

EXECUTIVE SUMMARY

ES 1. Introduction

This Santa Cruz Littoral Cell Coastal Regional Sediment Management Plan (Plan) delineates a number of sediment-management objectives for the central California coastline from Pillar Point in San Mateo County to Moss Landing in Monterey County (Figure ES-1). These objectives support the mission of the California Coastal Sediment Management Workgroup (CSMW), which is a collaborative effort of federal, state, and non-governmental organizations committed to evaluating California's coastal sediment management needs on a regional scale. This regional approach to sediment management will be referred to as regional sediment management (RSM) throughout this Plan. Objectives of this Plan include: (1) restoring, preserving, and maintaining coastal beaches and other critical areas of sediment deficit; (2) sustaining recreation and tourism; (3) enhancing public safety and access; (4) restoring coastal sandy habitats; and (5) identifying cost-effective solutions for the restoration of areas affected by excess sediment.

ES 2. Description of Plan Area

The Santa Cruz Littoral Cell – a self-contained system of sand sources and sand sinks that extends from Pillar Point to Moss Landing – demarcates the geographic scope of this Plan (Figure ES-1). Point San Pedro, a prominent headland north of Pillar Point, serves to effectively prevent sand from being transported from the north, and the Monterey Submarine Canyon traps essentially all of the sand that would be transported to Southern Monterey Bay by longshore currents. The regional wave climate induces a net direction of sand transport from north to south, with estimated net transport rates as high as 300,000 cubic yards (cy) per year.

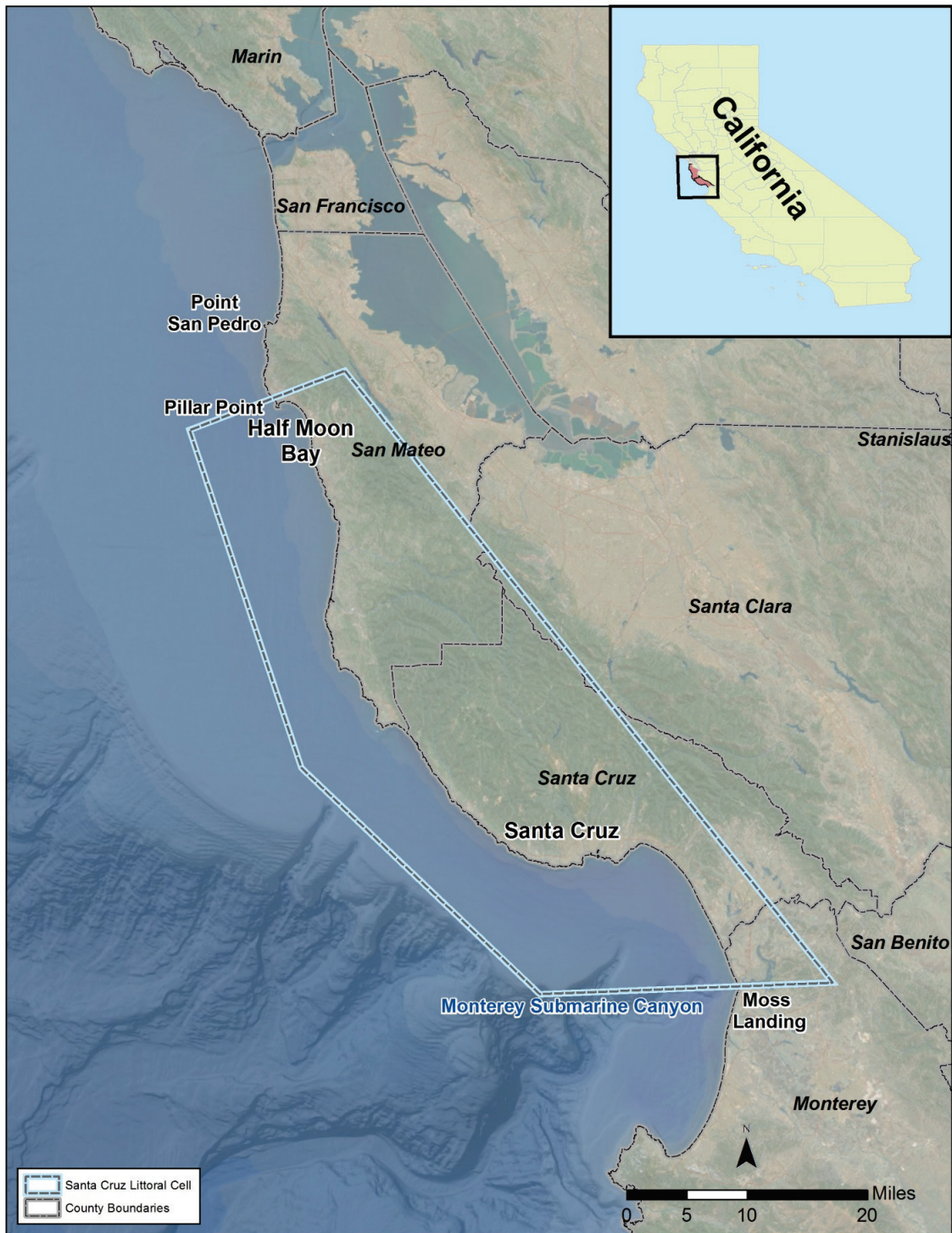


Figure ES-1. Location of the Santa Cruz Littoral Cell. All background topography and imagery in subsequent figures from ESRI, unless otherwise noted

The Santa Cruz Littoral Cell is a diverse region, with different coastal stretches (or reaches) characterized by distinct geomorphic and anthropogenic features. Acknowledging that diversity, the Plan area has been divided into seven reaches, which range from the rural and largely undeveloped rugged shoreline of southern San Mateo County to the heavily urbanized beaches and sea cliffs of northern Monterey Bay:

Reach 1: Pillar Point to Surfer's Beach

Reach 2: Surfer's Beach to Miramontes Point

Reach 3: Miramontes Point to Pescadero Creek

Reach 4: Pescadero Creek to Point Año Nuevo

Reach 5: Point Año Nuevo to Natural Bridges

Reach 6: Natural Bridges to New Brighton State Beach

Reach 7: New Brighton State Beach to Moss Landing

Each reach has distinct sediment management problems and opportunities that must be addressed in the context of a region-wide understanding of sand supply, transport, and erosion. In this context, the current scientific understanding is that the heavily used beaches that ring the northern Monterey Bay have been supplemented by the erosion of large sand dunes at Point Año Nuevo. The Año Nuevo Sand Reserve (ANSR) has recently been depleted, however, and it has been postulated this annual loss of approximately 50,000 cy of sand will result in the erosion of northern Monterey Bay beaches. In addition, it is anticipated that future sea-level rise will exacerbate beach erosion, particularly in areas where the position of the backshore has been fixed by armoring.

The construction of coastal infrastructure and modifications to contributing watersheds has also affected sediment supply and transport. There are several major coastal structures in the Santa Cruz Littoral Cell, and these structures are deemed to contribute to erosion of downdrift beaches because they reduce sediment supply. In several reaches, excess sediment has accumulated in coastal lagoons as a result of construction of coastal infrastructure and other modifications to the nearshore and beach environment. This excess sediment can impair important ecosystem functions, particularly with respect to sensitive fish species, and can induce flooding of adjacent land and infrastructure.

ES 3. Beach Erosion Concern Areas and Sediment-Impaired Coastal Habitats

An assessment of physical conditions and vulnerable coastal infrastructure was combined with input from a Stakeholder Advisory Group (SAG) and the public to formulate a list of Beach Erosion Concern Areas (BECAs) and Sediment-Impaired Coastal Habitats (SICHs). The BECAs are primarily concentrated along the heavily developed northern Monterey Bay shoreline, where well-documented beach and sea-cliff erosion threatens both public infrastructure and private development at a number of locations (Figure ES-2). These BECAs include sections of West Cliff Drive, East Cliff Drive, the Capitola Beach and Esplanade, the sea cliffs of Depot Hill, and the heavily developed beach running through Aptos and Rio Del Mar. There are also notable BECAs at the north end of the cell, where construction of the breakwaters to create Pillar Point Harbor have altered the nearshore wave environment and local sediment supply and transport.



Figure ES-2. Beach Erosion Concern Areas (BECAs) in the Santa Cruz Littoral Cell

The SICHs include a number of coastal lagoons where infrastructure has restricted the natural sediment exchange between the open coast and the lagoons (Figure ES-3). Some of this infrastructure is aging and in need of rehabilitation or replacement. There are at least two locations (Highway 1 bridges over Scott and Waddell Creeks) where future infrastructure replacement could be designed to facilitate a more natural sediment regime in the presently degraded coastal lagoons. Excessive sand accumulation at the mouth of the San Lorenzo River following the construction of Santa Cruz Harbor also poses a threat to infrastructure and public safety in addition to impairing ecological functions in the lagoon.

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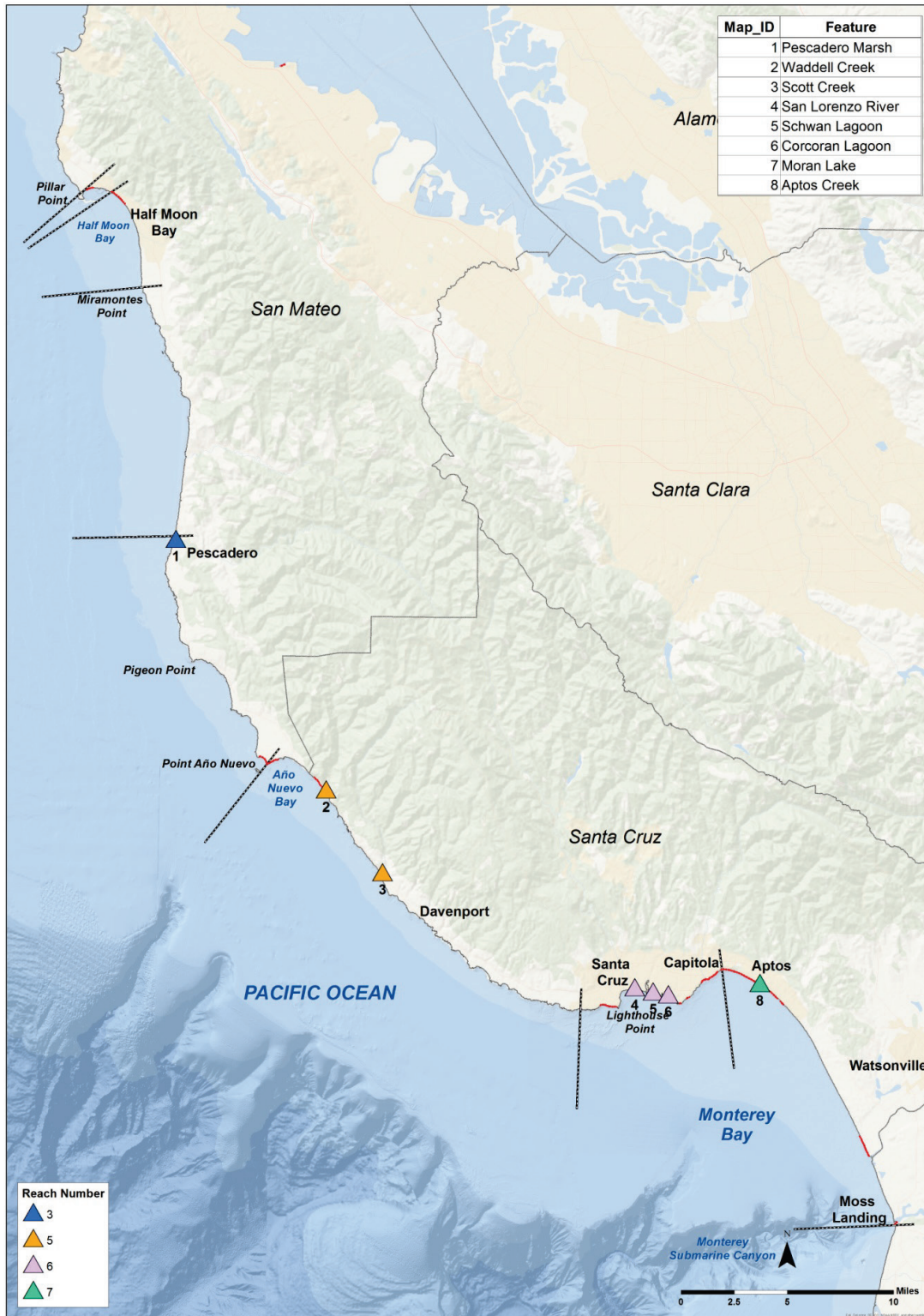


Figure ES-3. SICHs in the Santa Cruz Littoral Cell

ES 4. Regional Sediment Management Measures

A number of RSM measures could be implemented at the BECAs and SICHs. These measures span a wide range of actions beyond beach nourishment that can restore a more balanced coastal sediment budget. Such actions can include both soft and hard engineering measures along with the relocation of development and infrastructure from erosion hazard zones (managed retreat) to facilitate natural beach and sea-cliff erosion processes (Table ES-1). Each measure has distinct advantages and disadvantages, however, and some measures may be more suitable than others at given BECAs and SICHs. The suitability of measures at individual BECAs is further discussed in Section ES 8.

Table ES-1: Descriptions of RSM measures (strategies) considered in the Plan

MEASURE	DESCRIPTION
No Action	This approach assumes that the "status quo" will continue over the next 50 years, often with local interests maintaining existing erosion control measures.
Managed Retreat	This measure involves relocating development and infrastructure away from coastal erosion hazard zones.
Restoration of Beach and Marsh Environments and Modification of Infrastructure	This measure involves actions intended to restore natural processes to a given coastal environment, and is applicable to both BECAs and SICHs.
Beach Nourishment	This measure involves the direct placement of sand on the sub-aerial beach or in the shallow waters (less than 10 feet deep) of the surf zone.
Nearshore Berm	This measure differs from direct beach nourishment in that sediment is placed in nearshore waters, outside the surf zone and often up to depths of up to 30 or 40 feet.
Perched Beach	This measure involves utilizing a submerged sill to limit offshore sand transport, and thereby create a perched beach at a higher elevation than surrounding beaches.
Multipurpose Artificial Reef	This measure involves the construction of a submerged offshore reef that is designed to reduce beach erosion and provide recreational benefits. These structures induce accretion of sediment by altering the direction of wave approach, thereby reducing the rate of littoral drift and associated erosion.
Groins and Jetties	This measure involves construction one or more shore perpendicular structures designed to retain beach sand. These structures may be particularly useful in environments with high littoral drift rates and no existing barriers to this drift.
Cliff Stabilization by Seawall	This measure involves measures designed to stabilize sea cliffs that are subject to wave attack. Typical measures include construction of seawalls and stabilization with soil nail walls.

The Plan also identifies potential sources for beach quality sand and finer sediments that could be utilized in wetland restoration projects. This assessment involved the compilation of key information about each sediment source into a Geographic Information System (GIS) database based on guidance in the Sand Compatibility and Opportunistic Use Program (SCOUP). Sediment sources were divided into broad categories and mapped for each reach. Major sediment sources include harbors, offshore sand, beach sand, and fluvial sources (Table ES-2). This assessment only represents a preliminary effort, and significant coordination and planning (including permitting, etc) will be required to obtain sediment from most of the potential sources.

Table ES-2: Examples of potential sediment sources in the Santa Cruz Littoral Cell

SEDIMENT SOURCE TYPE	POTENTIAL SITE
Harbors	Pillar Point Harbor, Santa Cruz Harbor, Moss Landing Harbor
Offshore Sand	Deposit approximately 5 miles south of Santa Cruz Harbor
Beach Sand	Seabright Beach
Sediment Impaired Coastal Habitats	Pescadero Marsh, Scott Creek Lagoon
Flood Risk Management Projects and Dams	Butano Creek Channel, San Lorenzo River, Pajaro River Bench Excavation
Major Construction Projects	N/A
Stockpile Sites	Buena Vista Drive Landfill, Elkhorn Slough Wetland Restoration Project

ES 5. Biological Resources

The Monterey Bay National Marine Sanctuary (MBNMS) abuts the Santa Cruz Littoral Cell shoreline. The littoral cell encompasses several managed areas and protected habitats, including state marine conservation areas, marine reserves, state parks and beaches, and ecologically significant habitats (Tables ES-3 and ES-4). It is also host to a variety of species, including more than twenty cetaceans (whales, dolphins and porpoises), six species of pinnipeds (seals and sea lions), otters, several species of fish, and resident birds. Being located on the Pacific flyway, it serves as a temporary home to several migratory birds.

Table ES-3: Habitats in the Santa Cruz Littoral Cell

HABITAT TYPE	DESCRIPTION
Sandy Beaches, Coastal Dunes, and Strands	Sandy beaches provide primary habitat for invertebrates; forage, resting, and nesting habitat for birds, including threatened western snowy plover; and spawning habitat for California grunion. There is evidence that snowy plovers nest on sandy beaches within the littoral cell.

HABITAT TYPE	DESCRIPTION
Coastal Rivers, Creeks, Sloughs, and Lagoons	There are several rivers and creek mouths in the littoral cell, many of which serve as critical habitat for salmonids and tidewater goby. The mouths of rivers and creeks form estuary and adjacent wetland habitat where salmonids rear and gobies inhabit during all life stages.
Coastal Wetlands	Coastal wetlands include saltwater marshes, freshwater marshes, brackish marshes, swamps, mudflats, and fens.
Estuaries	Estuaries provide critical habitat for some life stages of several plants, fish, shellfish, and other organisms. Bays, sloughs, and associated wetlands provide a variety of habitats ranging from open water, mudflats, eelgrass beds, marshes, salt flats, and pannes and may support thousands of species of plants, invertebrates, fish, amphibians, reptiles, birds, and mammals.
Inlet Embayments	These areas have a relatively deep-water connection to the ocean and provide more protected habitats than the open ocean because of headlands, structural breakwaters, and distance from the open ocean. These protected embayments support hundreds of species, including a variety of invertebrates, fish, aquatic vegetation, fish-eating birds and waterfowl, and transient occurrence of marine mammals.
Littoral	Littoral habitat is found in the nearshore waters of the continental shelf, from the high water mark (typically mean high water) to a depth of approximately 660 feet.
Sublittoral	Sublittoral zones include the nearshore waters from the intertidal zone to a depth of approximately 660 feet.
Sandy Intertidal Zone	Sandy intertidal zones are characterized by soft bottom sands, shells, and occasionally cobble in the area between the highest and lowest tides. This zone provides important habitat for various organisms living under the surface of the sand, including clams, crabs, and other invertebrates, as well as feeding ground for invertebrates and shore birds.
Rocky Intertidal Zone	This habitat is found on rocky substrate between the lowest and highest tidal water levels. Rocky substrate habitats are capable of supporting hundreds of species of plants, invertebrates, and fish.
Rocky Subtidal	Rocky subtidal habitat is a highly productive zone inhabited by many species. Much rocky subtidal habitat in the littoral cell is characterized by dense kelp forests, comprised of giant kelp and bull kelp.
Kelp Forest, Eelgrass, and Surfgrass	Surfgrass beds are highly productive areas supporting invertebrates and many species of algae. Kelp beds grow in waters just beyond the breaker zone to depths of about 100 feet. They support hundreds of species of invertebrates and fish, many of which are prey for marine mammals. Eelgrass meadows occur on soft substrates in protected coastal areas, mainly embayments, but also may occur in the nearshore where suitable conditions exist.
Submarine Canyon and Deepwater Habitats	The canyon floor and the waters over the canyon provide unique habitat which extends from the shallow waters of the continental shelf to deep sea areas. Upwelling from the canyon supports most of the primary productivity for the entire Monterey Bay.

Table ES-4: State parks, State marine conservation areas, and State reserves

REACH	STATE MARINE CONSERVATION AREAS AND RESERVES	BECA OR SICH	NOTES
1 – 7	Monterey Bay National Marine Sanctuary (MBNMS)		Entire littoral cell is within the MBNMS. All sediment management activities conducted in the sanctuary will require approval from the MBNMS.
1	Pillar Point State Marine Conservation Area		Take of all living marine resources is prohibited; except for recreational take of pelagic fish, Dungeness crab, and squid.
1	James V. Fitzgerald Marine Reserve		Includes 5.5 miles of coastline along the park. Considered an area of special biological significance, which is a state water quality protection area.
4 and 5	Año Nuevo Point and Island and Año Nuevo State Marine Conservation Area	BECA 4: Año Nuevo State Reserve	Area includes waters from the mean high tide line to 200 feet shoreward. All species are protected in this area. Only hand harvesting of giant kelp is allowed. Several pinnipeds use the island and beaches as haul outs and/or rookeries.
4 and 5	Greyhound Rock State Marine Conservation Area		Area includes waters from the mean high tide line to three nautical miles off shore. Recreational and commercial fishing of giant kelp (by hand), salmon, and market squid. Recreational hook and line fishing of other fin fish is also allowed. All other species are protected.
5	Natural Bridges State Marine Reserve		Includes waters from the mean high tide line to a distance of 200 feet seaward. No fishing or other collection of organisms is allowed.
7	Elkhorn Slough State Marine Conservation Area National Estuarine Research Center	BECA 20: Moss Landing / Elkhorn Slough	Elkhorn Slough has ongoing and proposed restoration projects. Only recreational hook and line fishing of fin fish and clamming is allowed. Take of all other species is prohibited.
7	Elkhorn Slough State Marine Reserve	BECA 20: Moss Landing / Elkhorn Slough	Take of any species is prohibited.
7	Soquel Canyon State Marine Conservation Area		Includes 14,200 acres located 8 miles west of Moss Landing and 7 miles south of Santa Cruz. Only recreational and commercial fishing of pelagic finfish is allowed.

The littoral cell is also habitat for several special status species, including species protected under state and federal ESAs, protected marine mammals, migratory birds, and other state protections, such as fully protected species or species protected under various

California Fish and Game (CFG) codes. Table ES-5 identifies the designated critical habitats associated with each BECA or SICH.

Table ES-5: Designated Critical Habitats Associated with Each BECA or SICH

REACH	BECA OR SICH	NAME	CRITICAL HABITATS ¹
1	BECA 1	Princeton - Pillar Point Harbor	- Nearby Denniston Creek is Central California Coast (CCC) steelhead Evolutionary Significant Unit (ESU) Critical Habitat (CH) - Black Abalone ² CH is located in a portion of Pillar Point Harbor
2	BECA 2	El Granada County Beach	- Black Abalone ² CH
	BECA 3	Half Moon Bay – Mirada Road	- Black Abalone ² CH
3			
4	SICH 1	Pescadero Marsh	- Tidewater goby CH; red-legged frog CH - Pescadero and Butano Creeks are CCC steelhead ESU CH and CCC coho salmon ESU CH - Black Abalone ² CH at the coastal end of the marsh.
	BECA 4	Año Nuevo State Reserve	- Black Abalone ² CH; Steller Sea Lion CH; California red-legged frog CH
5	BECA 5	Waddell Bluffs	- Black Abalone ² CH; Marbled murrelet CH; California red-legged frog CH
	SICH 2	Waddell Creek	- Tidewater goby CH; CCC steelhead ESU CH; CCC coho salmon ESU CH; Marbled murrelet CH; California red-legged frog CH - Waddell Creek beach is western snowy plover CH - Black Abalone ² CH along the nearby coastline
	BECA 6	Scott Creek Beach	- Black Abalone ² CH; Western snowy plover CH; California red-legged frog CH - Directly adjacent to Scott Creek which contains additional CH (see SICH 3)
	SICH 3	Scott Creek	- Tidewater goby CH; CCC steelhead ESU CH; CCC coho salmon ESU CH; California red-legged frog CH - Runs though Scott Creek beach which contains additional CH (see BECA 6)
6	BECA 7	West Cliff Drive	- Black Abalone ² CH
	SICH 4	San Lorenzo River	- CCC steelhead ESU CH; CCC coho salmon ESU CH - Black Abalone ² CH at the coastal end of the river
	BECA 8	Twin Lakes State Beach	- Black Abalone ² CH - Santa Cruz tarplant CH is located to the immediate north of Schwan Lagoon at Twin Lakes State Beach
	SICH 5	Schwan Lagoon	- Santa Cruz tarplant CH to the immediate north

REACH	BECA OR SICH	NAME	CRITICAL HABITATS ¹
	SICH 6	Corcoran Lagoon	- Tidewater goby CH - Black Abalone ² CH along the adjacent coastline
	BECA 9	Del Mar Beach –Corcoran Lagoon and Moran Lake	- Tidewater goby CH; Black Abalone ² CH
	SICH 7	Moran Lake	- Adjacent to the southern end of designated Black Abalone ² CH
	BECA 10	East Cliff Drive – 37 th Ave to Larch Lane	--
	BECA 11	East Cliff Drive – Capitola	--
	BECA 12	Capitola Beach and Esplanade	- Adjacent Soquel creek is CCC steelhead ESU CH
	BECA 13	Depot Hill	--
7	BECA 14	Pot Belly Beach – New Brighton State Beach	--
	BECA 15	Seacliff State Beach - North	--
	SICH 8	Aptos Creek	- Tidewater goby critical habitat; CCC steelhead ESU CH
	BECA 16	Seacliff State Beach - South	--
	BECA 17	Rio Del Mar – Beach Drive	--
	BECA 18	Rio Del Mar – Via Gaviota	--
	BECA 19	Pajaro Dunes	- Western Snowy Plover CH - The Pajaro River directly adjacent down coast (0.5 miles) is Tidewater Goby and South-Central California Coastal Steelhead ESU CH
	BECA 20	Moss Landing and Elkhorn Slough	- Elkhorn Slough is South-Central California Coastal Steelhead ESU CH - Adjacent to Tidewater Goby, Western Snowy Plover and Monterey Spineflower CH at Moss Landing State Beach

Notes:

¹ Marine habitat in the entire littoral cell falls within Leatherback turtle critical habitat, which stretches along the California Coast from Point Arena to Pont Arguello. The marine areas of the entire littoral cell are also within green sturgeon critical habitat, which extends from Monterey Bay, California North and East.

² Black Abalone critical habitat is present in reaches 1-5 and the northern portion of reach 6 in the littoral cell. This includes rocky intertidal and subtidal habitat, and all waters from mean higher high water to a depth of 20 feet.

Coastal sediment management options, such as beach nourishment and construction of sediment retention structures, have the potential to affect these habitats and species in a variety of ways. In addition, removal of sand from aquatic and upland sources also has the potential to adversely affect biological resources in the littoral cell. Biological and natural resources are protected by various federal, state, and environmental laws and regulations.

ES 6. Regulatory and Policy Considerations

Implementing any of the RSM measures outlined in this Plan requires following a regulatory compliance process. Although the precise requirements and process depend on the specifics of each project, regulatory compliance can generally be broken down into two major components or processes: 1) Environmental Review and 2) Permitting.

Environmental review consists primarily of compliance with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA), but also with several other state and federal laws. Environmental review is typically completed or nearly completed prior to embarking on the permitting process, because the information developed during this phase will be used by permitting agencies in reviewing the project and making permit decisions (Table ES-6).

Table ES-6: Relevant regulations affecting beach restoration projects

POLICY/REGULATION	REQUIREMENT	PERMITTING/APPROVAL AGENCY
FEDERAL		
NEPA	Compliance	Lead NEPA Agency
Coastal Zone Management Act (CZMA)	Coastal Consistency Determination (CCD)	California Coastal Commission (CCC)
Rivers and Harbors Act (RHA)	Section 10 Permit	U.S. Army Corps of Engineers (USACE)
Clean Air Act (CAA)	Title V Operating Permit	California Air Resources Board (CARB) (below under State)
Clean Water Act (CWA)	Section 401 Certification or Waiver (401 Permit)	Regional Water Quality Control Boards (RWQCBs)+
CWA	Section 402 NPDES Permit (NPDES Permit)	RWQCBs+
CWA	Section 404 Permit (404 Permit)	USACE
Endangered Species Act (ESA)*	Section 7 Consultation	U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS)
National Historic Preservation Act (NHPA)*	Section 106 Approval	State Historic Preservation Officer (SHPO)

Fish and Wildlife Coordination Act (FWCA)*	Coordination Act Report (CAR)	USACE
Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA)*	Assessment of Impacts to Essential Fish Habitat (EFH)	NMFS
Outer Continental Shelf Lands Act (OCS)	Lease Agreement for Utilization of Outer Continental Shelf Sand	Minerals Management Service (MMS)
STATE		
CEQA	Compliance	Lead CEQA Agency
California Coastal Act (CCA)	Coastal Development Permit (CDP)	CCC
Porter-Cologne Water Quality Control Act (PCWQCA)	Compliance Permits under CWA Sections 401, 402, and 404	State Water Resources Control Board Regional Water Quality Control Boards
California State Lands Public Resources Code	Lease Agreement for Utilization of Sovereign Lands	California State Lands Commission (CSLC)
California Public Resources Code Section 1600	Streambed Alteration Agreement (SAA)	California Department of Fish and Wildlife (CDFW)
California Endangered Species Act (CESA)	Section 2081(b) Incidental Take Permit (State) Section 2081.1 Consistency Determination (State and Federal)	CDFW
Water Quality Control Plans (WQCPs) California Ocean Plan (COP)	Consistency Compliance	Regional Water Quality Control Boards (RWQCBs)+
Clean Air Act (CAA)	Title V Operating Permit	Air Pollution Control Districts (APCDs) and Air Quality Management Districts (AQMDs)
* Review and compliance is usually triggered through the initial CWA Section 404 permitting process by USACE.		
+ The State Regional Water Resources Control Board (SWRCB) has lead responsibility when a project involves jurisdiction by more than one RWQCB.		

Federal agencies involved in conducting, reviewing, approving, or permitting potential RSM projects identified in this plan include USACE, the USEPA, the National Oceanic and Atmospheric Administration's (NOAA) Monterey Bay and Gulf of the Farallones National Marine Sanctuaries (MBNMS and GFNMS), the U.S. Geological Survey (USGS), and the Minerals Management Service (MMS). The USEPA and USACE are the two main agencies involved in regulating discharges of fill and dredged material; however, numerous other federal agencies are also involved in the review of proposed beach-nourishment projects and must provide approval before permits can be issued. For example, any RSM project proposed within the boundaries of the MBNMS, which abuts the entire Santa Cruz Littoral Cell shoreline, will require sanctuary review and approval.

State agencies involved in conducting, reviewing, or approving potential RSM projects include the California Coastal Commission (CCC), California State Lands Commission (CSLC), State Coastal Conservancy (SCC), California Geological Survey (CGS), and Department of Parks and Recreation (DPR), including its Division of Boating and Waterways (DBW). The agencies with primary regulatory responsibility over shoreline protective structures are the CCC and the CSLC. The SCC and DBW are both involved with funding shoreline maintenance projects and data generation; the DPR is involved as a land manager; and the CGS is the state agency responsible for identifying geologic hazards.

ES 7. Economic Considerations

The beaches of the Santa Cruz Littoral Cell are a valuable source of recreation for locals and tourists alike, and they are a central part of the local economies. The coastal communities in the Plan area are home to approximately 108,000 people and 40,000 households. The vast majority of the population, property, and infrastructure at risk from coastal storm damage and erosion are located in and around the cities of Half Moon Bay and Santa Cruz.

In some locations, coastal erosion threatens the quality, accessibility, and existence of beaches. This affects not only the recreational value of the coast, but also puts infrastructure, homes, and businesses at greater risk of damage from storms. There is a history of storms causing damage to homes, businesses, parks, and public infrastructure located along the coast in this region. Although the specific timing, frequency, and magnitude of future damaging storms are unknown, their occurrence is a virtual certainty. Expected future sea-level rise will only increase the risk to the beaches and the assets behind them.

Beach nourishment is one of the ways to reduce the risk posed by coastal storms and more gradual long-term erosive forces. This economic impact evaluation uses existing data and describes some of the economic value at risk from coastal erosion in the Plan area. This evaluation could provide a basis for future, more-detailed feasibility and cost-benefit analyses of potential beach nourishment projects. A benefit-cost analysis would compare the anticipated reduction in future adverse impacts from erosion due to the project with the total cost of the project over its lifetime. The estimate of project benefits would consider impacts to recreation value as well as to properties and infrastructure. A project would be considered economically-justified if the total economic benefits exceeded the total economic cost of the project.

Benefit Assessment

The most intensively used beaches in the Plan area are located along the largely urbanized shoreline of northern Monterey Bay, with the relatively small Capitola City Beach having the highest intensity of use. As an estimate, more than six million people visit those beaches each year. Many of those visitors travel from other cities and counties and bring in important tourism dollars to the local economies (Tables ES-7 and ES-8).

Table ES-7: Beach attendance and intensity of use

REACH	BEACH OR AREA NAME	USABLE BEACH AREA (ACRES)	ESTIMATED ANNUAL ATTENDANCE (1,000s)	INTENSITY OF USE FACTOR**
1	Princeton-Pillar Point Harbor	n/a	n/a	n/a
2	El Granada (Surfer's)	5.0	40	8
	Half Moon Bay State Beach	45.7	684	15
3	San Gregorio	18.8	373	20
	Pomponio	22.5	201	9
	Pescadero	21.7	178	8
4	Bean Hollow	3.7	128	35
	Año Nuevo	26.2	178	7
5	Waddell Creek	6.2	179	29
	Natural Bridges	3.7	807 [^]	n/a
6	Lighthouse Point & Field	1.2	3,742 [^]	n/a
	Santa Cruz Main	26.2	750	29
	Twin Lakes	32.9	535	16
	Capitola	4.4	386	87
	New Brighton	5.9	348	59
7	Seacliff	32.6	558	17
	Manresa	47.9	241	5
	Sunset	68.9	273	4

Notes:

*Usable beach area an approximation - measured in a GIS using CA State Park Boundary shapefiles and aerial imagery.

**Intensity of Use Factor is the ratio of Annual Attendance and Usable Beach Area.

[^]Intensity of Use not calculated because no beach-only attendance data available.

Visitors to beaches stimulate the local economy by purchasing goods and services (gas, food, sunscreen, surf lessons, hotel stays, etc.) at or near the beach. The impact to the local and regional economy of tourist spending is a function of the number of tourists, the average spending per visitor, and to what extent each tourist dollar gets spent again in the

local economy (known as a multiplier). This impact is classified as a market impact because it can be measured in a market transaction (sales). This is the type of impact local governments are typically most interested in because of the impact on employment, income, and tax revenue in the region.

From a local or regional perspective, the actual impact of these direct expenditures exceeds their dollar value as the spending stimulates additional demand for goods and services. Economists classify the impact of spending on aggregate demand as either a direct, indirect or induced effect. For example, store shelves or inventories are restocked, and income received by owners and employees is spent elsewhere in the economy (indirect and induced expenditures). Table ES-8 shows the estimated total annual expenditures associated with five of the most popular beaches in the study area. The estimates rely on previous surveys of beach visitor expenditures conducted by others and the same major assumptions are applied to all of the beaches.

Table ES-8: Estimate of total expenditures for select Santa Cruz County beaches

BEACH NAME	ANNUAL ATTENDANCE (2013)	DIRECT EXPENDITURES MINUS LEAKAGE (1,000s)	INDIRECT & INDUCED EXPENDITURES (1,000s)	TOTAL ANNUAL EXPENDITURES (1,000s)
Natural Bridges	807,000	\$27,845	\$13,923	\$41,768
Santa Cruz Main	750,000	\$25,879	\$12,939	\$38,818
Capitola	358,900	\$12,384	\$6,192	\$18,576
New Brighton	347,700	\$11,997	\$5,999	\$17,996
Seacliff	558,000	\$19,254	\$9,627	\$28,881

Notes:

- 1) Inflation-adjusted spending per group: Overnight (20%) - \$275; Day Use (80%) - \$100 (SC County Visitor Profile, 2012).
- 2) Average of 3.13 persons per group (SC County Visitor Profile, 2012).
- 3) Assumptions: 80% capture rate, sales multiplier of 1.5.

Cost Assessment

This evaluation used the 2050 Coastal Erosion Hazard Zone developed by Philip Williams and Associates for a 2009 report by the Pacific Institute to define the extent of the land that is vulnerable to coastal erosion. It should be noted that there is a more recent erosion hazard dataset (developed by ESA in 2014) that considers multiple future scenarios and improves upon the resolution of the projections. This more recent dataset, however, is restricted to Santa Cruz County rather than covering the entire Plan area. For this reason the more recent dataset was not used in this analysis. A comparison of the datasets indicates that, although the extents of the predicted erosion zones are similar, using the

more recent dataset (which is more detailed but also extends to the year 2060) would have resulted in a modest overall increase in the estimated impact of erosion in this area.

The vast majority of the value at risk is located at a handful of beaches – most of them in the cities and towns of Santa Cruz, Capitola, and Aptos. These popular beaches have significant regional and national recreation values and have a large number of private properties and infrastructure in the erosion zone. At least \$862M in private land and structures across more than 1,200 parcels, nearly 10 miles of roadways, 1 mile of railway, and at least 11 miles of sewer and storm lines are in the erosion hazard zone (Table ES-9).

Table ES-9: Quantitative description of assets in the erosion hazard zone – select beaches

BEACH/AREA NAME	# PARCELS AFFECTED	ASSESSED VALUE OF LAND (1,000S)	ASSESSED VALUE OF STRUCTURES (1,000S)	PARCEL ACREAGE	ROADS (MILES)	RAILWAYS (MILES)	STORM & SEWER LINES (MILES)
Surfer's	23	n/a	n/a	2.5	0.7	0	n/a
Santa Cruz Main	36	\$16,434	\$20,446	24	0.8	0.6	1.3
Twin Lakes	109	\$60,527	\$22,425	9	1.2	0	2.2
Capitola	118	\$36,523	\$17,803	5	0.6	0	1.3
Depot Hill	30	\$29,700	\$18,000	7	0.1	0	0.08
Seacliff	258	\$140,011	\$51,255	23	2.4	0	6.1
Manresa	166	\$93,919	\$59,988	61	0.6	0.3	0.5
Sunset	526	\$183,208	\$112,258	71	3.1	0	0.1
Total		\$560,322	\$302,175	203	9.5	0.9	11.58

Notes:

- 1) Land and structure values from Santa Cruz County Assessor, August 2014. Because of California's Proposition 13, the actual current value is greater than the assessed value shown here.
- 2) Only privately-owned parcels and acreage included in data.
- 3) Assessor data and utility data not available for San Mateo County

ES 8. Recommended Regional Sediment Management Strategies

This Plan is not intended to prescribe a specific RSM measure at a given BECA or SICH, but rather present several potentially viable measures (or strategies) that could be considered for future implementation. Table ES-10 lists strategies that could facilitate the restoration and maintenance of beaches and coastal environments in accordance with the mission of the CSMW. It is important to note that the table only represents a preliminary step in addressing coastal sediment management issues on a regional scale, and it is up to the responsible stakeholders, jurisdictions, and agencies to decide which, if any, of the strategies should be implemented in the future.

Table ES-10: Recommended RSM strategies at BECAs and Sediment Impaired Coastal Habitats

BECA/ SEDIMENT IMPAIRED COASTAL HABITAT	NO ACTION	MANAGED RETREAT / INFRASTRUCTURE REALIGNMENT / RESTORATION	SEDIMENT REMOVAL / DREDGING	BEACH NOURISHMENT	PERCHED BEACH	MULTI- PURPOSE ARTIFICIAL REEF	GROIN (S) / JETTIES	CLIFF OR BLUFF STABILIZATION / SEAWALL / REVTMENT
Princeton - Pillar Point Harbor	X	-	-	X	X	-	-	X
El Granada County (Surfer's) Beach	X	X	-	X	-	X	-	X (described under No Action)
Pescadero Lagoon - Butano Creek	X	X	X	-	-	-	-	-
Waddell Beach and Lagoon	X	X	-	-	-	-	-	-
Scott Creek Beach and Lagoon	X	X	X	-	-	-	-	-
West Cliff Drive - Lighthouse Point State Beach	X	X	-	X	-	-	-	X
San Lorenzo River - Main Beach	X	-	X (Sea- bright Beach)	-	-	-	X (River Mouth)	-
Twin Lakes State Beach	X	-	-	X (described under No Action)	-	-	-	X (described under No Action)
Schwan Lagoon	X	X	-	-	-	-	-	-
Corcoran Lagoon	X	X	-	-	-	-	-	-
Moran Lake	X	X	-	-	-	-	-	-
Del Mar Beach	X	X	-	X	-	X	-	X
East Cliff Drive	X	-	-	X	-	-	X	X

BECA / SEDIMENT IMPAIRED COASTAL HABITAT	NO ACTION	MANAGED RETREAT / INFRASTRUCTURE REALIGNMENT / RESTORATION	SEDIMENT REMOVAL / DREDGING	BEACH NOURISHMENT	PERCHED BEACH	MULTI- PURPOSE ARTIFICIAL REEF	GROIN (S) / JETTIES	CLIFF OR BLUFF STABILIZATION / SEAWALL / REVETMENT
Capitola Beach and Esplanade	X	-	-	X	-	X	X	-
Depot Hill	X	X	-	X (if combined with groins)	-	X	X	X
New Brighton State Beach	X	X	-	X	-	-	-	-
Seacliff State Beach	X	X	-	X	-	-	X (Aptos Creek)	X (described under No Action)
Rio Del Mar	X	X	-	X	-	-	-	X (described under No Action)
Pajaro Dunes	X	X	-	X	-	-	-	X (described under No Action)
Moss Landing and Elkhorn Slough	X	X (described under No Action)	-	-	-	-	-	-

ES 9. Implementation and Governance Structure

This Plan recommends a diverse set of sediment-management measures (Section ES 8) and planning processes, which are distributed widely throughout the various sub-regions and individual BECAs. Simply put, implementation of the Plan would involve a coordinated effort among stakeholders to establish and maintain a RSM program and to evaluate and carry out these recommendations or other types of coastal management. Some of the recommendations in the Plan involve continuing existing activities – e.g., the ongoing Moss Landing and Santa Cruz Harbor dredging and opportunistic beach nourishment efforts. Others would be entirely new projects or planning processes that would require additional funding, staffing, resources, and feasibility studies. Although local jurisdictions would independently continue to plan and implement individual projects, implementing elements of this plan would allow for a Coastal RSM program that provides many potential benefits

from a regional perspective through stakeholder coordination and cross-jurisdictional collaboration.

It is recommended that Plan implementation involve five main components: developing a governance structure, establishing a process for RSM stakeholder coordination, developing an Outreach and Education Program, establishing and maintaining a dedicated funding source, and investigating and pursuing options for a streamlined permitting program. This section describes each of these components in more detail and provides potential options and specific recommendations for each. Examples are also provided from other CRSMPs that have been adopted in various regions in California.

This Plan's recommended activities would be located throughout a large and diverse geographical area that includes upland streams and rivers and the entire 75-mile stretch of shoreline. Therefore, full implementation of this Plan will require extensive coordination among numerous overlapping jurisdictions including close collaboration among state and federal agencies, local jurisdictions, and a variety of other stakeholders. Moreover, to fully implement this Plan, a governance structure that meets the specific needs of the Santa Cruz Littoral Cell region would have to be developed and adopted by local governments and stakeholders.

Developing an RSM governance structure typically entails establishing a coordinated CRSMP implementation approach led by an entity that has appropriate jurisdictional authorities and the ability to enter into contracts, oversee staffing resources, and facilitate a process for input and collaboration with local stakeholders as well as federal, state, regional, and local entities. Because of the complexities involved with the Santa Cruz Littoral Cell region and the lack of an obvious governance model and lead agency, further discussion among stakeholders and a more detailed assessment of alternatives are needed before informed decisions can be made, by local jurisdictions, on determining the appropriate governance structure and implementation model. Therefore, rather than recommending a specific governance model, this Plan identifies and describes a range of potential scenarios and encourages local jurisdictions, agencies, and other stakeholders to engage in a collaborative effort to further evaluate the options and make an informed decision on the most appropriate governance structure for the region.

Once a decision has been made on a governance structure and implementation model, the next steps would be: official adoption of the Plan, establishing and maintaining a coordination mechanism and an agreement among the participating stakeholders that clearly states roles and responsibilities and formalizes the process, establishing a means to

administer and seek funding and enter into contracts to conduct studies and collaborative planning efforts, and establishing and overseeing staff necessary to coordinate CRSMP implementation.

Local governments in the Santa Cruz Littoral Cell region are currently not budgeted to finance significant RSM projects and programs. Therefore, any level of Plan implementation will require a dedicated source of funding. A recommendation of this Plan is to work with local jurisdictions to identify and assess funding options for RSM activities and implementation of this Plan. As a starting point for these discussions, this Plan provides an initial description of potential federal, state, and private funding sources. In addition to funding sources, staffing resources are also required to implement the Plan and carry out recommended RSM measures. In the near term, it is recommended that funding be sought to establish a new staff position to coordinate initial RSM Plan implementation. This interim CRSMP coordinator, who could be seated within an existing agency, municipality, or other organization, would initiate and oversee Plan implementation and outreach efforts, coordinate governance structure development, and carry out some of the initial activities identified in this Plan. A long-term staffing plan should also be developed, which includes a dedicated program manager to oversee plan implementation and coordinate with stakeholders on a variety of recommended projects, studies, management, and funding strategies. In addition to a program manager, other support staff and technical specialists should be hired, if resources are available.

This Plan recommends developing a strategy with USACE, the MBNMS, the CCC, local jurisdictions, and other regulatory agencies described in Section ES 6 to identify options for and to pursue a regional streamlined permitting program. As part of the permitting streamlining process, it is also recommended to collaborate with MBNMS, the CCC, and other state and federal resource agencies to develop science-based resource protection guidelines aimed at avoiding and mitigating potential environmental impacts of sediment management projects in the region.

The Plan also includes a list of recommended next steps that would be required in the near term during the initial phases of implementation and outreach efforts (Table ES-11). It also lists potential options for short-term, long-term, and ongoing implementation actions, which can provide a basis for discussion during initial outreach and stakeholder collaboration efforts.

Table ES-11: Overview of recommended next steps for RSM Plan implementation

RECOMMENDED ACTION	CATEGORY
Begin an evaluation of options for governance structure, including considerations for potential lead agencies and partners, and processes for decision-making and information sharing.	Governance structure development
Develop a comprehensive list of potential partners and stakeholders and identify their possible roles in plan implementation.	RSM stakeholder coordination process
Connect with the relevant stakeholders, including agencies and local municipalities, to provide information about the Plan, discuss potential opportunities for collaboration, and assess their interest in participation.	RSM stakeholder coordination process
Reconvene the SAG that was formed for the development of this Plan for meetings to: present the final Plan; initiate discussions on RSM options; solicit recommendations on initial plan implementation, and; discuss the possibility of and options for the workgroup playing a permanent role in ongoing implementation of the Plan.	RSM stakeholder coordination process
Coordinate with the CSMW on initial plan implementation and stakeholder outreach strategies.	Outreach and education program
Establish a list of prioritized initial outreach actions and identify existing CSMW outreach products and tools that could be used to support initial implementation of the Plan.	Outreach and education program
Initiate focused outreach efforts by providing presentations to local governmental organizations, and holding individual meetings with stakeholders. Provide an explanation of what the Plan consists of, why it was developed, and how it could be carried out.	Outreach and education program
Partner with the CSMW to host at least two public workshops once the Plan has been finalized – one in Santa Cruz and another in Half Moon Bay – to present the final Plan and obtain input on initial implementation.	Outreach and education program
Develop and implement an initial outreach and education strategy to get the Plan into the hands of stakeholders that will use it and to ensure their input on RSM issues and plan implementation.	Outreach and education program
Seek near-term funding to establish a new staff position within an existing agency, municipality, or other organization to coordinate initial plan implementation.	CRSMP Funding
Begin to develop a detailed permitting roadmap and explore options for a streamlined regional RSM permitting program.	Permitting program