



CALIFORNIA BEACH EROSION ASSESSMENT SURVEY 2010

October 2010





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CALIFORNIA BEACH EROSION ASSESSMENT SURVEY PURPOSE AND OVERVIEW

THE CALIFORNIA COASTAL SEDIMENT MANAGEMENT WORKGROUP

The California Coastal Sediment Management Workgroup (CSMW) is a collaborative taskforce consisting of 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 the taskforce's main goals is to pursue innovative ways to solve coastal erosion problems along the California coast, often through placement of sand to augment eroding beaches at locations determined as appropriate for such placement. State membership includes the Natural Resources Agency, Department of Boating and Waterways (DBW), Department of Parks and Recreation, California Coastal Commission, California Geological Survey, San Francisco Bay Conservation and Development Commission, State Coastal Conservancy, Department of Fish and Game, and the State Lands Commission. Federal membership includes U.S. Army Corps of Engineers (USACE), U.S. Geological Survey, and the U.S. Environmental Protection Agency. Nongovernmental organization membership includes the California Coastal Coalition and the California Marine Affairs and Navigation Conference. The Natural Resources Agency and the USACE jointly chair the taskforce.

CALIFORNIA COASTAL SEDIMENT MASTER PLAN

CSMW efforts are primarily coordinated through development of the California Sediment Master Plan (SMP), which lays out a number of objectives, goals and tasks to implement Regional Sediment Management (RSM) throughout coastal California. A fundamental principle of RSM is the application and placement of sediment within a regional area of the coast to address problems such as eroding beaches. Consequently, the CSMW has determined that the SMP effort needs to identify those beaches where current or historical erosion is of concern to state, federal or local entities. This report fulfills this need by providing an initial listing of Beach Erosion Concern Areas (BECAs) throughout California. This list is intended solely to inform decision-makers on the extent and types of beach erosion problems facing the state; inclusion of a particular location in the list does not prescribe or imply that a particular remedial measure (e.g., beach nourishment) is appropriate at that location; only that it has been identified as of concern by some jurisdictional entity. The BECA list is based on information available to the CSMW at this time; locations may be added to or removed from the BECA list in the future as more information becomes available, especially as various segments of coastal California complete region-specific Coastal RSM Plans in coordination with the CSMW.

The basis for including specific locations in the list is described herein; Table 1 and Figures 1-4 summarize and illustrate the BECA locations. This report also discusses why effective solutions to beach erosion problems require regional assessment from both a coastal watershed and offshore area (i.e., littoral cell) perspective. This report further supports regional assessment efforts by identifying potential sources of sediment based on information currently compiled in CSMW's GIS database.

A littoral cell is a discrete coastal and nearshore area within which sediment (e.g., sand) moves 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

COASTAL SETTING

California's approximately 1,100 mile coastline is an extraordinary natural resource of significant economic, environmental, recreational and aesthetic value. This spectacular coastline includes sandy beaches, sheer bluffs, rocky headlands, intertidal zones, wetlands, lagoons and other diverse shoreline types. Beaches are extremely important to California for a number of reasons, and their degradation or diminishment due to coastal erosion will have many negative effects, including stresses to California's state economy.

The California coast can be divided into two distinct regions: southern and northern. The boundary occurs at Point Conception, where both the coastal alignment and the physical environment changes abruptly. The northern California shoreline is fully exposed to winter storm waves generated in the North Pacific, while southern California is afforded partial shelter from these waves by Point Conception and numerous offshore islands. South of Point Conception, the shoreline typically is backed by coastal plains and marine terraces. Expansive sandy beaches dominate, as in the case of Santa Monica Bay, although they may be separated by rocky headlands such as Palos Verdes Peninsula. The northern California coastline tends to be more rugged. At many locations, the mountains extend to the shoreline with only a narrow sliver of sand at their base. Prominent headlands interspersed with stretches of sea cliffs and small pocket beaches are common. Some areas, such as Big Sur, contain rocky bluffs and outcrops with relatively few beaches.

A significant portion of the California coast is actively eroding, due to complex oceanographic and geologic conditions and human activities. Erosion along the California coast is a natural process. However, human activities have substantially altered the natural movement of sand and drastically reduced the natural supply of sediment to the coastline, thereby modifying seasonal beach building and erosion cycles. Dams and debris basins, channelized rivers and streams, hardened shorelines, land areas covered with impervious surfaces and in-stream sand mining have all combined to substantially decrease the supply of beach-compatible sediment provided to the coastline. Harbor jetties, piers, groins and breakwaters interrupt the natural transport of sand along the coastline. Rising sea levels associated with unprecedented climate change will add to the coastal erosion through beach, bluff and dune erosion even if steps are taken to preserve coastal habitats.

Added to the 27 million people living in coastal counties are the 32 million annual out-of-state visitors to coastal beaches (King and Potepan 1997), all of whom contribute to increased development and infrastructure in the coastal zone. California's population is expected to increase to over 40 million people by 2010, putting additional development pressure on coastal communities. Many of the Beach Erosion Concern Areas (BECAs) identified in this report contain some kind of shoreline armoring along the backshore, to protect or provide infrastructure, private or commercial residences. This "fixing" of the backshore has or will result in the narrowing of beach width through passive erosion as sea levels rise. The "coastal squeeze" between coastal infrastructure and eroding coastlines threatens the very survival of the natural, cultural and economic resource of California's coastal beaches. Therefore, ways to enhance sediment supply to beaches or actions to preserve or restore natural sediment supply must be implemented so California's robust beach ecosystems and beach-centered economies will survive and thrive.



Long-term beach variation is currently being studied at University of California San Diego/Scripps Institute of Oceanography and University of California Santa Cruz. Results to date indicate that some beach widths may be cycling over decades as a result of Pacific Decadal Oscillation (PDO) cycles. Beach widths appear to vary between warm and cool phases of the PDO, which may affect the direction of wave attack on the shoreline. Therefore, not all the locations identified in this report are necessarily eroding on a systematic or regular basis. However, with sea levels rising for the past several thousand years and expected to continue and accelerate in the future, coastal erosion and beach loss will continue to be an important issue for California.

BEACH VALUE

Beaches are an invaluable social, economic, natural, and cultural resource. Coastal areas provide human inspiration, spiritual renewal and irreplaceable statewide recreational and educational opportunities. Over two-thirds of Californians visit the beach each year. California's beaches experienced an estimated 659 million visitor-days in 2001, more than twice as many as the visitor-days at all U.S. National Parks combined. California beaches inject billions of dollars into the economy through recreation and tourism. Our beaches provide important habitats for native, threatened, and endangered species such as birds (Brown Pelican, California least tern, Western snowy plover), turtles (Pacific green sea turtle) and fish (tidewater goby, grunion). Beaches and associated dunes often provide a safety buffer between the ocean and our coastal communities, thus reducing storm damage to public infrastructure, private development and important habitats.

In southern California, favorable weather and ocean conditions, combined with the high population density of the region, have resulted in these beaches becoming the most popular recreation destination in the state. In their natural condition, many southern California beaches were incapable of supporting the recreational needs of the human population. Wide, sandy beaches tended to be the exception rather than the rule. Today, however, there are some broad, sandy beaches in southern California resulting from historic projects to place sand directly on beaches or in the adjacent surf zone. Renowned sites such as Santa Monica and Venice, generally regarded as some of the finest beaches in the world, exist in their present condition only because they have received extensive sand through historical nourishment. These and other enhanced beaches provide numerous benefits, including increased recreational and tourism opportunities, restored wildlife habitats, improved and safer coastal access, and greater protection from coastal storms.

Many beaches in northern California remain in a near-natural condition, largely due to the lack of dams, stream channelization and other anthropogenic factors. Exceptions do exist, however, including the highly urbanized San Francisco shoreline and the communities surrounding Monterey Bay. The nature of coastal recreation and usage in northern California is distinctly different from that in southern California. For example, a cooler climate and higher energy waves in the north limit the popularity of some water sports such as bathing. The coast is valued for its scenic beauty, in that it contains some of the most spectacular vistas in the country. As a result, recreation frequently involves leisurely travel along the coast for enjoyment of the rugged scenery. A lower population density results in less beach visitation than in southern California. Beaches provide habitat for a variety of shorebirds, including threatened species such as the snowy plover, haul-out locations for pinnipeds,



spawning habitat for grunion, and many rare plants and fauna inhabit dunes backing the beaches.

THE NEED FOR REGIONAL SEDIMENT MANAGEMENT

Coastal geologists and engineers have demonstrated that any alteration of sediment transport within a region will likely impact, to some degree, the movement and availability of sand elsewhere within that region. This can result in either positive or negative impacts on coastal resources and development. Activities associated with our urbanizing society have resulted in sediment imbalances, such that too much sediment may exist in one location (e.g., harbor channels, inundated wetlands, dams) while adequate sediment may be lacking in other areas of the region (eroding beaches and wetlands). It is only through a holistic evaluation of sediment supply issues across the region that these sediment imbalances can be restored to equilibrium. Regional Sediment Management (RSM) has emerged over the past few years as the process most suited to address such sediment imbalances.

The CSMW held a series of public and technical workshops regarding development of the Sediment Master Plan (SMP) and implementation of RSM, and it was clear that sediment management issues and solutions varied across coastal California. Therefore, a major SMP thrust is close coordination with regional and associated local entities to develop individual Coastal RSM Plans that focus on sediment management issues of import within their region. Each Coastal RSM Plan has or will identify BECAs and potential sediment sources for beneficial reuse, and develop an associated management plan to best apply RSM principles within that region. Three Coastal RSM Plans have been developed to date; many of the BECAs were included as a result of the regional entity identifying that location as of concern within their Coastal RSM Plan. Four additional Coastal RSM Plans are currently under development and two more are expected to start in 2010/2011 fiscal year. Information from those Plans will be incorporated into future versions of CBEAS.

BEACH EROSION CONCERN AREAS

Through tables, figures, and appendices, this report does the following:

- 1) Identifies BECAs important to state, federal or regional entities across coastal California, based on available information to date;
- 2) Provides the rationale for including a specific coastal location in the BECA list;
- 3) Presents information to help assess appropriate sediment management options for the BECA sites, including beneficial reuse;
- 4) Describes how current sediment management processes have exacerbated sediment imbalance (i.e., too much or too little sediment) throughout regions and how RSM can help resolve those problems at a given BECA; and
- 5) Describes various management options available to address coastal erosion at the BECAs.

Beneficial reuse of sediment involves removing clean excess sediment, either trapped in wetlands, harbors, shipping channels, and flood control structures or generated during construction projects, and transporting it to locations with inadequate sediment supply. For example, Port of Oakland dredge materials were used to restore wetlands in San Francisco Bay, while dredge materials are often placed on nearby beaches in southern California.



Table 1 provides a summary list of BECAs identified to date, and Figures 1-4 show their locations along the California coast. These locations have been compiled in a GIS database, and they are available for reference or download from CSMW's spatial data website (www.dbw.ca.gov/csmw/default.aspx). Figures 1-4 distinguish (i.e., "Listing Source") whether the BECA was included in the CBEAS list as a result of:

- The Department of Boating and Waterways initial assessment of appropriate candidate sites,
- The location is being investigated by the U.S. Army Corps of Engineers to assess federal interest,
- The coastal stretch was identified as of concern in a Coastal RSM Plan, or
- CSMW member(s) had reason to believe that the location was of particular concern and had not yet been identified through one of the other efforts.

Supporting Information

Information used to compile the BECA list is presented in a series of appendices. Spatial locations of the BECAs are also available on CSMW's spatial data website, <http://coastalsediment.resources.ca.gov/>. The appendices presented within this report are summarized below:

Appendix A presents the BECA sites, listed from north to south. Each description includes location, setting, anticipated lead agency(ies) for potential projects, problem assessments, and the Listing Source. This list is not meant to be a final list, but rather a starting point that can be added to or subtracted from as more information becomes available. Inclusion on this list does not imply that a particular type of remedial measure should be implemented, only that the location was of concern to regional, state or federal stakeholders. More information would need to be analyzed to determine whether a specific solution was appropriate at a given location. For example, beach nourishment would need to consider costs, replenishment source, biological constraints, current littoral processes, and long-term (or short-term) effectiveness in light of rising sea levels. Natural or managed retreat would need to consider the presence of critical infrastructure and costs associated with relocation and land acquisition. The BECAs are not prioritized; this is a recommended next step and such prioritization should include how the locations could be impacted by sea level rise.

Appendix B describes how the list was developed. BECA determinations were accomplished in a multi-step process. An initial survey was conducted, with the collected information assessed and field checked by DBW. The initial list was then condensed, based on various criteria described within Appendix B. Locations being investigated by the USACE were added to the list. The BECAs were vetted with various local and regional agencies and then augmented with information from Coastal RSM Plans being prepared in coordination with CSMW. Further additions and changes can be expected as additional Coastal RSM Plans are prepared for other parts of coastal California.



Appendix C presents a detailed explanation of the need for, and benefits of Regional Sediment Management, and how CSMW is implementing RSM through the development of Coastal RSM Plans. Figures illustrate: how man-induced changes have affected sediment transport; CSMW's vision on how RSM can help resolve sediment imbalance issues, and; littoral cells, BECAs and potential sources of sediment along the California coast. BECAs are also grouped within coastal geomorphic sections, organized from north to south, for purposes of discussion. Each section describes physical processes operating within that section of coastline, and identifies known potential sources of sediment (e.g., harbors, wetlands, flood control structures, offshore deposits) available for beneficial reuse as appropriate.

Appendix D contains an overview of sediment management-related alternatives that could address coastal erosion at the BECA. This pre-defined list of alternatives does not imply that they are the only ones that should be considered for the project, nor do they represent any endorsement by CSMW member agencies, but are instead presented solely to assist decision-makers in a preliminary assessment of whether sediment management-related alternatives could be applicable at the BECA in question. Other alternatives may be appropriate and could arise during the permitting and environmental assessment phases. The pre-defined list of potential alternatives includes No Action, RSM, Managed Retreat, Beach Nourishment, Retention Structures, and, Beach Management.

CONCLUSION

This report and initial list of Beach Erosion Concern Areas provides decision-makers with locations where beach erosion has been identified by the CSMW as a concern to federal, state or regional entities in certain portions of coastal California. It does not quantify the financial resources needed to address these problems nor does it identify specific solutions for erosion at the BECAs. Additional efforts by federal, state, and regional/local agencies to quantify needed financial resources would be appropriate once recommended solutions are identified and prioritized. Please note that the CSMW intends to periodically update this report and BECA list as other regions of coastal California develop Coastal RSM Plans.

DISCLAIMER:

Information is presented in this report solely for consideration by federal, state, and local government agencies, organizations, and committees involved in the management and protection of coastal resources in California. The list of BECAs has not been accepted nor approved by any governmental agencies and, as such, should not be construed to represent policy for any agency mentioned in this document. This document was prepared with significant input from CSMW members but does not necessarily represent the official position of any CSMW member agency.



TABLE 1- BECA Locations

County	Location	Listing Source	Page No. (Appendix A)
Alameda	Robert W. Crown Memorial State Beach	Survey	16
San Mateo	Coyote Point	Survey, County	16
San Francisco	Ocean Beach (San Francisco)	USACE	17
San Mateo	Princeton	CSMW	17
San Mateo	El Granada County Beach	Survey	18
Monterey	Southern Monterey beaches	CRSMP	18
Santa Barbara	Refugio State Beach	Survey	19
Santa Barbara	El Capitan State Beach	Survey	19
Santa Barbara	Isla Vista	Survey	20
Santa Barbara	Goleta Beach County Park	Survey, USACE	20
Santa Barbara	Arroyo Burro County Beach	CRSMP	21
Santa Barbara	Butterfly Beach	CRSMP	21
Santa Barbara	Summerland Beach	CRSMP	22
Santa Barbara	Santa Claus Beach	CRSMP	22
Santa Barbara	Carpinteria City Beach	Survey, USACE	23
Santa Barbara	La Conchita Beach	Survey	23
Ventura	Oil Piers beaches	USACE	24
Ventura	Hobson County Park	Survey	24
Ventura	North Rincon Parkway	CRSMP	25
Ventura	South Rincon Parkway/Emma Wood County Beaches	CRSMP	25
Ventura	Emma Wood State Beach	Survey	26
Ventura	Surfers Point Park	Survey, CRSMP	26
Ventura	San Buenaventura State Beach	Survey	27
Ventura	Pierpont Beach	Survey	27
Ventura	Oxnard Shores/Mandalay State Beach	CRSMP	28
Ventura	Hueneme Beach	CRSMP	28
Los Angeles	Leo Carrillo State Park	Survey	29
Los Angeles	Nicholas Canyon County Beach	CRSMP*	29
Los Angeles	Dan Blocker County Beach	Survey, CRSMP*	30
Los Angeles	Malibu Surfrider/Malibu Lagoon State Beach	Survey, CRSMP*	30
Los Angeles	Topanga County Beach	Survey, CRSMP*	31
Los Angeles	Will Rogers State Beach	Survey, CRSMP*	31
Los Angeles	Venice City Beach	Survey, CRSMP*	32
Los Angeles	Dockweiler State Beach	Survey, CRSMP*	32
Los Angeles	Redondo County Beach	Survey, CRSMP*	33



TABLE 1- BECA Locations

County	Location	Listing Source	Page No. (Appendix A)
Los Angeles	Redondo/Torrance County Beach	CRSMP*	33
Los Angeles	Long Beach City/Peninsula Beach	CSMW	34
Orange	Surfside - Sunset Project	USACE	34
Orange	Huntington Cliffs	Survey	35
Orange	San Clemente	Survey, USACE	35
San Diego	South Oceanside/North County San Diego	Survey, USACE, CRSMP	36
San Diego	Carlsbad State Beach	CRSMP	36
San Diego	Agua Hedionda/Encinas	CRSMP	37
San Diego	South Carlsbad State Beach/Encinas Creek	Survey, CRSMP	37
San Diego	Batiquitos Lagoon Beach	CRSMP	38
San Diego	Leucadia State Beach	CRSMP, USACE	38
San Diego	Moonlight State Beach	CRSMP, USACE	39
San Diego	Cardiff State Beach/San Elijo Lagoon Beach	CRSMP	39
San Diego	Solana Beach/Fletcher Cove	CRSMP, USACE	40
San Diego	Del Mar City Beach/San Dieguito Lagoon Beach	CRSMP	40
San Diego	Torrey Pines State Beach	CRSMP	41
San Diego	Mission Beach	CRSMP	41
San Diego	Ocean Beach (San Diego)	CRSMP	42
San Diego	Coronado	CRSMP	42
San Diego	Imperial Beach	CRSMP, USACE	43
San Diego	Border Field State Park	CRSMP	43

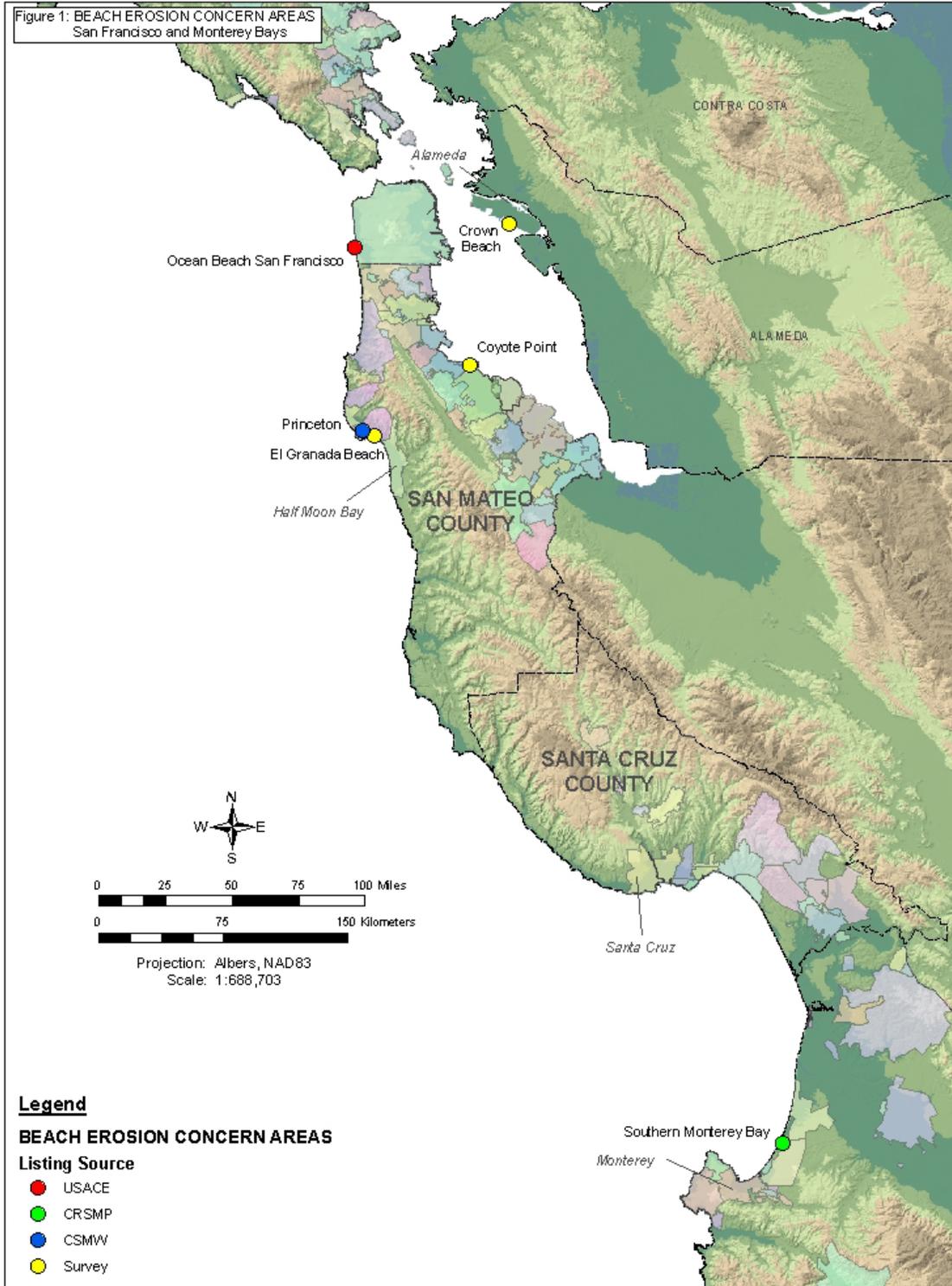
Survey- Location was identified in DBWs initial survey of erosion sites

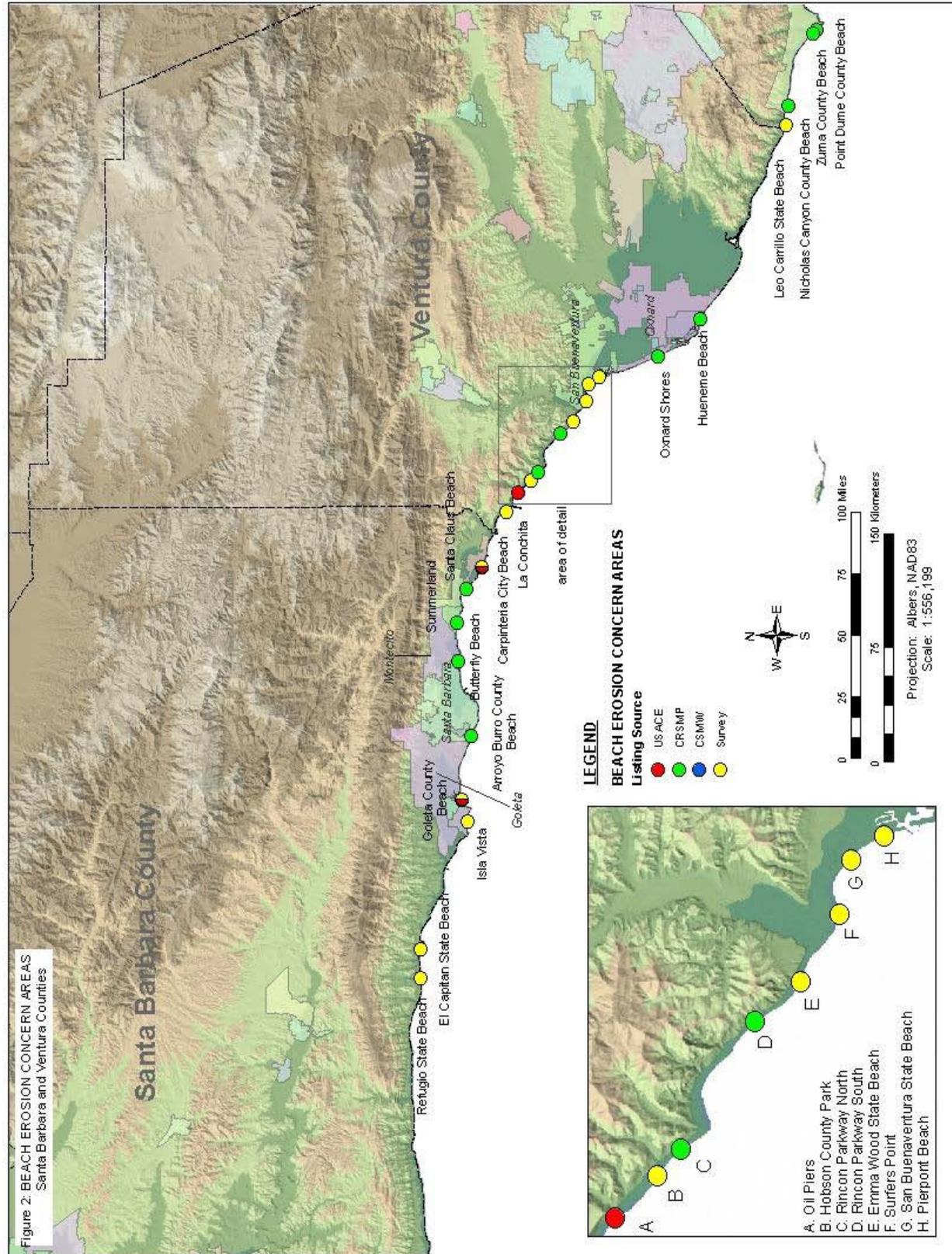
USACE- Location is currently being assessed for federal interest

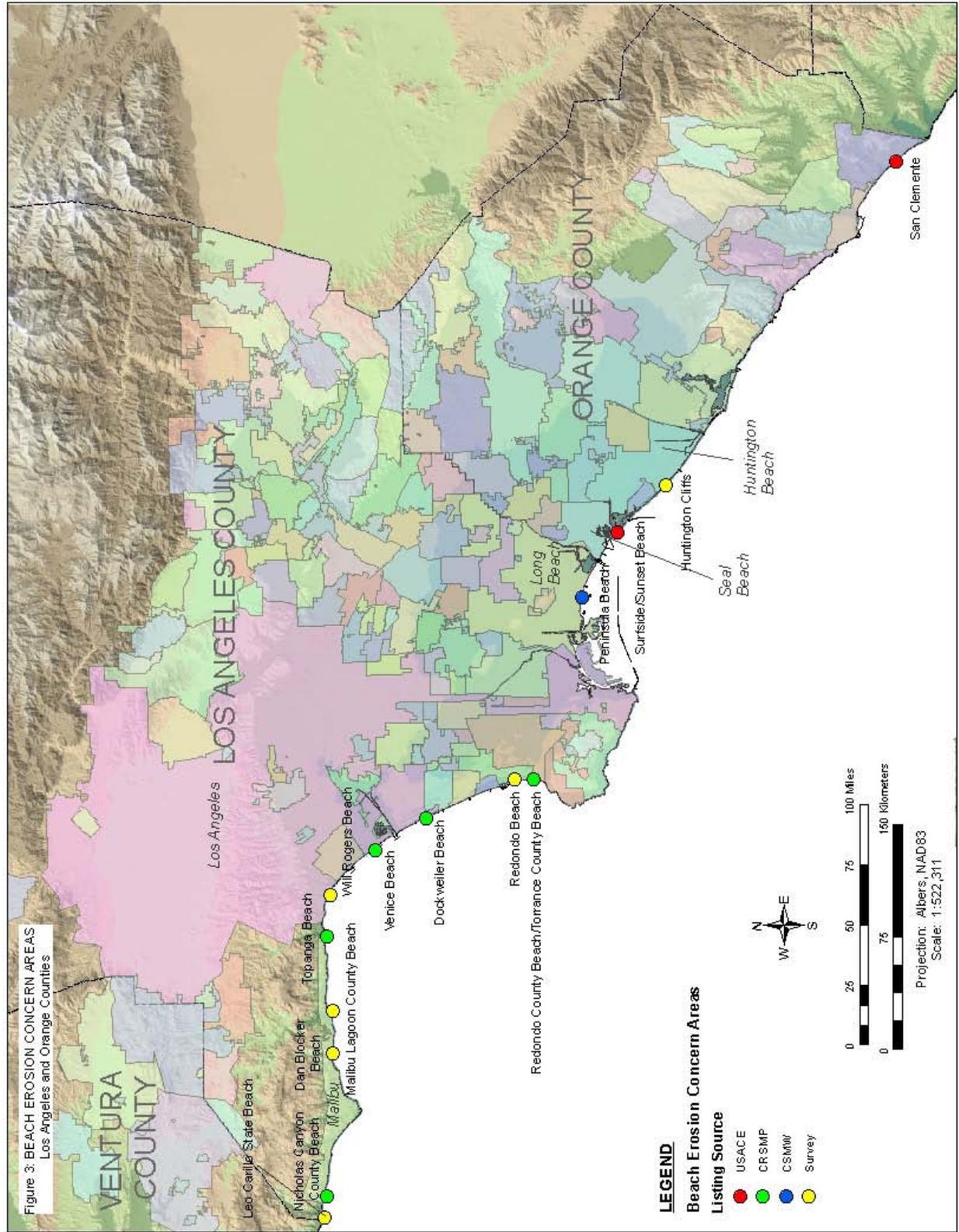
CRSMP- Location is identified within Coastal RSM Plan

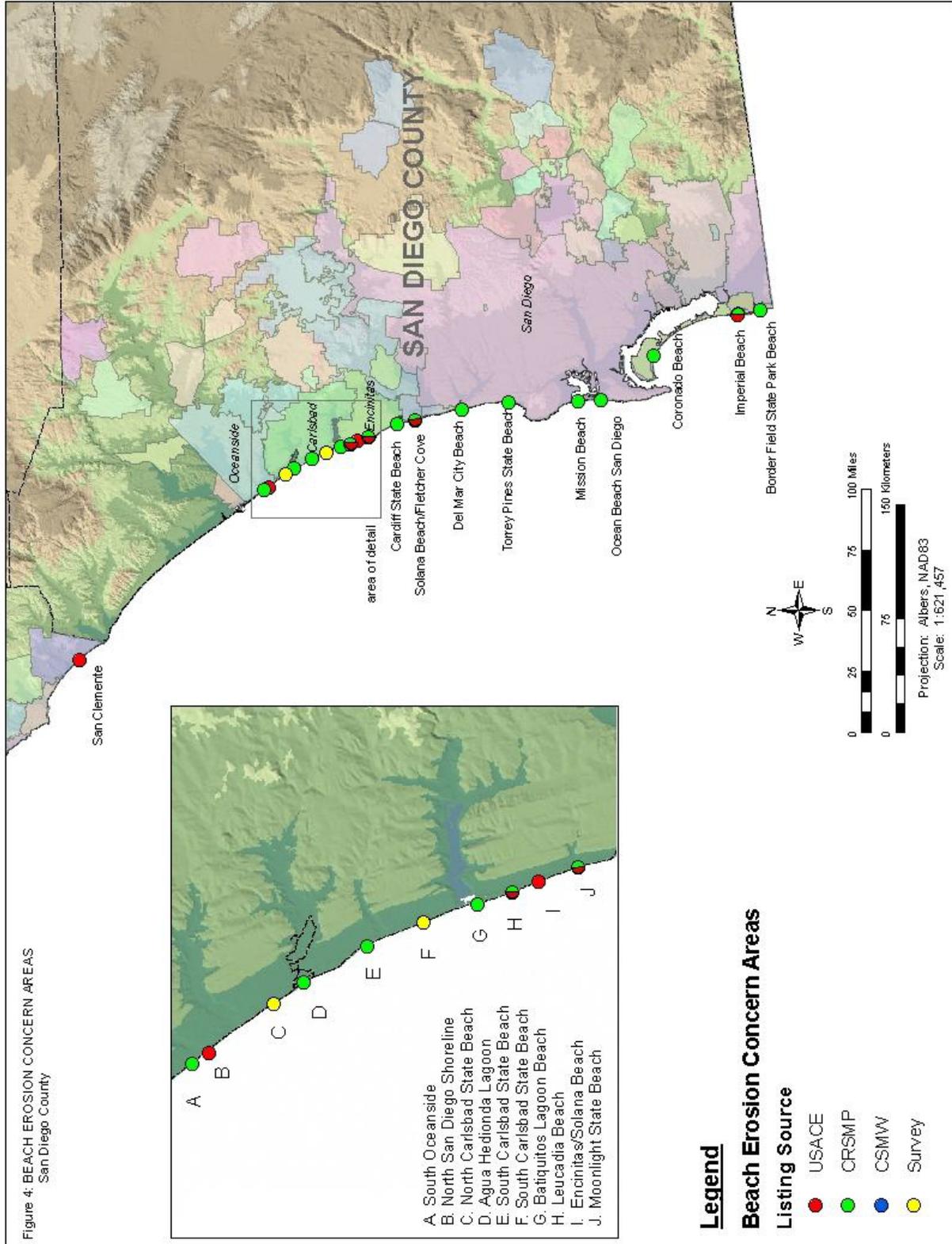
CSMW- Additional location identified by CSMW member(s)

* LA County Department of Beaches and Harbors provided areas of concern in advance of LA County's upcoming Coastal RSM Plan











APPENDIX A

BECA Descriptions

Robert W. Crown Memorial State Beach
 East Bay Regional Park District
 Alameda County
 Listing Source: Survey

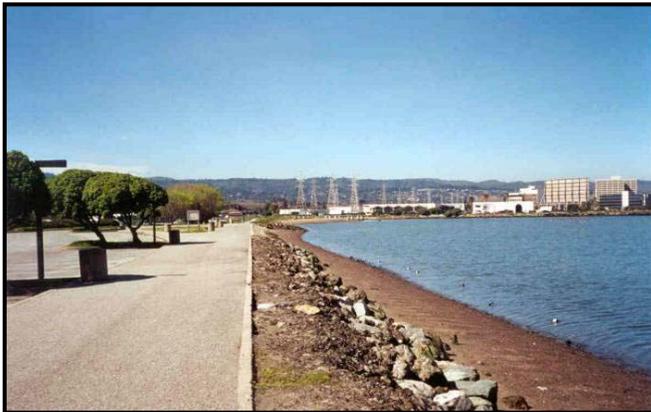
Setting: Long sandy beach requiring periodic nourishment. Sheet pile groins are located at each end. Shore-side improvements include parks, parking lots, streets & dunes.

Project Lead: East Bay Regional Park District, BCDC?



PROBLEM ASSESSMENT

Littoral transport moves sand away from the beach and partially outside of the retaining structures, resulting in a loss of recreational benefits.



Coyote Point

San Mateo County

Listing Source: Survey; County of San Mateo

Setting: County Park with 2,400 feet of beach, a promenade, parking lot, and park buildings. This is an active windsurfing area.

Project Lead: San Mateo County, BCDC?

PROBLEM ASSESSMENT

Storm erosion has damaged the concrete walkway and promenade. Part of the promenade has collapsed and access to the Bay has been limited for over 300 feet of the promenade. Existing shoreline protection along approximately 600 linear ft currently protects the promenade. The remainder is unprotected and has suffered significant erosion. The area does not meet FEMA requirements for 100-year flood elevations.

Ocean Beach - San Francisco

San Francisco County

Shoreline Mile: 6.5 - 7.1

Listing Source- USACE

Setting: Sandy irregular beach backed by active dunes, highway, roads, parking lot, park and houses.

Project Lead: USACE



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PROBLEM ASSESSMENT

Chronic erosion has resulted in loss of recreational beach and damage to the City and Golden Gate National Recreation Area improvements. Erosion is especially severe along a 0.6 mile stretch where the Great Highway and utilities beneath that highway are threatened. Recreation and tourism opportunities, public health and safety benefits and coastal habitats are also threatened. Loss of parking lot could diminish public access.



Princeton (Pillar Point Harbor)

San Mateo County

Shoreline Mile 17.9 - 18.3

List Source- CSMW

Setting- This stretch of sheltered shoreline is highly desirable for beach combing and strolling, and is located within the Pillar Point Harbor breakwater

Project Lead: San Mateo County?

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www.californiacoastline.org

PROBLEM ASSESSMENT

Long term erosion of the beach is impacting habitat, recreation, coastal access and coastal development in this 0.4 mile section of shoreline. Passive erosion adjacent to areas of development with hardened shoreline is prohibiting lateral beach access through narrowing of the beach.

El Granada County Beach

San Mateo County

Shoreline Mile 19.0-19.3

Listing Source- Survey

Setting: Narrow sandy beach backed by a low bluff. A rock revetment north of the bluff protects Highway 1.

Project Lead: San Mateo County



PROBLEM ASSESSMENT

High beach usage/access area. Bluff erosion occurs during high tides and storm wave activity. Erosion threatens a wetland behind the former parking area. Undermining of Highway 1 is imminent. Passive erosion may be contributing to beach width loss due to the presence of rigid structures behind the beach. This location is part of, and subject to regulations pertaining to the Gulf of Farallones National Marine Sanctuary. Accumulated sediment inside the adjacent breakwater for Pillar Point Harbor could be used for nourishment, but such activity is subject to the sanctuary regulations which currently prohibit such activity.



Southern Monterey Beaches

Monterey County

Shoreline Miles: 16.2-19.2

Listing Source- CRSMP

Setting: This stretch of shoreline is a highly desirable beach combing and strolling area located along the picturesque Monterey Bay National Marine Sanctuary and fronting the Cities of Sand City and Monterey.

Project Lead: Association of Monterey Bay Area Governments

PROBLEM ASSESSMENT

Erosion of the beach and coastal dunes are impacting critical habitats, coastal access, and threatening public infrastructure such as a raw sewage transport pipeline for much of southern Monterey Bay. Passive erosion fronting areas of hardened shoreline will eventually prohibit lateral beach access through narrowing of the beach. Seawalls continue to be built to protect individual structures from erosion-related damages. A 3-mile stretch of shoreline from Wharf II north to Sand City was recommended for restoration in the Coastal RSM Plan, which also indicates erosion rate of 1.0-3.5 ft/year along this stretch.

Refugio State Beach

Santa Barbara County
Shoreline Mile 72.1-72.8
Listing Source- Survey

Setting: Narrow sandy beach backed by a parking lot, day use area, and overnight camping facilities. Beach is flanked by rocky headland and creek.

Project Lead: California Department of Parks and Recreation



PROBLEM ASSESSMENT

Existing beach is inadequate in width and berm height during winter months to fully protect back beach area from storm waves and coastal flooding. Palm trees are in imminent danger of erosion damage. Erosion results in recreational loss during summer season.



El Capitan State Beach

Santa Barbara County
Shoreline Mile 74.9-75.6
Listing Source- Survey

Setting: Narrow sandy beach backed by sea cliffs, parking lot day use area, and over night camping facilities. Beach is flanked by rocky headlands and creek.

Project Lead: California Department of Parks and Recreation

PROBLEM ASSESSMENT

Existing beach is inadequate in width and berm height throughout the winter months to fully protect cliff toe and backlands from storm waves and coastal flooding. Existing restroom building is partially protected by retaining wall structure. Exposed cobble in winter provides some erosion protection.

Isla Vista

Santa Barbara County
Shoreline Mile 84.9-85.9
Listing Source- Survey

Setting: Narrow to non-existent sandy beach backed by sea cliffs. Back beach/development includes sensitive fresh water wetlands, private property, and U.C. campus.

Project Lead: Santa Barbara County/BEACON



PROBLEM ASSESSMENT

Existing beach is inadequate in width and berm height throughout the year to support recreation use. Sea cliff toe is continually exposed to waves which threatens development and infrastructure. Public Research Institute Sea Level Rise study estimates erosion back to the ocean front road by 2100.



Goleta Beach County Park

Santa Barbara County
Shoreline Mile 87.4-88.2
Listing Source- Survey, USACE

Setting: Sandy beach backed by park facilities, lagoon, slough, marsh and airport.

Project Lead: BEACON, USACE

PROBLEM ASSESSMENT

Episodic erosion following major El Niño events has resulted in loss of recreational beach and damage to park improvements. Calm periods between El Niños usually result in wider beaches. Beach was renourished in 2004. This area is part of an ongoing USACE shoreline protection study.

Arroyo Burro County Beach

Santa Barbara County

Shoreline Miles: 92.3-92.7

Listing Source- CRSMP

Setting: Narrow sandy beach and offshore reef backed by high bluff underlain by fractured and folded bedrock. Creek mouth /lagoon bordered by park facilities.

Project Lead: BEACON

PROBLEM ASSESSMENT



Wave-cut bluff produces frequent slides along base and face of bluff. Bluff is also susceptible to large block failure in Monterey Shale, and numerous homes are at risk. Park facilities and coastal access stairways subject to damage from high waves and flooding.



Butterfly Beach

Santa Barbara County

Shoreline Miles: 98.8-99.4

Listing Source- CRSMP

Setting: Narrow sandy beach backed partially by wavecut terrace containing a cemetery, and partially by seawall and revetment protecting road and hotels.

Project Lead: BEACON

PROBLEM ASSESSMENT

Bluff contains many active slides, and road is threatened by cliff erosion. Low lying areas behind street are subject to flooding during high wave conditions. Passive erosion may be contributing to narrowing beach width due to presence of seawall and revetment.

Summerland Beach

Santa Barbara County

Shoreline Miles: 101.7- 102.4

Listing Source- CRSMP

Setting: Narrow sandy beach backed by wave-cut uplifted marine terrace containing Park facilities and railroad; houses are located nearby.

Project Lead: BEACON



PROBLEM ASSESSMENT

Active slides are located along the base and face of the bluff. Portions of the railroad embankment are protected by massive rock revetment



Santa Claus Beach

Santa Barbara County

Shoreline Miles: 105.6-105.8

Listing Source- CRSMP

Setting: Popular, narrow sandy beach backed by rock rubble seawall, houses and commercial development, including the railroad.

Project Lead: BEACON

PROBLEM ASSESSMENT

Houses and railroad are subject to flooding and damage during major storm events.

Carpinteria City Beach

Santa Barbara County

Shoreline Miles: 106.3 - 106.8;

Listing Source- Survey; USACE

Setting: Sandy beach backed by houses, park facilities and adjacent to creek mouth.

Project Lead: USACE; BEACON

PROBLEM ASSESSMENT

This beach is highly susceptible to storm erosion and resulting damages. Damages to the private property and public facilities will continue as a result of shoreline retreat, storm damage, and coastal flooding. USGS reports long-term trends of erosion to west, accretion to east; erosion hotspot migrated onto west end of beach during 97-98 El Nino with erosion rates of 0.3-2.33 m/year, caused by flanking erosion of updrift structure. This area is part of an ongoing USACE shoreline protection study.



La Conchita Beach

Ventura County

Shoreline Mile 1.0-2.4

Listing Source- Survey

Setting: Narrow to non-existent sandy beach backed by seawall and Highway 101. Beach is flanked by rocky headlands.

Project Lead: Ventura County

PROBLEM ASSESSMENT

Beach has been compromised by historical encroachment of railroad and highway infrastructure. Recreation opportunity exists by virtue of lateral access. Direct access is difficult and hampered by lack of parking. Passive erosion may be contributing to narrowing beach width due to presence of seawall backing the beach.

Oil Piers

Ventura County

Shoreline Mile 3.7-3.9

Listing Source- USACE; CRSMP

Setting: Narrow to non-existent sandy beach backed by seawall and frontage road. Beach located at former location of pier to oil platform

Project Lead: USACE



PROBLEM ASSESSMENT

The rock revetment-backed beach at Oil Piers has narrowed in recent years due to demolition of the Mobil oil pier in 1998. Shoreline erosion between the demolished oil pier location and the shoreline has increased since removal. A sand retention structure, or multi-purpose reef, located offshore is proposed for this location by USACE. The main goal of the reef is to retain sand that will be placed along the shoreline, without having a negative impact to the adjacent shoreline. The reef is also designed to enhance natural resources and recreation opportunities (i.e. surfing) as additional benefits. Passive erosion may be contributing to narrowing beach width due to presence of seawall backing the beach.



Hobson County Park

Ventura County

Shoreline Mile 4.9-5.0

Listing Source- Survey

Setting: Narrow to non-existent sandy beach backed by seawall, RV/tent campground, and the old coast highway.

Project Lead: Ventura County

PROBLEM ASSESSMENT

Beach has been compromised by historical encroachment of railroad and highway infrastructure. Recreation opportunity exists by virtue of lateral access. Passive erosion may be contributing to narrowing beach width due to presence of seawall backing the beach.

North Rincon Parkway

Ventura County

Shoreline Miles: 5.1-6.8

Listing Source- CRSMP

Setting: Narrow to non-existent sand and cobble beach, backed by massive rock revetment and seawall. Extremely popular roadside RV parking. Hobson County Park is located at the north end.

Project Lead: BEACON

PROBLEM ASSESSMENT:

Road subject to damage during high wave conditions from wave overtopping. Passive erosion may be contributing to narrowing beach width due to presence of seawall backing the beach.



South Rincon Parkway/Emma Wood State Beach

Ventura County

Shoreline Miles 7.1-10.4

Listing Source- CRSMP

Setting: Narrow sand and cobble beaches backed by rock revetment, deteriorating concrete seawall, Highway 101 and homes. Emma Wood State Beach is located at south end of the Parkway.

Project Lead: BEACON

PROBLEM ASSESSMENT:

Road and homes are subject to flooding and damage from overtopping waves during severe storm events. Passive erosion may be contributing to narrowing beach width due to presence of seawall backing the beach.

Emma Wood State Beach

Ventura County

Shoreline Mile 10.4-12.0

Listing Source- Survey

Setting: Narrow to non-existent sandy beaches backed by seawall, revetment, road side RV camping, and the old coast highway.

Project Lead: California Department of Parks and Recreation



PROBLEM ASSESSMENT

Beach has been compromised by historical encroachment of railroad and highway infrastructure. Seawall has been breached historically, and park facilities and access road are subject to damage during high storm conditions overtopping seawall. Passive erosion may be contributing to narrowing beach width due to presence of seawall backing the beach.



Surfers Point Park

Ventura County

Shoreline Mile 12.8-13.3

Listing Source- Survey; CRSMP

Setting: Transient cobble and sandy beach backed by coastal access improvements, public street, and County fairgrounds on artificial fill.

Project Lead: BEACON

PROBLEM ASSESSMENT

Area has experienced chronic erosion exacerbated by historical encroachment on shoreline. Recreation opportunity exists by virtue of lateral access.

San Buenaventura State Beach

Ventura County

Shoreline Mile 13.7-15.6

Listing Source- Survey

Setting: Wide sandy beach backed by day-use recreation facilities, a commercial center, and private homes. Shoreline stabilized by groin field.

Project Lead: California Department of Parks and Recreation



PROBLEM ASSESSMENT

Six rubble-mound groins built in 1960's are in need of maintenance and rehabilitation to maintain function and prevent shoreline from receding.



Pierpont Beach

Ventura County

Shoreline Mile 15.6-15.8

Listing Source- Survey; CRSMP

Setting: Narrow beach backed by private homes and public street.

Project Lead: BEACON

PROBLEM ASSESSMENT

This beach is technically part of San Buenaventura State Beach but has different recreational patterns and issues compared to that beach. Beach is chronically narrow at terminus of groin field and harbor jetty. Recreation opportunity exists by virtue of lateral access. Wind-blown sand creates a nuisance hazard. Passive erosion may be contributing to narrowing beach width due to presence of hard structures backing the beach.

Oxnard Shores/Mandalay Beach

Ventura County

Shoreline Miles: 19.7-20.3

Listing Source- CRSMP

Setting: Narrow sandy beach backed by wide, intermediate dune field. Some houses are protected by seawalls and/or built on pilings.

Project Lead: BEACON



PROBLEM ASSESSMENT

Beach subject to extreme changes. Wind-blown sand creates a nuisance hazard.



Hueneme Beach Park

Ventura County

Shoreline Miles: 24.6-26.6

Listing Source- CRSMP

Setting: Wide sandy beach with dunes backed by park facilities, commercial and industrial development. Beach periodically nourished with sediment from the dredging of the Channel Islands Harbor's sand trap.

Project Lead: BEACON

PROBLEM ASSESSMENT

Local park facilities subject to damage during high wave conditions. Nourishment location and placement needs to be optimized to enhance longevity of sand on beach before it is lost down Mugu submarine canyon.

Leo Carrillo State Park

Los Angeles County
Shoreline Mile 0.0 - 0.5
Listing source- Survey

Setting: Narrow beach backed by a low bluff. A paved day use parking lot and recreation facilities are located adjacent to beach.

Project Lead: California Department of Parks and Recreation



PROBLEM ASSESSMENT

Beach is inadequate in width and elevation to fully protect back beach improvements from severe storm erosion episodes. Natural rock outcrop at downcoast end of beach is insufficient to act as retention structure. Complete loss of parking lot and facilities is expected to occur in the future.



Nicholas Canyon County Beach

Los Angeles County
Shoreline Mile 1.7 - 2.0
Listing Source- Los Angeles County Department of Beaches and Harbors

Setting: Narrow beach backed by low bluff. Beach protects recreation facilities and paved roadway used for public access and emergency lifeguard services.

Project Lead: Los Angeles County

PROBLEM ASSESSMENT

The berm is inadequate in width and elevation to fully protect back beach improvements from severe storm erosion episodes. Natural outcrop at the downcoast end of beach provides limited sand retention capability. Complete loss of facilities is expected to occur in the future.

Dan Blocker County Beach

Los Angeles County
Shoreline Mile 14.2 - 14.7
Listing Source- Survey

Setting: Narrow beach backed by low bluff, limited lateral parking, and Pacific Coast Highway.

Project Lead: Los Angeles County



PROBLEM ASSESSMENT

Beach is inadequate in width and elevation to fully protect highway from severe storm flooding episodes. Natural outcrop at downcoast end of beach is insufficient to act as retention structure. Need to improve recreation opportunities and infrastructure. Passive erosion may be contributing to narrowing beach width due to presence of rigid structures backing the beach.



Malibu Surfrider/Malibu Lagoon State Beach

Los Angeles County
Shoreline Mile 17.5 - 18.2
Listing Source- Survey, Los Angeles County Department of Beaches and Harbors

Setting: Narrow pocket beach formed by delta of Malibu Creek and the semi-protected embayment resulting from the shoreline orientation.

Project Lead: Los Angeles County

PROBLEM ASSESSMENT

Discharges from Malibu Creek meander laterally downcoast. Erosion channel cuts into berm and has caused chronic erosion condition. Beach is inadequate in width and elevation to serve recreation demand and protect upland facilities and infrastructure from storm swell. There are no natural features to retain sand.

Topanga County Beach

Los Angeles County

Shoreline Mile 24.0 - 24.4

Listing Source- Survey; Los Angeles County Department of Beaches and Harbors

Setting: Narrow beach backed by low bluff and Pacific Coast Highway. Beach protects paved day use parking lot, recreation improvements, and lifeguard facilities.

Project Lead: Los Angeles County



PROBLEM ASSESSMENT

Lifeguard headquarters building is in jeopardy of storm flooding and erosion damages. Shoreline is relatively stable at mouth of Topanga Creek due to cobble-armored nearshore. However, artificial headland at east end of beach segment is inadequate in width to retain sand within the pocket.



Will Rogers State Beach

Los Angeles County

Shoreline Mile 24.9 - 25.4, 26.5 - 27.1

Listing Source- Survey, Los Angeles County Department of Beaches and Harbors

Setting: Wide sandy beach stabilized by rubble-mound groins. Beach protects paved day use parking lot, recreation facilities, and Pacific Coast Highway.

Project Lead: Los Angeles County

PROBLEM ASSESSMENT

Existing groins are deteriorated and LA County desires that they be removed or rehabilitated and nourished. The existing beach width is inadequate for the recreation demand and insufficient to provide storm protection for the back beach infrastructure. Continued degradation of groins will result in significant loss of beach width over time.

Venice City Beach

Los Angeles County

Shoreline Mile 31.3 - 32.3

Listing Source- Survey, Los Angeles County
Department of Beaches and Harbors

Setting: Wide sandy beach stabilized by rubble-mound groins and breakwater. Beach protects paved day use parking lot, recreation facilities, and private homes.

Project Lead: Los Angeles County



PROBLEM ASSESSMENT

Venice Breakwater has formed a tombolo that acts as a terminal groin. The downcoast section of beach has adjusted by eroding. Loss of sand has exposed facilities and infrastructure to storm damage. Chronic erosion and storm exposure is expected to degrade with time. LA County expects that shortening the Venice Breakwater could remove its tombolo effect and establish a more stable shoreline configuration.



Dockweiler State Beach

Los Angeles County

Shoreline Mile 33.5 - 37.5

Listing source- Survey, Los Angeles County
Department of Beaches and Harbors

Setting: Wide sandy beach stabilized by rubble-mound groins. Beach protects paved day use parking lot, recreation facilities, access street and infrastructure.

Project Lead: Los Angeles County

PROBLEM ASSESSMENT

The existing groins are widely spaced and deteriorated. Areas of narrower berm width and low elevation result in increased exposure to storm damages. Continued degradation of groins will result in more loss of beach width and storm damage over time. LA County expects that a new groin would improve sand retention at the midpoint.

Redondo County Beach

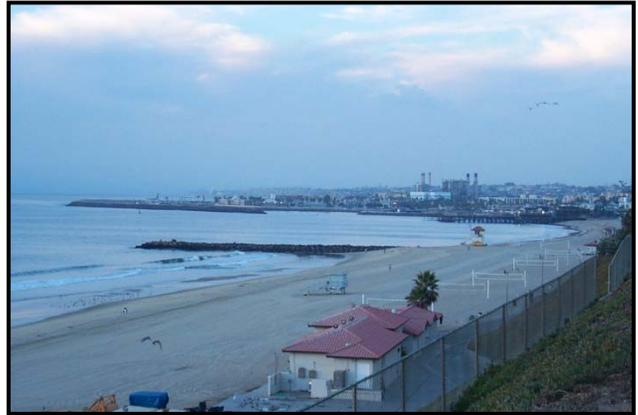
Los Angeles County

Shoreline Mile 43.0 - 43.5

Listing Source- Survey, Los Angeles County
Department of Beaches and Harbors

Setting: A narrow sandy beach is backed by public access way and high density residential buildings.

Project Lead: Los Angeles County



PROBLEM ASSESSMENT

The beach is located between the Topaz terminal groin and the King Harbor municipal pier. The proximity of the beach segment to the head of the Redondo Submarine Canyon results in chronic loss of sand. Beach widths are narrow and facilities and improvements are continually exposed to damage during severe storm events.



Redondo/Torrance County Beach

Los Angeles County

Shoreline Mile 43.5 - 45.4

Listing source- LA County Department of
Beaches and Harbors

Setting: Sandy beach backed by public access facilities, high-density residence buildings, and single story homes.

Project Lead: Los Angeles County

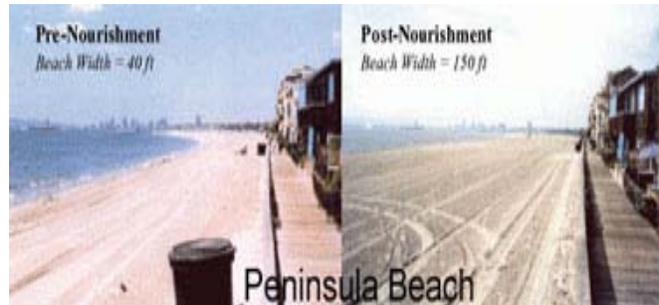
PROBLEM ASSESSMENT

The beach was nourished in 1970 to restore the shoreline and provide adequate beach width for recreation and storm damage protection. At least one-half of the original nourishment volume has eroded. LA County expects that the beach is in need of nourishment to re-establish its original project width.

Peninsula Beach

Los Angeles County
Shoreline Mile 43.0 - 43.5
Listing Source- City of Long Beach

Setting: Perennially-eroding beaches within artificially closed littoral cell between Los Angeles River and San Gabriel River jetty



Project Lead: City of Long Beach

PROBLEM ASSESSMENT

Littoral transport related to gap between east end of Federal Breakwater and San Gabriel River jetty causes sand to erode from the middle and east beaches to pile up against Shoreline Marina jetty and on beaches within the breakwater's shadow. Sand has to be perennially moved from areas of accumulation back to eroding beaches.

Surfside - Sunset Project

Orange County
Shoreline Mile: 1.8 - 2.7
Feeder miles: 2.7 - 17.6
Listing Source- USACE

Setting: Sandy beach backed by houses, immediately downcoast of Anaheim Harbor jetty.

Project Lead: USACE



PROBLEM ASSESSMENT

Chronic erosion due to the construction of the Anaheim Bay jetties has resulted in loss of recreational and protective beach through interruption of long-shore transport. Houses are subject to severe damage if beach is not nourished periodically. Periodic renourishment since 1945 utilizes this area as a feeder beach for downcoast beaches within the San Pedro Littoral Cell, providing shoreline protection, recreation and tourism opportunities, public health and safety benefits, and enhances downcoast coastal habitats.



Huntington Cliffs

Orange County

Shoreline Mile: 6.5 - 7.8

Listing Source- Survey

Setting: Narrow beach backed by wave cut bluff of low coastal plain with oil wells, highway and oil refinery.

Project Lead: City of Huntington Beach

PROBLEM ASSESSMENT

Lack of sediment supply from the Los Angeles and San Gabriel Rivers and the construction of the Anaheim Bay Jetties combined with subsidence in the Huntington Oil Field have resulted in the loss of adequate recreational and protective beach width and leave the bluffs susceptible to erosion. Health and safety are impacted by inadequate and unsafe access and unsightly and dangerous concrete rubble along the bluff toe. Bluff erosion rates have been estimated at 0.5 to 1.0 feet per year. Erosion threatens public lands occupied by parking, picnic areas and pedestrian/bike pathway.

San Clemente

Orange County

Shoreline Mile 38.9 - 39.6

Listing Source- USACE, Survey

Setting: Narrow sandy beach backed by park facilities, railroad and high coastal bluffs.

Project Lead: USACE



PROBLEM ASSESSMENT

Loss of shore protection and recreational beach width is a continuous problem for the City of San Clemente. Damages to coastal, residential, and commercial properties from storm-induced waves have become a serious threat. Railroad is often overtopped and damaged during high wave conditions. This location is part of an USACE Shoreline Erosion Feasibility Study; they have estimated erosion rate at 0.33 ft/year. Passive erosion may be contributing to narrowing beach width due to presence of rigid structures backing the beach.



South Oceanside/North County San Diego Beaches

San Diego County

Shoreline Miles: 17.4 - 20.8

Listing Source- USACE, Survey, CRSMP

Setting: Narrow sandy beaches backed private homes, lagoons and/or highway. Onshore and nearshore placement proposed in CRSMP.

Project Lead: USACE, SANDAG

PROBLEM ASSESSMENT

Chronic erosion has resulted in loss of recreational beach and damage to the City of Oceanside's improvements. Federal navigation features at Oceanside/Camp Pendleton may have contributed to shoreline recession problems at the City of Oceanside. Possible feeder beach location for the north county segment of the Oceanside Littoral Cell, providing shoreline protection, recreation and tourism opportunities, public health and safety benefits and enhance downcoast coastal habitats. This area is part of an ongoing USACE shoreline protection study. Passive erosion may be contributing to narrowing beach width due to presence of rigid structures backing the beach.

Carlsbad State Beach

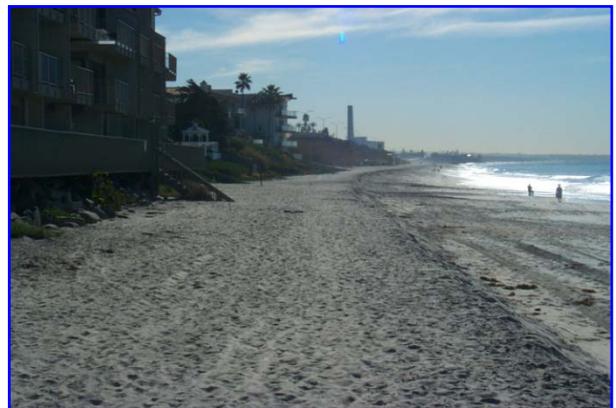
San Diego County

Shoreline Mile: 21.2 - 22.0

Listing source- CRSMP

Setting: Narrow sandy and cobble beach backed by low wide coastal terrace bluff with houses and apartments on top of bluff.

Project Lead: SANDAG



PROBLEM ASSESSMENT

Although much of the city's shoreline is protected by revetment or seawall, beach erosion and sand loss will continue to impact public recreation opportunities, economic activity and environmental resources. Coastal Commission staff have compiled erosion rate of 0.11 ft/year. Beach areas provide recreation and tourism opportunities, public health and safety benefits for the city and its visitors, and coastal habitats are in need of enhancement.



Agua Hedionda/Encinas

San Diego County

Shoreline Mile 22.75 - 24.1

Listing Source- CRSMP

Setting: Narrow, low, sand and cobble spit beach backed by Pacific Coast Highway, wave cut terraces and Encinas Power Plant. Jetties stabilize inlets used to draw in water for the power plant.

Project Lead - City of Carlsbad; SANDAG

PROBLEM ASSESSMENT-

Beach and road are subject to flooding damage, debris accumulation and closure during storm wave conditions. Dredged material from maintenance of inlet and lagoon is placed on beaches but material is too fine to remain long under current wave conditions. Poorly consolidated, young marine terrace forms sloping cliff face and is easily eroded.

South Carlsbad State Beach/Encinas Creek

San Diego County

Shoreline Mile 24.1- 27.0

Listing source- Survey; CRSMP

Setting: Narrow cobble beach with occasional sand, backed by steep wave-cut cliffs. Pacific Coast Highway and South Carlsbad State Beach campgrounds are at bluff top.

Project Lead- CA Department of Parks and Recreation; SANDAG



PROBLEM ASSESSMENT

Cliffs are susceptible to landslides and erosion during storm wave conditions. Beaches have never fully recovered from subaerial sand losses associated with the 1982-1983 winter storms. Beach areas provide recreation and tourism opportunities, public health and safety benefits for the city and its visitors, and coastal habitats are in need of enhancement.



Batiquitos Lagoon Beaches

County of San Diego

Shoreline Mile 27.0 - 27.5

Listing Source- CRSMP

Setting: Narrow beach with cobble berm and fine-grained sand foreshore is backed by Pacific Coast Highway and Batiquitos Lagoon. Onshore and nearshore receiver sites recommended by the CRSMP

Project Lead- Cities of Carlsbad and Encinitas; SANDAG

PROBLEM ASSESSMENT

The low-lying road is subject to flooding and closure during storms. During the winter of 1982-1983 large quantities of cobble moved onto and closed PCH. Batiquitos Lagoon impounds most materials washing down the watershed, preventing them from reaching the coast.

Leucadia State Beach

County of San Diego

Shoreline Mile 27.5 - 30.0

Listing Source- CRSMP

Setting: Narrow to non-existent sandy beach overlying cobble or exposed wave-cut terrace, backed by steep sea cliff. Cliff edge is densely developed.

Project Lead- City of Encinitas, SANDAG, USACE



PROBLEM ASSESSMENT

This beach incorporates South Ponto, Stone Steps and Beacon's beaches. Some stretches are relatively inaccessible except from private property. Wave-induced erosion of cliffs is threatening cliff edge development. Cliffs comprised of poorly to moderately consolidated sandstone standing near its stability limit and subject to landslides. Coastal Commission staff have compiled erosion rates of 0.15 ft/year(Ponto Beach); 0.5 ft/yr (Leucadia State Beach). This area is also within an ongoing USACE shoreline protection study.



Moonlight State Beach

San Diego County

Shoreline Mile 30.0 - 31.0

Listing Source- USACE, CRSMP

Setting: Narrow sandy beaches backed by steep wave-cut terrace, park facilities, commercial establishments, houses, apartments and/or highway.

Project Lead: USACE, SANDAG, City of Encinitas

PROBLEM ASSESSMENT

Chronic erosion has resulted in loss of recreational beach, safety concerns, and damage to City improvements. This is a part of an USACE shoreline protection study, which extends some distance north of Moonlight Beach.

Cardiff State Beach/San Elijo Lagoon Beach

County of San Diego

Shoreline Mile 33 - 33.7

Listing Source- CRSMP

Setting: Narrow sand and cobble spit beach backed by Pacific Coast Highway, restaurants and park facilities. Protected by non-engineered rock and concrete rubble revetment. Excellent access and very popular beach in summer. Onshore and nearshore sites recommended in CRSMP



Project Lead- City of Encinitas, SANDAG

PROBLEM ASSESSMENT

Storm waves strip sand away, exposing cobbles and unsightly rip rap.



Solana Beach/Fletcher Cove

San Diego County

Shoreline Mile: 33.9 - 35.2

Listing Source- USACE, CRSMP

Setting: Narrow sandy beaches with frequent rock outcrops and offshore reefs, backed by steep wave-cut terrace, park facilities, houses, apartments, and commercial establishments.

Project Lead: USACE, City of Solana Beach, SANDAG

PROBLEM ASSESSMENT

Chronic erosion has resulted in loss of recreational beach, safety concerns, and damage to City improvements. Coastal Commission staff compiled an erosion rate at Solana Beach of 0-3.88 ft/yr. This is part of a USACE shoreline protection study.

Del Mar City Beach/San Dieguito Lagoon Beach

San Diego County

Shoreline Mile 35.4 - 36.6

Listing source- CRSMP

Setting: Pocket beach backed by San Dieguito Lagoon and Pacific Coast Highway. City beach is moderately wide. Both beaches are heavily used for recreation. Nearshore receiver site recommended in CRSMP

Project Lead- City of Del Mar, SANDAG



PROBLEM ASSESSMENT

During severe winters, protective beach is eroded and development behind the City beach is subject to flooding and damage. Location is heavily armored, but is often subject to damage and overtopping. Spit is susceptible to wave overwash and some streets may also be flooded by San Dieguito River.



Torrey Pines State Beach

San Diego County

Shoreline Mile 38.8- 39.2

Listing source- CRSMP

Setting: Narrow sand and gravel spit, overlain by Pacific Coast Highway. Beach backed by low active dunes and high, steep eroding cliffs to the south. Easy access, and heavy recreational use in the summer. Onshore and nearshore receiver sites recommended in CRSMP

Project Lead- California Department of Parks and Recreations, City of Del Mar, SANDAG

PROBLEM ASSESSMENT

Severe winter storms erode cobble berm back to PCH in some places, and also erode dunes and cliffs. Over steepened cliffs are subject to some large and numerous small landslides. Lateral extent of receiver site is limited by offshore reefs and kelp cover. Passive erosion may be contributing to narrowing beach width due to presence of rigid structures backing the beach.

Mission Beach

San Diego County

Shoreline Mile 51.1 - 51.6

Listing source- CRSMP

Setting: Variable width sandy beach is backed by esplanade, parks, residential and commercial developments. Area is heavily utilized due to proximity to San Diego. Nearshore receiver site was recommended in CRSMP.

Project lead- City of San Diego, SANDAG



PROBLEM ASSESSMENT

Mission Beach is overtopped by waves during large storm events, such as winter of 1982-1983 and 1988. The littoral cell is losing small volumes of sand over time with little or no natural sand inflow, and relies on nourishment to maintain its condition. It is a historical sand placement site for the US Army Corps of Engineers.



Ocean Beach (San Diego)

San Diego County

Shoreline Mile 53.1 - 53.5

Listing source- CRSMP

Setting: Sandy pocket beach, located between the San Diego river mouth's south jetty and the rocky headlands of Sunset Cliffs, and backed by residential and commercial development.

Project lead- City of San Diego, SANDAG

PROBLEM ASSESSMENT

The littoral cell is losing small quantities of sand over time with no natural input. The San Diego River is no longer a viable sediment source. No nourishment has occurred in decades, and the beach can be overtopped by significant storm wave events. Its location at the west end of a major interstate highway renders it a strategic placement site for sand coming from the inland San Diego River valley.

Coronado City Beach

San Diego County

Shoreline Mile 64.1 - 65.2

Listing Source- CRSMP

Setting: The beach fronting the Coronado Shores is seasonally narrow and retreats landward toward a public path at the base of the buildings. The backshore is protected with a high revetment to protect property during winter storms. OC Register calls the beach "future best beach in America"

Project Lead- City of Coronado, SANDAG



PROBLEM ASSESSMENT

Coronado's beaches vary in width throughout the City and are narrowest in front of the Coronado Shores. The beach can be completely absent during winter storm wave conditions. The City desires to maximize project with nourishment.



Imperial Beach

San Diego County

Shoreline Mile 73 - 73.7

Listing Source- USACE; CRSMP

Setting: Narrow sandy beach backed by recreational facilities, houses, motels, apartments and restored estuary. Onshore and nearshore receiver sites recommended in CRSMP.

Project Lead: USACE, SANDAG, City of Imperial Beach

PROBLEM ASSESSMENT

Chronic erosion has resulted in loss of recreational beach and damage to the City improvements. This is a USACE authorized shoreline protection project. Tijuana Estuary has been partially restored south of the City improvements. Dunes protecting the estuary from sea water intrusion are threatened, and are predicted to breach by 2045 unless restored. Passive erosion may be contributing to narrowing beach width due to presence of rigid structures backing portions of the beach.

Border Field State Park Beach

San Diego County

Shoreline Mile 74.7 - 75.1

Listing Source- CRSMP

Setting- Narrow sandy beach backed by dunes and Tijuana Estuary.

Project Lead- California Department of Parks and Recreation



PROBLEM ASSESSMENT

Area is subject to flooding and damage during storm wave conditions, including clogging of estuary channels. Sand shortage is caused by dams located on the Tijuana River. Modeling indicates breaching of dunes protecting estuary from salt-water inundation could occur by 2045 if dunes/beaches are not restored. This is the location of a demonstration project (Tijuana Estuary Sediment Study) to assess whether sediment with high percentage of fines can be placed in the nearshore without adverse biological effects and whether beach and dune nourishment effects are observed as a result of such placement.



APPENDIX B

Beach Erosion Concern Areas List Development



BECA LIST DEVELOPMENT

Compilation of the BECA list has occurred in several stages:

- The California Department of Boating and Waterways effort was conducted through a mail survey and subsequently field verified,
- Locations under investigation by U.S. Army Corps of Engineers to determine federal interest in coastal erosion at those sites were added,
- Various local and regional entities were invited to comment and contributed their concerns,
- Locations identified within Coastal RSM Plans completed to date were incorporated, and
- Areas of coastal erosion known by CSMW members to be of concern to some jurisdictional entity that had not been identified through one of the above methods were added to the list.

Locations identified through these efforts are shown on Table 1 and Figures 1-4 within the main report and Figures C-3 through C-5 in Appendix C. The BECA list is based on considerations currently known to CSMW. The list is not meant to be all-inclusive, but instead a starting point for coastal managers as they assess locations for sediment management solutions.

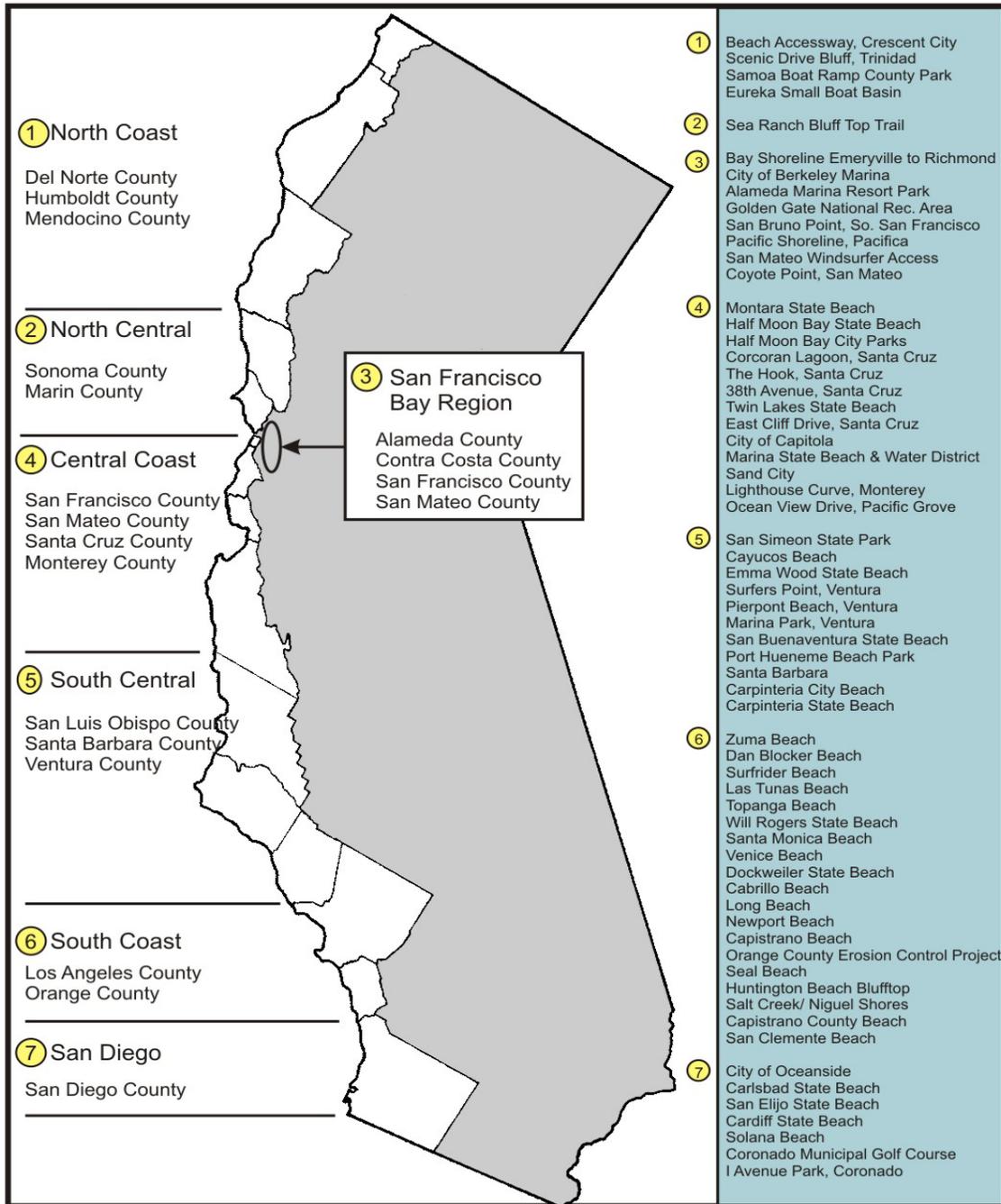
Department of Boating Waterway's Survey:

The Department of Boating and Waterways (DBW), one of the departments within California Natural Resources Agency, provides much of the state funding for SMP activities. DBW is responsible for studying and reporting on beach erosion problems and developing effective stabilization via Article 2.5 of the Harbors and Navigation Code. Passage of the Public Beach Restoration Act (Assembly Bill 64, 1999) placed additional emphasis and priority for beach restoration and the need to allocate appropriate resources toward restoration of the State's beaches.

DBW initiated a survey ("Survey") by requesting that local communities and public agencies across coastal California respond to a questionnaire about the magnitude and extent of shoreline erosion in their area. Administered with the assistance of the Public Research Institute of San Francisco State University, responses were collected and summarized into an initial list of 64 shoreline erosion sites. In general, problem areas were more prevalent in the southern third of the State, where population density is greatest and urbanization of the coastal zone most extensive.

The initial list of candidate sites (Figure B-1) was then refined to ensure compliance with DBW's technical and funding requirements. Field reconnaissance was conducted to determine the magnitude and extent of erosion at each candidate site. In general, locations considered to be unqualified for State beach erosion assistance (and therefore removed from the ongoing list) were those experiencing damages caused primarily by non-marine related influences, such as hydrologic processes, storm water runoff, ground water seepage, unstable soil

conditions, etc. Additional areas with observed shoreline erosion problems that had not been included within the initial survey list were added to the potential projects list as appropriate.



Shoreline Regions from "Assessment and Atlas of Shoreline Erosion" (DBW, 1977)

Figure B-1: DBW Survey- Initial Candidate Sites

Sites involving protection or restoration of private property were removed from further consideration due to their ineligibility under DBW's statutory funding requirement.



Upon completion of the inventory, conceptual measures needed to address each problem area were formulated. Considerations for potential shoreline protection projects included protection of public and/or recreational infrastructure, public health and safety, and potential improvements in habitat and foraging areas. For purposes of this report, the Survey findings were further refined to remove locations where the recommended response to erosion was construction of hard structures such as seawalls.

Federal Projects:

Under existing national shore protection laws, Congress has authorized Federal participation in the cost of restoring and protecting the shores of the United States. The intent of this legislation is primarily directed toward reduction of storm-related damages to upland development that results in an economic benefit to the Nation. Congressionally authorized shore protection studies and projects are administered by USACE.

State and federal agencies have different project criteria for public financial assistance consideration. However, both require a determination of public benefit to receive financial support. Public benefits, in general, include improvements to public recreation, protection of public infrastructure, public health and safety, and improvements to habitat or foraging areas. Federal projects also consider actions that would be taken if a project were not implemented and the costs of those actions are included as benefits. Those avoided actions could include the need to build shore protection structures, such as revetments and seawalls, as well as the cost of repairing or moving infrastructure and public buildings.

Several shoreline segments within California are currently being studied by USACE to determine whether there is a federal interest in correcting identified shoreline erosion problems. These federal projects are included in Table 1 and shown on Figures 1-4. Site descriptions are included in Appendix A.

Local and Regional Efforts:

After initial compilation, the preliminary list was provided to several local and regional agencies for review and input. A few responses were received, most notably from Los Angeles County Department of Beaches and Harbors, who provided an extensive list of locations of concern to them within Los Angeles County. The locations and problem descriptions provided by the local and regional agencies were then incorporated into the list of BECAs.

As described in Appendix C, CSMW is working to implement the Sediment Master Plan through a series of Coastal RSM Plans that target specific regions and issues existing within those regions. Each regional effort has or will identify coastal erosion areas of concern to that region. To date, Coastal RSM Plans have been prepared by SANDAG (San Diego Association of Governments) covering three littoral cells in San Diego County, BEACON (Beach Erosion Authority for Clean Oceans and Nourishment) covering one large littoral cell in Santa Barbara and Ventura Counties, and AMBAG (Association of Monterey Bay Area Governments) for a littoral cell in southern Monterey Bay. Preliminary locations identified by these regional entities are included in Table 1 and Figures 1-4. While the Coastal RSM Plan for LA County is just getting underway, locations and concerns provided by LA County Beaches and Harbors was considered as input from a Coastal RSM Plan for purposes of list construction. Two



locations (Zuma and Point Dume beaches) were not included in the BECA list as the County's concern was related to creekside erosion.

CSMW Additions:

There are several regions of the coast that have not yet undertaken development of a Coastal RSM Plan, and therefore locations of local/regional concern are not fully quantified. This lack of completeness for the BECA list will be addressed in the future through CSMW collaboration with regional entities to collect that data during Coastal RSM Plan development within those regions. As a first step in collating that information, locations known to CSMW members to be of concern to jurisdictional entities within the unquantified regions have been added to the list and identified as CSMW BECAs.



APPENDIX C

Regional Sediment Management And Coastal RSM Plans



REGIONAL SEDIMENT MANAGEMENT

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, as well as jobs and significant tax revenues. Beaches also provide a buffer or transition zone between the ocean and the land, protecting California's coastal infrastructure from erosion-related damages.

Over millennia natural forces (e.g., wind, rain, and stream flows) have mobilized and transported sediment (e.g., gravel, sand, silt, and 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, however, significantly altered these natural supplies of sediment to the coast, as well as the transport of materials along the coast. Figure C-1 describes how man-induced changes have adversely impacted California beaches.

Sediment is an integral component of the coastal ecosystem and the centerpiece of California's tourism economy. It represents a public good or resource that must be managed to provide for quality of life, natural resource protection and economic sustainability. Sediment imbalances resulting from alteration of the natural environment therefore threaten the viability of the public good and require management to restore the natural balance. Many sediment supply-related problems (e.g., coastal erosion, harbor shoaling) can be at least partially associated with the failure to recognize, communicate and implement regional (i.e., littoral cell) solutions. For instance, the historical approach to addressing sediment imbalances by state and federal agencies has been a project-by-project assessment, with a narrow focus on solving the local problem. State and federal agencies have implemented 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.

Regional Sediment Management, or RSM, can be thought of as systematic management for sediment. Areas of sediment deficit (eroding areas) and excess across a specified region (typically a littoral cell or sometimes a regional jurisdictional entity) are examined. Ways to restore or augment adversely impacted natural processes are developed to help minimize or eliminate the sediment imbalances. Figure C-2 illustrates CSMW's vision of how RSM can be implemented in California (see also www.dbw.ca.gov/csmw/PDF/SMP_Brochure.pdf).

Littoral Cells

The coastline of California can be divided into a set of distinct, essentially self-contained littoral cells or beach compartments. The compartments are geographically limited and consist of a series of sediment sources (such as rivers, stream and eroding bluffs) that provide sand to the shoreline; sand sinks (such as submarine canyons) where sand is lost from the compartment; and alongshore transport or littoral drift that moves sand along the shoreline. Sediment within each cell includes the sand on the exposed or dry beach as well as the finer-grained sediment that lies just offshore. Patsch and Griggs (2006) report on California's major littoral cells is available at http://www.dbw.ca.gov/csmw/littoral_cells.aspx. California's major littoral cells are illustrated on Figures C-3 through C-8.



Due to the regional and self-contained nature of littoral cells, they represent the minimum appropriate planning unit for RSM, similar to watershed planning. Coastal watersheds feeding sediment into the littoral cell are important to understand, as sediment management activities within the watershed affect delivery of that sediment to the coastline and littoral cell. In some areas, for practical purposes, it may be more feasible to consider a regional entities' jurisdiction as the planning area, as long as it encompasses one or more littoral cells.

An Example of RSM in Use

An example of how RSM can be practiced is in the San Pedro littoral cell; the Orange County Erosion Control Project (aka Surfside Sunset Project). Since 1945, USACE, in conjunction with DBW, County of Orange, Cities of Huntington Beach and Newport Beach and the Surfside Colony Special District has conducted 16 episodes of placing sediment dredged from the Anaheim Harbor entrance at the Surfside Colony shoreline adjacent to the southern Anaheim Bay jetty. The construction of Anaheim Bay jetties in the 1940's interrupted the natural flow of littoral sand, thus creating an erosion shadow down coast. The sand periodically placed at Surfside Colony has drifted downcoast and restored beach widths along the 17-mile stretch of shoreline south of the Surfside Colony to the upcoast jetty at Newport Bay. In the recently completed Coast of California Storm and Tidal Waves Study for Orange County, USACE determined, based on sediment volume measurements, that 75% of the Surfside Sunset Project sand is still present in the littoral budget. The success of this project along with similar opportunistic sand placed in Santa Monica Bay clearly indicate that RSM works to provide widened and restored beaches along with associated public, environmental and economic benefits.

Conceptual RSM Activities

There are many areas along the California coast where similar RSM activities could be appropriate and undertaken, especially when they are associated with maintenance dredging in harbors and ports or removal of sediment from coastal wetlands and flood control channels. An example would be dredging associated with Ventura or Channel Islands Harbors. Ventura County has the notable distinction of possessing the highest percentage of armored shoreline in the state. If a portion of the annual dredged sediment from either or both of these harbors were, for example, transported upcoast to Rincon Parkway, a heavily armored area along Highway 101, and deposited onshore or in the nearshore, then beaches would start to accrete (assuming retention structures are also deployed). Wider beaches cover unsightly shoreline armor, provide safer public access, increase sandy habitat, create additional beach recreational area and increase recreational spending in the region. Dependant on location, effective retention strategies should be employed along with sand placement.

State and Federal RSM Efforts

For many years, DBW has coordinated with the USACE on beach restoration efforts through a project-by-project basis. In 1999, The California Natural Resources Agency (of which DBW is a Department) and USACE entered a formal agreement to jointly investigate regional solutions to sediment supply and demand issues through the Coastal Sediment Management Workgroup. The California Coastal Sediment Master Plan Status Report 2008 (available at



www.dbw.ca.gov/csmw/default.aspx) presents planning, coordination, information and tools designed to address environmental, process, technical and regulatory issues expected to be encountered during implementation of RSM.

As part of their SMP efforts, CSMW has preliminarily identified BECAs throughout the State that can be addressed through RSM. This list (Table 1; Figures 1-4; Appendix A) can serve as a starting point for developing regional solutions to California's coastal sediment problems. Coastal planners and managers can use the BECA list and any additional locations of regional/local concern to help focus local Coastal RSM Plans designed to restore sediment imbalances within that particular region. The list of BECAs can also be used as a starting point to scope financial resources needed to address appropriate coastal erosion issues via sediment management.

Coastal RSM Plan Development

Developing RSM plans for individual segments of the California coast is the next logical step in effective implementation of the Sediment Master Plan. Participation by local and regional governments as well as non-governmental stakeholders is essential to this process in order to build consensus on a regional plan for sediment management. The Coastal RSM Plans 1) are based upon region-specific coastal processes, socio-economic, environmental, and geographic data, 2) use current reports and data, 3) consult educational, process, regulatory and informational tools developed and compiled by CSMW as part of the Sediment Master Plan, and 4) address the needs of local and regional governments as well as local non-governmental stakeholders.

CSMW developed general guidance for the Coastal RSM Plan program to provide consistency across regions throughout coastal California. However, Plan development is geared towards the needs of each Region. Basic elements of each Plan include Governance, Outreach and Plan Development. At the time of this Report, CSMW has developed and is now implementing Coastal RSM Plans with regional partners SANDAG (three littoral cells in San Diego County), BEACON (Santa Barbara Littoral Cell covering Ventura and Santa Barbara Counties) and AMBAG (Southern Monterey Bay Littoral Cell). These regional entities were best able to focus Plan development on the needs of their region. Orange County and Eureka Littoral Cells are currently under development, and Los Angeles County and San Francisco Bay are gearing up to conduct needed studies. Northern Monterey Bay and San Francisco Open Coastline will begin development activities when Coastal Impact Assistance Program (CIAP) funds become available.

Figures C-3 through C-8 illustrate the type of information relevant to RSM and Coastal RSM Plans along the California coast. Displayed information is derived from spatial data compiled by CSMW in their GIS database (<http://coastalsediment.resources.ca.gov/>), and includes:

- Regional framework for consideration (littoral cell and county boundaries),
- BECA locations coded by the source for inclusion in the list, and
- Potential sources of sediment (ports/harbors, wetlands, flood control projects, and offshore sources).

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.

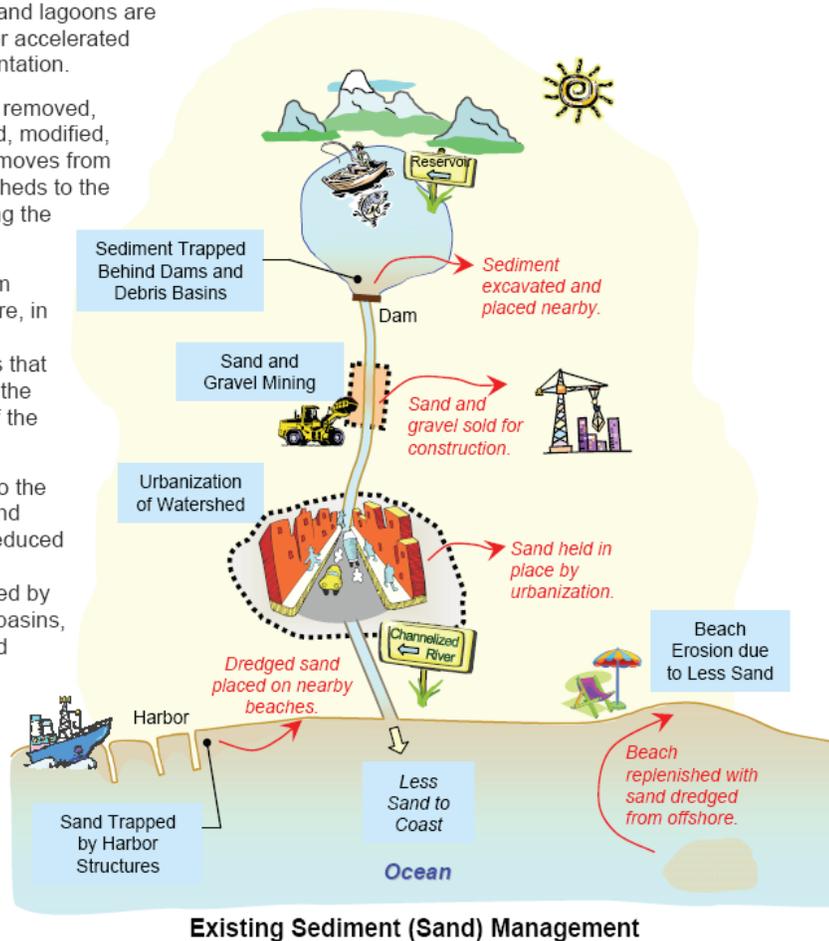
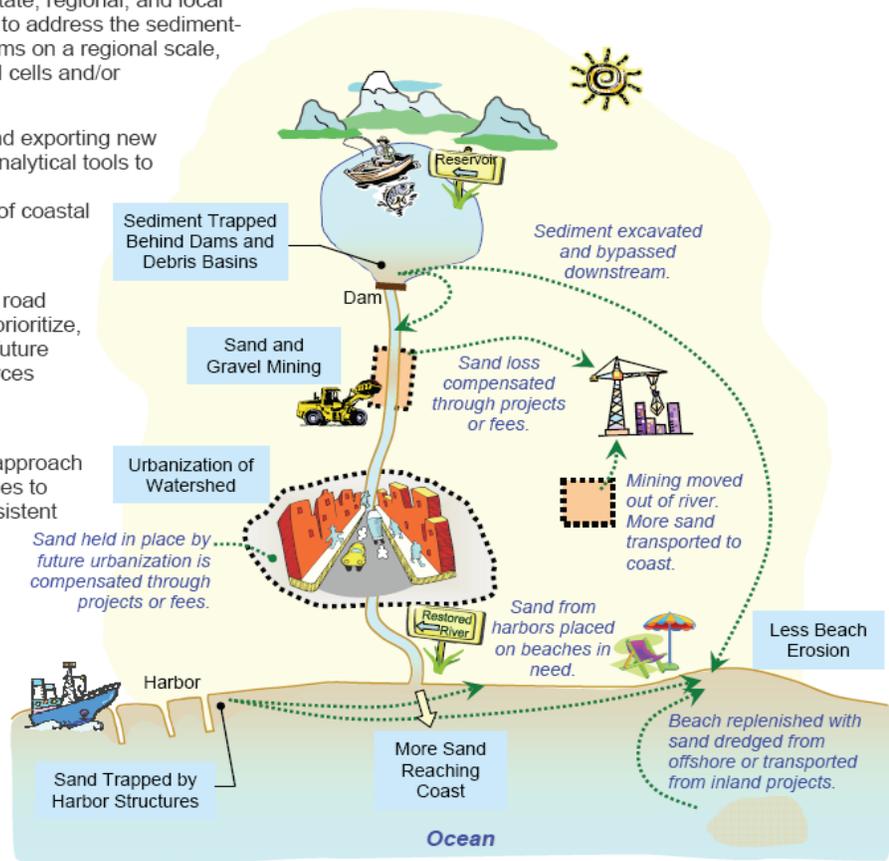


Figure C-1: Human induced adverse impacts on transport of sediment to the coast

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 C-2: How RSM can help resolve sediment imbalance problems in California

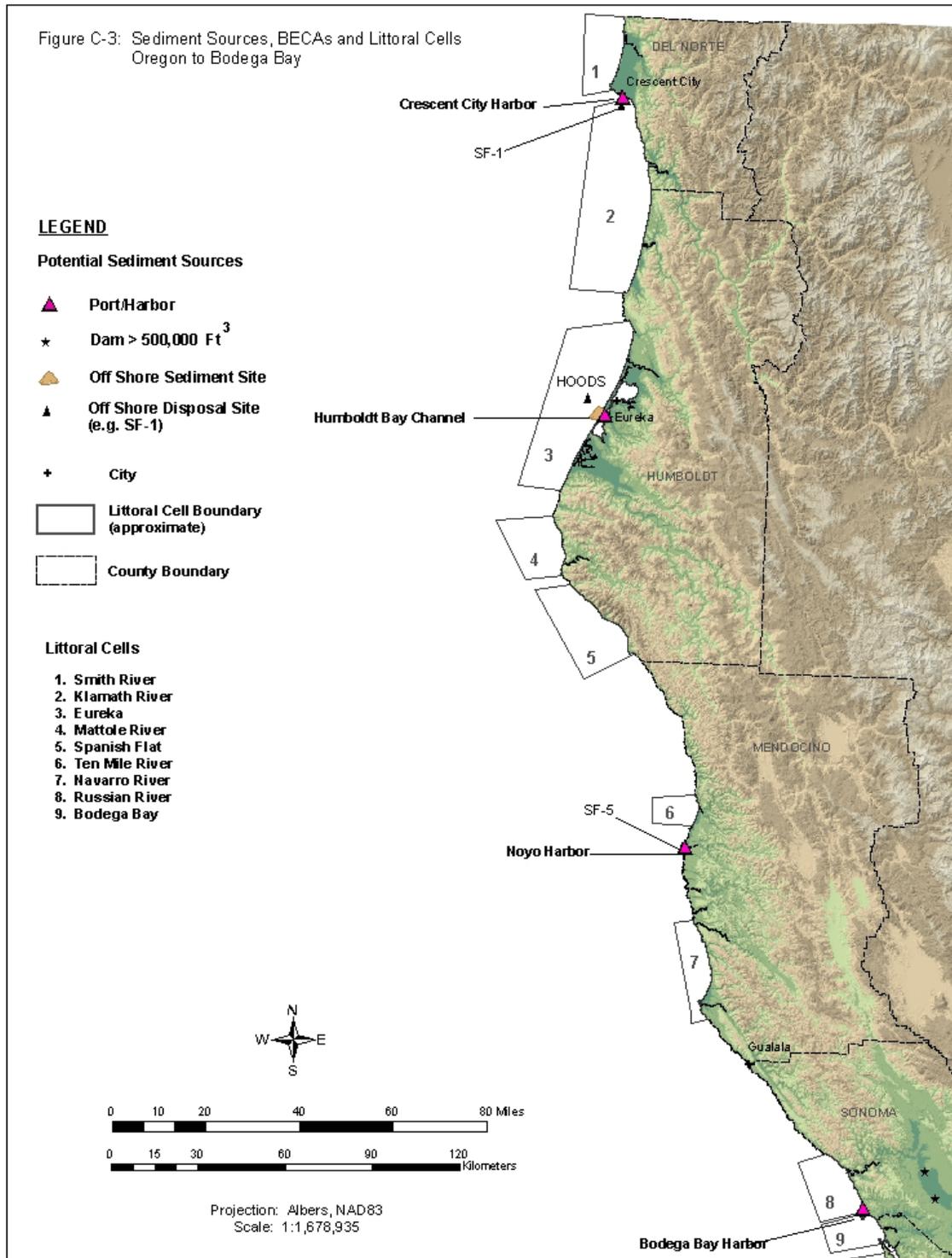
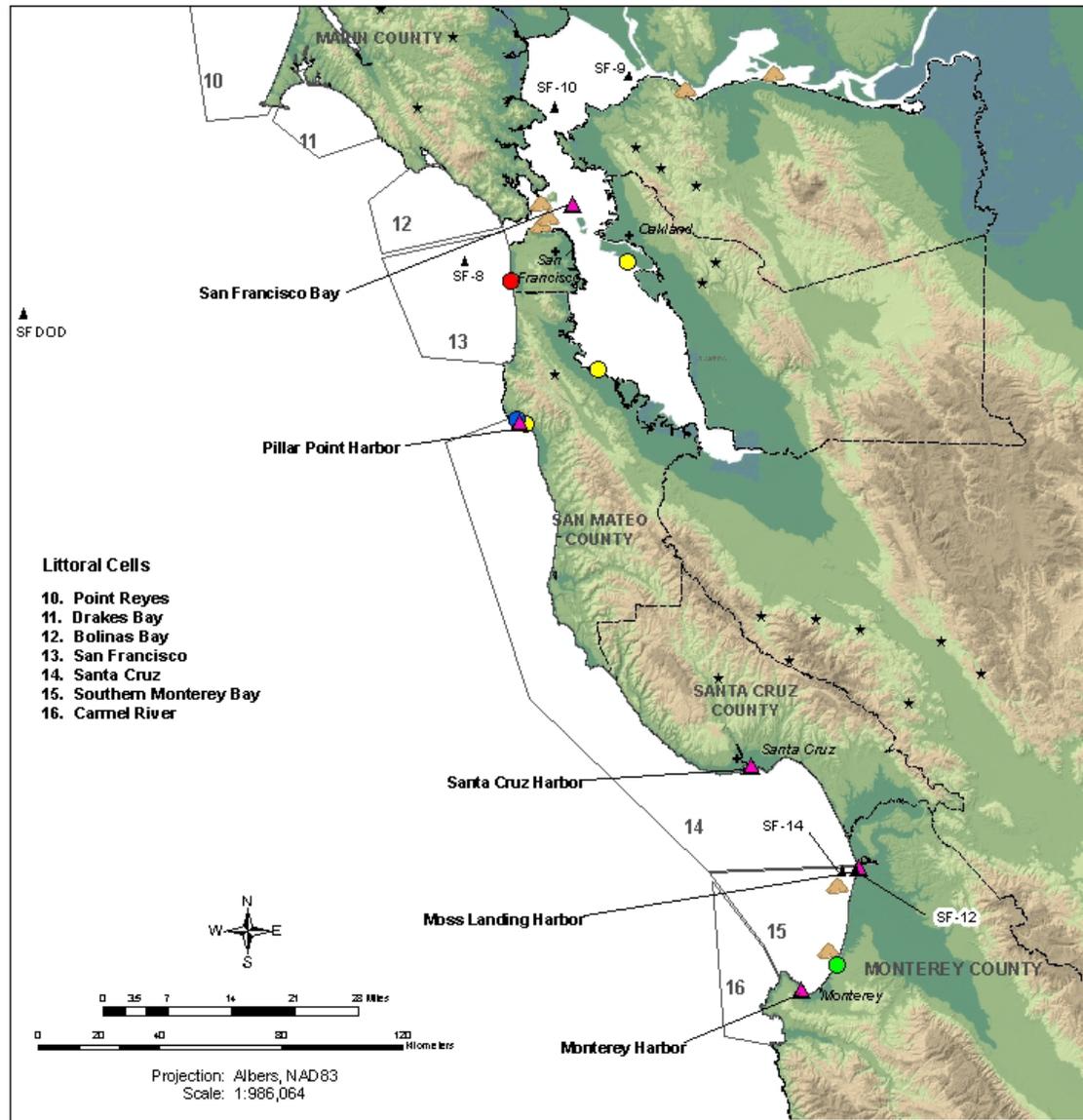


Figure C-4: Sediment Sources, BECAs and Littoral Cells Point Reyes to Big Sur



LEGEND

Beach Erosion Concern Areas

Listing Source

- USACE
- CR SMP
- CSMW
- Survey

See Figure 1 for BECA Site Names

Potential Sediment Sources

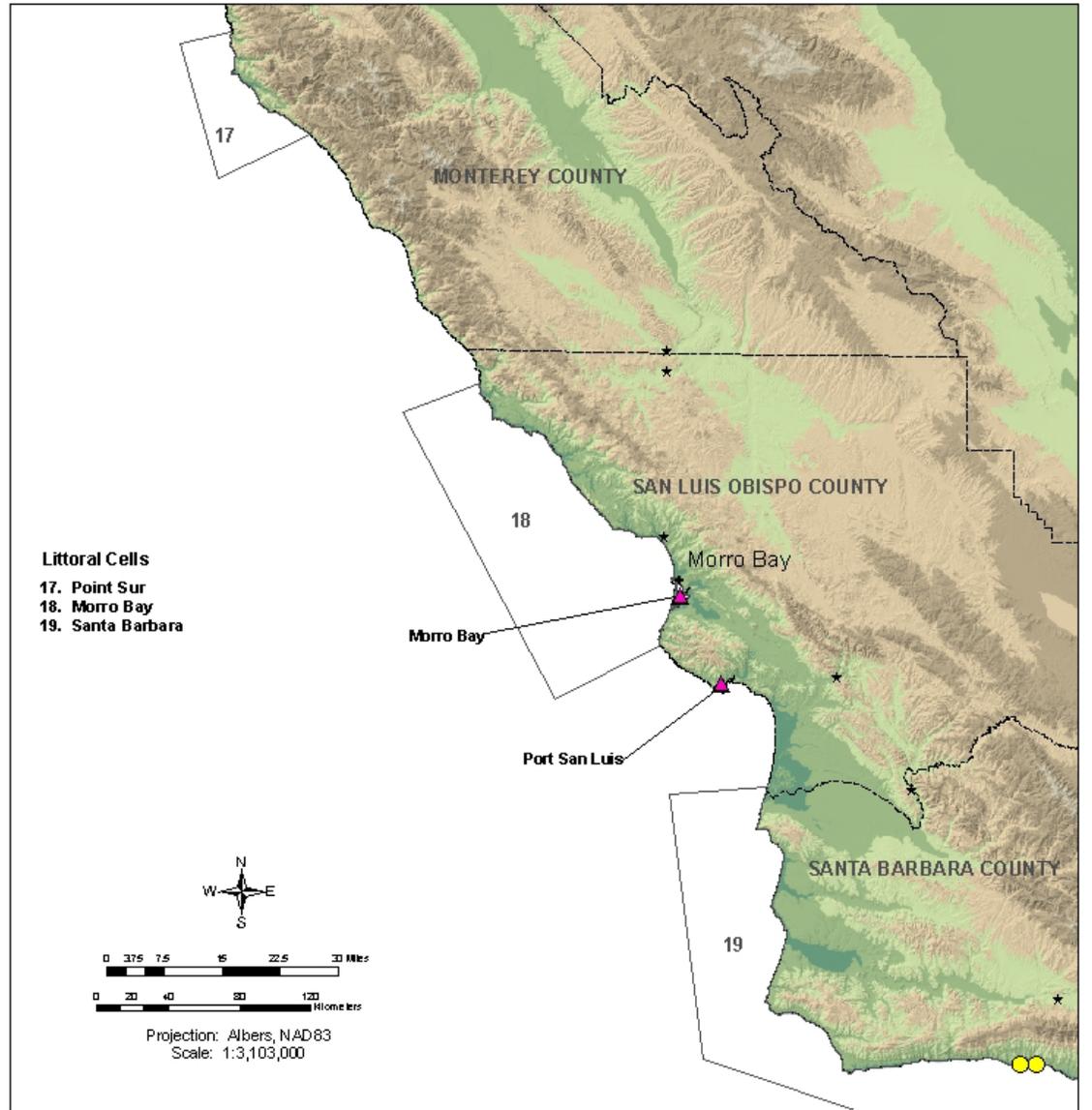
- ▲ Port/Harbor
- ★ Dam > 500,000 Ft³
- ▲ Off Shore Sediment Site
- ▲ Off Shore Disposal Site (e.g. SF-8)

+ City

□ Littoral Cell Boundary (approximate)

□ County Boundary

Figure C-5: Sediment Sources, BECAs and Littoral Cells
Big Sur to Point Conception



Legend

BEACH EROSION CONCERN AREAS

Listing Source

- USACE
- CR SMP
- CSMW
- Survey

Potential Sediment Sources

- ▲ Port/Harbor
- ★ Dam > 500,000 Ft³
- Littoral Cell Boundary (approximate)
- + City
- County Boundary

Figure C-6: Sediment Sources, BECAs and Littoral Cells
Santa Barbara and Ventura Counties

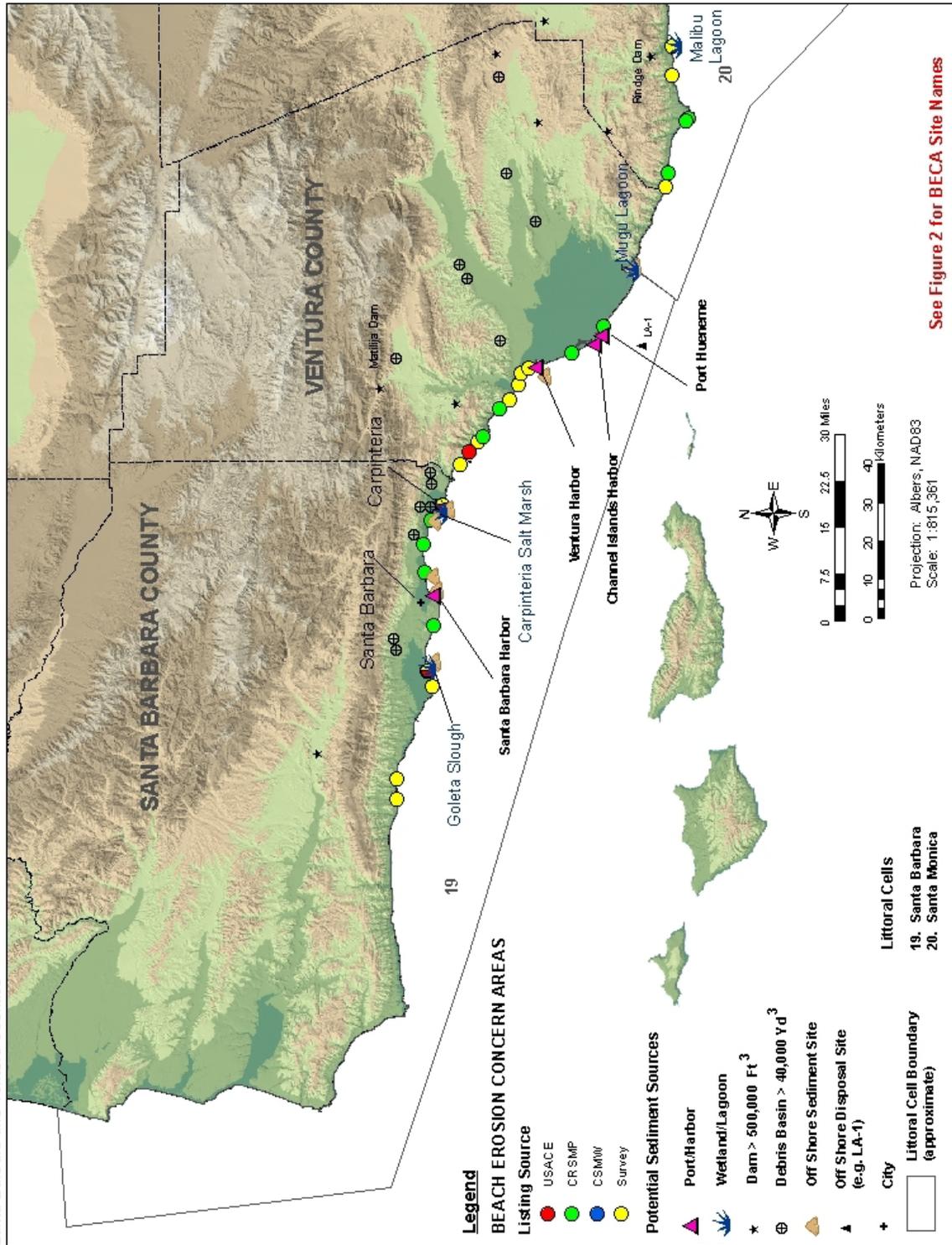
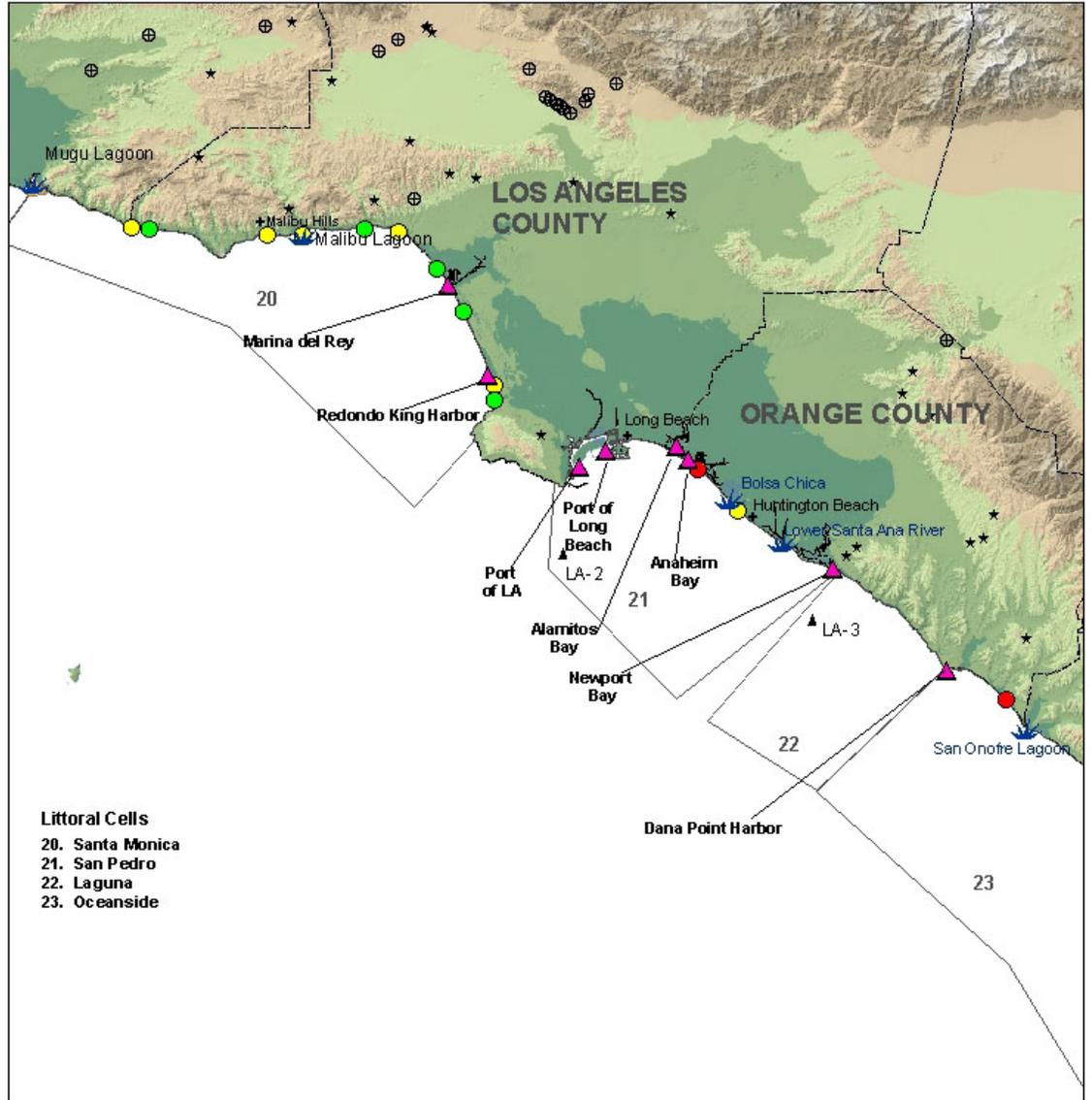


Figure C-7: Sediment Sources, BECAs and Littoral Cells
Los Angeles and Orange Counties



Littoral Cells
 20. Santa Monica
 21. San Pedro
 22. Laguna
 23. Oceanside

Legend

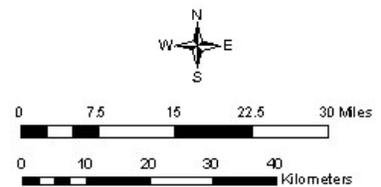
BEACH EROSION CONCERN AREAS

Listing Source

- USACE
- CRSMP
- CSMW
- Survey
- Littoral Cell Boundary (approximate)

Potential Sediment Sources

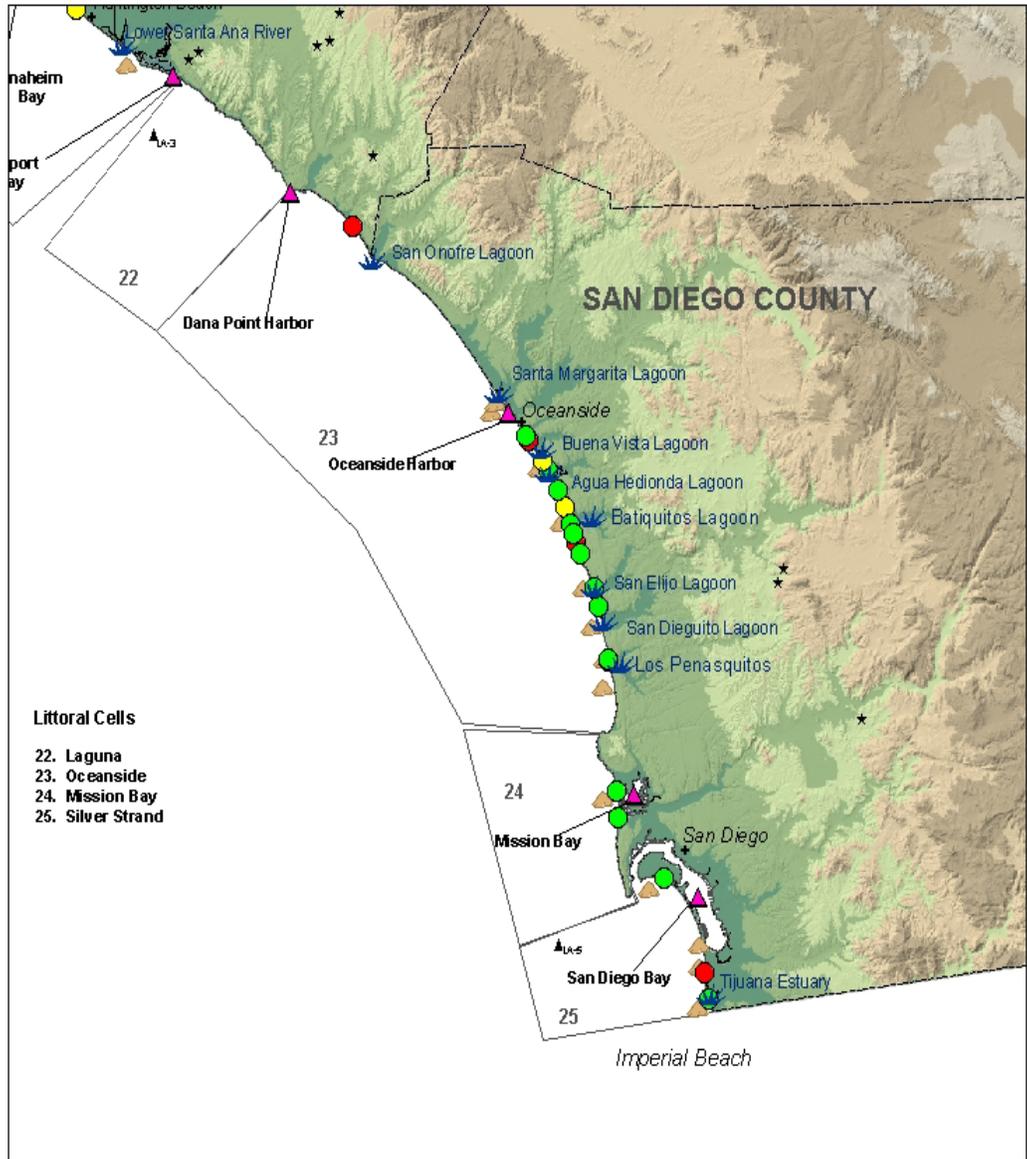
- ▲ Port/Harbor
- ⦿ Wetland/Lagoon
- ★ Dam > 500,000 Ft³
- ⊕ Debris Basin > 40,000 Yd³
- ▲ Off Shore Sediment Site
- ▲ Off Shore Disposal Site (e.g. LA-2)
- + City



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

See Figure 3 for CBRs Site Names

Figure C-8: POTENTIAL SEDIMENT MANAGEMENT SITES
San Diego County



Legend

BEACH EROSION CONCERN AREAS

Listing Source

- USACE
- CRSMF
- CSMW
- Survey
- Littoral Cell Boundary (approximate)

Potential Sediment Sources

- ▲ Port/Harbor
- ✋ Wetland/Lagoon
- ★ Dam > 500,000 Ft³
- + Debris Basin > 40,000 Yd³
- ▲ Off Shore Sediment Site
- ▲ Off Shore Disposal Site (e.g. LA-5)
- + City



0 7.5 15 22.5 30 Miles

0 10 20 30 40 Kilometers

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

See Figure 4 for BECA Site Names



Coastal Sediment
Management Workgroup

COASTAL REGIONS

For purposes of discussion, the California coast was divided into several geographic sections. Each section's discussion includes an overview of the physical processes within the region, BECAs within the section, and potential sources of sediment (e.g., harbors, wetlands, flood control structures) that could be used to combat erosion at those BECAs. Figures C-3 through C-8 were developed to help assess the locations of these potential sediment management sites within ongoing or potential future Coastal RSM Plan areas.

Oregon Border to Bodega Bay

Much of the northern California shoreline is mountainous coast interspersed with pocket beaches located between headlands. Longer stretches of sand spits exist near the mouths of major rivers (e.g., Eel, Gualala, and Russian), and sections of narrow beaches backed by sea cliffs may also be found. Wide and long sandy beaches are present at the Point Reyes National Seashore and the coastline west of Bodega Bay. Most of the shoreline is undeveloped and sparsely populated. However, the beaches of Sonoma County are well utilized, especially during the summer months, and serve as a destination point for campers and weekend visitors. Doran Beach (adjacent to southern Bodega Bay/Harbor), popular with locals and campers, was nourished in the late 1980s with sediment dredged from the harbor entrance channel, and is beginning to exhibit signs of erosion.

Some beaches have been observed to have widened substantially in modern times and the sediment character has become finer-grained (Vaughn, p.c., 2008). Ten small to medium littoral cells have been defined along the northern coast (see Figure C-3).

Almost 1,000,000 yds³ of sand is dredged annually from the entrance to Humboldt Bay, and disposed of in an USEPA-approved offshore disposal site (HOODS). Finding an economical and beneficial reuse for this volume of beach-quality material has been a challenge for the USACE. Currently, they are evaluating a potential nearshore disposal location north of the entrance channel for beneficial reuse of channel dredge material. A Coastal RSM Plan for the Eureka Littoral Cell is currently underway, led by CSMW's regional partner, the Humboldt Bay Harbor Recreation and Conservation District.

Identified BECAs:

- a) None identified to date.

Potential sediment sources (Figure C-3):

- a) Crescent City Harbor dredging,
- b) Humboldt Bay dredging,
- c) Noyo Harbor dredging, and
- d) Bodega Bay and Harbor dredging.



San Francisco Bay and Coastline

This stretch of coastline includes:

- 1) San Francisco Bay and
- 2) Coastal San Francisco Peninsula.

Two relatively minor littoral cells have been defined upcoast of the entrance to San Francisco Bay, and one cell to the south (San Francisco). These cells are significantly affected by sediment discharged from San Francisco Bay through the Golden Gate, and the US Geological Survey is currently conducting a provenance study to assess the connections.

San Francisco Bay

The inland waters of San Francisco Bay contain the urbanized shorelines of Marin, Alameda, Contra Costa, and San Mateo Counties. Eight sites within the central portion of the Bay Area were initially identified as in need of shoreline stabilization measures. Four sites passed the initial screening, and two sites are currently considered as BECAs. CSMW members San Francisco Bay Conservation and Development Commission (BCDC), USEPA and USACE are currently working collaboratively on the development of a Coastal RSM Plan for the Bay.

Identified BECAs (Figure 1):

- a) Robert Crown Memorial State Beach and
- b) Coyote Point.

Potential sediment sources (Figure C-4; not all shown):

- a) Port of Oakland dredging and
- b) Ship channel dredging at various locations within the Bay.

Coastal San Francisco Peninsula

The coastline along much of the San Francisco peninsula consists of a long strip of relatively narrow beach. A seawall separates Ocean Beach from the City of San Francisco and related developments. A 4-lane highway lies immediately behind much of the seawall; critical water supply and other utilities are buried beneath this highway. Significant and severe coastal erosion is ongoing in the vicinity of Ocean Beach. Recent erosion has undermined a portion of the highway and threatens the utilities beneath it. Emergency work is currently underway to protect the remainder of the highway and utilities. A Coastal RSM Plan for the San Francisco Littoral Cell (Golden Gate to Pacifica) is planned for 2011, assuming Coastal Impact Assistance Program funds are received.

Identified BECAs (Figure 1):

- a) Ocean Beach (San Francisco).

Potential sediment sources (Figure C-4; not all shown):

- a) Bolinas Lagoon dredging and
- b) Golden Gate channel and vicinity dredging.



San Mateo, Santa Cruz and Monterey Bay

This stretch of coastline includes:

- 1) San Mateo and Santa Cruz open coastline and
- 2) Monterey Bay.

The San Mateo coastline consists of rocky coast backed by mountains or sea cliffs, and narrow pocket beaches. Eroding sea cliffs along this section pose significant shoreline erosion problems. Population is concentrated along this stretch at Half Moon Bay and at the northern and southern edges of Monterey Bay (e.g., Santa Cruz and Monterey). A major littoral cell (Santa Cruz) extends from Pacifica to central Monterey Bay; the southern Monterey Bay littoral cell extends from Moss Landing (head of the Monterey submarine canyon) to the Monterey peninsula. Significant coastal armoring has occurred in the vicinity of Santa Cruz.

Beaches along much of Monterey Bay are locally wide with extensive sand dunes, except in Santa Cruz where the east-west shoreline aspect contributes to rapid littoral drift and high erosion rates. Significant coastal erosion is ongoing throughout Southern Monterey Bay, especially south of the back beach sand mining operation at Marina. Elkhorn Slough is also undergoing significant erosion. Santa Cruz Harbor dredges sediment on an ongoing basis, and could be a source of sediment for eroding areas in the region. The Monterey Submarine Canyon extends close to shore at the mid-point of the Bay, and serves as a sink for littoral cells on either side of the canyon (Santa Cruz littoral cell to the north, Southern Monterey Bay littoral cell to the south). Bypassing sand around the submarine canyon could potentially serve as a viable source of sediment. CSMW is currently investigating whether sand traps or interceptors constructed near the head of the canyon could provide a viable source of sediment to treat critical erosion areas within the region. The Coastal RSM Plan for southern Monterey Bay determined that a significant sand source was located just offshore of Sand City.

The Monterey Bay National Marine Sanctuary (MBNMS) and Gulf of the Farallones National Marine Sanctuary (GFNMS) are federally protected marine areas offshore of this stretch of coastline. The sanctuaries were established for resource protection, research, education and public use. Sanctuary regulations generally prohibit placement of dredged sediment within the boundaries of the sanctuaries. MBNMS recently completed a Harbors and Dredge Disposal Plan which provides a framework to address disposal of dredged materials coupled with protection of MBNMS resources, and plans to assess policy and regulatory options to permit beach nourishment and other erosion response alternatives that may conflict with current interpretations of sanctuary regulations.

Identified BECAs (Figure 1):

- a) Princeton,
- b) El Granada County Beach, and
- c) Southern Monterey beaches (from Sand City to Monterey).

Potential sediment sources (Figure C-4):

- a) Pillar Point Harbor dredging,
- b) Santa Cruz Harbor dredging,
- c) San Lorenzo River channel maintenance,



- d) Moss Landing Harbor dredging,
- e) Near Monterey submarine canyon head,
- f) Littoral convergence zone offshore of Sand City,
- g) Fort Ord sand dunes, and
- h) Monterey Harbor dredging.

Big Sur Coast to San Luis Obispo

This incredibly scenic reach of coastline consists primarily of rocky coast backed by mountains or sea cliffs, and beaches are narrow to non-existent. The stretch of coastline is remote and sparsely populated. Due to the rapid emergence of this coastline due to tectonic uplift and unstable geologic materials, the sea cliffs continually fail by landsliding, undermining or covering portions of the only highway along this stretch. The California Department of Transportation is repeatedly removing sediment off Highway 1 to keep it open for tourist and local traffic; a beneficial use and/or destination for much of this material is highly desired. Two smaller littoral cells have been defined along the Big Sur coastline, however, due to the emergent nature of and limited access to this coastline, coastal processes in this stretch of coastline are poorly understood. A larger littoral cell exists in the vicinity of Morro Bay.

Potential BECAs (to be evaluated for inclusion in the BECA list at a later date):

- a) Cayucos Beach and
- b) Pocket beaches along Pismo Beach.

Potential sediment sources along this coastline (Figure C-5):

- a) Morro Bay Harbor dredging and
- b) Port San Luis dredging.

Santa Barbara and Ventura Counties

At Point Conception, the California shoreline transitions from its general northwesterly alignment to a predominantly east-west direction. The change in shoreline orientation, together with the shelter afforded by the Channel Islands, results in a semi-protected coastline within the Santa Barbara Channel, with warmer ocean waters and milder climate. This coastal setting has been responsible for stimulating higher population growth, more rapid development and higher levels/variety of coastal recreation. One major littoral cell (Santa Barbara) encompasses this stretch of coast, extending from north of Point Conception to the Mugu submarine canyon, which extends very close to and may be impacting the coastline near Mugu Lagoon. Due in large part to the change in shoreline aspect and exposure to western swells, littoral drift is relatively consistent in direction along the Santa Barbara, Ventura, and western portion of the Los Angeles County coastlines.

The cumulative effect of urbanization over the past century has altered the natural coastal processes and the ability of the beaches to naturally replenish. Damming of streams and rivers upstream from the shoreline, coastal urbanization, and other development impacts have impacted the dynamic balance of littoral sand movement and the process of natural beach replenishment.

Ventura and Santa Barbara Harbors dredge their entrance channels regularly, and Ventura Harbor, in particular, is considered a viable source of sediment for eroding areas elsewhere in



the region. Matilija Dam is under consideration for decommission and removal, and, if associated problems can be resolved, also represents a significant sediment source. Numerous other flood control structures (e.g., debris basins) are located throughout the region; those closest to the coastline may also represent viable sources of sediment for eroding coastal areas. A Coastal RSM Plan for the two counties was completed in January 2009.

Within this region coastal geomorphology includes:

- 1) Relatively narrow beaches in front of the sea cliffs and mountainous terrain along the Santa Barbara and northwestern Ventura County coastlines and
- 2) Generally wider and more contiguous beaches backed by the Oxnard alluvial plain along southeastern Ventura County shoreline.

Santa Barbara Coastline

Identified BECAs (Figure 2):

- a) Refugio State Beach,
- b) El Capitan State Beach,
- c) Isla Vista,
- d) Goleta Beach County Park,
- e) Arroyo Burro County Beach,
- f) Carpinteria City Beach,
- g) Butterfly Beach,
- h) Summerland Beach,
- i) Santa Claus Beach,
- j) La Conchita Beach,
- k) Oil Piers Beach,
- k) Hobson County Park,
- l) North Rincon Parkway,
- m) South Rincon Parkway, and
- n) Emma Wood State Beach.

Potential sources of sediment (Figure C-6):

- a) Santa Barbara Harbor/West Beach,
- b) Goleta Slough tributaries,
- c) various flood control projects,
- d) Carpinteria West offshore,
- e) Carpinteria East offshore,
- f) Santa Barbara offshore, and
- g) Goleta offshore.

Oxnard Plain

Identified BECAs (Figure 2):

- a) Surfers Point,
- b) San Buenaventura State Beach,
- c) Oxnard Shores/Mandalay Beach,
- d) Pierpont Beach, and
- e) Hueneme Beach.



Potential sediment sources (Figure C-6):

- a) Matilija Dam,
- b) Ventura Harbor dredging,
- c) Channel Islands Harbor dredging,
- d) Port Hueneme Harbor dredging,
- e) Mugu Lagoon,
- f) near Mugu Submarine Canyon head, and
- g) Santa Clara River delta offshore.

Los Angeles and Orange Counties

This portion of the coast is heavily populated, developed, and intensely valued for its recreational resources. Three littoral cells (Santa Monica, San Pedro, and Laguna) have been defined along this stretch of coast, typically terminated by submarine canyons. Littoral drift is significant along the western portion of the Los Angeles County shoreline. The wide, sandy beaches present at the middle and southern portions of the Santa Monica Cell are due in large part to lower erosion rates and also to large historical beach nourishment projects coupled with groin fields constructed to help retain sand.

Maintenance of existing beach stabilization projects has been identified as a principal need within this region. Since the early 1900's, the beaches within Los Angeles and Orange County have been artificially enhanced and renourished to support commercial, recreational, and developmental purposes. The beach at Surfside-Sunset has had multiple large nourishment events since the 1945 and the sand has and continues to nourish downcoast beaches.

The entrances to Anaheim harbor is dredged periodically. Other potential sources of sediment exist throughout the region that could be used for regional beach width maintenance programs, including wetland restoration projects and offshore deposits, and smaller potential sources from construction projects, etc.

Extensive information on potential BECAs for Los Angeles County was provided by Los Angeles Beaches and Harbors as their early assessment of areas of concern. They are currently gearing up to conduct a full-fledged Coastal RSM Plan. Orange County Public Works (Parks) is currently collecting data to identify BECAs and sediment sources within the County and its littoral cells, and their list will likely expand once the Coastal RSM Plan for the county has been completed.

The geomorphology of this shoreline reach consists of:

- 1) Relatively narrow beaches backed by sea cliffs and hilly terrain of the Santa Monica Mountains, from southeastern Ventura County to western Los Angeles County,
- 2) Wide and contiguous sandy beaches backed by the broad sandy expanse of the Los Angeles Plain along the eastern section of Los Angeles County and northwestern section of Orange County, and
- 3) Narrow pocket beaches backed by sea cliffs along the southeastern half of Orange County.



Santa Monica Mountains

Identified BECAs (Figure 3):

- a) Leo Carillo State Park,
- b) Nicholas Canyon County Beach,
- c) Dan Blocker Beach,
- d) Malibu Surfrider/Malibu Lagoon State Beach,
- e) Topanga County Beach, and
- f) Will Rogers State Beach.

Potential sediment sources (Figure C-7; not all shown):

- a) Rindge Dam,
- b) numerous flood control structures, and
- c) Malibu Lagoon.

Los Angeles Plain

Identified BECAs (Figure 3):

- a) Venice Beach,
- b) Dockweiler State Beach,
- c) Redondo County Beach,
- d) Redondo/Torrance County Beach,
- e) Surfside-Sunset Beach, and
- f) Huntington Cliffs.

Potential sediment sources (Figure C-7):

- a) Marina del Rey dredging,
- b) King Harbor dredging,
- c) Los Angeles River dredging, and
- d) Numerous flood control structures.

Southeastern Orange County

Identified BECAs (Figure 3):

- a) San Clemente Beach.

Potential sediment sources (Figure C-7):

- a) Dana Point Harbor dredging,
- b) San Onofre Lagoon,
- c) Santa Margarita Lagoon, and
- d) Lower Santa Ana River.



San Diego County

Except for the portion of coast within the U.S. Marine Corps base (Camp Pendleton), the region is heavily populated, developed, and intensely valued for its recreational resources. Three littoral cells (Oceanside, Mission Bay and Silver Strand) have been defined along this stretch of coast, typically terminated by submarine canyons.

The region contains some of the most severe beach erosion problems in the State. Maintenance of existing beach stabilization projects has been identified as a principal need within this region. The beaches south of and including the City of Oceanside have a long history of beach nourishment activity. A Regional Beach Fill Program placed offshore sands at twelve beaches in San Diego County in 2001. A Coastal RSM Plan covering most of the county was completed in March 2009.

The entrance to Oceanside Harbor is dredged periodically; the sediment is placed downcoast, nourishing beaches both local and more distant. An extensive fillet of beach quality sand has been trapped upcoast of the northern jetty to the harbor, and represents one of the most economically viable sources of offshore sand in the region. Other potential sources of sediment exist throughout the region that could be used for regional beach width maintenance programs, including wetland restoration projects, offshore deposits, and smaller potential sources from construction projects, etc. San Diego Bay is a large potential source of sediment, but the presence of ordnance from historic military activities prevented its use for the 2001 Regional Beach Fill Program. The Tijuana Estuary has been inundated by sediment from Mexico, and finding a beneficial reuse for the excess sediment will help restore the estuary.

The geomorphology of this shoreline reach consists of:

- 1) The San Diego shoreline is a nearly continuous length of sandy beach of variable width, backed mostly by low to high sea cliffs and
- 2) A wide sandy beach with low dunes fronts most of San Diego Bay and the Tijuana Estuary.

San Diego Shoreline

Identified BECAs (Figure 4):

- a) South Oceanside/North County San Diego,
- b) Carlsbad State Beach,
- c) Agua Hedionda/Encinas Creek,
- d) South Carlsbad State Beach,
- e) Batiquitos Lagoon Beaches,
- f) Leucadia State Beach,
- g) Moonlight State Beach,
- h) Cardiff State Beach,
- i) Solana Beach/Fletcher Cove,
- j) Del Mar City Beach,
- k) Torrey Pines State Beach,
- l) Mission Beach, and
- m) Ocean Beach (San Diego).



Potential sediment sources (not all of these are shown on Figure C-8):

- a) Camp Pendleton- Santa Margarita River,
- b) Camp Pendleton- nearshore,
- c) Camp Pendleton- Del Mar boat basin,
- d) Oceanside Harbor,
- e) Santa Margarita Lagoon,
- f) Loma Alta Creek maintenance,
- g) El Corazon project,
- h) Oceanside Beach Resort,
- i) Poinsettia Train Station,
- j) Buena Vista Lagoon restoration,
- k) Carlsbad City Retention Basins,
- l) Agua Hedionda Lagoon,
- m) Encinas Creek maintenance,
- n) Agua Hedionda Creek maintenance,
- o) Batiquitos Lagoon,
- p) Carlsbad hotel development,
- q) Carlsbad Condo development,
- r) Encinitas Resort development,
- s) Encinitas Pacific Station project,
- t) San Elijo Lagoon restoration,
- u) Solana Beach Train Station project,
- v) Solana Beach I-5 widening,
- w) San Dieguito Lagoon/Wetlands restoration,
- x) Torrey Pines Retention Basin,
- y) Torrey Pines South (near Black Beach),
- z) Los Penasquitos Lagoon inlet restoration,
- aa) San Luis Rey watershed,
- ab) SANDAG RBFP I & II offshore locations SO-5, SO-6, MB-1, SM-1, and TP-1,
- ac) Various flood control structures, and
- ad) near Scripps Submarine Canyon head.

San Diego Bay and Tijuana Estuary

Identified BECAs (Figure 4):

- a) Coronado City Beach,
- b) Imperial Beach, and
- c) Borderfield State Park.

Potential sediment sources (not all shown on Figure C-8):

- a) San Diego Bay dredging,
- b) Tijuana Estuary/Goat Canyon Catchment Basins, and
- c) SANDAG RBFP I & II offshore location SS1.



APPENDIX D

Potential Sediment Management Options



POTENTIAL SEDIMENT MANAGEMENT ALTERNATIVES

The descriptions presented below are potential sediment management options that could be used to address coastal erosion. Other options exist and may be appropriate, dependent on conditions at the location under consideration. This list is presented only to identify options worthwhile to consider when evaluating sediment management efforts and does not imply that other options should not be considered. These potential Sediment Management Alternatives include:

- No Action- The erosion described in the Problem Assessment would be allowed to continue, and threatened structures, recreation opportunities and habitat would eventually be lost.
- RSM- This alternative would describe how regional sediment supply concerns could be brought into an analysis of coastal erosion and help optimize solutions. This option would focus on ways to restore or augment natural processes, thereby increasing the delivery of sand from the watershed to and along the coastline. This could include placement of sand at the BECA to serve as a feeder beach for downcoast beaches, upcoast placement to feed the beach of concern, opportunistic use of potential sources of sediment within the region (e.g., harbors, wetlands, dams, debris basins, construction, offshore sources), or otherwise address aspects that create or aggravate sediment imbalances (e.g., reduce in-stream sand mining, facilitate transport of sediment around dams, restore rivers).
- Managed Retreat- The gradual removal or movement of development from areas of high geologic hazard; a policy of developing (or not developing) land to avoid situations in which public safety is jeopardized and natural processes are impeded. Tools to implement this alternative include: moveable structures; construction setbacks to avoid risks posed by structures located close to, or within, high geologic hazard areas; rolling easements that allow structures to be developed but condition their removal to allow for natural coastal processes; tax and other incentives when viable, to encourage property owners in high-risk areas to relocate out of harm's way; full hazard disclosure rules on real estate transactions in high geologic hazard areas; prohibitions against rebuilding damaged structures in high geologic hazard areas; acquiring and conserving endangered or undeveloped property for conversion to public parkland.
- Beach Nourishment- The width of beaches can be increased or maintained by depositing sand upcoast of, directly on, or in the nearshore waters adjacent to beaches. The benefits from beach nourishment can be substantial by providing wide sandy beaches for recreation, wildlife habitat, and in many cases backshore protection. Investments of millions of dollars to maintain beaches will help support billions in revenues from recreation and tourism. Challenges associated with beach nourishment include initial installation and maintenance costs, limited sand sources, difficulty in transporting and placing sand, the possibility of significant environmental effects, and complicated procedures for obtaining funding and regulatory approvals. Beach nourishment can be an effective tool, but is one that may not be technically, economically, or environmentally justified for all sites, especially those with high rates of beach erosion or an abundance of offshore reefs.



- Retention Structures- this alternative relates to those areas where it might be appropriate to combine sand retention structures (i.e., submerged reef, breakwater, or groins) with beach nourishment in order to reduce the rate of alongshore movement of sand, thereby maintaining the nourished beach for a longer period of time. It also includes those areas where groin repair may be appropriate.
- Beach Management- Several options could reduce the amount of beach erosion. Native plant restoration could be used as an inexpensive means to reduce sand transport associated with wind erosion and build beach topography needed by beach dependent biota. Exotic species could be removed that alter beach morphology and reduce the amount of open strand useful for recreation and habitat. Beach grooming must be performed carefully to ensure that plants and wrack, which can hold sand in place, are left undisturbed to the degree feasible and reasonable.