APPLICATIONS OF THE REGIONAL SEDIMENT MANAGEMENT APPROACH

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ABSTRACT

There is growing interest in developing and applying integrated approaches to managing sediment in order to better address the multiple interrelated economic and environmental objectives involving or affecting this resource. The regional sediment management (RSM) approach is evolving through the efforts to coordinate, integrate and leverage sediment-related programs, activities, and policies on at both project (local) and strategic levels. This approach integrates working with natural processes to accomplish better sediment management across a region. The understanding of sediment systems provides a context for managing projects and activities involving sediments. It recognizes sediment as a resource that is integral to economic and environmental vitality. Stakeholder teams identify inter-related sediment resource needs and opportunities, and collaboratively leverage programs, data, information and other resources to carryout activities, projects and programs that balance sediment-related objectives over time. The US Army Corps of Engineers launched its application of the RSM approach by integrating the knowledge of sediment system processes and budgets to inform project level decisions resulting in more effective and efficient plans, designs and operations. Additional benefits were realized through improved coordination among projects and activities interrelated through a given sediment system. The growing appreciation for using system approaches in addressing interrelated water resource issues has resulted in strategic level RSM initiatives to address sediment resource issues in regions that span connected watershed and coastal sediment systems. The resulting RSM plans, developed collaboratively by federal, state, local agencies and other stakeholders, are tailored to the regional needs, priorities, and opportunities. These plans integrate the management of sediment resources, including dredged material, into the context of regional strategies, to be implemented by a range of stakeholders and funding sources, depending upon the plan. This paper presents examples of current RSM management strategies and applications in a range of settings and scales.

Keywords: Dredged material management, beneficial use, collaborative planning, working with nature, sediment management plans.

INTRODUCTION

Over the last decade there has been renewed and increased emphasis on using “system” and “integrated” approaches to water resources development and management. There is also a growing appreciation for the need to manage sediment as a resource, and integral to a broad range of watershed, coastal and marine management objectives.

Sediment is a resource, much like water is a resource. As with water, quantity, quality and timing of movement are fundamental management challenges, complicated by competing objectives and associated demands. Similarly, shortages or over abundance can result from both natural processes and human activities. Additionally, like water, sediment movement is:

- along gradients from upstream to downstream in channels or over land flow,
- through the surface into underground streams or aquifers
- currents and waves along the shore, on and off shore in coastal zones

The management of both sediment and water resources involve or is affected by many agencies and stakeholders.

Many human activities affect sediment systems and sediment resources, yet most individuals and organizations do not see themselves as “sediment managers,” and may not recognize the effects on their actions on sediment “systems.” Sediment management activities can be described as actions that affect the transport, erosion, removal, & deposition of sediment in a region. Examples include:

- Dredging and placement of dredged material
- Structures that divert, trap or impound sediment

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- Changes in flows that result in erosion or deposition
- Erosion protection structures or methods for riverbanks, shorelines, sea beds, and channel bottoms
- Habitat stabilization and restoration measures
- Sand and gravel mining (in rivers and off shore) for construction or other purposes

Regional approaches to sediment management approaches are emerging as ways to more effectively and efficiently address the range of sediment issues, needs and opportunities in different regions around the country and through different scales of activities and strategies. The regional sediment management approach is helping to facilitate integrated management of sediment resources in order to better address the multiple interrelated economic and environmental objectives involving or affecting sediment. Regional Sediment Management (RSM) is a system-based approach for collaboratively addressing interrelated sediment issues within a regional context that integrates knowledge of sediment systems and processes. The RSM approach facilitates economically and environmentally balanced and sustainable solutions to managing sediments. Stakeholders identify inter-related sediment resource needs and opportunities, and collaboratively leverage programs, data, information and other resources to address them in efforts to balance sediment-related objectives over time. This approach is evolving from localized implementation, to larger scale, strategic applications involving multiple agency and levels of government, and stakeholders.

DREDGING AND THE RSM APPROACH

Dredging activities are carried out to accomplish a broad range of objectives, and may be components of large and small scale projects. Rather than thinking of dredging as the project itself, when developing RSM strategies, it is useful to think of dredging as a management measure or as a component of a management measure in support of regional objectives, some of which involve sediment. For example, dredging may be under taken for the purposes of:

- Maintaining the depth and with of a navigation channel, waterway.
- Obtaining material for shore protection
- Obtaining material to protect or restore habitat (e.g. beaches, barrier islands, wetlands)
- Restoring storage capacity of a reservoir or storm water detention pond/lake
- Altering/restoring hydraulic characteristics or hydrologic connectivity of a system
- Altering the substrate characteristics, elevation, chemical quality, etc.
- Sand and gravel mining for shoreline protection or beach nourishment
- Mining for mineral extraction
- Mining for commercial construction or fill material
- Removal of contaminated sediments for the specific purpose of reducing the exposure of aquatic life and humans to contaminants and/or to prevent the spread of contaminants to other areas of the water body.

These practices have often not explicitly considered regional sediment processes and associated effects on the broader management or development objectives, and implications over time. Recently, however, there has been growing interest the mutual integration of watershed and dredged material management and other navigation concerns (NDT -2006).

INITIAL RSM APPLICATIONS

The US Army Corps of Engineers launched its application of the RSM approach by integrating the knowledge of sediment system processes and budgets into project level analysis and decisions, resulting in more effective and efficient plans, designs and operations. Additional benefits have been realized through improved coordination among projects and activities interrelated through a given sediment system. The growing appreciation for using system approaches in addressing interrelated issues has resulted in strategic level RSM initiatives to address sediment resource issues in regions that span connected watershed and coastal sediment systems. These regional plans provide strategies for leveraging a range of partner and stakeholder resources and capabilities in implementing the recommendations developed in each. The Corps is participating in these efforts which are often lead by other agencies, a state or regional commission. This section presents examples of a number of the RSM applications at these different scales. The information presented does not include a comprehensive summary for m each of these examples. Rather it represents selected attributes and experiences which may be of interest to the conference participants and readers, representing but small insights into the diverse initiatives being undertaken in each.

In October 1999, the USACE, Mobile District initiated the Northern Gulf of Mexico RSM Program. The goal of the initiative was to change the paradigm of project-specific management to use of a regional approach in which the Corps as well as state and local agencies, stopped managing projects and begin "managing the sediment", and therefore taking a systems approach to management. The objectives of the Mobile District RSM Program were:

- Implement Regional Sediment Management Practices;
- Improve Economic Performance by Linking Projects;
- Development of New Engineering Techniques to Optimize/Conserve Sediment;
- Determine Bureaucratic Obstacles to Regional Sediment Management; and
- Manage in Concert with the Environment.

Benefits identified by the Mobile District RSM team include: improved communication and relationships within the organization and with Federal, state, and local agencies ,academia and the public; improved District planning and management practices; increased participation from project sponsors; improved data, technical tools; improved understanding of regional processes and therefore management decisions; improved storm damage reduction, navigation, and recreational areas; and habitat restoration.

In 2000, the Corps initiated a National RSM Demonstration Program to facilitate the integration of this approach into its Civil Works programs, projects and activities. Participants were to scope its application to needs and opportunities in their region and identify impediments and innovations in its application, and share technology, information and lessons learned. The program was originally designed as a series of coastal regional sediment management demonstrations, but the application has extended into the river systems. Initial challenges included using the available technologies (tools and models) to predict regional consequences of local sediment management actions, along with policy and institutional constraints. Initially, six Corps District offices were tasked with implementing RSM sediment management concepts as a part of their business practices and relevant projects. Today's network of Corps RSM practitioners spans over 20 offices.

Initial project-level RSM applications included:

- Coordinating the availability and placement of maintenance dredging material with storm damage reduction, habitat restoration and other beach nourishment
- Coordination that resulted in reduced mobilization and demobilization costs
- Using ebb shoals a sources of material for restoration to storm damage reduction and contributing to maintaining navigation
- Stockpiling dredged material for future use, instead of "losing material from system"
- Use knowledge of system processes to inform alternative placement sites
- By-passing and back passing
- Accomplishing habitat restoration w/"emergency dredging" materials

Benefits of integrating the RSM approach at these levels include: cost savings from reduced rehandling of material, extended dredging cycles, sharing equipment to reduce mobilization and demobilization costs, sharing information for regional analyses, and avoided duplication of data collection. Other benefits result from improved sediment regimes due to reintroduction of sediment into "sand starved" littoral systems, reducing the requirement for beach nourishment and sustaining habitat for threatened and endangered species. Framework for shared regional-scale data management systems, models, and other tools have been put in place to improve project-level decisions and help achieve greater consistency in analytical results among studies and projects within a region. Improvements in interagency and stakeholder relationships have resulted in opportunities for collaboratively leveraging financial and manpower resources in data collection and analysis, tool development, project implementation, along with collaboration and coordination that streamline regulatory processes.

The partnerships developed through integration of the RSM approach have contributed to reducing the time necessary to accomplish regulatory and environmental compliance requirements for habitat restoration projects. In several instances the time to accomplish these requirements was reduced by a year or more, saving approximately $100,000-200,000 in labor costs at the districts, and beneficial use sediment management activities were able to be scheduled in concert with the navigation dredging schedule.

As an example, when Hurricane Ivan struck the Alabama Gulf Coast (reaching a Category 5 level and causing 91 fatalities and $18.7 billion in damages), the surge significantly eroded nearby beaches as well as choking hundreds

of thousands of sediment into the Perdido Pass Inlet. The collaborative partnerships with the US Fish & Wildlife Service and the State of Alabama that had been formed through RSM, expedited environmental compliance requirements, enabling habitat restoration to be accomplished coincident with the emergency dredging of the navigation channel. The team was able to coordinate, obtain environmental clearances, and construct the project in less than three months. Prior to the RSM partnership, the restoration project may have taken two years.

DREDGED MATERIAL MANAGEMENT PLANS

The Corps conducts dredged material management planning for all Federal harbor projects to ensure that maintenance dredging activities are performed in an environmentally acceptable manner, use sound engineering techniques, are economically warranted, and that sufficient confined disposal facilities are available for at least the next 20 years. These plans address dredging needs, disposal capabilities, capacities of disposal areas, environmental compliance requirements, potential for beneficial usage of dredged material and indicators of continued economic justification. The Dredged Material Management Plans (DMMPs) are to be updated periodically to identify any potentially changed conditions (USACE, 2000).

These planning efforts can assess the merits of linking dredging projects in a region with one another, and with beneficial use opportunities. They can also help integrate the contemporary knowledge of the regional sediment system into decisions affecting the project and sediment management in a region over the longer term. Information about the regional littoral and fluvial sediment processes can be useful for siting of placement/disposal areas, and anticipating site life expectancy. Regional sediment management planning enhance overall dredge material management through matching regional sediment needs and opportunities, watershed sediment management to foster sustainable sediment loads to waterways and navigation channels, coordinate dredging in a sediment system/region, and help address competing and complimentary sediment management needs in region.

DMMPs can also identify and examine opportunities to achieve savings through coordinating projects and economies of scale, opportunities for beneficial use, and other opportunities to contribute to coastal watershed goals in a region that are related to sediment management. While DMMPs are to be developed for all projects, they can also be developed for multiple projects within a region. They can consider may be able to integrate relevant sediment management opportunities and priorities in a region, including those identified in watershed studies or other comprehensive studies.

Application of “life cycle analysis” can enhance opportunities for cost savings and achieving other benefits in connection with dredging and dredged material management. The DMMP's appear to be an appropriate vehicle for conducting "life cycle analysis" for dredged material management, and in doing this analysis helping to identify potential efficiencies and other benefits that could be gained by regional approaches to sediment management.

GULF OF MEXICO REGION SEDIMENT MANAGEMENT MASTER PLAN

The Gulf of Mexico Alliance was formed around a shared vision for a healthy and resilient Gulf of Mexico coast by the Gulf states of Alabama, Florida, Louisiana, Mississippi, and Texas, and support from thirteen federal agencies. The *Governors' Action Plans (2006 and 2009)* outline six priority areas, two of which identify the need for integrated strategies for improved sediment management in the region. In response to this, efforts are underway to develop a Gulf Region Sediment Management Master Plan, that will support both the habitat conservation and restoration priorities as well as those related to coastal community resilience. Initial efforts included the development of a technical framework document to help inform and guide more detailed components of the GRSMMP.

The Alliance partners identified sediment resources as critical in accomplishing many of the GOMA conservation and restoration initiatives and objectives, as well as a number of the coastal community protection and resiliency goals. They identified the need for a comprehensive understanding of regional sediment systems and processes. Further, a GRSMMP would help in using the understanding of sediment dynamics (inputs, outputs, movement) to manage sediment resources in the context of environmental restoration, conservation, and preservation, while reducing coastal erosion, storm damages, and associated costs of sediment management. The plan will provide an inventory of potential sediment sources, along with sediment needs; assess competing needs for sediment; develop

regional strategies that facilitate cooperation among stakeholders; and enhance abilities to make informed, cooperative management decisions.

Include in this technical framework document is material on: the Gulf setting and processes, sediment resources (including offshore and dredged materials), ecological considerations associated with dredging and sediment management, conservation and restoration objectives relative to sediment management, fostering shared information, and policies, authorities and funding relevant to the GRSMMP. Among the next steps for developing the GRSMMP is to examine the framework information at sub-regional levels with the Gulf to more specifically define sediment management needs, opportunities and priorities.

REGIONAL SEDIMENT MANAGEMENT AT THE MOUTH OF THE COLUMBIA RIVER

The RSM approach is being implemented to understand and reconcile a range of interconnected sediment management issues at the Mouth of the Columbia River (MCR), between the States of Washington and Oregon. In January 2008, the Lower Columbia Solutions Group[2] signed a Declaration of Cooperation to initiate work on a Regional Sediment Management Plan (RSMP) for the lower Columbia River to maximize regional benefits (economic, social and environmental) and reduce regional costs associated with dredging activities.
The goals for the plan and the planning process are:

- To develop a comprehensive regional sediment management plan that is consistent with laws and regulations to guide agency decisions on the removal and placement of sediment in a manner that balances competing needs for sediment resources in the river system and associated coastal littoral cells.
- To improve and utilize scientific understanding of sediment processes including a refined sediment budget, as well as current management practices, and beneficial use opportunities, as a foundation for the plan.
- To maximize the beneficial use of sediments for societal uses, while minimizing adverse impacts on biological resources and providing for safe navigation.
- To develop the community, administrative, regulatory, scientific, economic and logistical support needed to implement the plan.

An important consideration in achieving these goals is the need to improve and maintain a functional, safe navigation system in the lower Columbia River and support water-dependent development in a manner that protects environmental quality.

Work has been initiated to develop a recommended Regional Sediment Management Plan for management of dredged materials at the mouth of the Columbia River that will identify potential new nearshore or on-shore beneficial use disposal sites in Oregon and Washington. The new sites will be designed to restore sediment in the littoral zone and help protect nearshore fishery habitats, coastal beaches and the Columbia River jetties from erosion. The sites will provide sustainable long-term alternatives to deep water disposal of sediment and will be adaptively managed to avoid and minimize adverse environmental, resource and safety effects (LCSG).

GALVESTON BAY PROGRAMMATIC SEDIMENT MANAGEMENT PLAN

The development of a Programmatic Sediment Management Plan has been initiated for Galveston Bay, Texas. The product will serve as a m*anagement strategy for sediment resources in the region.* The effort includes identification of sediment pathways, and current management practices to facilitate understanding of the sediment system and relevant effects of and on sediment management activities in the future. The roles *responsibilities and authorities* of agencies and stakeholders in region are also being identified. A sediment needs and opportunities list will be developed, and the plan will also help p*rioritize RSM projects, strategies, cooperative* efforts, and identify constraints. It will examine existing confined disposal facilities as sediment sources for ecosystem restoration. Beneficial use opportunities from private dredging will also be examined. The effort will examine life-cycle costs to

[2] The Lower Columbia Solutions Group is a bi-state partnership convened by the governors of Oregon and Washington as a forum for nearly 30 local, state and federal stakeholders to raise issues, collaborate on policy, and develop solutions for sediment management in the lower Columbia River. The LCSG includes representatives from local, state and federal government, crabbing and fishing interests, coastal communities and conservation groups.

help inform dredged material management and potential beneficial use opportunities. A dredged material marketing program will be explored.

LONG ISLAND COASTAL PLANNING PROJECT

Efforts are underway to integrate the RSM approach to accomplish more effective sediment management on Long Island, New York. The Atlantic (south) Coast of Long Island, is a varied shoreline spanning a demographic range from heavily developed New York City, more to pristine barrier island and back-bay habitats. Geomorphic features include six ocean inlets, three significant bays, glacial till bluffs, sandy barrier islands, tidal marshes, and more. Dredging activities in inlets, creeks, and harbors are essential to regional navigation and the regional economy, yet dredging occurs primarily on a project-by-project basis. Placement of suitable dredged material on adjacent shorelines and beach fill from offshore and upland sources are integral to shore management, and like these efforts have traditionally been managed as individual projects. Both dredging and fill placement activities are carried out by local, state, and Federal interests in the region.

Regional awareness has been growing regarding the interconnectivity between dredging and fill placement projects, and of the systemic implications in sediment management activities. However, challenges remain in moving from the focus on individual projects, to a truly regional understanding of impacts from individual projects, and managing accordingly. Opportunities for improved regional sediment management hinge on developing effective advance communication of sediment supplies from dredging activities and needs for sediment throughout the area. This project will help improve the collection and availability of sediment process data, and facilitate cooperation among federal and non-federal interests.

The project will integrate the "Long Island Sediment Needs Assessment" involving all inlets, interior navigation channels and harbors on the south shore of Long Island - Federal (including the Department of Interior and US Coast Guard), and non-Federal activities. The Long Island sediment needs assessment will help connect supplies and demands for sediment in the area. Ultimate goals include providing sediment where needed at lower cost to end users, using sediment more effectively within and between Corps projects, keeping sediment in the system, improving the ability to manage sediment resources effectively, and expanding available disposal locations for channel maintenance projects. A GIS tool will be used to help illustrate the locations of dredging operations, volumes removed and placed, and frequency of operations. Information will be compiled on dredging and placement activities by all levels of government and private concerns to define current practices to inform future practices. Potential stockpile locations, sediment suitability information, and stakeholders and other information will be included. This information will be compiled visually in a map-based GIS format that will be readily accessible to users.

RSM AND WATERSHED MANAGEMENT

In its 2002 Action Agenda, the National Dredging team emphasized the need to strengthen and accelerate RSM, particularly in the context of watershed management and planning (National Dredging Team 2002). Coordination between estuary programs and navigation stakeholders can help accomplish this and produce results that are complimentary and synergistic. Estuary programs are adaptive community-based programs, that use a watershed focus, use science to inform decision-making, emphasize collaborative problem solving, and involve the public. They can facilitate involvement with stakeholders key to a number of sediment issues related to but typically addressed separately from managing navigation channels and dredged material. In at least one instance, an estuary program has produced an RSM plan – the New York-New Jersey Harbor Estuary Program Regional Sediment Management Plan. This initiative is described below. There are other initiatives underway involving partnerships with estuary programs to meld collaborative approaches to addressing regional sediment resource needs and opportunities (.e.g. the Mobile Bay Watershed RSM Initiative – in partnership with the Mobile Bay National Estuary Program, and the Delaware River Estuary RSM Plan, recently initiated with the Partnership for the Delaware Estuary).

NEW YORK-NEW JERSEY HARBOR ESTUARY PROGRAM RSM PLAN

The New York-New Jersey Harbor Estuary Program provides a forum to develop and implement actions for improving the health of the Estuary by convening a partnership of interested stakeholders, using sound science in

analyzing issues, and working to carry out recommendations that are environmentally and economically responsible. Among the goals in the programs' Action Plan is to "support an economically and ecologically viable estuary and port." More specifically, "The Port of New York and New Jersey will be an integral and complementary part of the world-class NY-NJ Harbor Estuary that is environmentally sustainable, economically efficient, and safe for commercial and recreational navigation." (NJ-NJ HEP, 2008).

A Regional Sediment Management Work Group was formed in 2005, and was charged with a vision that: "Sediments of the New York-New Jersey Harbor will support and sustain both a healthy ecosystem, including sensitive life stages, and a robust regional economy. Sediments will be managed as a resource to achieve this vision." The Workgroup, composed of representatives of a variety of federal, state, and local agencies and non-government public interest groups was formed as an ad hoc committee to develop a plan for an RSM Program that integrates sediment management activities for the Harbor Estuary.

The RSM Plan initiates a proactive, long-term, regional management perspective that spans state lines to coordinate various stakeholders involved in sediment management in the 13,600 square mile watershed, in order to control sources of sediment and contaminants, reduce dredging needs and impacts, promote beneficial use of dredged material, link dredging to brownfields and economic development, and restore a healthy ecosystem. Rather than a localized issue, the RSM plan acknowledges sediment management in the Harbor Estuary as a regional issue that can only be successfully implemented as a joint effort between federal, state, and local entities and the public. The RSM plan moves sediment management from the historically localized, "end of the pipe" approach, to one that considers the watershed, broader interrelated sediment resource needs, and provides a policy and regulatory framework required to improve sediment management throughout the Harbor Estuary. The Estuary program has helped improve public understanding of the interconnection of the streams in the upper parts of the watershed, and meaningful management of sediment in the estuary.

The plan has three major components: sediment quality, sediment quantity, and dredged material management. White papers written early in the process helped identify issues and concerns regarding these three themes. Information and ideas on these topics evolved through Workgroup discussions and later were expanded upon and integrated into the challenges, status and recommended actions included RSM Plan. The RSM presents eight objectives (listed below) and 45 recommended actions, which represent the consensus of the Workgroup members and states that they need to be considered in their entirety.

The New York- New Jersey Harbor Estuary Program RSM Objectives include:

- Sediment Quality
  - Ensure new sediments are clean
  - Ensure new sediments entering the Harbor Estuary system remain clean
  - Reduce direct exposure
  - Reduce transport of contaminants to other areas
- Sediment Quantity
  - Ensure sufficient sediment to support healthy ecosystem processes
  - Reduce sediment deposition in shipping channels/berths
- Dredged Material
  - Improve dredging operations
  - Improve dredged material management

The plan also presents recommendations for implementing an RSM program. This includes discussion of the general management structure, and an issue resolution process. It identifies critical involvement needed from the states to overcome institutional and organizational barriers, and full engagement of the public in the decision-making processes. The plan recognizes that meaningful public involvement promotes stewardship and creates the political support necessary to ensure that sediment issues, which affect the health and economy of the Harbor Estuary, become a high priority.

CALIFORNIA'S COMPREHENSIVE APPROACH TO RSM

In California, a broad set of partnerships and initiatives are underway to define the complex array of sediment management issues, to develop information and tools critical to improved sediment management along the state's entire coast and in related watersheds, and to identify priorities for action. These efforts also include recommendations for on the institutional and governance infrastructure necessary to address these priorities, and alternative ways to finance implementation of the recommended actions.

These efforts are being lead by a California Coastal Sediment Management Workgroup (CSMW). This group is developing a Sediment Master Plan (SMP) which is supporting and guiding the development of more detailed regional Coastal Regional Sediment Management (CSRSM) plans (CSMW 2006).

The California Coastal Sediment Management Workgroup is a collaborative effort by federal, state, and local agencies and non-governmental organizations working to address California's coastal sediment management needs on a regional and system-wide basis. The workgroup's mission is to: *Conserve, restore, and protect California's coastal resources by developing and facilitating regional approaches to managing sediment.*

Their goals are: *To reduce shoreline erosion and coastal storm damages; restore and protect beaches and other coastal environments by restoring natural sediment supply from rivers, impoundments and other sources to the coast; and optimize the use of sediment from ports, harbors, and other opportunistic sources.*

The Natural Resources Agency and the US Army Corps of Engineers jointly chair the workgroup. Nine state agencies, two other federal agencies, and two non-government organizations are members of the CSMW. Funding for these efforts was initiated with a grant from the National Oceanic and Atmospheric Administration Coastal Impact Assistance Program administered by the Natural Resources Agency of California. The Corps and the State of California have provided subsequent funding.

California Coastal Sediment Master Plan**.** The CSMW is facilitating implementation of RSM throughout the entire California Coast, through a multi-year effort to compile a California Coastal Sediment Master Plan (SMP). The SMP is an ongoing, collaborative effort to evaluate California's coastal sediment management needs and promote regional, system-wide solutions. It is intended to provide an integrated approach to sediment management that enables agencies to work together to leverage financial and intellectual resources. Initial SMP efforts focused on compiling and developing informational products or tools of state-wide utility that address the major concerns related to coastal regional sediment management. Numerous products have been made available and others are underway. Among the SMP initial efforts were:

- Identification of critical coastal erosion areas
- Identification of potential sources of sediment to replace or restore lost sediment (e.g., ports/harbors, wetlands, coastal dams and debris basins, offshore sediment sources),
- Examination of the governmental frameworks (policies, procedures and regulations) concerning sediment management,
- Assessment of the natural and biological systems involved with or affected by sediment management
- Fostering team building between agencies with disparate missions and objectives, and
- Contributing to the scientific database regarding issues related to sediment management.

Tools, information and resource documents along with the RSM strategies developed to date, along with annual status reports are available through on the CSMW website: *http://www.dbw.ca.gov/csmw/* .

The objectives of the SMP are to:

- Promote the use of RSM strategies to address problems caused by sediment imbalances.
- Support implementation of the California Ocean Protection Council (COPC) Strategic Plan.
- Develop an adaptive plan to meet current and future needs of coastal sediment managers.
- Identify and then help to prioritize critical coastal erosion and sediment accretion areas.
  Provide resource managers informational tools and techniques to assist their decision making.
- Facilitate and coordinate beach and coastal watershed efforts with federal, state, local and public stakeholders.
- Collaborate with regulatory agencies to provide a consistent permit framework for coastal sediment projects.

- Demonstrate the value of sediment as a coastal resource for habitat, recreation, shoreline protection, and economics.
- Support requests for funding from local/regional authorities and eliminate inefficient use of public funds.
- Foster the beneficial use of sediment dredged from ports, harbors, wetlands, and other sources.

When completed, the SMP will be a compilation of tools, strategies and informational documents designed to assist and guide sediment managers and others in implementing RSM throughout the California Coast. These products include:

Educational and Informational Reports:
• Beach Restoration Regulatory Guide
• Development of Sand Budgets for California's Major Littoral Cells
• Sources, Dispersal and Fate of Fine Sediment supplied to Coastal California
• Littoral Cells, Sand Budgets and Beaches

Computer-Based Tools:
• Web-based Spatial Data Mapping Tool
• Augmented spatial database
• Coastal Sediment References Searchable Database
• CSMW Website Enhancements

Regionally-based Coastal RSM Plans.(A series of Coastal RSM Plans addressing regional and local characteristics, issues and opportunities.)
• Southern Monterey Bay
• Ventura and Santa Barbara Counties
• San Diego County
(Others are underway)

The region-specific Coastal RSM Plans and Programs. Recognizing the diverse nature of the California coast, the CSMW is supporting the development of a series of Coastal Regional Sediment Management Plans that are targeted to sub-regions of the coast. Technical and political boundaries (e.g., littoral cells and counties) provide a basis for the regional efforts. These plans are developing regionally relevant policy and guidance to address their specific sediment issues, needs and opportunities. These regional efforts have access to the reports, data, educational and informational tools developed and compiled by the Statewide Master Plan (CSMW, 2006), as well as region-specific geographic, economic, environmental and societal data and input. Local and regional governments and all stakeholders are being invited to participate in these efforts to find consensus on regional plan projects and opportunities.

These Regional Coastal RSM Planning efforts include:
- Defining the regional frameworks (i.e., littoral cell boundaries, sediment budgets, and regional regulatory jurisdiction),
- Examining the human activities that have altered coastal sediment supply and transport,
- Identifying priority areas within each region for implementation activities,
- Identifying opportunities to restore sediment balance throughout the affected region through modifications to the sediment transport processes,
- Identification of issues that may impede implementing these opportunities and tools to address these issues in an environmentally responsible manner,
- Identification of alternatives for funding incremental costs associated with implementing RSM,
- Educating concerned stakeholders on the value of sediment and need for RSM,
- Recognizing the need to use non-traditional sources of sediment to help re-establish wide beach areas, and
- Promoting cooperative and coordinated efforts by agencies involved in protection of California coastal resources.

All of the plans were developed to help inform the public and decision-makers about sediment issues, deficits, sources and other interrelated characteristics of the region. These plans can provide a rich source of ideas for RSM implementation elsewhere too. The notion of identifying short-term and long term actions, and recommendations

for not only federal and state agencies but for county and city agencies, are integral to the comprehensiveness of these plans which span a broad range of activities that involve or affect sediment. This information is often lacking in the more opportunistic RSM initiatives. The Regional Coastal RSM Plans provide ideas regarding governance structures tailored to the regions, and for collaborative implementation. They also provide ideas regarding financing from federal, state and local sources, as well as incentives, along with potential federal, state and local permitting requirements that would support plan implementation. (SANDAG, 2008, AMBAG 2008, BEACON, 2009).

CONCLUSIONS

Sediment management involves regional issues that are multi-jurisdictional, interdisciplinary and involve interrelated economic, environmental and social interests that may be in conflict. Regional approaches to sediment management are emerging as ways to more effectively and efficiently address the range of sediment issues, needs and opportunities in different regions around the country and through different scales and complexities of activities and strategies. Many RSM applications exist from which to draw lessons and ideas.

Understanding the regional sediment system, and the human activities that have altered sediment supplies and transport is critical to developing future regional sediment management strategies. Implementing beneficial use of dredged material projects without this information should raise questions about the sustainability of such projects or their potential effects on the system over the long term.

In spite of the increasing applications of the RSM approach, there continues to be a common perception among some that that sediment is a waste product requiring disposal, rather than a resource, that wisely managed, can benefit public infrastructure, habitat, the economy and quality of life. The historical approach by federal, state, and local agencies towards sediment imbalance and deficit/supply problems has been a project-by-project approach to solve site-specific problems. This approach does not account for regional sediment implications both immediately and over time. Benefits may be gained by consideration of the regional sediment regime associated with individual, even if there is no larger scale RSM plan or strategy.

The growing interest in the RSM approach in consistent with the trends to pursue more comprehensive and integrative solutions to water and environmental resource management challenges. Advances in technology and science are enhancing our ability to understand and address system level resource management problems.

Funding continues to challenge the development and implementation of RSM plans. Given the fragmented nature of responsibilities for sediment management, successful efforts will likely to have to be highly leveraged through collaborative partnerships. However, sharing costs across a broader group of beneficiaries may produce greater collective benefits in a region.

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