable at the scale of 30,000 cy of sediment, impacts will change with scale of project. In addition, it is important to consider how the demonstration project interacts/influences the scale of natural disturbance in the project area.
2) To determine what is monitored and the scale of monitoring that is needed, it is important to consider the different scales that are proposed during the course of this multi-year project. The costs and complexity of monitoring will increase as the project is scaled up, thus monitoring needs must be prioritized.
3) It is important to pick metrics for impact assessment that are appropriate to scale of project. The limited demonstration project is so small that it will be difficult to measure any effects. Yet, the third phase of the project, which could dispose of >1 million cy of sediment annually, is undefined at this point, but could have substantial impacts in terms of intensity and spatial area effected. Thus, the group recommends that in terms of monitoring impacts to fish, birds, and mammals, the intermediate phase (which would dispose ~150,000 cy of sediment) should be the emphasis.
4) Design of a monitoring process and associated protocols is a critical next step.

Synthesis of the Workshop

Gail Achterman provided a synthesis of the workshop. She noted that for each of the topics of interest to the Nearshore Project team, themes and possible next steps from a scientific perspective had been identified. Important themes from the workshop include agreement from the scientific community that sand depletion and erosion south of the South Jetty is a serious problem that is escalating in severity. The scientists also agreed that the objective of the Nearshore Project—retaining and restoring sediment to the nearshore littoral environment—is worthwhile.

Examples of high-priority information needs include a better understanding of wave, current, and sediment transport patterns in the proposed demonstration project area, which would complement information that is currently available about the larger MCR area. The workshop also identified lower-priority actions, such as detailed monitoring for impacts to such animals as seabirds, based on scientific advice regarding the potential for impacts to various species. This collection of information can help guide the team as the Project activities move forward.

Outcomes from the workshop include both next steps by INR and LCSG and associated products: 1) A debrief with white paper authors and breakout group facilitators would occur immediately to compile information from the workshop for presentation to decision-makers; 2) A science-policy workshop will occur on May 3rd, 2005 at which the scientific findings and key messages from the 5/2 workshop will be presented to decision-makers; 3) A proceedings document from both workshops will be published on the INR website to provide documentation of important science- and policy-relevant information to inform the Nearshore Project's future deliberations about demonstration project design and monitoring.

SUMMARY OF MAY 3, 2005 SCIENCE-POLICY WORKSHOP

Welcome and Overview of the Workshop Objectives

Louise Solliday, Oregon Governor's Natural Resource Office, welcomed participants to the workshop on behalf of Oregon's Governor, and emphasized the purpose of the day's session: bringing policy-makers and scientists together to inform policy choices for the nearshore area off the Mouth of the Columbia River (MCR).

Framing the Issues

Nearshore Sand Depletion

Jonathan Allan, a geologist with the Oregon Department of Geology and Mineral Industries, presented an overview of nearshore sand depletion issues. Highlights of his presentation include:

- The Columbia River is the primary source of sediment (sand) in the 165 km shoreline of the Columbia littoral cell. The contribution of sand from the Columbia has decreased from about 4.3 million cubic meters per year prior to jetty construction to about 1.4 million cubic meters per year today.
- Factors in the reduction of Columbia River sediment include the jetties, the construction of 11 major and more than 200 smaller dams, pile dike construction, and dredging practices. In addition to literally holding back sediment, the dams have affected sediment supply to the nearshore area by reducing peak flows – the spring freshet discharge is now half the volume it once was.
- Jetty construction in 1885 began to change the historical sand distribution in the littoral cell. Significant erosion took place in the near shore area between the 1870's and the 1930's. That erosion has continued in subsequent decades, and has now spread both northward and to the beaches along Clatsop Spit and Peacock Spit.
- The nearshore sediment shoals were a major source of supply of sand to the beaches on Clatsop Spit, but now that this supply has severely eroded, we can expect a significant impact on the beaches (and the south jetty itself), including some private property. The result will be an increase and deepening of the erosion, and this deepening will itself increase the erosion of the beaches.

The Nearshore Beneficial Use Project

Steve Greenwood, project facilitator, provided an overview of the Nearshore Beneficial Use project. He explained that the intent of the project is to utilize dredged sediments to replenish the eroded sands in the near-shore area. This area includes ocean depths of from 35 to 70 feet, approximately one mile from shore. Highlights from the presentation:

- The Lower Columbia Solutions Group, a bi-state group formed to collaboratively address sediment management issues in the lower Columbia, formed a Nearshore Project team in fall of 2003.

- This is a collaborative project, involving several agencies and levels of government, as well as key players from the private sector, making it distinct from a more standard Corps of Engineers Project (though the Corps will play an important role). The Oregon Department of Land Conservation and Development's Coastal Management Program has been the major sponsor and instigator of the project thus far.
- The project team has designed a 3-phased, iterative approach to the project:

  Phase I – A very limited (30,000 cubic yards) demonstration of "enhanced dumping", designed to result in a very thin layer of sediment deposited on the ocean-bottom. This demonstration is intended to help the project team evaluate this technique, and if successful, assist in the design assumptions for future project phases.

  Phase II – A larger (150,000 cubic yards) demonstration involving a small (3-ft) berm to determine the degree and direction of migration of deposited sediments in the near-shore environment. In addition, at this stage, there would be modeling and measurement of biological impacts and navigational safety (wave) impacts.

  Phase III – Full-scale (1-2 million cubic yards per year) project implementation, dispersing material in the near-shore environment and building it up over time.
- The science/policy questions that remain to be answered prior to full-scale implementation are:
  a) Is this even doable, i.e. if we put the sand in the near-shore area at 35-70 ft depth, will it remain in place or will it migrate out of the littoral zone?
  b) Can it be done without creating a navigational hazard due to wave amplification?
  c) How do we minimize impacts on biological communities, particularly commercial and threatened or endangered species?

Recap of the Day 1 Scientific Workshop and Charge for Day 2 Workshop Participants

Gail Achterman, Director of the Institute for Natural Resources at Oregon State University, provided a brief summary of the outcome of the previous day.

- There is a consensus in the scientific community that erosion in the Columbia nearshore area is a real and growing problem, and that keeping sand in the littoral system should be an important policy objective.
- The method and specifics of *how* we keep that sand in the littoral zone, particularly in the use of dredged sands for that purpose, could potentially have social impacts (e.g. impacts to Dungeness crabs-an important commercial species, and navigational hazards caused by wave amplification) as well as environmental impacts on fish, shellfish, birds, mammals, and benthic organisms.
- While there is good data about the general area of the Columbia littoral zone, we will need to invest additional resources in evaluating and monitoring the nearshore project area, as there is little site-specific data on that area.

Susan Brody, staff for the Lower Columbia Solutions Group, presented the charge for Day 2 of the Science-Policy Workshop: Take the scientific findings from Day 1 and explore the policy ramifications for the Nearshore Beneficial Use Project and sediment management at the mouth of the Columbia.

White Paper Presentations and Summary of Breakout Group Findings
For each topic, the technical white paper authors presented a condensed version of their white paper findings, followed by an overview of the technical "peer review" discussions of Day 1.

Sediment Migration & Wave/Current Patterns
Dan Cox, Oregon State University's O.H. Hinsdale Wave Research Laboratory, described the sediment migration patterns documented over the last few decades.

- Currents in the mouth of the Columbia are complex, with sediment migration generally to the north, though some "excursions" south along the Clatsop plain
- We are losing sediment in the nearshore area. Over 2000 feet of beach have been lost at Benson Beach on Peacock Spit in Washington, near the North Jetty of the Columbia.
- If you lose the shoals, you lose protection for the jetties.
- There is still an open question about which way the sand migrates in the project area (one mile off the south jetty, approximately 40–70 ft depth). We don't have the kind of information on waves and currents in the project area that we need.

Tuba Ozkan-Haller, Oregon State University, described wave formation:

- Through the processes of "diffraction" and "refraction" shoals (or man-made berms) can focus wave energy like a lens focuses light.
- The model used to predict wave patterns should be the one that best incorporates the relevant physical processes, such as refraction or diffraction. A "spectral" rather than monochromatic model will likely be probably more effective for the nearshore area.
- After choosing a wave model and calibrating it for the area, the model should be validated through empirical observation.

Steve Greenwood, Nearshore Beneficial Use project facilitator, gave an overview of the previous day's discussion. Key points of agreement include:

- The problem of erosion is real and significant.
- Need to keep sand in littoral zone.
- We know about and agree on big-picture sediment transport.
- However, we don't understand sediment transport in project area itself
- An iterative process is needed: there likely will need to be more intermediate steps (in addition to 150K phase II)
- Creating a mound CAN create amplification (not necessarily to the extent of being a navigational hazard, but must use models to help determine this).

The remaining scientific questions fall into three categories:

Basic Goal:

- Are the geologic trends simply too big for the Nearshore project to have any impact?
- Can supplementing sediment in the nearshore area really reduce wave energy on the South Jetty? Can that be done without creating a navigational hazard?
- Should we be looking, long-term, at upstream sources of the sediment supply to the nearshore environment?

Strategic Issues:

- Will sand dispersed in the nearshore area stay there? Or, will it all go out to deeper water or even simply back into the channel? (i.e. do we need to put the material closer in to the beach itself?)
- If the next step, beyond the 2005 Demonstration, is to answer some basic questions about sediment movement in that area, will 150,00 cubic yards be enough? (Answer: probably not)
- Can we "gently fill in" the former shoals of the nearshore area, without creating a "mound" that presents navigational hazards due to wave amplification?

Implementation Issues/Problems:

- 150,000 cubic yards is not enough for Phase II, but monitoring of sediment transport will be difficult in any case, as the natural processes are quite complex, our models are not as good, and it is difficult to distinguish movement of project sands from other sands.
- Time (temporal considerations) may be important in any monitoring. Should the monitoring of sediment changes be done over a one-month, one-year, or 5-year period?

Benthic Infauna

Gary Braun, TetraTech EC, Inc., presented information about the benthic organisms in the nearshore environment.

- Benthic communities along the Oregon and Washington coasts are quite similar. These species are adapted to high-energy environments (waves, sediment movement).
- Several studies show similar patterns: greater variability and abundance just west of the MCR than in south jetty area.
- Razor clams exist primarily in the -2 to +3 tidal range. Razor clams are rapid vertical burrowers, but laterally restricted. The nearshore project material is not expected to be silty, but if it were, studies show it could have an impact on razor clams.
- Project impacts to the benthic community will depend upon the quality and quantity of material dispersed. If the material is similar to existing material, mortality will be low, and recovery will be more rapid.

Dan Ayres, Washington Department of Fish and Wildlife, presented a summary of the Day 1 discussion:

- The group mostly agreed with Gary Braun's presentation. The Nearshore project should not have a long-term impact on the benthic community.
- What is well-understood: a) the benthic community has patchy distribution in this area, and b) the benthic community is adapted to the high-energy environment.
- What is not well-understood: a) Is the project dredged material similar to the sediment found at the project site? b) Impact to razor clams of dispersal at that depth.
- To minimize project impacts, disperse clean sand

- Monitoring recommendations: 1) Use Sediment Profile Imagery both pre- and post-dispersal to monitor impacts to the benthic community; 2) Archive benthic samples in the project area; 3) Monitor impacts to razor clams on an ongoing basis

Dungeness Crab

Walt Pearson, Pacific Northwest National Laboratory, gave a summary of his white paper findings:

- We know quite a bit about Dungeness crab life history, and general information about the ocean and estuary crab.
- There is "incredible variability" in crab population and distribution from year to year and place to place.
- There are no site-specific data on crab population for the Nearshore project site. We need more site-specific information on distribution, abundance, and habitat. In particular, we need to know if this is an area of high female crab population.
- There are a number of possible impacts from the project to crab populations; including burial, surge currents, and bait odor problems. The bait odor problem appears very unlikely.
- Burial can lead to mortality, but under what conditions is not clear. Studies show that younger crab may be more successful at digging out after burial. The problem is: previous studies do not really mimic in-situ conditions and opportunities for escape.

Dale Blanton, Oregon Department of Land Conservation and Development, summarized the policy implications of the Day 1 scientific discussion:

- We need more site-specific information on Dungeness crab, by age class, sex, and condition. We need to assess the value of the project site (biological, economic, and social).
- The project could possibly be an enhancer of crab habitat, if the area is currently poor habitat due to sediment erosion.
- Surge current impacts to crab, while a possibility, should be less of a concern if "enhanced" (thin-layer) dumping is used.
- Policy-makers should look at the net impacts to crab, i.e. comparing impacts to current sediment dumping sites. Question: should we be looking at other alternatives, such as direct beach nourishment?
- Monitoring of impacts is important for all three project phases. A question: Will studies at one phase really enable prediction at the next phase?
- Likely to be *some* crab mortality. The question is how much and how quickly will populations recover?

Marine Fish, Birds, and Mammals

Bill Pearcy, Oregon State University, provided a summary of his white paper on fishes in the near-shore environment.

- Two varieties of fish found in the area: benthic (bottom) fish and pelagic fish. Eleven species account for 95% of the catch in fish trawl studies. Sand sole, Starry Flounder, and English Sole are the bottom fish species that dominate the northern Oregon coastline. There is considerable variability of findings, however, depending upon time and location.

- Four Endangered Species Act-listed species are found in the area. Large numbers of sub-yearling Chinook inhabit these nearshore waters.
- Dynamic shifts in fish populations will make monitoring and evaluation of dumping impacts extremely difficult.
- Because of the dynamic nature of the nearshore zone (wave action, turbidity, sediment movement) fish populations inhabiting this area are adaptive to these conditions, and studies show they are unlikely to be negatively affected by sediment disposal.
- To the extent that there is greater turbidity, salmon may swim closer to the surface to avoid the turbidity and thus be more subject to predation by birds.

Craig Strong, Crescent Coastal Research, presented a summary of his white paper on Marine Birds in the nearshore environment off the MCR.

- Common Murre and Surf Scoters are the dominant bird species found in the several bird surveys that have been done for the south jetty area.
- Brown Pelicans (a listed species) become very common in the study area in the summer through the fall.
- Marbled Murrelet, another listed species, is also found in the area.
- Impacts to bird populations from the proposed project would be non-lethal (foraging, energy expenditure). There would be a possible impact to Marbled Murrelet if there is an impact on benthic prey.
- We can use the project to monitor and examine impacts (positive or negative) of increased turbidity. Monitoring would include both vessel surveys and shore surveys.

Jan Hodder, University of Oregon, presented an overview of marine mammals found in the proximity of the project area.

- Pinnipeds: Harbor Seals are found in the Desdemona Sands area of the Columbia Estuary. California Sea Lions are found at the South Jetty itself. Their lowest numbers are in the summer months.
- Cetaceans: Gray Whales and Harbor Porpoises have been seen near the project area, but are usually found much further offshore.
- Impacts from the project on marine mammals should be "negligible".

Greg McMurray, Oregon Department of Land Conservation and Development, summarized the Day 1 discussion on Fish, Birds, and Mammals.

- There were no major disagreements with the scientific white papers.
- Fish: There are a few dominant species, and we have good information on distribution. However, there is great seasonal and spatial variability, making monitoring of project impacts difficult. Pelagic fish, such as salmon, may be more vulnerable to turbidity from dumping.
- Marine birds: We have good information on distribution. This is an area of generally low abundance. While some species, those more habitat-specific such as Brown Pelican or Marbled Murrelet, will be more vulnerable to impacts from the project, actual impacts from the project are expected to be low.
- Marine Mammals: Likelihood of project impacts is quite low.

- Overall: Major questions which will need to be answered through monitoring of the demonstration projects: 1) Are juvenile fish more vulnerable to impacts from the project? 2) Is turbidity a major issue or not?
- Monitoring recommendations: 1) Perform analysis of existing samples; 2) Flatfish most feasible for monitoring; 3) New LIDAR technology may be helpful; 4) Supplement monitoring with lab experiments
- Need to compare *net* impacts of project to impacts of current disposal practices.

Plenary Discussion and Synthesis

Louise Solliday, Oregon Governor's Natural Resource Office, led a discussion of the group about the themes, issues requiring additional discussion and/or research, and next steps. The discussion and synthesis drew upon information from both the scientific workshop and the science-policy workshop.

Commonalities and Shared Themes from the Workshop Discussions:

1) It is important to keep sand in the nearshore area. Depletion of sand is a critical issue for the jetty and for beaches.
2) It is important to determine if "thin-layer" deposition of sand is possible, through the proposed 2005 demonstration project.
3) There exists the possible need for more phases of the project than the three that have been proposed. Findings from one phase should be used to shape the design of subsequent phases.
4) Collecting baseline information about the demonstration project site is important.
5) The *relative* impacts of alternatives should be considered when evaluating the impacts of potential solutions.
6) Developing a monitoring plan is an important next step in designing the larger demonstration.

Issues for Further Discussion:

1) Deposition of material may itself change waves, through mounding. More information about this is needed.
2) A key policy issue: Can sand management be done in a way that supports jetty preservation?
3) Beach preservation is also important.
4) Are there other, more effective ways to track sediment (e.g., marking)?
5) Material should go into the Deep-Water Site as last alternative.
6) Concern exists about least-cost calculation used by the Army Corps of Engineers. Rather than short-term calculations only, the process should be interpreted to consider the long term.
7) Core sampling and sediment profile imaging (i.e., using cameras) should be considered to look at benthic infauna.
8) How long will it take for crab sites to recover? (Site B is unlikely to recover.)
9) How much can you learn from monitoring when crabs are so mobile?

10) Sand will become a commodity in the future. Is this the most strategic placement of sediment to restore sand to beaches? The Project may need to look at opportunities for beach placement of material.

Next Steps:

1) The results of the scientific and science-policy workshops will be summarized and distributed by the end of this month to participants and other decision-makers. They will also be available on the Institute for Natural Resources website (http://inr.oregonstate.edu).
2) The Columbia Nearshore Project Team will meet in the next month to discuss the outcome of the workshop and its implications for the project.
3) The Lower Columbia Solutions Group will also discuss the implications of the workshop and the white papers at their next meeting in June.
4) A bi-state policy conversation is needed about how regional sediment management is going to happen over the long term. The Nearshore Project cannot continue a piecemeal approach to this problem. The solution has to be truly regional in scope. If the project can get to that point, it may be able to come up with creative methods of funding. LCSG members are perfectly positioned to do this.
5) A unified approach to solving this problem must be developed and then communicated to decision-maker. The approach would recognize the problem of nearshore sand depletion, identifies what the consequences are of not addressing this, and articulates how to address, monitor, and pay for implementation of a solution. Once this unified approach is refined, it needs to be taken not only to Governors' offices, but also to the Congressional delegation and administrators of federal agencies (beyond the Army Corps of Engineers). The region should not wait to react, which would place people in a crisis situation of needing to repair a breach (as has happened in Coos Bay). Instead, the project team can be proactive, and LCSG can facilitate and/or spearhead this.
6) The Corps' least-cost policy must be dealt with. Questions persist about who will pay the incremental cost over and above the current disposal costs in order to get the sand closer to shore.

IMPLICATIONS FOR THE COLUMBIA RIVER NEARSHORE BENEFICIAL USE PROJECT

Several issues were identified that have implications for the Nearshore Project. This information will be used by the Nearshore Project group and its partner organizations to help guide future activities aimed at addressing concerns about resource protection in the nearshore environment south of the MCR.

- There is agreement that the problem of sand depletion needs to be addressed.
- The ultimate goal of the project needs to be clarified (i.e., South Jetty protection specifically and/or nearshore disposal more broadly). The goal will affect the design of the project. By trying to accomplish both, does the project risk not accomplishing anything?
- The sequence and objectives of the project are clear: testing thin-layer feasibility in high-energy environment for limited demonstration in 2005, and assessing where the disposed sand is going using a larger scale test in the future.
- Phase I has great importance in terms of perceptions about moving forward for some of the stakeholders
- The workshops will help in designing monitoring plans.
- With no biological monitoring during 2005, is the project obtaining as much information as possible. The decision to conduct no biological monitoring of the limited demonstration project was decided because of 1) financial constraints and 2) the team not having enough time to put together a monitoring plan to track where the sand goes.
- How do you decide if thin-layer disposal is successful? The current monitoring proposal includes sediment accumulation basins inside and outside of project area to measure accumulation depths and multi-beam bathymetric surveys to determine if a mound is created. Sediment profile imaging (SPI) was proposed, but may not be able to measure accumulations >6–8 inches. More information about the capability and cost of this technology is needed.
- Thin-layer disposal may not work. If it does not, will the project team consider an alternative approach?
- This year, timing of the demonstration project is driven by crabbing season. However, in the future, coastal engineers should advise the project team about the most appropriate timing to maximize chances of achieving the project goals. The current timing raises concerns with salmon, but regulators may be willing to work around this if benefits are maximized by conducting the demonstration project during this time.
- The design of Phase II (i.e., the phase following the 2005 limited demonstration project) needs to be rethought.
- It is important to make clear to policymakers that this project is an *experiment*.
- New technologies are available to help with monitoring that can provide information more cost effectively. However, application of these technologies has associated financial requirements, so it is important to convince policymakers to make investments on this front.
- There may be implications for the Nearshore Project if the Corps' budget shrinks.

- Some lessons have been learned from the Benson Beach project. The Nearshore Project is at the stage where the Benson Beach project was several years back. They also encountered resistance to Phase I focused on the issue of why is more than just testing feasibility of an approach/technology not being done. However, once this happened, they were able to move forward, but one step at a time and with tremendous resources.