THE CALIFORNIA COASTAL SEDIMENT MASTER PLAN

Status Report

PREPARED BY

California Coastal Sediment Management Workgroup

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http://www.dbw.ca.gov/csmw/default.aspx

IMPORTANT NOTE

This status report documents the on-going activities of the California Coastal Sediment Management Workgroup in their efforts to compile the California Coastal Sediment Master Plan. Funding for this program was initiated by a $1,200,000 grant from the National Oceanic and Atmospheric Administration Coastal Impact Assistance Program administered by the Natural Resources Agency of California. The U.S. Army Corps of Engineers ($1,440,000) and the State of California ($3,100,000) have provided subsequent funding (as of May 2009).

This biannual report updates the 2006 Status Report and details CSMWs efforts and accomplishments since the last report. Current information can also be obtained from the CSMW website at www.dbw.ca.gov/csmw/default.aspx.

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EXECUTIVE SUMMARY

Problem Statement: Coastal Sediment

Human activities over the last 150 years have altered the natural supply of sediment (e.g., gravel, sand, silt, clay/mud) to the coast, as well as the transport of sediment along the coast. Flood control projects (e.g., dams trap sediment moving through coastal streams and rivers and reduce peak stream flows, both of which reduce downstream transport of sediment. Inappropriately-conducted timber harvesting and land development can increase the amount of fine-grained sediment being transported over that produced from unaltered land. Land and stream channels covered by roads, buildings or other impermeable surfaces can reduce the volume of sediment available for beaches far below the unaltered condition. Similarly, hard structures along the coast (e.g., seawalls) reduce the natural contribution of coastal bluffs and dunes to beach sediment. In-stream and coastal sand and gravel mining operations, while supplying a societal need for aggregate materials, have removed a significant amount of material that might have otherwise been available to beaches. Coastal structures (e.g., groins and breakwaters) alter the transport of sediment along the coast, while harbors and related maintenance activities trap sediment and modify the transport patterns through dredging and disposal practices. Coastal wetlands, particularly in southern California, are being inundated with sediment due to lessened flushing capabilities associated with reduced flow and possibly sea level rise, further reducing the amount of sediment reaching the coast.

The activities described above are not intended to adversely affect California's coastline, but often they do. Beaches require an ongoing source of sediment to maintain their width, but many of California's coastal beaches have lost width over time due to an inadequate natural supply of sediment. This is a significant problem because California's coastal beaches are a highly valued resource, providing access to the open ocean, areas for recreation, and habitat for numerous coastal species. In addition, coastal beaches provide a natural buffer or transition zone between the ocean and the land. This buffer is extremely important because it provides coastal protection during storm events when public infrastructure or private homes are threatened and this natural buffer also reduces the need to armor the shoreline.

In other areas sediment is too abundant or is a construction by-product such as flood control maintenance projects, port/harbor expansion/maintenance projects, and coastal wetland restorations. Unfortunately, a common misperception of developers and regulatory agencies is that this excess coastal sediment is a waste product requiring disposal, rather than a resource, that if wisely managed, can benefit public infrastructure, habitat and recreational needs.

The historical approach by federal, state, and local agencies towards these sediment imbalance and deficit/supply problems has been a project-by-project approach, which focuses solely on solving site-specific problems. Consequently, these agencies

have historically implemented many projects to optimize cost benefit per individual project, rather than attempting to resolve the regional sediment imbalances. This inability to consider excess sediment at one location as beneficial use at another has contributed significantly to the perception that sediment is a waste.

Regional Sediment Management

Over the last several years a new paradigm for addressing coastal sediment supply related problems and imbalances has emerged throughout the nation, including California. This approach, known as Regional Sediment Management, or simply "RSM", systematically addresses sediment supply and imbalances on a regional basis rather than attempting to resolve sediment problems on a site-specific location/project. RSM also optimizes the beneficial reuse of sediment by recognizing that sediment is a valuable resource rather than a waste product. RSM incorporates the restoration or augmentation of natural processes, whenever and wherever possible.

As an example, a dredging project to deepen a navigational channel at a port can provide the sediment (i.e., sand) needed to replenish an eroded coastal beach or restore a coastal wetland. Scientists and resource managers will evaluate the costs and benefits of moving sediment from the channel to the beach site and wetland site. This evaluation may lead to a determination that one site is a more feasible and appropriate location to receive sediment due to economic, environmental, and engineering factors and concerns. Scientists and resource managers have determined that RSM could best be utilized to balance coastal sediment and sand movement within self-contained regional areas known as littoral cells.

A littoral cell is a discrete coastal and nearshore area within which sediment (e.g., sand) moves to and then along the coast, temporarily resides on a beach, and then exits through a "sink" (e.g., submarine canyon). Littoral cells that are adjacent to one another typically do not share sand.

Coastal Sediment Management Workgroup

The California Coastal Sediment Management Workgroup (CSMW) is a collaborative effort by federal, state, and local agencies and non-governmental organizations (NGOs) working to address California's coastal sediment management needs on a regional and system-wide basis. One of CSMWs main goals is to pursue innovative ways to solve coastal erosion problems along the California coast, often through beneficial reuse of sediment (i.e., sand) to fortify eroding beaches. State membership includes the Natural Resources Agency (CNRA), Department of Boating and Waterways (CDBW), Department of Parks and Recreation (DPR), California Coastal Commission (CCC), California Geological Survey (CGS), San Francisco Bay Conservation and Development Commission (BCDC), State Coastal Conservancy (SCC), Department of Fish and Game (CDFG), and the State Lands Commission (CSLC). Federal membership includes U.S. Army Corps of Engineers (USACE), U.S. Geological Survey (USGS), and the U.S.

Environmental Protection Agency (USEPA). NGO membership includes the California Coastal Coalition and the California Marine Affairs and Navigation Conference (CMANC). The Natural Resources Agency and the USACE jointly chair the taskforce.

> *CSMW Mission: Conserve, restore, and protect California's coastal resources by developing and facilitating regional approaches to managing sediment.*
>
> *Goals: 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.*

California Coastal Sediment Master Plan

In order to facilitate implementation of RSM throughout the entire California Coast, the CSMW has embarked on a multi-year effort to compile a California Coastal Sediment Master Plan (SMP).

The objectives of the SMP are to:

- Promote the use of RSM strategies to address problems caused by sediment imbalances.
- Support the California Ocean Protection Council (COPC) in the implementation of their 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 Sediment Master Plan 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 fall under three general categories:

- Educational and informational reports and data,
- Computer based tools, and
- A series of Coastal RSM Plans that will determine how sediment can be best managed within regions and collectively address differences in local issues across coastal California.

Development of the Sediment Master Plan is expected to occur over an extended period, estimated at approximately 10 years. A series of biannual Status Reports are envisioned to document completed, on-going, and anticipated future activities of the CSMW in compiling the Sediment Master Plan. Additions, revisions and other updates will be presented in the appropriate Status Reports. An initial SMP Status Report was released by CSMW in September 2006. This Status Report provides:

- Discussion on why RSM is needed to address sediment management problems;
- Descriptions of the various types of products being developed by CSMW to implement RSM across coastal California ;
- Maps identifying Beach Erosion Concern Areas and potential sediment sources identified to date by CSMW within coastal California; and
- Case studies of successful RSM implementation in California.

CSMW Efforts Completed During This Reporting Period

In addition to those reported in the previous SMP Status Report, CSMW has completed the following efforts related to the Sediment Master Plan:

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

Coastal RSM Plans:

- Southern Monterey Bay
- Ventura and Santa Barbara Counties
- San Diego County

1.0 Sediment Management Overview

This section describes the sediment availability problem leading to coastal erosion and inundated areas, and describes the Coastal Sediment Management Workgroup's (CSMW's) vision for the road to solutions through Regional Sediment Management (RSM). CSMW is described, and their efforts to implement RSM through the Sediment Management Plan are introduced.

1.1 Problem Statement

Portions of California's coastline are actively eroding, often leading to economic losses, reduced recreational opportunities, and habitat destruction. California's coastal beaches are a highly valued resource, providing access to the open ocean, areas for recreation, and habitat for numerous coastal species. In addition, beaches provide a buffer or transition zone between the ocean and the land, expanding and contracting over the seasons in response to waves and sand supply.

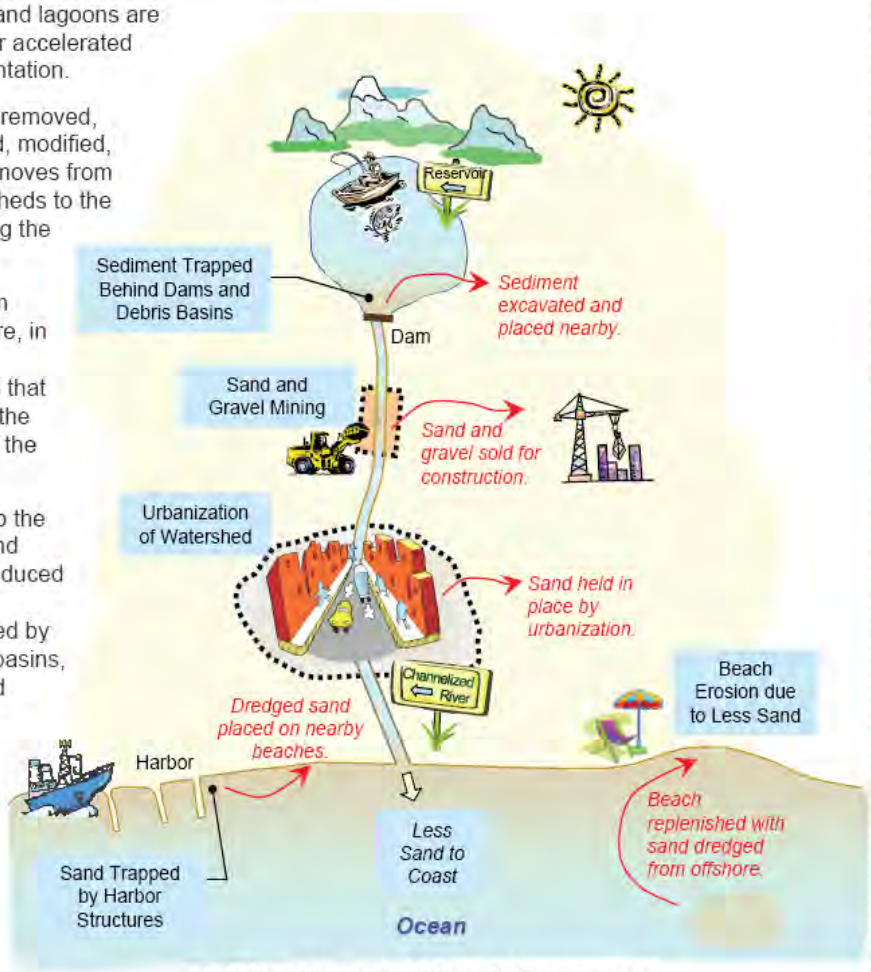
Over millennia, natural forces (e.g., wind, rain, and stream flows) have mobilized and transported sediments (e.g., gravel, sand, silt, clay/mud). Coastal beaches have benefited from much of this natural transport, receiving sand from coastal streams and rivers, sea cliff or bluff erosion, gullies incised by rainfall runoff and dunes built and deflated by wind. Human activities over the last 150 years have significantly altered these natural supplies of sediment to the coast, as well as the transport of materials along the coast. Dams block the transport of sediment through coastal streams and rivers and reduce the peak stream flows, which in turn reduces the downstream transport of beach materials. Major land clearing projects, through timber harvesting or for development, if not properly constructed can mobilize volumes of sediment much larger than that produced from the unaltered land. If the cleared land is subsequently covered by roads, buildings or other impermeable surfaces, the volume of sediment available for mobilization will drop far below the unaltered condition. Sand and gravel mining operations, while providing for a societal need for aggregate materials, has removed a significant amount of material that might have otherwise been available to California's coastal beaches. Coastal structures, like groins and breakwaters, alter the alongshore transport of sediment. Harbors can trap sediment and maintenance operations modify the transport patterns through dredging and disposal practices. Coastal wetlands, particularly in southern California, are being inundated with sediment due to lessened flushing capabilities associated with reduced flow and possibly sea level rise, further reducing the amount of sediment reaching the coast. While many of these activities are not intended to alter beaches, the net effect often is an alteration of the coastline. Figure 1 illustrates the ways in which human actions impact the supply of sediment to the coast.

Most sediment supply-related problems can be associated with societal failure to recognize, communicate and implement regional (i.e., littoral cell) solutions to sediment-related projects. For instance, the approach to addressing sediment imbalances by state and federal agencies has historically been on a project by project

The Problem – Human Modifications Have Altered Processes and Impacted Uses

Humans have substantially altered natural sediment transport processes within California's coastal watersheds, reducing storm protection, habitat and recreation. Dams, built to control floods and store water, trap sediment in reservoirs. Sand and gravel are mined from stream systems for use in construction. Timbering, grading, and earth moving strip off vegetation and expose the watersheds to excessive erosion. Conversely, construction of channels, roads, and buildings hardens the watershed, which reduces erosion and leads to decreases in the amount of coarse sediment available for delivery via streams. Some coastal structures such as harbors, jetties, groins, and breakwaters alter movement of sediment along the shoreline while other coastal structures such as riprap and seawalls reduce the amount of sediment supplied directly to the shoreline through the reduction of bluff and cliff erosion. Human modifications to the coastal watersheds and shorelines of California have resulted in the following sediment-related problems:

- Beaches are undergoing accelerated erosion, reducing recreational opportunities, contributing to loss of habitat, and increasing the probability of storm damage along the coast.
- Coastal stream water quality has become impaired.
- Coastal wetlands and lagoons are experiencing either accelerated erosion or sedimentation.
- Sediment is being removed, trapped, redirected, modified, and polluted as it moves from the coastal watersheds to the shoreline and along the coast.
- Sand dredged from harbor channels are, in many instances, placed in locations that does not optimize the beneficial reuse of the material.
- Sediment supply to the coast has been, and continues to be, reduced as a result of interruptions caused by dams and debris basins, mining of sand and gravel, artificially stabilizing the shoreline, and hardening of the coastal watersheds.



Existing Sediment (Sand) Management

FIGURE 1: The Problem- Existing California Coastal Sediment Management

basis with a narrow focus on solving a very local problem. Further, state and federal agencies would typically implement sediment projects in order to optimize cost benefit per individual project, rather than attempting to resolve the regional imbalance that was producing either the sediment excess or deficit. This approach has led to the unfortunate perception that coastal sediment is a waste product requiring disposal, rather than a potential beneficial resource, as well as a lack of understanding of the regional benefits of sediment management and lost opportunities for beneficial reuse.

1.2 Opportunity Statement: The New Regional Approach

RSM aims to increase efficiency by managing sediment demand and excess on a regional basis. RSM also optimizes the beneficial reuse of sand by considering coastal sediments to be a valuable resource instead of waste. Previously independent projects are considered in conjunction with each other to maximize sediment reuse.

For example, the cost of dredging navigation channels can be combined with obtaining sand for where it is most needed to remediate beach erosion. This approach is successful because it considers costs and benefits not previously counted. Benefits arise from an array of potential sources valued on their contribution to the region rather than just for an individual project. The most technically appropriate "region" for such management of sediment is the littoral cell. The RSM approach is illustrated in Figure 2.

A littoral cell is a discrete coastal and nearshore area within which sediment (e.g., sand) moves to and then along the coast, temporarily resides on a beach, and then exits through a "sink" (e.g., submarine canyon). Littoral cells that are adjacent to one another typically do not share sand.

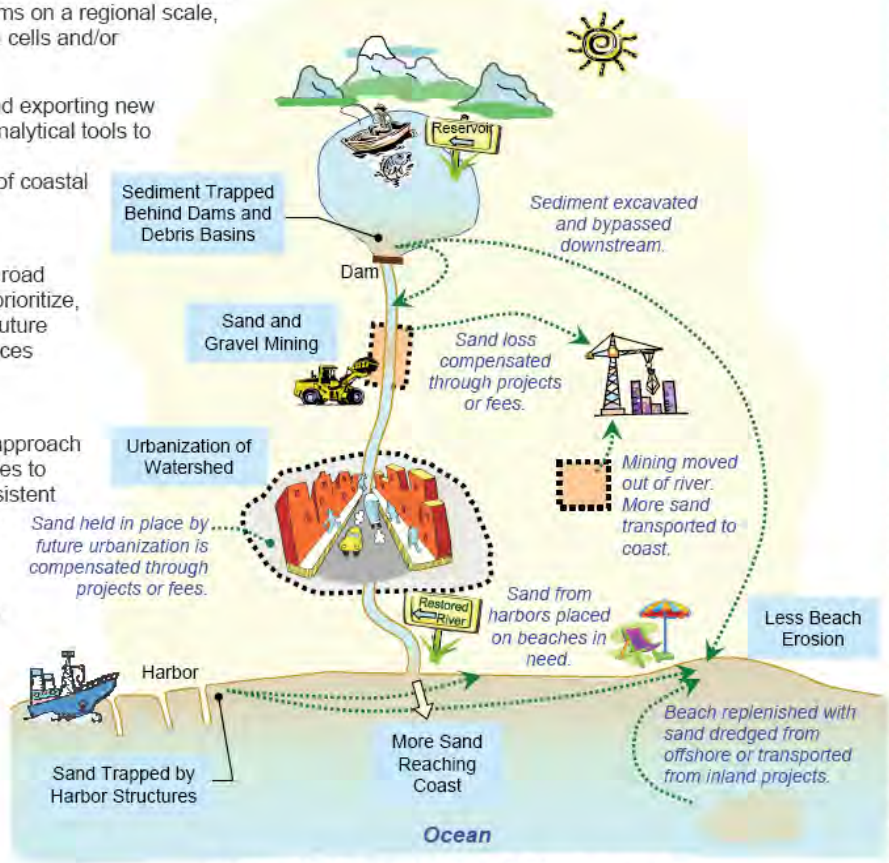
Some of the main principles associated with implementing RSM include:

- Establishing the regional framework (i.e., littoral cell boundaries, sediment budgets, and regional regulatory jurisdiction),
- Examining the human activities that have altered coastal sediment supply and transport,
- Developing 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,
- Determining issues that may inhibit implementation of these opportunities and develop tools to address these issues in an environmentally responsible manner,
- Obtaining funds for 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's priceless coastal resources.

The Road to Solutions – The California Coastal Sediment Master Plan

Many watershed and shoreline problems caused by human modifications to the coast can be solved and/or addressed through the development of a new approach known as Regional Sediment Management (RSM). The California Coastal Sediment Management Workgroup (CSMW), a partnership of several federal and state agencies, is currently developing the California Coastal Sediment Master Plan (SMP) study, to foster a regional sediment management approach for the entire state. The SMP will provide a framework for finding solutions through RSM by:

- Identifying sediment-related problems along the California coast, such as beach erosion, wetland erosion/sedimentation, habitat loss, and water quality impairment.
- Defining the causes of sediment-related problems such as dams; debris basins; dredging; sand and gravel in-stream mining; coastal structures; lack of project coordination; and inconsistent policies, procedures, and regulations.
- Providing a solid scientific framework and database regarding technical issues within the coastal environment to support sediment management decisions.
- Developing a framework, through collaboration with federal, state, regional, and local governments, to address the sediment-related problems on a regional scale, such as littoral cells and/or watersheds.
- Developing and exporting new and existing analytical tools to assist in the management of coastal resources.
- Providing a programmatic road map to plan, prioritize, and program future coastal resources projects.
- Fostering a collaborative approach among agencies to provide a consistent framework for project proponents.
- Establishing a streamlined process for coastal resources related project approvals.



Regional Sediment (Sand) Management

FIGURE 2: The Opportunity- New Approach to California Coastal Sediment Management.

1.3 California Coastal Sediment Management Workgroup

The Coastal Sediment Management Workgroup (CSMW) is a collaborative effort by federal, state, and local agencies and non-governmental organizations committed to evaluating and addressing California's coastal sediment management needs on a regional, system-wide basis. The CSMW was formed in response to concerns raised by the State of California Resources Agency (now Natural Resources Agency or NRA), U.S. Army Corps of Engineers (USACE), and local governments during meetings in 1999 regarding shore protection needs in California. CSMW hosted public workshops between February and June 2004 to gather input on coastal sediment management issues in California. At these workshops and meeting, there was consensus that integrated coastal sediment management is a key factor in the development of strategies to conserve and restore California's coastal beaches and watersheds.

CSMW's Mission: Conserve, restore, and protect California's coastal resources by developing and facilitating regional approaches to managing sediment.
Goals:
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 optimizing the use of sediment from ports, harbors, and other opportunistic sources.

The California Natural Resources Agency and the USACE co-chair the CSMW. The Natural Resources Agency is composed of multiple departments, boards, commissions, conservancies and programs including, but not limited to, the Ocean Resources Management Program, Department of Boating and Waterways (DBW), California Coastal Commission (CCC), State Lands Commission (SLC), State Coastal Conservancy (SCC), Department of Parks and Recreation (DPR), and the California Geological Survey (CGS). The Natural Resources Agency and its departments have responsibilities related to conserving, enhancing and managing California's natural and cultural resources, including coastal beaches and watersheds, and the ocean ecosystem.

The USACE participates as the lead federal agency and has federal responsibilities related to managing and restoring coastal shorelines, wetlands, and watersheds. In addition, the USACE has lead federal authority for flood control, ecosystem restoration, and navigation activities. The California Coastal Coalition (CalCoast), a non-profit organization comprised of cities, counties and regional government agencies along the coast, assists the CSMW. CalCoast provides the CSMW with local feedback and updates regarding projects and studies underway in coastal communities. The California Marine Affairs and Navigation Conference (CMANC) participates in CSMW to provide insights and concerns related to issues affecting California's ports and harbors. CSMW also works directly with regional government agencies to prepare, provide and implement the documents, tools and Coastal RSM Plans comprising SMP development.

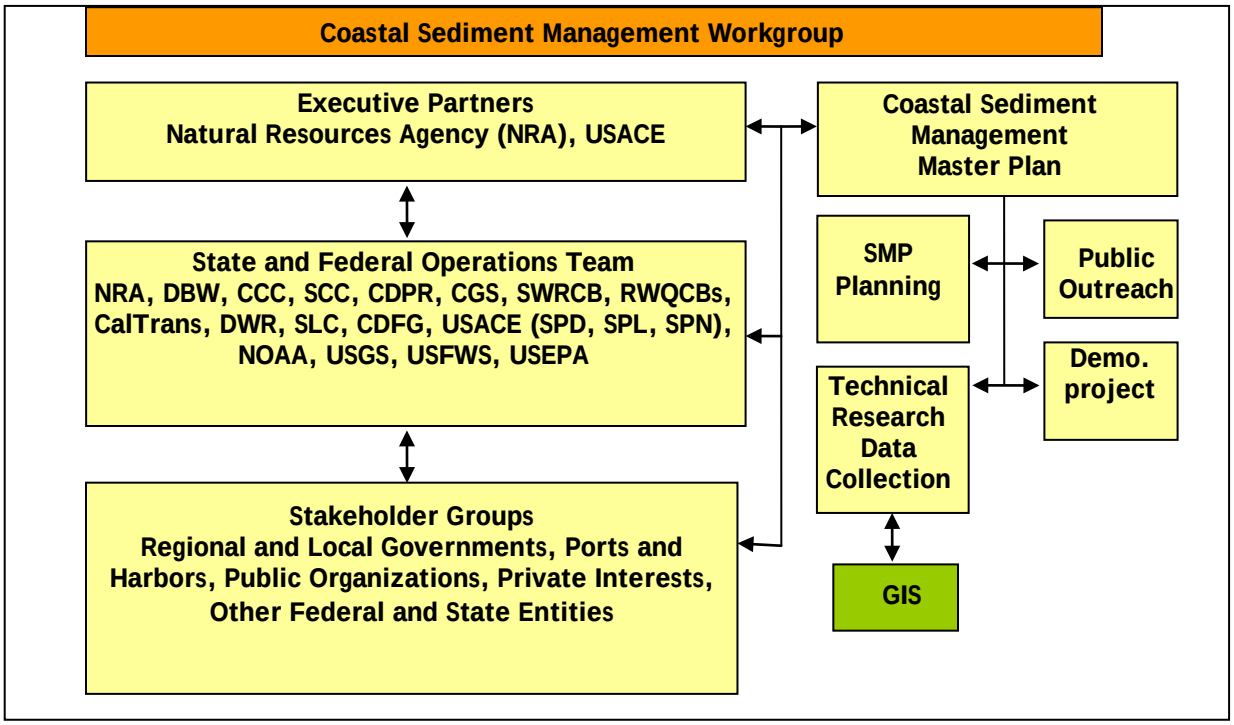


FIGURE 3: CSMW Structure

In addition to the federal, state, regional and local coordination, each participant in the CSMW can use group discussions to strengthen their own programs within the context of statewide and regional RSM implementation. State agencies have used the CSMW to coordinate the development and review of projects undertaken through recent state funding and bond issue programs. The CSMW provides a forum to enhance these individual efforts, minimize redundant studies and ensure that various studies are being conducted in a complementary way.

The CSMW anticipates adding representatives from wetland and watershed groups, flood control agencies, NGOs and other groups in an effort to better address the needs of various coastal stakeholder groups outside of state and federal government.

1.4 California Coastal Sediment Master Plan

In order to facilitate implementation of RSM throughout the entire California Coast, CSMW has embarked on a multi-year effort to compile a California coastal Sediment Master Plan (SMP). The Sediment Master Plan (SMP) is 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 fall under three general headings:

- Educational and informational reports and data,
- Computer based tools, and

- A series of Coastal RSM Plans that will determine how sediment can be best managed within regions and collectively address differences in local issues across coastal California.

A series of biannual Status Reports are envisioned to document completed, on-going, and anticipated future activities of the CSMW in compiling the Sediment Master Plan. Additions, revisions and other updates will be presented in the appropriate SMP Status Reports. This Status Report provides:

- Discussion on why RSM is needed to address sediment management problems;
- Descriptions of the various types of products being developed by CSMW to implement RSM across coastal California ;
- Maps identifying Beach Erosion concern Areas identified to date by CSMW within coastal California; and
- Case studies of successful RSM implementation in California.

2.0 Sediment Master Plan Overview

This section provides overviews of why a SMP is needed, SMP objectives and development, and products being developed by the CSMW to help implement RSM across coastal California.

2.1 Why a Sediment Master Plan is needed

After holding numerous public workshops and meetings, the Coastal Sediment Management Workgroup determined that a Sediment Master Plan was needed in order to accomplish the following throughout coastal California:

- Reduce shoreline erosion and coastal storm damages;
- Provide sediment for environmental restoration and protection;
- Increase and restore natural sediment supply to the coast;
- Restore and preserve coastal beaches;
- Improve water quality along coastal beaches;
- Foster the beneficial use of sediment dredged from ports, harbors, wetlands, and other sources;
- Provide for sufficient receiver sites for port and harbor dredge materials; and
- When completed, the Sediment Master Plan (SMP) will be a comprehensive plan for the regional management of sediment in coastal California over the next 20 years.

2.2 Sediment Master Plan Objectives

The objectives of the Sediment Master Plan are:

- Promote the use of RSM strategies to address areas of sediment imbalance in order to restore coastal habitats and beaches.
- Support the California Ocean Protection Council (COPC) in the implementation of their Strategic Plan.
- Support the West Coast Governor's Agreement on Ocean Health to utilize RSM principles and techniques along the entire west coast of the United States.
- Develop an adaptive plan to meet current and future needs of coastal sediment managers.
- Identify critical coastal erosion and accretion areas.
- Provide those who manage sediment with informational tools, techniques and strategies 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.
- Add to the scientific database regarding technical issues within the oceanic environment.
- Demonstrate the value of sediment (mud, silt, sand, gravel and cobble) 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.

2.3 Sediment Master Plan Development

Development of the Sediment Master Plan (SMP) is organized under the following five activities: 1) Planning, 2) Public Outreach, 3) Technical Research/Data Collection, 4) Interagency Coordination and 5) Demonstration Projects. Components of each activity are shown in Figure 4 below.

Initial SMP efforts focused on compiling and developing informational products or tools of state-wide utility that cover the major concerns related to coastal regional sediment management. The main issues addressed by these initial efforts were identification of critical coastal erosion areas and potential sources of sediment to replace or restore lost sediment, examination of the governmental frameworks (policies, procedures and regulations) concerning sediment management, and assessment of the natural and biological systems involved with or affected by sediment management. In addition, the SMP effort has and continues to foster team building between agencies with disparate missions and objectives, and added to the scientific database regarding issues related to sediment management.

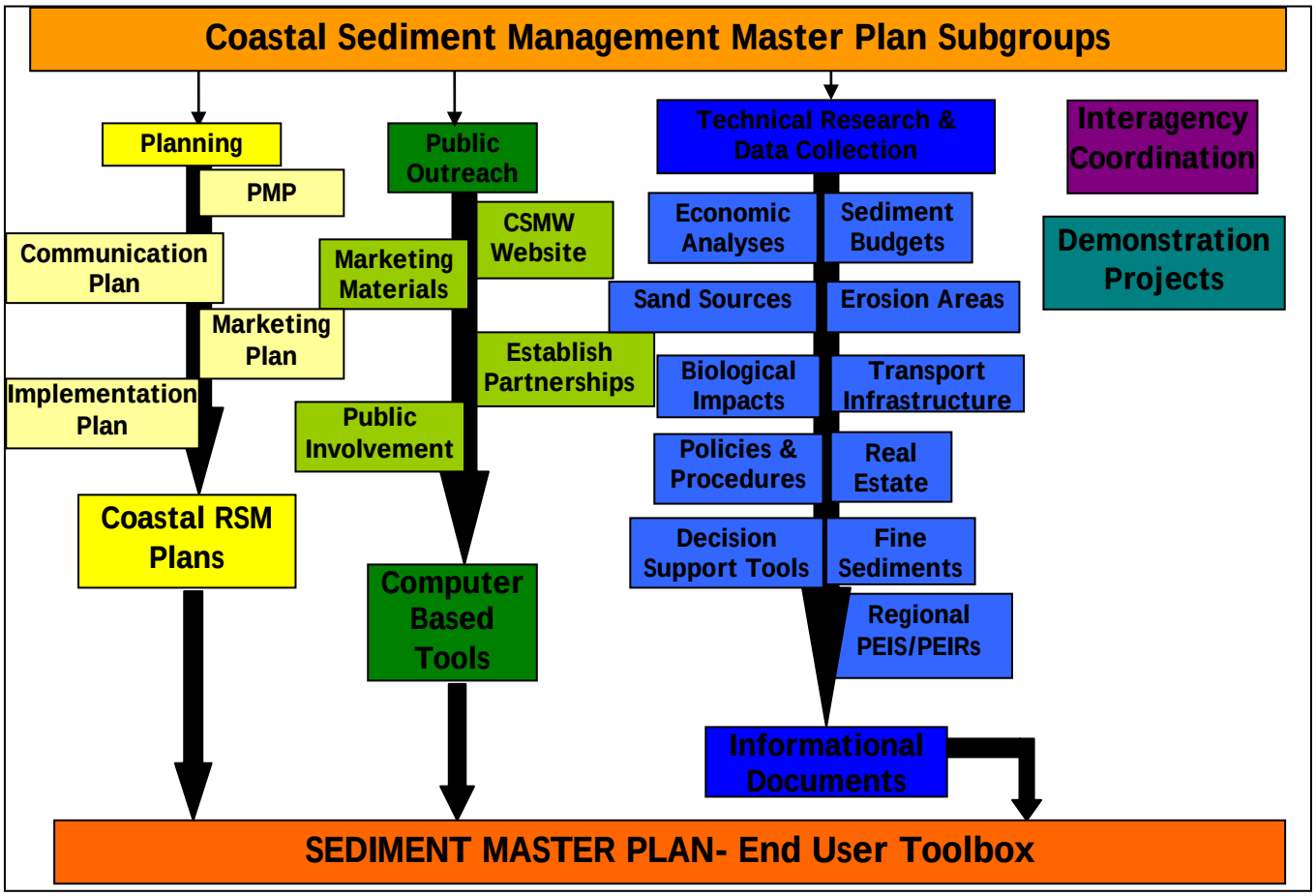


FIGURE 4: Sediment Master Plan Development Structure

The SMP will continue to support and augment these initial state-wide efforts. During this reporting period, SMP efforts have focused on more regionally specific strategies for RSM, since most sediment management implementation occurs at the local or regional scale. Regionally based strategies to address sediment supply issues of concern are being developed within specific regions that utilize the reports, data, educational and informational tools developed and compiled by CSMW for the Sediment Master Plan. Local and regional governments and other stakeholders are invited to participate in the effort to find consensus on a regional plan for beneficial reuse of opportunistic sediment as well as planned shoreline restoration project. Three Coastal RSM Plans have been developed during this reporting period, and lessons learned are being extended to other coastal regions as resources become available to develop Coastal RSM Plans for those regions.

When completed the SMP will have:

- Identified critical coastal erosion areas throughout coastal California;
- Located potential sources of sediment to replace and/or restore lost sediment;
- Developed a series of Coastal RSM Plans along the entire California coastline providing strategies by which sediment can be managed regionally to remediate the eroding areas,;
- Identified species and habitats of concern that could be impacted by regional sediment management activities as well as means to minimize such impact during those activities;
- Incorporated regulatory-appropriate procedures designed to streamline RSM permitting activities while protecting natural and economic coastal resources;
- Fostered team-building between agencies with disparate missions and objectives;
- Increased scientific understanding of technical issues that arise within the coastal and oceanic environment as a result of RSM activities; and
- Provided for public input to meet stakeholder concerns.

2.4 Sediment Master Plan Tools and Products

Sediment Master Plan tools available for public use can be found on the CSMW website, as can the most recent accounting of project status. Tools, strategies and informational documents that either have been or will be developed for the Sediment Master Plan are identified in this section.

2.4.1 Previous Reporting Period

Products previously completed by CSMW are listed below. Please refer to the CSMW website or the SMP Status Report 2006 report for a more detailed discussion of the individual tool, document or strategy.

- Cumulative Loss of Sand Due to Dams
- The Economics of Regional Sediment Management in Ventura and Santa Barbara Counties
- Sand Compatibility and Opportunistic Use Program (SCOUP)
- SCOUP Pilot Project Mitigated Negative Declaration
- California Sediment Master Plan Brochure
- CSMW Website- www.dbw.ca.gov/csmw/default.aspx
- Public Outreach Program
- California Regional Sediment Management Information System (CRSMIS)
- Sediment Master Plan Status Report 2006

2.4.2 CSMW Efforts Completed During This Reporting Period

As of May 1, 2009, in addition to those reported in September 2006 SMP Status Report, CSMW has completed the following products related to the Sediment Master Plan:

- Beach Restoration Regulatory Guide- Guidance for local coastal stakeholders. This informational report and strategy was prepared to help clarify the regulatory process and requirements for sediment managers. Usage of the report should help standardize approaches and content of proposed sediment projects.
- Development of Sand Budgets for California's Major Littoral Cells- Comprehensive review and compilation of dredging records and other relevant sediment source/sink information on a littoral cell basis. This informational document demonstrates background conditions allowing for assessment by coastal managers of the need for sediment and appropriate project size at a BECA.
- Sources, Dispersal and Fate of Fine Sediment supplied to Coastal California- Summarizes the natural transport and volumes of fine-grained materials to and within the ocean. This informational report provides a mega-regional analysis on the migration and deposition of suspended material. This informational report provides background for comparison against sediment management projects, and begins the understanding of fines fate and transport in the ocean as a means to address a potentially major impediment to RSM.
- Littoral Cells, Sand Budgets and Beaches- Layman's explanation of the physical processes involved in building beaches and the issues/considerations involved when artificially renourishing them. This educational tool is meant to educate concerned stakeholders who are unfamiliar with beach genesis and coastal processes.
- Web-based Spatial Data Mapping Tool (WebMapper) - User-friendly viewer developed to display spatial data, relevant to sediment management issues and compiled in the CRSMIS Geographic Information System (GIS) database. Use of this computer-based tool provides easy access to numerous data types, providing for rapid, visual assessments of occurrence, extent and interconnectedness of the data. http://coastalsediment.resources.ca.gov/
- Coastal RSM Information System (CRSMIS) - This staging repository for relevant spatial data includes information obtained by CSMW from numerous sources, as well as data layers created specifically for CSMW efforts. Various layers of spatial

data have been included in WebMapper to illustrate information valuable to coastal sediment managers. All data shown on WebMapper are consistent with a reference coastline; inconsistencies between data layers have been addressed, and attribute information added when appropriate to allow for use within WebMapper.

- Coastal Sediment References Searchable Database- Allows for electronic search of references compiled for the Coastal Reference Compendium and subsequent CSMW products (including completed Coastal RSM Plans) by Region, Author, Title and through various subject Categories. The Access database was an original request from stakeholders received during the Public Outreach program.
- CSMW Website Enhancements- The website is continually upgraded to include new developments and information.
- Southern Monterey Bay Coastal RSM Plan- This was the first Plan to be developed through CSMWs regional effort. Most current understanding of physical processes, biological occurrences, recommended activities and strategies for implementing RSM regionally are identified from Moss Landing to Point Piños in Monterey. The Association of Monterey Bay Area Governments has adopted the Plan for implementation.
- Ventura and Santa Barbara Counties Coastal RSM Plans- Details physical processes and suggested projects, activities and strategies to implement RSM in the Santa Barbara Littoral Cell (Point Conception to Mugu Lagoon (submarine canyon). Beach Erosion Authority for Clean Oceans and Nourishment (BEACON) has adopted plan for implementation.
- San Diego County Coastal RSM Plans- Provides comprehensive analysis of potential receiver sites, biological occurrences and strategies to address sediment deficits for the Silver Strand, Mission Bay and southern Oceanside Littoral Cell, from Camp Pendleton to the Mexican Border. Plan has addressed all expressed stakeholder concerns and is expected to be adopted for implementation by the San Diego Association of Governments (SANDAG) in late May, 2009.
- Beach Erosion Concern Areas- Figures 5-10 illustrate locations, compiled through various CSMW efforts, of beach erosion of concern to various agencies and potential sources of excess sediment that could be beneficially reused to address coastal erosion. These locations will be presented in the California Beach Erosion Assessment Survey (see below) when that report is finalized.

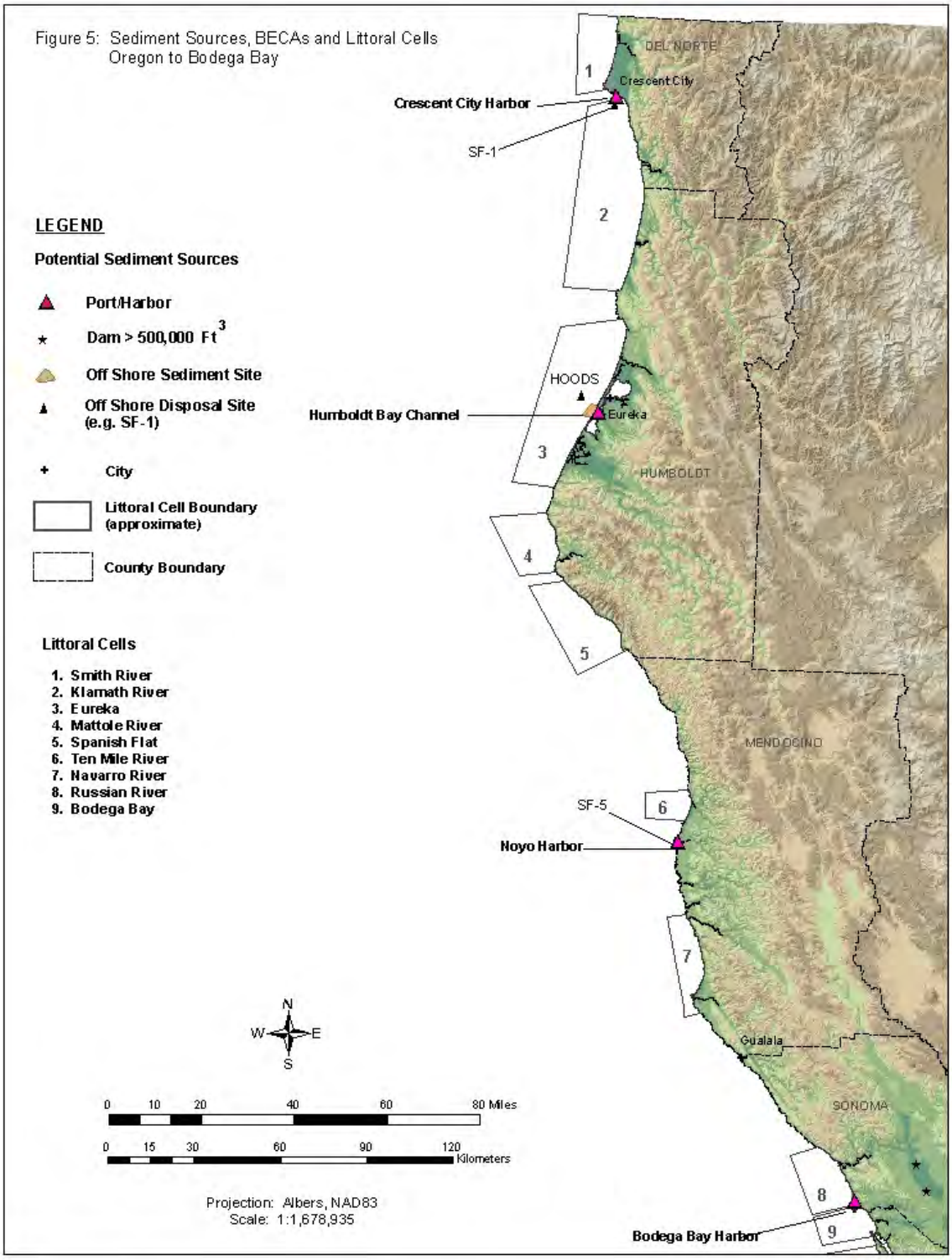
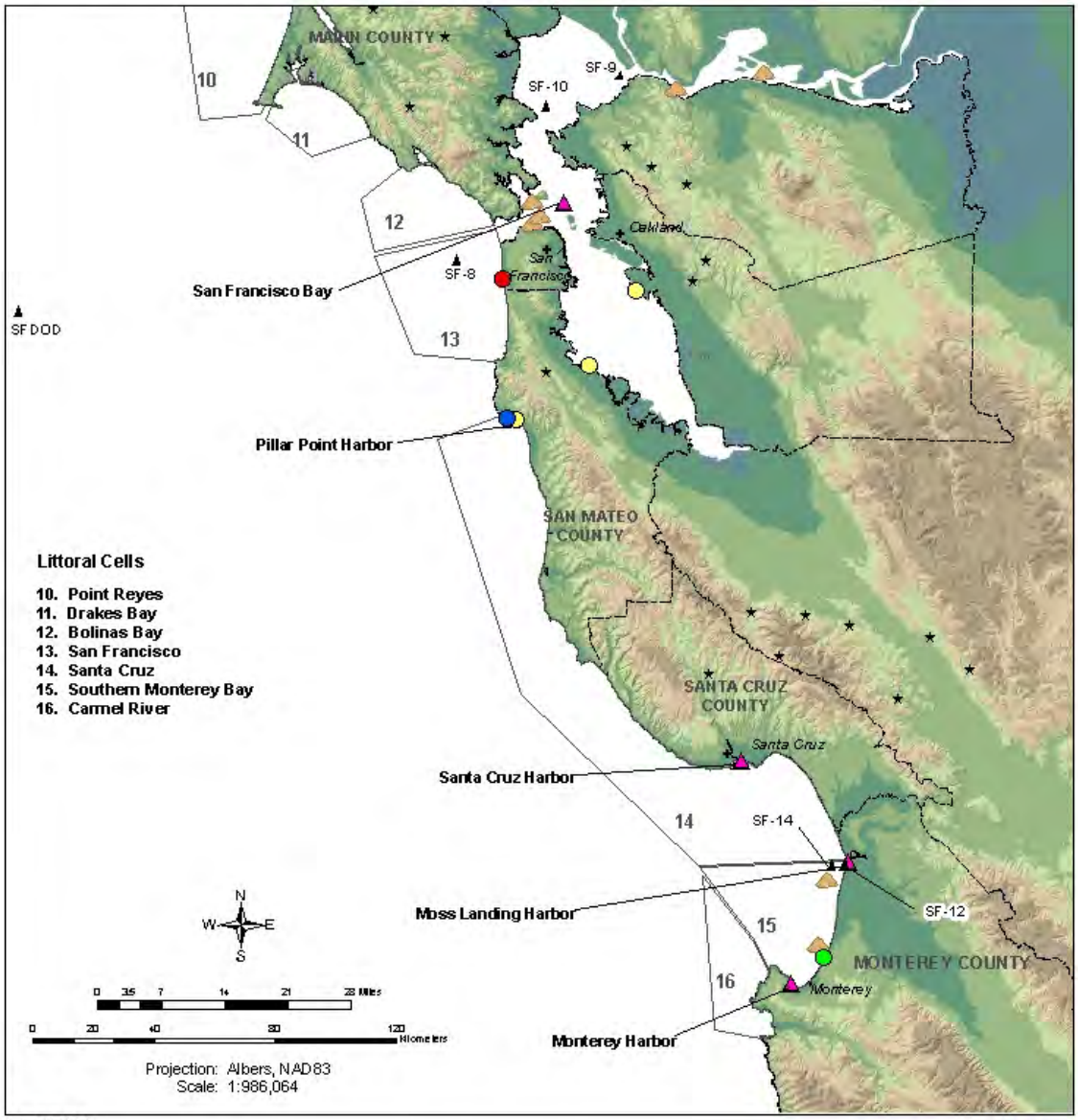


Figure 5: Sediment Sources, BECAs and Littoral Cells
Oregon to Bodega Bay
LEGEND
Potential Sediment Sources
Port/Harbor
Dam > 500,000 Ft3
Off Shore Sediment Site
Off Shore Disposal Site (e.g. SF-1)
City
Littoral Cell Boundary (approximate)
County Boundary
Littoral Cells
1. Smith River
2. Klamath River
3. Eureka
4. Mattole River
5. Spanish Flat
6. Ten Mile River
7. Navarro River
8. Russian River
9. Bodega Bay
DEL NORTE
Crescent City
Crescent City Harbor
SF-1
HOODS
Eureka
Humboldt Bay Channel
HUMBOLDT
MENDOCINO
SF-5
Noyo Harbor
Gualala
SONOMA
Bodega Bay Harbor
N
W
E
S
0 10 20 40 60 80 Miles
0 15 30 60 90 120 Kilometers
Projection: Albers, NAD83
Scale: 1:1,678,935

Figure 6: Sediment Sources, BECAs and Littoral Cells
Point Reyes to Big Sur



LEGEND

Beach Erosion Concern Areas

Listing Source

- USACE
- CRSMP
- CSMW
- Survey

See Figure 6a for BECA Site Names

Potential Sediment Sources

- Port/Harbor
- Dam > 500,000 Ft^3
- Off Shore Sediment Site
- Off Shore Disposal Site (e.g. SF-8)

- City
- Littoral Cell Boundary (approximate)
- County Boundary

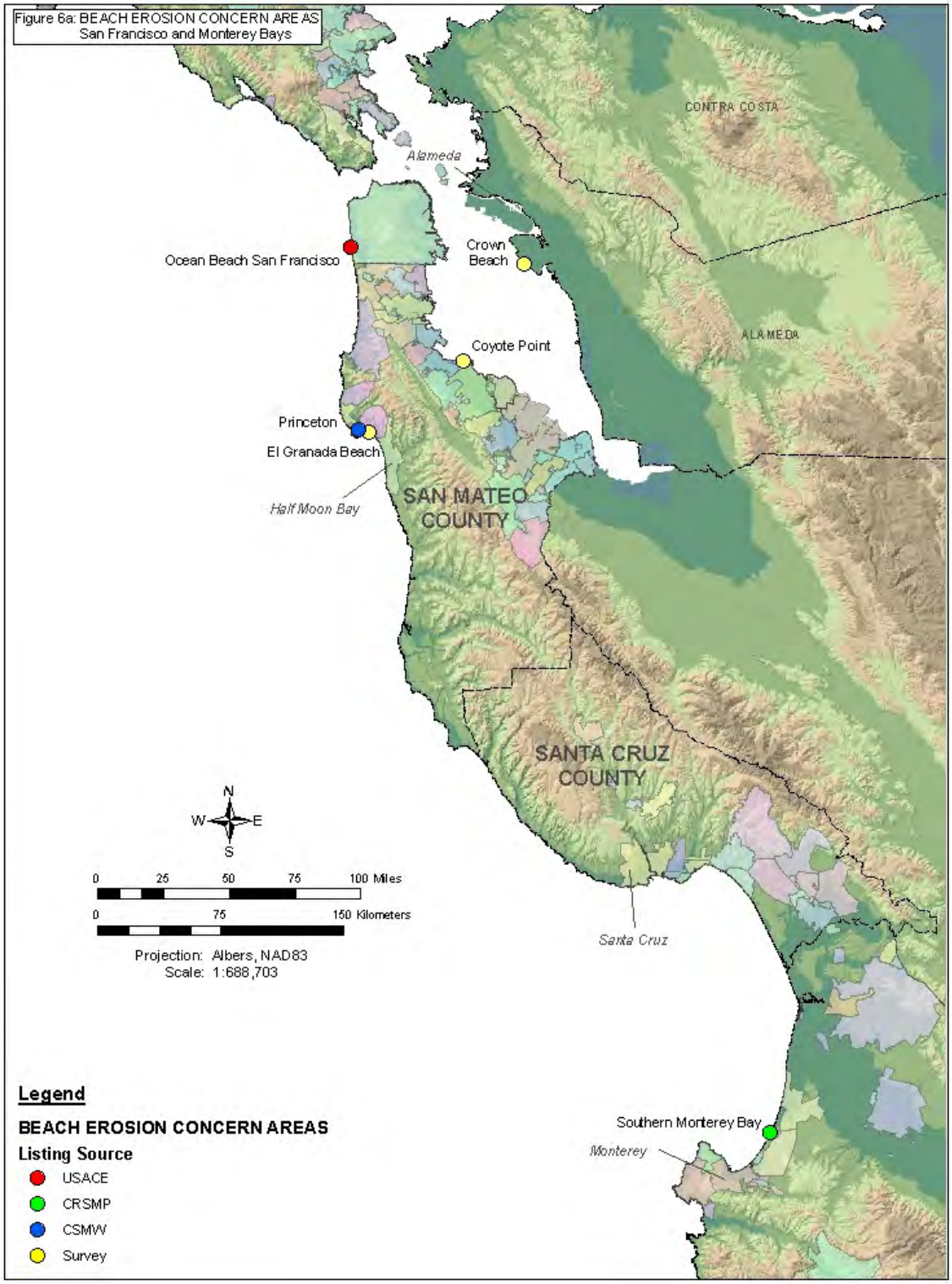
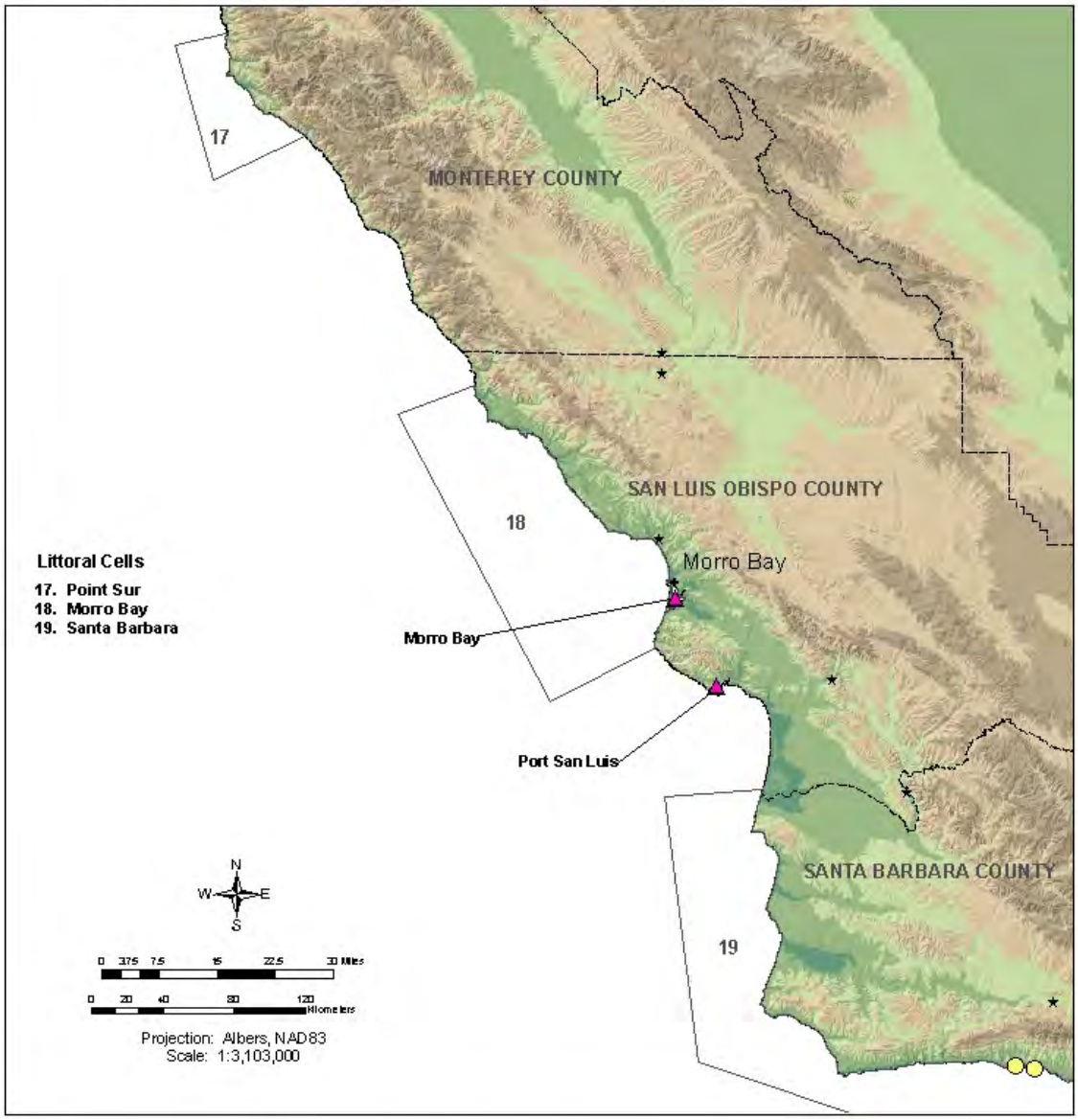


Figure 6a: BEACH EROSION CONCERN AREAS
San Francisco and Monterey Bays
CONTRA COSTA
Alameda
Ocean Beach San Francisco
Crown Beach
ALAMEDA
Coyote Point
Princeton
El Granada Beach
Half Moon Bay
SAN MATEO COUNTY
SANTA CRUZ COUNTY
N
W
E
S
0 25 50 75 100 Miles
0 75 150 Kilometers
Projection: Albers, NAD83
Scale: 1:688,703
Santa Cruz
Southern Monterey Bay
Monterey
Legend
BEACH EROSION CONCERN AREAS
Listing Source
USACE
CRSMP
CSMW
Survey

Figure 7: Sediment Sources, BECAs and Littoral Cells
Big Sur to Point Conception



Legend

BEACH EROSION CONCERN AREAS

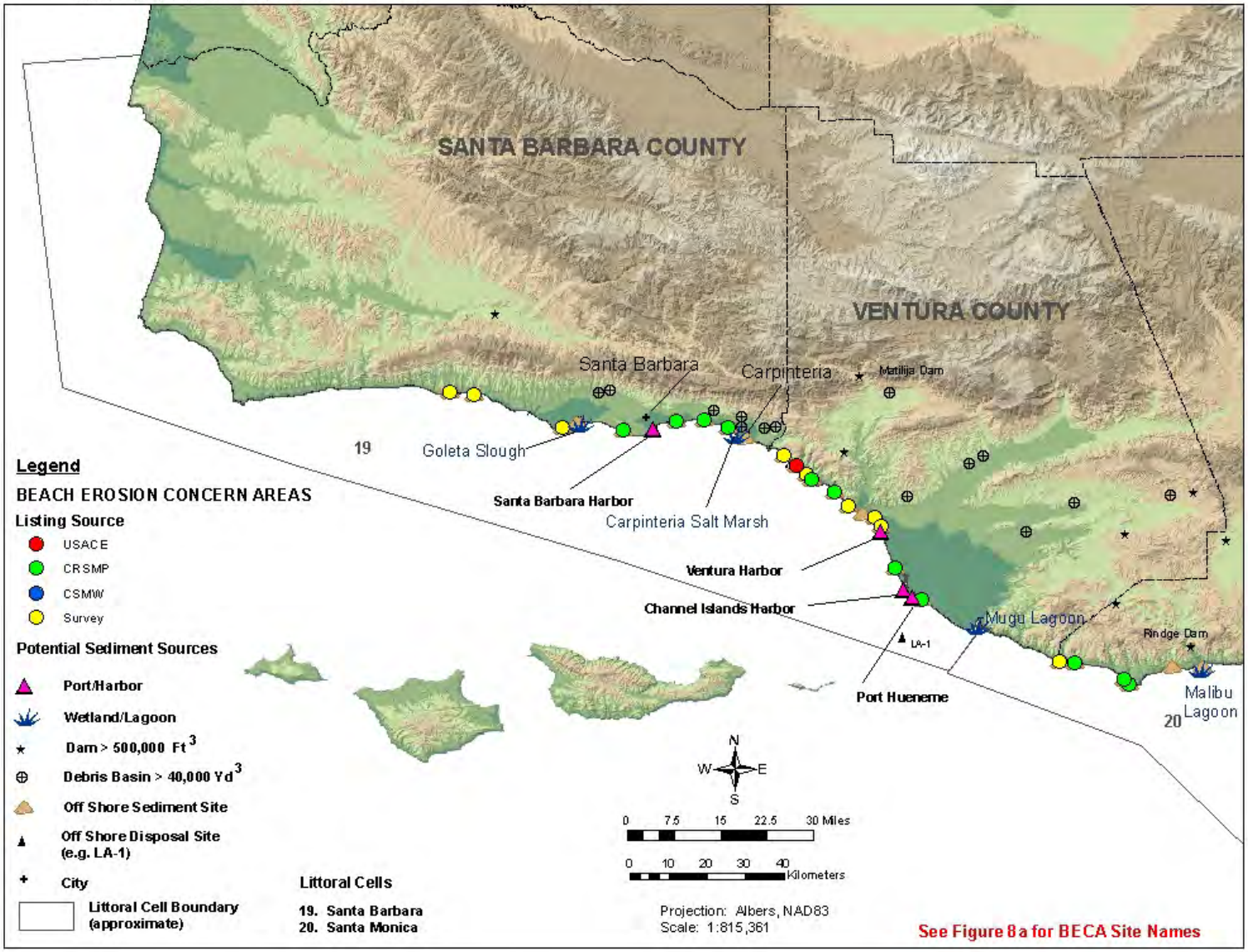
Listing Source

- USACE
- CRSMP
- CSMW
- Survey

Potential Sediment Sources

- Port/Harbor
- Dam > 500,000 Ft^3
- Littoral Cell Boundary (approximate)
- City
- County Boundary

Figure 8: Sediment Sources, BECAs and Littoral Cells
Santa Barbara and Ventura Counties



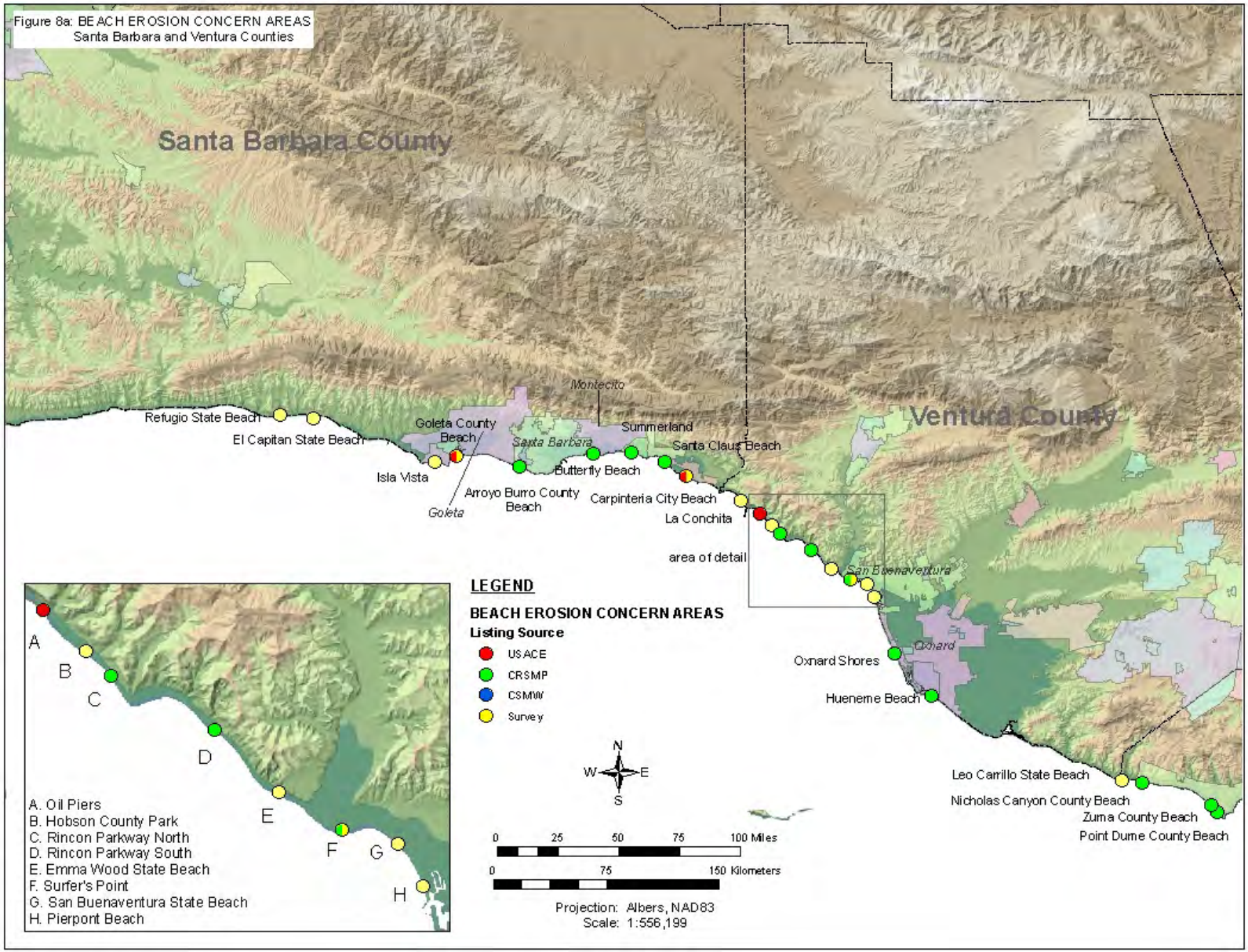
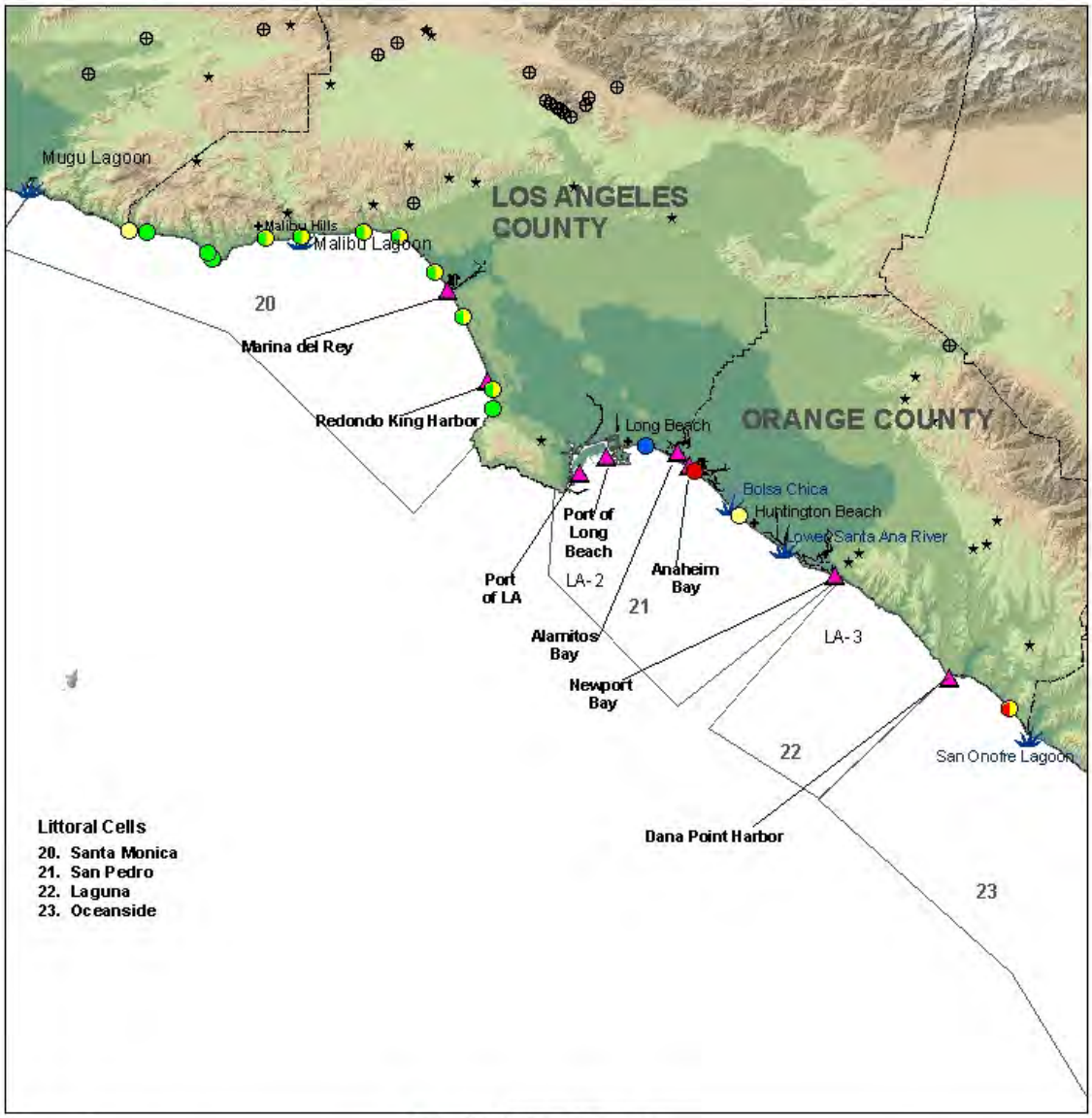


Figure 8a: BEACH EROSION CONCERN AREAS
Santa Barbara and Ventura Counties
Santa Barbara County
Ventura County
Refugio State Beach
El Capitan State Beach
Goleta County Beach
Isla Vista
Goleta
Arroyo Burro County Beach
Butterfly Beach
Santa Barbara
Montecito
Summerland
Santa Claus Beach
Carpinteria City Beach
La Conchita
area of detail
San Buenaventura
Oxnard
Oxnard Shores
Hueneme Beach
Leo Carrillo State Beach
Nicholas Canyon County Beach
Zuma County Beach
Point Dume County Beach
LEGEND
BEACH EROSION CONCERN AREAS
Listing Source
USACE
CRSMP
CSMW
Survey
N
W
E
S
0 25 50 75 100 Miles
0 75 150 Kilometers
Projection: Albers, NAD83
Scale: 1:556,199
A
B
C
D
E
F
G
H
A. Oil Piers
B. Hobson County Park
C. Rincon Parkway North
D. Rincon Parkway South
E. Emma Wood State Beach
F. Surfer's Point
G. San Buenaventura State Beach
H. Pierpont Beach

Figure 9: Sediment Sources, BECAs and Littoral Cells
Los Angeles and Orange Counties



Legend

BEACH EROSION CONCERN AREAS

Listing Source

- USACE
- CRSMP
- CSMW
- Survey

Littoral Cell Boundary (approximate)

Potential Sediment Sources

- **Port/Harbor**
- **Wetland/Lagoon**
- **Dam > 500,000 Ft^3**
- **Debris Basin > 40,000 Yd^3**
- **Off Shore Sediment Site**
- **Off Shore Disposal Site (e.g. LA-2)**
- **City**

N W E S

0 7.5 15 22.5 30 Miles

0 10 20 30 40 Kilometers

Projection: Albers, NAD83
Scale: 1:787,980

See Figure 9a for BECA Site Names

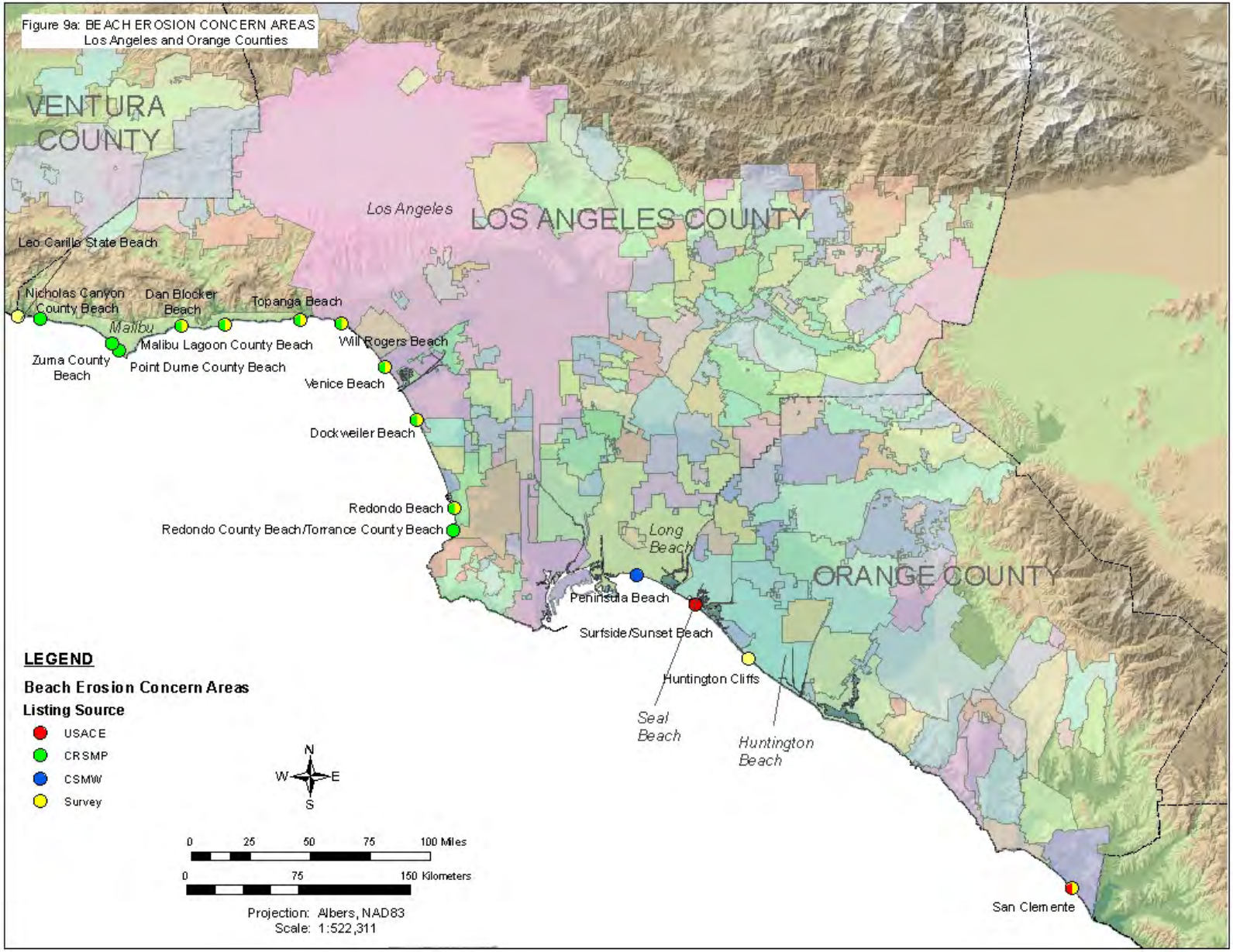
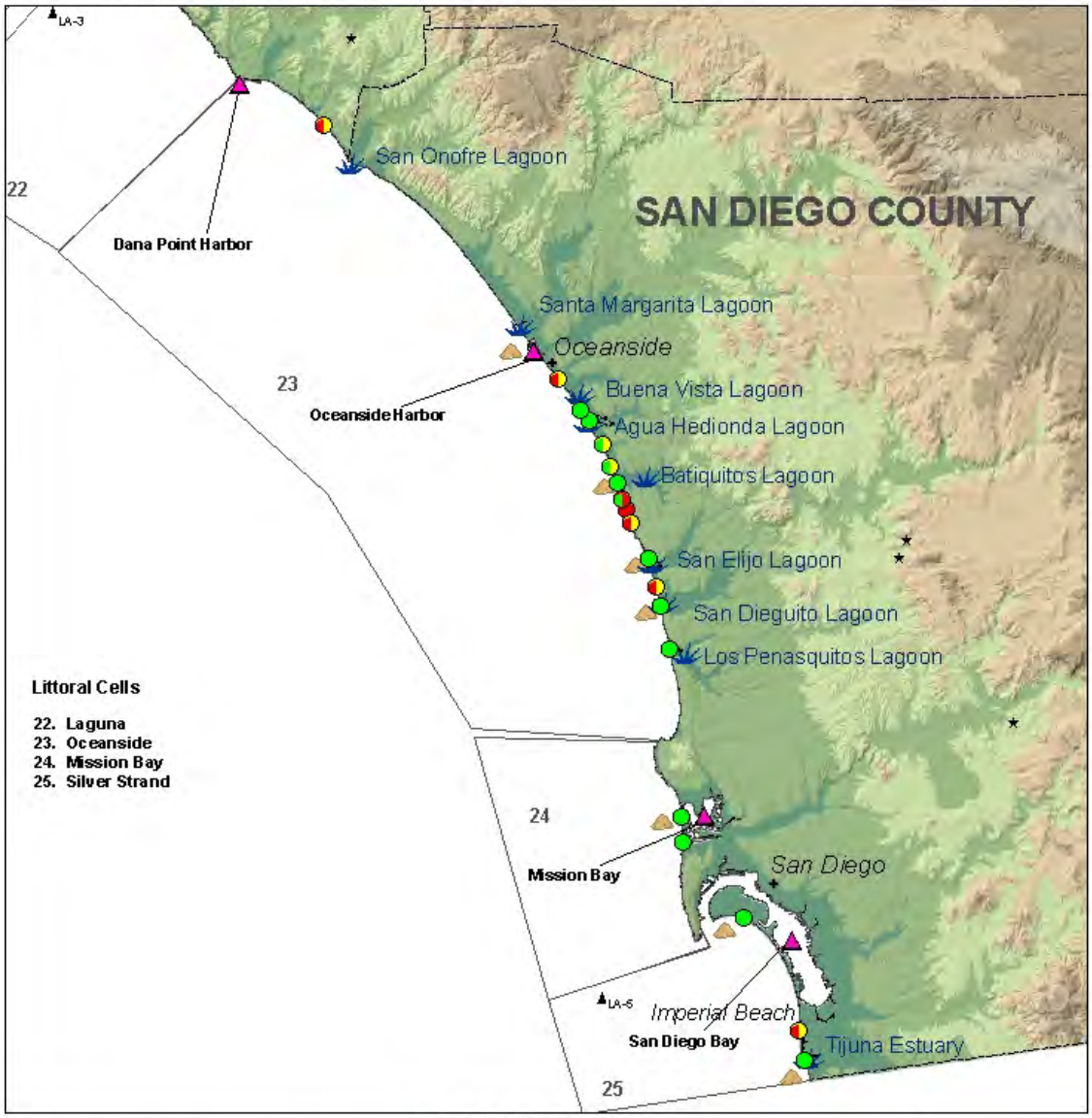


Figure 9a: BEACH EROSION CONCERN AREAS
Los Angeles and Orange Counties
VENTURA COUNTY
Los Angeles
LOS ANGELES COUNTY
ORANGE COUNTY
Leo Carillo State Beach
Nicholas Canyon County Beach
Dan Blocker Beach
Topanga Beach
Malibu
Malibu Lagoon County Beach
Zuma County Beach
Point Dume County Beach
Will Rogers Beach
Venice Beach
Dockweiler Beach
Redondo Beach
Redondo County Beach/Torrance County Beach
Long Beach
Peninsula Beach
Surfside/Sunset Beach
Huntington Cliffs
Seal Beach
Huntington Beach
San Clemente
LEGEND
Beach Erosion Concern Areas
Listing Source
USACE
CRSMP
CSMW
Survey
N
W
E
S
0 25 50 75 100 Miles
0 75 150 Kilometers
Projection: Albers, NAD83
Scale: 1:522,311

Figure 10: Sediment Sources, BECAs and Littoral Cells
San Diego County



Legend

BEACH EROSION CONCERN AREAS

Listing Source

- USACE
- CRSMP
- CSMW
- Survey

Littoral Cell Boundary (approximate)

Potential Sediment Sources

- **Port/Harbor**
- **Wetland/Lagoon**
- **Dam > 500,000 Ft^3**
- **Debris Basin > 40,000 Yd^3**
- **Off Shore Sediment Site**
- **Off Shore Disposal Site (e.g. LA-5)**
- **City**

N W E S

0 7.5 15 22.5 30 Miles

0 10 20 30 40 Kilometers

Projection: Albers, NAD83
Scale: 1:708,690

See Figure 10a for BECA Site Names

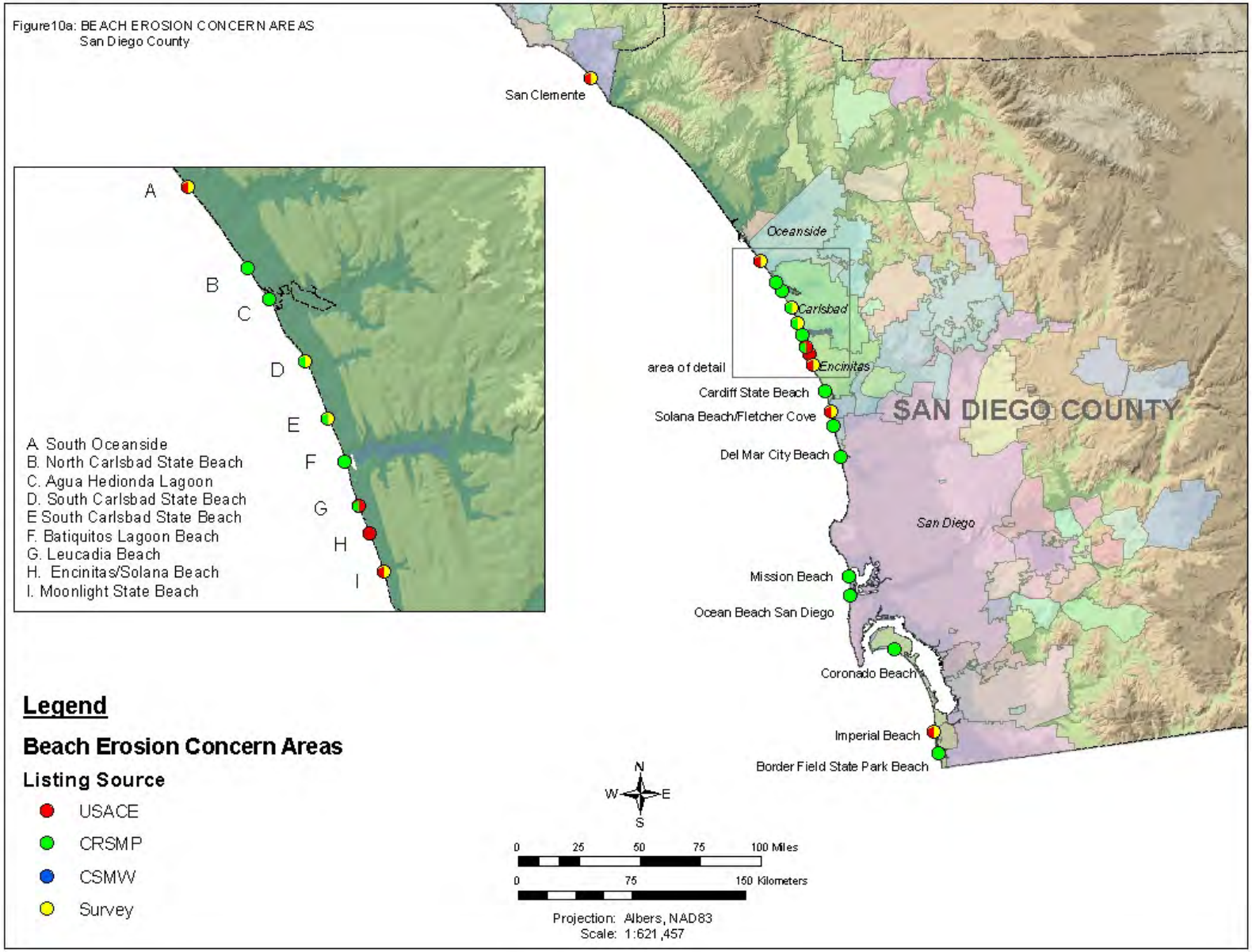


Figure10a: BEACH EROSION CONCERN AREAS
San Diego County
San Clemente
Oceanside
Carlsbad
Encinitas
area of detail
Cardiff State Beach
Solana Beach/Fletcher Cove
Del Mar City Beach
SAN DIEGO COUNTY
San Diego
Mission Beach
Ocean Beach San Diego
Coronado Beach
Imperial Beach
Border Field State Park Beach
A
B
C
D
E
F
G
H
I
A. South Oceanside
B. North Carlsbad State Beach
C. Agua Hedionda Lagoon
D. South Carlsbad State Beach
E South Carlsbad State Beach
F. Batiquitos Lagoon Beach
G. Leucadia Beach
H. Encinitas/Solana Beach
I. Moonlight State Beach
Legend
Beach Erosion Concern Areas
Listing Source
USACE
CRSMP
CSMW
Survey
N
W
E
S
0 25 50 75 100 Miles
0 75 150 Kilometers
Projection: Albers, NAD83
Scale: 1:621,457

2.4.3 CSMW Products Expected During Next Reporting Period

Several products are near completion and are expected to be finalized in the next SMP reporting interval. Many of these reports have been delayed in order to accommodate additional stakeholder review and therefore better address the goals and objectives of CSMW and the SMP. These products include:

- California Beach Erosion Assessment Survey (CBEAS): This informational report and strategy identifies critical coastal erosion locations known to CSMW where beach erosion has been of concern to jurisdictional entity (ies). Also identifies locations of excess sediment (ports, harbors wetlands, flood control projects, etc.) that could be used to address erosion through RSM applications.
- Biological Impacts Analysis Report: This informational report and strategy provides standardized references for environmental documentation, and assists sediment managers in pre- project planning by science-based identification of impact to critical biota and appropriate mitigation measures. Resource Protection Guidelines and Workshops will ensure the product is of maximum use to agency staff charged with protecting natural resources.
- Coastal Sediments Benefit Analysis Tool: This computer-based tool allows the sediment manager to examine issues, costs and benefits associated with different regional alternatives for sediment procurement, transport, and placement.
- Offshore Canyon Sand Capture: This informational tool identifies submarine canyons along the coast of California where artificial measures to reduce or eliminate the amount of sand being lost to the canyon and recovery of that sand for beach nourishment activities might prove cost-effective and environmentally benign, and offers suggestions about how that might be accomplished.
- Policies, Procedures and Regulations (PPR) Recommendations White Paper: This informational report was meant to provide a comprehensive review of legislative and procedural requirements that affect sediment management. Recommendations will provide a coordinated strategy on how to reduce impediments to effective, resource-protective RSM.
- Coastal RSM Plans: Several additional Plans are expected to be developed during the next reporting period. See Section 3.2.4 for a description of these efforts.
- Tijuana Estuary Sediment Study (TESS): This project is meant to determine whether there are any adverse environmental affects of placing sediment with more that 20% fines in the nearshore. Conducted under State Coastal Conservancy guidance, findings could lead to possible amendments to the USEPAs 80/20 rule of thumb for beneficial reuse of sediment on coastlines, and facilitate redevelopment of coastal wetlands, dam restorations and other efforts at restoring natural processes.

3.0 Regional Sediment Management in California

The SMP is a long-term project with an anticipated lifespan of approximately ten years. The Sediment Master Plan will develop a series of tools and products designed to assist in addressing issues expected to arise during implementation of RSM. These products include but are not limited to a) Coastal RSM Plans that identify regional linkages between areas with sediment deficits and excesses and provide various tools to promote effective regional sediment decisions, b) functional geospatial databases to assist in determining potential project sites as well as the possible impacts; c) sampling and analysis standards for non-traditional sources of sediment, d) biological recommendations for use in environmental documents and project planning, and e) regional permits. Products are and will be available through CSMW's website (www.dbw.ca.gov/csmw/default.saspx) and other venues. Bi-annual status reports will describe accomplishments to date and future plans.

3.1 SMP Efforts Needed for Effective RSM Implementation

Figures 5-10 illustrate some of the information compiled to date by the CSMW as part of its SMP development effort. Technical and political boundaries (e.g., littoral cells and counties) provide a basis for the regional framework. Beach Erosion Concern Areas have been compiled and represent location of high concern to state, federal and regional entities known to CSMW at the time of this report. Additionally, larger potential sources of sediment have been compiled through CSMW efforts, including the first phase of Coastal RSM Plans (completed during this reporting period. These potential sources (e.g., ports/harbors, wetlands, coastal dams and debris basins, offshore sediment sources) and BECAs help begin the assessment of regional sediment supply and demand along the California coast. Additional potential sources of sediment and areas of need will be identified in future Coastal RSM Plans and included in future SMP Status Reports.

Implementation efforts needed to accomplish the objectives, goals and mission of the CSMW and the Sediment Master Plan were discussed in Section 2. These "next steps" were developed based on roundtable discussions with staff from regulatory, resource and flood control agencies, planners, managers, scientists and the general public. These efforts include but are not limited to:

- Collecting data needed to characterize the coastal environment.
- Performing economic studies to determine cost-effectiveness of potential projects.
- Developing tools to inform, educate, and promote littoral cell based (regional) sediment management.
- Disseminating new and existing tools to assist resource managers.
- Collaborating among agencies with shared and disparate missions including the California Ocean Protection Council.
- Developing process-related guidance to help eliminate confusion with the regulatory process and streamline project permitting.

- Developing Regional General Permits and region-based Environmental Impact Statement/Environmental Impact Reports for beach restoration.
- Expanding available knowledge on species and habitats of concern that could be impacted by RSM activities and best protective measures.
- Encouraging use of the SMP by California's coastal sediment managers.
- Implementing a public outreach program to identify and promote two-way communication with coastal stakeholders.
- Developing educational materials that will support sediment-based solutions and consideration of sediment as a resource rather than a waste.
- Assisting ports, harbors, wetlands restoration groups and flood control agencies in resolving their sediment-related issues.

3.2 Coastal RSM Plans

To date, three Coastal RSM Plans have been developed to date, one more is ready to initiate, and CSMW expects to have financial resources to begin three additional Coastal RSM Plans during the next reporting period. These efforts are as follows:

3.2.1 Southern Monterey Bay Coastal RSM Plan

This Plan was coordinated by CSMW through the Association of Monterey Bay Area Governments (AMBAG) and covers the Southern Monterey Bay Littoral Cell, which extends from Moss Landing to Point Piños in Monterey. The stakeholder group included the Southern Monterey Bay Coastal Erosion Workgroup (SMBCEW), consisting of local jurisdictions and other stakeholders and led by the Monterey Bay National Marine Sanctuary (MBNMS). A public meeting was held, and the strategies identified in the Plan were subsequently adopted by the AMBAG Board of Directors in November 2008. A Programmatic Environmental Impact Report is planned to address recommendations within the Coastal RSM Plan, including those contained in a Coastal Erosion Feasibility Analysis currently being conducted by the MBNMS and SMBCEW.

3.2.2 Santa Barbara and Ventura Counties Coastal RSM Plan

This Plan was coordinated by CSMW through the Beach Erosion authority for Clean Oceans and Nourishment (BEACON), and covers the Santa Barbara Littoral Cell from Point Conception to Point Mugu. A public meeting was held, and the BEACON Board of Directors subsequently adopted the strategies identified in the Plan in January 2009. A Strategic Implementation Plan is currently under development to begin the process of Plan implementation, and a PEIR has just started up.

3.2.3 San Diego County Coastal RSM Plan

This Plan was coordinated by the CSMW through the San Diego Association of Governments (SANDAG), and covers the southern Oceanside, Mission Bay and Silver Strand Littoral Cells, from Camp Pendleton to the Mexican border. The stakeholder group included SANDAG's Shoreline Preservation Working Group (SPWG), consisting of local jurisdictions, state/federal agencies and environmental NGOs. A PEIR is underway covering many of the locations identified as receiver sites in the Coastal

RSM Plan. The Plan has been approved by SPWG and is expected to be adopted by SANDAG's Board of Directors in May 2009.

3.2.4 Future Coastal RSM Plans

Funding for the Los Angeles County Coastal RSM Plan has been obtained, and CSMW expects that the Plan will be coordinated through LA County Beaches and Harbors, who provided information on BECAs in LA County included on Figure 9. CSMW is currently awaiting completion of an assessment of physical processes by the USACE, through their Coast of California Storm and Tidal Waves Study prior to initiating the Coastal RSM Plan effort.

CSMW is currently evaluating several other littoral cells across coastal California to determine which ones should receive the limited funding that CSMW currently expects to have available for such efforts. Once such funding has been obtained, CSMW will initiate up to three additional Coastal RSM Plans. Such initiation is currently expected to occur in Spring-Summer 2009.

Appendix A
List of Acronyms

AB-64	Assembly Bill 64 (Public Beach Restoration Act)
BEACON	Beach Erosion Authority for Clean Oceans and Nourishment
BECA	Beach Erosion Concern Area
BIA	Biological Impacts Assessment
BRRG	Beach Restoration Reference Guide
CalCoast	California Coastal Coalition
CBECS	California Beach Erosion Concern Survey
CCC	California Coastal Commission
CDBW	California Department of Boating and Waterways
CDFG	California Department of Fish and Game
CDIP	California Data Information Program
CDPR	California Department of Parks and Recreation
CEQA	California Environmental Quality Act
CGS	California Geological Survey
CMANC	California Marine and Navigation Council
CNRA	California Natural Resources Agency
COPC	California Ocean Protection Council
CRSMIS	California Regional Sediment Management Information System
CSBAT	Coastal Sediment Benefits Analyst Tool
CSLC	California State Lands Commission
CSM	Coastal Sediment Management
CSMO	Coastal Sediment Management Office
CSMW	Coastal Sediment Management Workgroup
CWO	California and the World Ocean Conference
DMMO	Dredge Materials Management Office
GIS	Geographic Information System
ITM	Inland Testing Manual
MBNMS	Monterey Bay National Marine Sanctuary
MMS	U.S. Mineral Management Service
NGO	Non-Governmental Organization
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
PMP	Project Management Plan
PPR	Policies, Procedures and Regulations
RSB	Regional Sediment Budget
RSM	Regional Sediment Management
RWQCB	Regional Water Quality Control Board
SANDAG	San Diego Association of Governments
SCC	State Coastal Conservancy
SCOUP	Sand Compatibility and Opportunistic Use Program
SMBCEW	southern Monterey Bay Coastal Erosion Workgroup
SMP	Sediment Master Plan
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency

USGS U.S. Geological Survey

Appendix B
Glossary

Acre-foot – The quantity of water required to cover 1 acre to a depth of 1 foot, equivalent to 43,560 cubic feet or about 326,000 gallons or 1,233 cubic meters.

Backshore – The upper part of the active beach above the normal reaches of the tides and wave run-up (high water), but episodically affected by high waves occurring during a spring high tide.

Beach – That portion of land and seabed above Mean Lower Low Water (MLLW). Includes the foreshore and backshore areas.

Bedload – The material moving on or near the streambed by rolling, sliding, or briefly moving into the flow of water just above the streambed.

Bed material – The sediment composing the streambed.

Bedrock – Rock underlying other, unconsolidated material.

Closure depth – The maximum depth of average seasonal cross-shore sand movement. This depth represents the seaward end of the receiver site profile, and essentially remains unchanged on average over the long term. Sand that moves beyond the depth of closure in a seaward direction is typically lost to the littoral cell and not available for natural seasonal beach recovery. The actual closure depth is typically approximately -30 feet MLLW in Southern California and -40 feet MLLW or deeper in Northern California.

Compatibility (physical) of source and receiver site – When the range of grain sizes of a potential sand material source lies within the range (envelope) of natural grain sizes existing at the receiver site, with certain allowances for exceedances of coarse and fine-grained sediments.

Compatibility (chemical) – The potential source has been determined to not contain pollutants at levels considered unsafe.

Discharge – The volume of water or total fluid plus suspended sediment that passes a given point within a given period of time.

Downdrift (or downcoast) – In California, typically refers to southward direction of littoral drift.

Drainage area – The area, measured in a horizontal plane, enclosed by a topographic divide from which direct surface runoff from precipitation normally drains by gravity into the stream above the specified point.

Drainage basin – The area that is occupied by a drainage system, which consists of a surface stream or body of impounded surface water, together with all tributary surface streams and bodies of impounded surface water.

El Niño/Southern Oscillation (ENSO) - A pattern of large-scale oscillations of a number of oceanic and atmospheric variables (sea surface temperature, sea level pressure, etc.) in the Tropical Pacific. The oscillation switches phase in a 3-5 year cycle. El Niño and La Niña refer to extreme phases of this oscillation.

Fine-grained materials (or fines) - Clays and silts that pass through the #200 soil grain size sieve, or are less than 0.074 millimeters in diameter.

Foreshore – The beach area between approximately Mean Higher High Water and Mean Lower Low Water.

Instantaneous discharge – The discharge at a particular instant in time.

Less-than-0ptimum beach fill material – Material that is not compatible in grain size with sand at the dry beach, but is compatible with material within the nearshore portion of the receiver site. The fines fraction should be within 10% of that of the existing nearshore sediments that exist along a profile.

Littoral cell – A portion of the coastline where sand flows in (e.g., a river mouth), along, and then out of an area (e.g., a submarine canyon). Littoral cells have distinct boundaries and their own sources of sand and removal areas.

Littoral drift – Entrained sand grains moving in the direction of the longshore current. Can be thought of as a river of sand moving parallel to the shore, moving the sand from one coastal location to the next until the sand is eventually lost to the littoral system.

Longshore current – The zigzag movement of sand entrained in upwash and backwash that effectively creates a current parallel to the coastline.

Mean discharge – The arithmetic mean of individual daily mean discharges during a specific period.

Mud – Sediment less than 0.0625 mm in diameter. This includes both Silt and Clay fractions (Wentworth Grainsize Scale).

Nearshore – That portion of the seafloor between the closure depth and Mean Lower Low Water.

Offshore – That part of the seafloor beyond the depth of closure.

Opportunistic sand – Surplus sand from various source materials, including inland construction, development projects, flood control projects, dredging of harbors/ wetlands, etc.

Optimum beach fill material: Material compatible with the dry beach portion of the beach profile. The fines fraction of the grainsize of this material can be within 10% of that of the existing dry beach sediments.

Pacific decadal oscillation (PDO) - A pattern of atmospheric and oceanic conditions of the north Pacific Ocean. It is characterized by sea surface temperature (SST) anomalies of one sign in the north-central Pacific and SST anomalies of the opposite sign to the north-eastern Pacific (Aleutians and Gulf of Alaska). The cycle is a multi-decadal, with each phase (warm or cool) lasting 20-30 years.

Profile - A cross-section through the beach and nearshore perpendicular to the beach slope; it may include a dune face or sea wall, extends across the beach and seaward into the nearshore zone to the closure depth.

Receiver site – The entire related system of coastal environments that would receive opportunistic materials, including the dry beach, nearshore and offshore regions.

Sand – Sediment between 0.0625 and 2 mm in diameter (Wentworth Grainsize Scale).

Sand budgets – A concept used by scientists to identify and quantify, to the degree possible, additions and losses of sand that influence beach width.

Sediment – Particles of inorganic and organic material of various sizes that have been transported by air, water, or ice and have accumulated in loose form behind dams, in bays, in streams, on beaches, in marine canyons, and in other areas. Examples of sediment are gravel, sand, silt, clay/mud.

Sediment discharge – The rate at which the dry mass of sediment passes a section of a stream.

Sediment load – The total sediment being transported as bedload and suspended load, expressed in terms of mass or volume (tons, m^3, etc.)

Sediment yield – The quantity of sediment that is produced per unit area and time

Suspended load – Sediment that is moved and maintained in suspension in water by the upward components of turbulent currents or by colloidal suspension.

Updrift (or upcoast) – In California, typically refers to northward direction of littoral drift.

Water year – The 12-month surface water record that starts October 1 and ends September 30 of each year; designated by the calendar year in which it ends.