Encinitas-Solana Beach Coastal Storm Damage Reduction Project Integrated Feasibility Study
&
Environmental Impact Statement/ Environmental Impact Report (EIS/EIR)

San Diego County, California

U.S. Army Corps of Engineers
Los Angeles District

December 2012

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DRAFT Encinitas-Solana Beach Coastal Storm Damage Reduction Project Integrated Feasibility Study & Environmental Impact Statement/Environmental Impact Report (EIS/EIR) San Diego County, California

This integrated feasibility study report and Environmental Impact Statement/Environmental Impact Report (Integrated Report) presents a summary of the ongoing planning process for the Encinitas-Solana Beach Coastal Storm Damage Reduction Project. The purpose of the Encinitas-Solana Beach Coastal Storm Damage Reduction Project is to effectively reduce risks to public safety and economic damages associated with bluff erosion and to restore beaches along the shorelines of the cities of Encinitas and Solana Beach. The Federal lead agency responsible for implementing the National Environmental Policy Act (NEPA) is the U.S. Army Corps of Engineers, Los Angeles District (USACE). The local lead agencies responsible for implementing the California Environmental Quality Act (CEQA) are the City of Encinitas and the City of Solana Beach.

The tentatively recommended plan for Encinitas is EN-1A and for Solana Beach is SB-1A. The tentatively recommended plan is comprised of beach nourishment of a 100 foot (ft) wide beach for the City of Encinitas with renourishment cycles every 5 years and a 200 ft wide beach for the City of Solana Beach with renourishment cycles every 13 years. The tentatively recommended plan will result in an initial placement of sand of 680,000 cubic yards (cy) at Encinitas and 960,000 cy at Solana Beach. Sand would be dredged from offshore, beyond the depth of closure, using borrow sites designated as SO-5, MB-1, and SO-6. That material would then be placed directly onto the two receiver sites within Encinitas and Solana Beach.

Impacts associated with the Encinitas alternatives have been evaluated for all resource topics and were determined to be less than significant for all resources except cultural resources (discovery) and noise during construction. Impacts associated with the Solana Beach alternatives have been evaluated for all resource topics and determined to be less than significant for all resources except biological resources, cultural resources (discovery), and noise during construction. Mitigation is proposed for the impacts identified under each alternative and the severity of these impacts is directly relative to the size of the proposed beach and associated number of days for construction, with the greatest potential for impacts to occur associated with Alternative SB-1A and SB-2A, and reduced severity of potential impacts associated with Alternative SB-1C and SB-2B.

All comments must be received by the contact person below on or before the following date: 26 February 2013.

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ENCINITAS-SOLANA BEACH COASTAL STORM DAMAGE REDUCTION PROJECT INTEGRATED FEASBILITY STUDY & ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT (EIS/EIR)

Note: The Feasibility Study and joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for this study have been integrated into one document to comprehensively meet USACE planning requirements as well as federal and state environmental requirements.

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<u>Appendices</u>

Note * = will be provided for final report

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EXECUTIVE SUMMARY

S.1 Introduction

This Integrated Report presents a summary of the ongoing planning process for the Encinitas-Solana Beach Coastal Storm Damage Reduction Feasibility Study. This Integrated Report is prepared in response to the resolution adopted by the House Committee on Public Works and Transportation, dated May 13, 1993 and April 22, 1999 Resolution of the House Committee on Transportation and Infrastructure.

This report describes baseline conditions, the formulation and evaluation of alternative plans, and the identification of a tentatively recommended plan. The lead Federal agency for this study is the U.S. Army Corps of Engineers, Los Angeles District (USACE), in coordination with the non-Federal study Sponsors, the Cities of Encinitas and Solana Beach. Multiple agencies have and continue to contribute to this study effort.

S.2 Study Area

The Encinitas and Solana Beach shoreline study area is located along the Pacific Ocean in the Cities of Encinitas and Solana Beach, in San Diego County, California. Encinitas is approximately 10 miles south of Oceanside Harbor, and 17 miles north of Point La Jolla, as shown in **Figure ES-1**.

The study area refers to the area that was studied to identify the need for and formulation of a coastal storm damage reduction plan. The study area extends from the southern limits of the City of Solana Beach to the northern limits of the City of Encinitas. The Study Area was used to evaluate potential need and opportunities to reduce storm damages caused by the erosion of coastal bluffs resulting from wave attack. Within the study area two segments, shown in **Figure ES-2**, were identified as presenting the greatest potential for protection value. Segment 1 is a portion of the beach within the city limits of Encinitas that extends approximately 7,800 ft from the 700 block of Neptune Avenue south to West H Street. Segment 2 is the majority of the beach within the city limits of Solana Beach, approximately 7,200 ft long extending from the southern city limits north to Tide Park, close to the northern city limits of Solana Beach. The environmental analysis herein looked at the segments and the surrounding areas for the purposes of evaluating the potential for impacts in the context of the location and setting as prudent for each topic and distinct from the Study Area. For example in addition to the segments where impacts would occur directly, the water quality assessment included the nearshore waters and the offshore water areas where dredging would occur, the assessment of noise impacts included residences and receptors along the bluff tops, and the assessment of air quality impacts included contributions to the San Diego Air Basin.

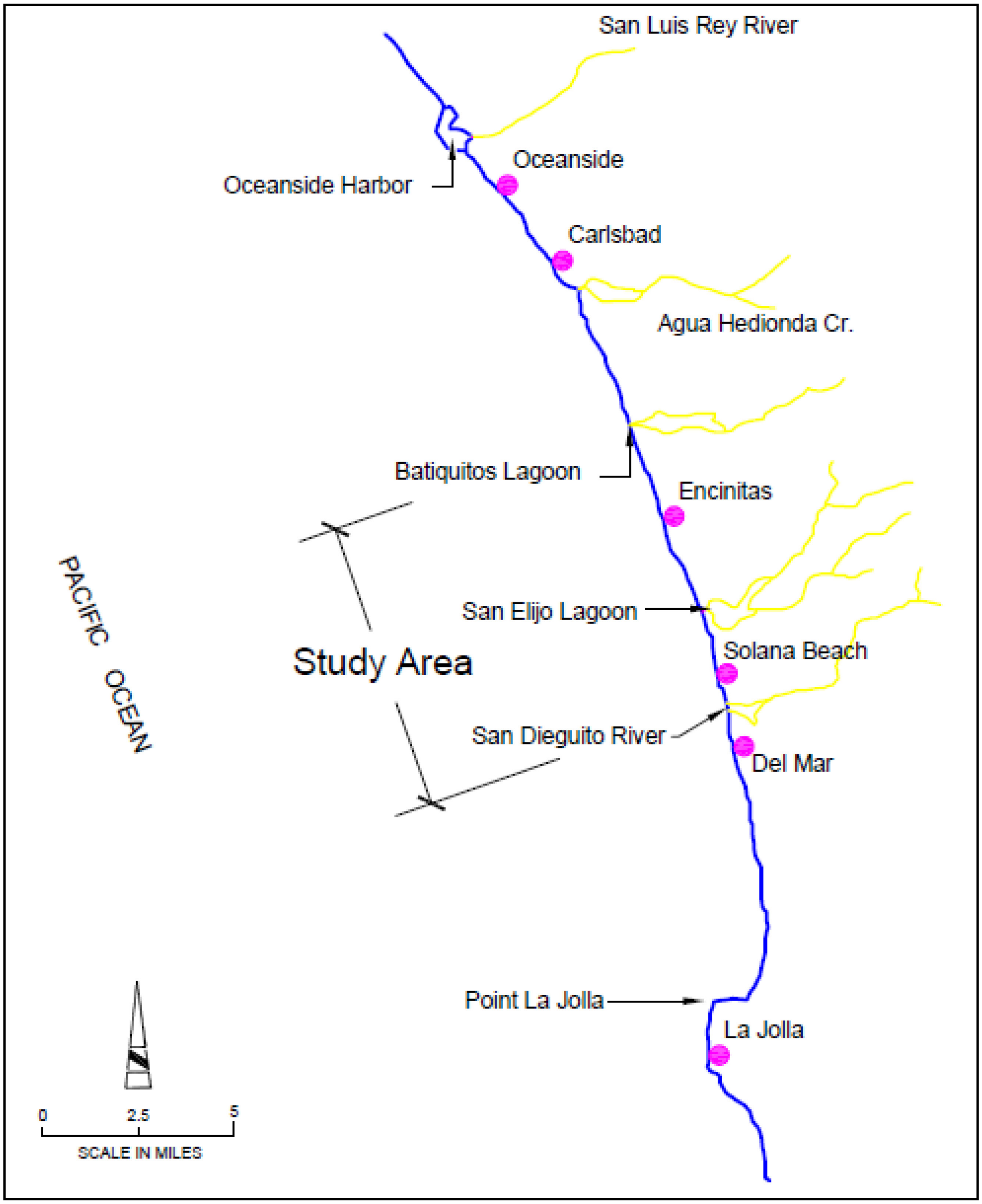

Figure ES-1 Location Map

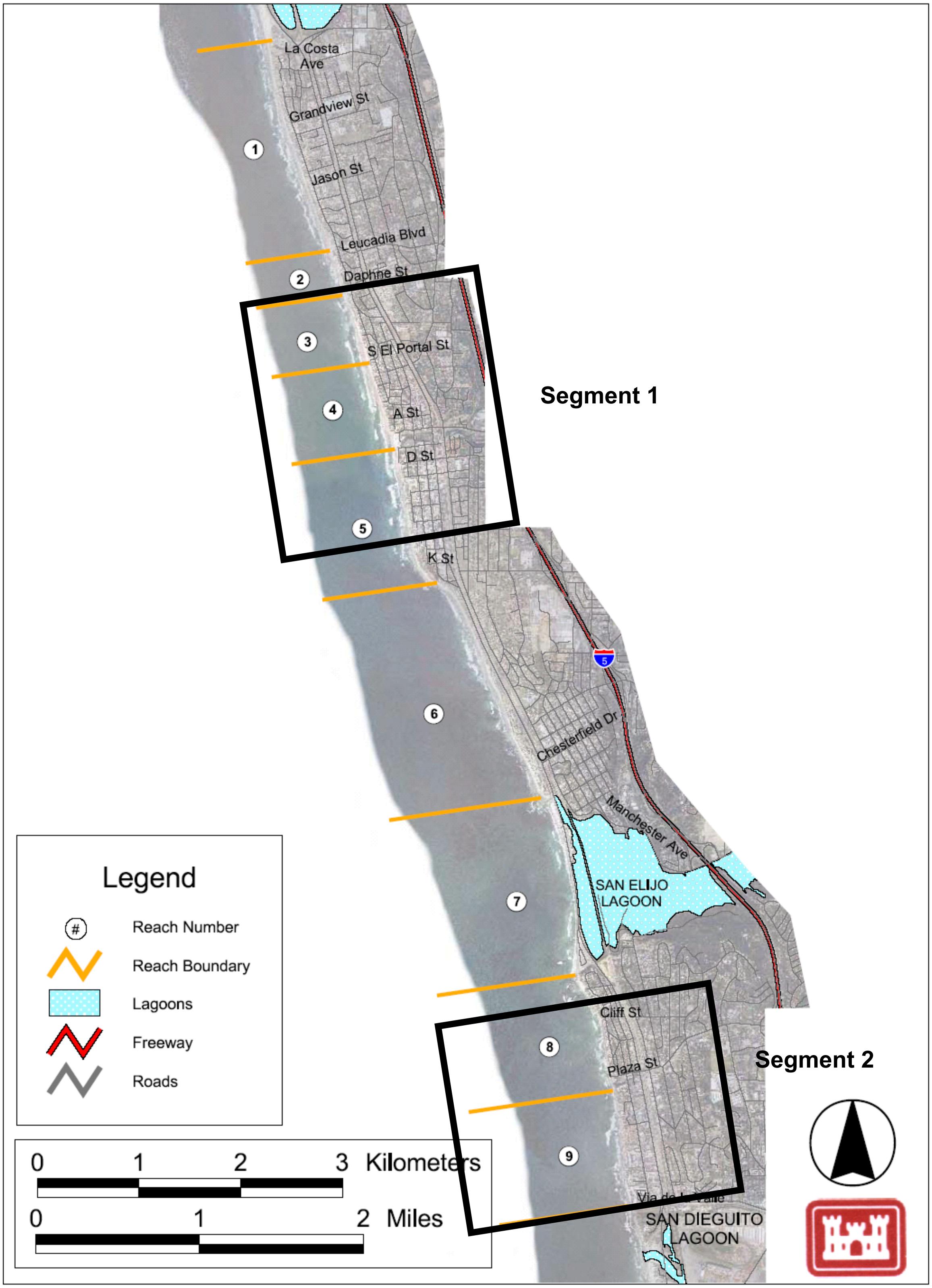

Figure ES-2 Segments 1 and 2

S.3 Purpose and Need

The purpose of the Encinitas-Solana Beach Coastal Storm Damage Reduction Project is to effectively reduce risks to public safety and economic damages associated with bluff erosion and to restore beaches along the shorelines of the cities of Encinitas and Solana Beach.

The need for the proposed action is that ongoing bluff erosion and storm surge along unprotected shorelines will result in structural damages and threats to public safety that include Highway 101 closures and catastrophic damage to occupied buildings; and ongoing beach erosion will also result in reduced recreational use of beaches, as described below.

PROBLEM STATEMENT: The Encinitas-Solana Beach shoreline has narrow beaches with coastal bluffs exposed to crashing waves, particularly during the winter storm season. As sea levels rise, the bluffs will be even more exposed to crashing waves, which carve notches into the bluffs. Bluffs affected by these notches are then prone to episodic collapse. Consequently, public facilities and residential properties on the upper bluff experience land loss and damages to the property. In addition to this problem, the study area also has high demand for recreation while the narrow beach area combined with bluff failures represent a significant safety issue for those recreating.

Planning Objectives

Public concerns were used to develop problem statements and study goals and objectives. These were established as objectives for the proposed action.

- Reduce coastal storm damages to property and infrastructure along the study area shoreline and the bluff top, prior to the need for emergency action, throughout the period of analysis.
- Improve public safety in the study area by reducing the threat of life-threatening bluff failures caused by wave action against the bluff base, throughout the period of analysis.
- Reduce coastal erosion and shoreline narrowing to improve recreational opportunities for beach users within the study area throughout the period of analysis.

S.4 Plan Formulation

A full array of structural and non-structural measures were formulated to address identified problems and opportunities. Models and studies prepared for this study were used to evaluate and compare proposed alternative measures and plans.

Alternatives Analyzed Include:

- No Action
- Managed Retreat
- Beach Nourishment at Various Increments
- Notchfills
- Hybrid-Beach nourishment and notchfill
- Visible Breakwaters
- Submerged Breakwater/Artificial Reef
- Groins

- Seawalls
- Revetment

Preliminary screening eliminated the following alternatives:

- Managed Retreat
- Emergent Breakwaters
- Submerged Breakwater/Artificial Reef
- Groins
- Revetments

These alternatives were screened out because they would not meet project needs and objectives and/or because the costs for implementation to meet the needs and objectives would be disproportionately high.

Secondary Screening eliminated the following alternatives:

- Notchfill
- Seawalls

These alternatives were determined to have the potential to meet a basic project need or objective of the project at proportionally lower implementation costs than those alternatives screened out in the preliminary screening. However, these alternatives do not meet all the project needs and objectives. Furthermore, the degree to which the screened out alternatives are effective, considering the implementation costs, is not favorable when compared to the alternatives carried forward.

The alternatives carried forward meet the project needs and objectives. Numerous scenarios for potential additional beach widths at each segment and at high and low sea level rise (SLR) scenarios were explored to determine the most prudent and practicable design widths, from 50 ft to 400 ft of additional width at 50–ft increments. Alternatives for Encinitas were analyzed and justified independently of Solana Beach (and vice versa). The alternatives for Encinitas could be paired with any of the alternatives for Solana Beach (and vice versa). The alternatives carried forward have been developed for this Integrated Report and are considered at an equal level of detail so decision makers and the general public can make a fully informed decision regarding coastline management.

The final array of alternatives included beach nourishment at various increments and a hybrid of beach nourishment and notchfills, as shown in **Table ES-1**.

Table ES-1 Final Alternatives 1

Encinitas (EN)		**Alternative EN - 1A: Beach Nourishment (100 ft; 5-yr cycle)**	**Alternative EN - 1B: Beach Nourishment (50 ft; 5-yr cycle)**		**Alternative EN-2A: Hybrid (100 ft; 10-yr cycle)**	**Alternative EN-2B: Hybrid (50 ft; 5-yr cycle)**	**Alternative EN -3: No Action**
Initial Placement Volume (cy)	High SLR	730,000	390,000		800,000	390,000	Assumes that the continued practice of emergency permitting for seawalls along the segment would continue.
	Low SLR	680,000	340,000		700,000	340,000	
Re-Nourishment Cycle	High SLR	5-yr	5-yr		10-yr	5-yr	
	Low SLR	5-yr	5-yr		10-yr	5-yr	
Added Beach MSL Width	High SLR	100 ft	50 ft		100 ft	50 ft	
	Low SLR	100 ft	50 ft		100 ft	50 ft	
Solana Beach (SB)		**Alternative SB - 1A: Beach Nourishment (200 ft; 13-yr cycle)**	**Alternative SB - 1B: Beach Nourishment (150 ft; 10-yr cycle)**	**Alternative SB-1C: Beach Nourishment (100 ft; 10-yr cycle)**	**Alternative SB-2A: Hybrid (150 ft; 10-yr cycle)**	**Alternative SB-2B: Hybrid (100 ft; 10-yr cycle)**	**Alternative SB-3: No Action**
Initial Placement Volume (cy)	High SLR	1,620,000	790,000	540,000	790,000	540,000	Assumes that the continued practice of emergency permitting for seawalls along the segment would continue.
	Low SLR	960,000	700,000	440,000	700,000	440,000	
Re-Nourishment Cycle	High SLR	14-yr	10-yr	10-yr	10-yr	10-yr	
	Low LSR	13-yr	10-yr	10-yr	10-yr	10-yr	
Added Beach MSL Width	High SLR	300 ft	150 ft	100 ft	150 ft	100 ft	
	Low SLR	200 ft	150 ft	100 ft	150 ft	100 ft	

S.4 Summary of Potential Environment Effects and Proposed Mitigation

As detailed in Section 5, each of the potential alternatives have been evaluated to determine if implementation would result in potential effects on the environment. Each alternative was identified to have effects that would not be substantial or adverse for the issues including Geology and Topography, Oceanographic and Coastal Processes, Water and Sediment Quality, Air Quality, Greenhouse Gasses, Aesthetics, Socioeconomics/Environmental Justice, Transportation, Land Use, Recreation, Public Safety and Public Utilities. Potential effects that require mitigation consist of: 1) covering vegetated rocky substrate within the near shore would result from implementation of the nourishment at the Solana Beach receiver site, requiring mitigation consisting of providing additional rocky substrate in the near shore that can be vegetated, as well as monitoring to record effects and whether any unexpected adverse effects occur; 2) the potential for discovery of cultural resources at the borrow sites during dredging exists, necessitating that monitoring be undertaken to ensure that should such a discovery be made it can be documented; and 3) implementation of nourishment activities would occur on a 24-hour, 7 day a week basis during which nighttime noise levels would exceed each of the city's noise regulations, necessitating a variance from the cities to implement activities though the night. With the exception of the No Action Alternative, all alternatives resulted in the similar potential effects and need for mitigation, the degree or severity of the impacts varied amongst the alternatives and, for the biological impacts, the acreage of necessary mitigation area varied amongst the alternatives.

Affected Environment

This Integrated Report provides a description of the existing environmental conditions in the project areas, describing existing conditions for the following resource categories: topography, geology and geography, oceanographic and coastal processes, water and sediment quality, biological resources, cultural resources, aesthetics, air quality, noise, socioeconomics, transportation, land use, recreation, public safety, and public utilities. Hazardous materials were eliminated from further review after determination that no hazardous materials are present in the project area.

Environmental Consequences

Table ES-2 summarizes the potential effects under each of the alternatives, including the No Action Alternative. Impacts associated with the Encinitas alternatives have been evaluated for all resource topics and were determined to be less than significant for all resources except cultural resources (discovery). Mitigation is proposed for the impacts identified under each alternative and the severity of these impacts is directly relative to the size of the proposed beach and associated number of days for construction, with the greatest potential for impacts to occur associated with Alternative EN-1A and EN-2A, and reduced severity of potential impacts associated with Alternative EN-1B and EN-2B.

Impacts associated with the Solana Beach alternatives have been evaluated for all resource topics and determined to be less than significant for all resources except biological resources and cultural resources (discovery). Mitigation is proposed for the impacts identified under each alternative and the severity of these impacts is directly relative to the size of the proposed beach and associated number of days for construction, with the greatest potential for impacts to occur associated with Alternative SB-1A and SB-2A, and reduced severity of potential impacts associated with Alternative SB-1C and SB-2B.

ES-2 Summary of Potential Impacts

Alternative	Biological Resources	Cultural Resources
Encinitas		
EN-1A: Beach Nourishment (100 ft; 5-yr cycle)	Less than significant	**Significant** The sensitivity of prehistoric resources within each borrow site may vary laterally based on the occurrence of submerged landforms, and vertically, based on the types of sediments revealed by the vibracore sample. While the sensitivity of contexts around the borrow sites is generally assessed as low, there is the potential for discovery and/or loss of sensitive cultural resources during dredging activities. A monitoring program will be implemented to avoid potential impacts associated with discovery of resources.
EN-1B: Beach Nourishment (50 ft; 5-yr cycle) and EN-2A: Hybrid (100 ft; 10-yr cycle) and EN-2B: Hybrid (50 ft; 5-yr cycle)	Less than significant	**Significant** Monitoring will be similar to EN-1A. Consequences are similar to EN-1A, however, since the volume of material to be dredged under these alternatives is reduced; the potential for discovery and impact to prehistoric resources is incrementally reduced.
EN-3: No Action	Less than significant	Less than significant

Alternative	Biological Resources	Cultural Resources
Solana Beach		
SB-1A: Beach Nourishment (200/300 ft; 13/14-yr cycle)	**Significant** Sand introduced into the system would indirectly impact up to 8.4 acres of marine biological resources (benthic habitat) as a result of burial or degradation of sensitive habitats and resources, under the low sea level rise scenario. Mitigation in the form of a 16.8-acre artificial reef would be required.	**Significant** The sensitivity of prehistoric resources within each borrow site may vary laterally based on the occurrence of submerged landforms, and vertically, based on the types of sediments revealed by the vibracore sample. While the sensitivity of contexts around the borrow sites are generally assessed as low, there is the potential for discovery and/or loss of sensitive cultural resources during dredging activities. A monitoring program will be implemented to avoid potential impacts associated with discovery of resources.
SB-1B: Beach Nourishment (150 ft; 10-yr cycle) and SB-2A: Hybrid (150 ft; 10-yr cycle)	**Significant** Sand introduced into the system would indirectly impact up to 6.8 acres of marine biological resources (benthic habitat) as a result of burial or degradation of sensitive habitats and resources, under the low sea level rise scenario. Mitigation in the form of a 13.6-acre artificial reef would be required.	**Significant** Consequences are similar to SB-1A, however, since the volume of material to be dredged under these alternatives is reduced; the potential for discovery and impact to prehistoric resources is incrementally reduced. A monitoring program will be implemented to avoid potential impacts associated with discovery of resources.
SB-1C: Beach Nourishment (100 ft; 10-yr cycle) and SB-2B: Hybrid (100 ft; 10-yr cycle)	**Significant** Sand introduced into the system would indirectly impact up to 1.6 acres of marine biological resources (benthic habitat) as a result of burial or degradation of sensitive habitats and resources, under the low sea level rise scenario. Mitigation in the form of a 3.2-acre artificial reef would be required.	**Significant** Consequences are similar to SB-1A, however, since the volume of material to be dredged under these alternatives is reduced; the potential for discovery and impact to prehistoric resources is incrementally reduced. A monitoring program will be implemented to avoid potential impacts associated with discovery of resources.
SB-3: No Action	Less than significant	Less than significant

Cumulative Impacts

California guidelines for implementing California Environmental Quality Act (CEQA) require a discussion of significant impacts resulting from incremental effects considerable significant when viewed in combination with the effects of "past, present, and probably future projects," or in relation to "a summary of projections contained in an adopted general plan or related planning document" (Cal. Code. Regs, Title 14, § 1506(c) and § 15130(b)(1)(A)(B)). Federal guidelines for implementing the National Environmental Policy Act (NEPA) define a cumulative impact as one that would result from the incremental impact of an action when added to other past, present, and reasonably foreseeable actions (40 C.F.R. § 1508.7).

Using this guidance, cumulative impacts were analyzed in consideration of other reasonable foreseeable projects in the vicinity of project areas. Cumulative projects considered in this analysis included other ongoing or proposed beach nourishment projects adjacent to the receiver sites; capital improvement or development projects proposed in areas adjacent to the receiver sites; and proposed actions planned for areas adjacent to the borrow sites. The results of this analysis concluded that significant cumulative impacts would not occur as a result of implementing any of the action alternatives with the implementation of mitigation measures.

Effects Found Not to Be Significant

Issues that were brought forward for the proposed Encinitas-Solana Beach Coastal Storm Damage Reduction Project for further analysis and included in this Integrated Report included topography, geology and geography, oceanographic and coastal processes, water and sediment quality, biological resources, cultural resources, air quality, greenhouse gases, noise, socioeconomics, transportation, land use, recreation, public safety, and public utilities. This analysis determined that the proposed project would not have a long-term significant effect on these elements and the analyses of these issues are detailed in this document in Section 5.0.

Issues found not to be significant were not analyzed in this Integrated Report, including hazardous materials. Federal, state, and local regulatory databases were searched to determine whether any known contaminated sites are located in the study area. According to a search performed by Environmental Data Resources, Inc., no hazardous waste materials were found in the project area. Based on the research performed during the initial study, significant hazardous, toxic, or radioactive waste issues associated with the shoreline and borrow site activities are not expected.

Significant Unavoidable Adverse Effects

This Integrated Report considered the potential impacts of the alternatives, in addition to the No Action Alternative, according to several resource categories: topography, geology and geography, oceanographic and coastal processes, water and sediment quality, biological resources, cultural resources, aesthetics, air quality, greenhouse gases, noise, socioeconomics, transportation, land use, recreation, public safety, and public utilities. No significant impacts have been identified that would be unavoidable or that could not be mitigated to below the level of significance. However, significant unavoidable impacts to biological resources may occur to marine biological resources (quality or quantity of benthic habitat) because it would take at least 2 years to identify impacts, during which time some temporal loss of habitat is unavoidable. These impacts are shown in **Table ES-2**.

Environmental Commitments

ES-3 1 Summary of Design Features/Monitoring Commitments and Mitigation Measures (if necessary)

Design Features	Purpose	Timing	Implementation Responsibility
Topography, Geology, and Geography			
Use of concrete for notch fill material	Mimic natural erosive processes	During notch fill	Construction contractor
Oceanographic Characteristics and Coastal Processes			
Use of concrete for notch fill material	Mimic natural erosive processes	During notch fill	Construction contractor
Water and Sediment Quality			
Construct “L”-shaped berms at all receiver sites	Anchor sand placement operations and reduce nearshore turbidity	During beach fill	Construction contractor
Maintenance for land-based vehicles will occur in staging area away from beach and sensitive areas	Avoid minimal contamination from leaks, if any	During beach nourishment/notch fill	Construction contractor
Use proper Best Management Practice (BMPs) during vehicle fueling	Avoid petroleum spills	During beach nourishment/notch fill	Construction contractor
Generate plan for hazardous spill prevention and containment	Ensure minimal contamination from fuel leaks, if any	During operation of equipment on the beach or in the water	Construction contractor
Biological Resources			
Design borrow sites to maintain adequate distance from artificial reefs, kelp, and other features	Avoid direct impacts to artificial reefs and kelp	Final engineering and during construction	Engineering contractor and construction contractor
Construct second transverse berm to begin a new cell if grunion spawning or eggs are encountered during construction	Section of beach with grunion would be avoided and bypassed	If grunion spawning or eggs are encountered	Construction contractor, in coordination with USACE
No construction shall be performed within 1,400 ft of any sensitive bird species that have clear line of sight to the construction area during breeding and nesting season; no beach construction shall occur within 790 ft of any sensitive bird species during the breeding and nesting season	Minimize impacts to sensitive wildlife of noise emissions	During beach nourishment/notch fill	Construction contractor
Air Quality			
Use of BMPs to reduce air quality impacts such as the use of BACT and/or BART for the dredge	To reduce air emissions	During all construction activities	Construction contractor
Construction equipment will be properly maintained and tuned	To reduce air emissions	During beach nourishment/notch fill	Construction contractor

Aesthetics			
Notch fill material will be colorized and textured to match the existing bluff face.	Improve aesthetics of erodible concrete	During notch fill	Construction contractor
Cultural Resources			
A plan for unanticipated discoveries will be provided to the construction contractor.	Prepare for unanticipated discoveries	During excavation	USACE
Noise			
Construction equipment shall be fitted with mufflers, air intake silencers, and engine shrouds; stationary noise sources will be located far from residential receptor locations.	Minimize noise emissions	During beach nourishment/ notch fill	Construction contractor
A noise variance shall be obtained for work done after 7 p.m. from the City of Encinitas and the City of Solana Beach.	Public notification and approval	Prior to the commencement of any work	Construction contractor
In Solana Beach, no beach construction shall be performed within 1,400 ft of any sensitive bird species that have a clear line of sight to the construction area during the breeding and nesting season; no beach construction shall be performed within 790 ft of any sensitive bird species during the breeding and nesting season.	Minimize impacts to sensitive wildlife of noise emissions	During beach nourishment/notch fill	Construction contractor
Socioeconomics			
Coordinate with commercial fishermen; establish offshore transit corridors in consultation with a commercial fishermen representative; issue Notice to Mariners.	Avoid gear conflicts and provide for compensation if loss occurs	Before and during dredging operations	Coast Guard (via construction contractor) and USACE
Recreation			
Communicate with local jurisdictions to avoid recreational events.	Avoid disruption of established recreational events.	During beach nourishment/notch fill	Construction contractor
Public Safety			
Avoid placing fill material near storm drain outlets.	Continue proper drainage	During beach nourishment/notch fill activities	Construction contractor, in coordination with City Engineer
Generate plan for hazardous spill prevention and containment.	Ensure minimal contamination from fuel leaks, if any	During operation of equipment on the beach or in the water	Construction contractor
Issue Notice to Mariners and maintain 500-ft buffer around active dredge equipment.	Warn boaters/fishermen of dredging activities to ensure avoidance	Before and during dredging activities	Coast Guard (via construction contractor)

Generate safety plan to restrict public access at receiver and notch fill sites and maintain 150-ft buffer around construction areas.	Public safety during construction	During beach nourishment/notch fill activities	Construction contractor, in coordination with local lifeguards
Relocate of temporary lifeguard towers.	Public safety during construction	During beach nourishment activities/notch fill	Construction contractor, in coordination with local lifeguards
Plan sand placement to avoid blocking line-of-sight at permanent lifeguard towers.	Public safety during construction	During beach nourishment activities	Construction contractor, in coordination with local lifeguards
Monitoring Commitments			
Cultural resources: Provide observation by a qualified archaeological monitor during sediment removal.	Identify existing cultural resources and avoid potential impacts	During excavation	USACE
Water and Sediment Quality: Monitor turbidity levels.	Avoid turbidity impacts to fish and aquatic species	During dredging operations and beach fill activities	
Biology: Conduct nearshore underwater surveys.	Establish baseline data for comparison purposes and determine if any natural/biological resources/habitats have been adversely impacted by the project	Prior to construction and after construction	Qualified biologist
Biology: Monitor weekly for grunion spawning in construction area, establish buffer extending 100 ft shoreward of high tide line and 100 ft upcoast and downcoast (total 200 ft), until eggs hatch (minimum of one lunar month) and surveys show no subsequent spawning.	Avoid grunion eggs and protect until hatched	April through September and per CDFG annual pamphlet *Expected Grunion Runs*.	Qualified biologist
Public Safety: Generate safety plan to restrict public access at receiver and notch fill sites and maintain 150-ft buffer around construction areas.	Public safety during construction	During beach nourishment/notch fill activities	Construction contractor, in coordination with local lifeguards
Post-Project Mitigation Measures (If Necessary)			
Biology: Restore or create like habitat at a functional equivalent (assumed to be 2:1 for the purposes of evaluation) to be determined with the responsible resource agencies according to the long-term significant impacts, if any, to marine resources.	Mitigate for significant, long-term Impacts, if any, to sensitive marine resources caused by sediment placement or transport	Subsequent to resource agency review of monitoring reports and determination that significant impact occurred	Qualified biologist

S.5 The Tentatively Recommended Plan

The tentatively recommended plan is composed of the alternatives that have been identified as the NED plans for Segment 1 (Encinitas - EN-1A) and for Segment 2 (Solana Beach - SB-1A). Alternatives EN-1A and SB-1A involve sand nourishment on the study area beaches as the method of reducing coastal storm damages.

EN-1A has an initial placement of 680,000 cy of sand (under Low Sea Level Rise LSLR) that extends the base year beach width at mean-sea level approximately 100 ft. Nourishments would occur every 5 years and require dredging 280,000 cy. Net annual benefits are expected to be $1.44 million annually.

SB-1A has an initial placement of 960,000 cy of sand (LSLR) that extends the base year beach width at mean-sea level approximately 200 ft. Nourishments would occur every 13 years and require dredging 420,000 cy. Net annual benefits are expected to be $1.11 million annually.

Sand would be dredged from offshore, beyond the depth of closure, using borrow sites designated as SO-5, MB-1 and SO-6. That material would then be placed directly onto the two receiver sites within Encinitas and Solana Beach. Information on both plans is presented below. Initial construction includes sand replenishment, mitigation measures, monitoring, and all other costs related to the initial project construction. Continuing construction is all subsequent cost related to sand replenishment after the initial replenishment through the 50 year study period. Annual National Economic Development (NED) benefits are increases in the net value of the national output of goods and services. NED benefits are amortized, which means they are discounted and spread evenly across each year of the 50 year study period. The benefit-cost ratio (BCR) is the ratio of project benefits to costs. Ratios greater than 1.0 indicate benefits are greater than costs. The BCR is presented with full recreation benefits. During the plan formulation process recreation benefits are not allowed to exceed Coastal Storm Damage Reduction benefits to ensure alternatives are formulated for the primary purpose of Coastal Storm Damage Reduction. "Full recreation benefits" are the entire amount of recreation benefits the project is estimated to generate.

Low SLR	EN-1A SEGMENT 1	SB-1A SEGMENT 2
Initial Construction	$16,999,400	$21,635,600
Continuing Construction	$97,297,000	$41,189,000
Total Cost	$114,296,400	$62,824,600
Annual Net NED Benefits[1]	$1,282,000	$1,504,000
BCR (incl full Recreation Benefits)	1.53	1.91
BCR (CSDR Benefits only)	0.83	0.76

FY13 Price Level

[1] Full recreation benefits included

1 INTRODUCTION

The U.S. Army Corps of Engineers (USACE), Los Angeles District (USACE-SPL), in conjunction with the Cities of Encinitas and Solana Beach (Sponsors), is conducting a coastal storm damage reduction feasibility study along the shorelines of Encinitas and Solana Beach.

This feasibility study uses the USACE six step plan formulation process carried out in conjunction with the Sponsors, interested stakeholder, resource agencies, and the public. Problems and needs related to coastal storm damage reduction within the Cities of Encinitas and Solana Beach have been identified through the study process. Prior studies and reports were reviewed and new information has been acquired to inventory current conditions and forecast future trends (which serve as the "baseline" conditions of the "no action" alternative) related to the public concerns, problems and needs of the study. Alternative plans have been formulated, evaluated and compared to each other as well as to the baseline conditions to select a tentatively recommended plan of action for coastal storm damage reduction. The Feasibility Study identifies the most cost-effective plan to address the problems and opportunities related to coastal storm damage reduction that complies with applicable laws, regulations and policies of the USACE Civil Works program.

1.1 Report Organization and Guiding Regulations

This report is an integrated Feasibility Report and joint Environmental Impact Study/ Environmental Impact Report (EIS/EIR) [Integrated Report]. This Integrated Report includes the alternatives analysis, which develops options that focus on the reduction of storm damages along with an assessment of environmental impacts. The alternatives are evaluated, and preliminary recommendations are made. This feasibility study was conducted in accordance with current USACE regulations and policies including, but not limited to the Principles and Guidelines for Water Resources and ER 1105-2-100, Planning Guidance notebook (22 April 2000), and Guidance for Conducting Civil Works Planning Studies, (Dec 1990). The report was also prepared in accordance with the requirements of the National Environmental Policy Act (NEPA) (42 USC 4321 et. seq), Council on Environmental Quality (CEQ) NEPA implementing regulations (40 C.F.R parts 1500-1508), and USACE NEPA regulations (33 C.F.R. part 230).

This report provides the existing and future without-project (baseline) conditions, formulation and evaluation of alternatives and identification of a tentatively recommended plan for the Encinitas and Solana Beach Feasibility Study. This Integrated Report includes a combined draft EIS/EIR to address requirements of both NEPA and the California Environmental Quality Act (CEQA). The Integrated Report also includes technical appendices that support the plan formulation and evaluation process. Technical appendices that provide detailed information on studies related to the coastal engineering and sediment transport analyses, geotechnical investigations and proposed borrow sites, nearshore impact analyses, detailed cost estimates, and economics, and real estate investigations.

Both the Feasibility Study and the EIS/EIR are contained in this Integrated Report. Because it is integrated, it appears slightly different in structure and content then a stand-alone document. The required contents of each report are contained in this integrated version. To help the reader navigate this Integrated Report, an overview of the contents and purpose of each section are contained in this Preface.

- <u>Section 1 - Introduction</u>: identifies the authorizing legislation, project background, an overview of the study area and environmental setting, and prior studies and reports. The structure of this section is closely linked to the typical Feasibility Study contents, but contains information necessary for an EIS/EIR.

- Section 2 - Need For and Objectives of Proposed Action: establishes the purpose and need, planning objectives and criteria, planning constraints, and provides an overview of the regulatory setting. The structure of this section is also closely linked to the typical Feasibility Study contents but contains information necessary for an EIS/EIR, including the Purpose and Need analysis required in an EIS.
- Section 3 - Alternatives: sets out the Plan Formulation with and without project, identifies alternatives subject to preliminary screening and secondary screening, lists alternatives eliminated from further consideration and design features incorporated into alternatives. The final array of feasible alternatives to be fully evaluated in the EIS/EIR is described in more detail via text, tables, and figures. The full disclosure of alternatives considered but rejected and alternatives carried forward for further study is key to both the Feasibility Study and the EIS/EIR.
- Section 4 - Affected Environment: describes the existing, potentially affected environment in the Encinitas – Solana Beach study area for a total of 15 issue areas. These include topography, water and sediment quality, aesthetics, recreation, air quality, noise, biological and cultural resources, etc. Regulations specifically applicable to each issue are noted. This section is consistent with NEPA terminology, but corresponds to the description of Existing Conditions under CEQA.
- Section 5 - Environmental Consequences: discloses the potential consequences of implementing each of the alternatives for each of the 15 issue areas. Mitigation measures are identified, if applicable. This section is consistent with NEPA terminology, but corresponds to Impact Analysis under CEQA.
- Section 6 - Cumulative: evaluates the potential impacts associated with implementation of each alternative in combination with other past, present and reasonably foreseeable projects.
- Sections 7-11: include other NEPA/CEQA requirements such as effects found not to be significant, unavoidable significant impacts, environmental commitments, energy requirements, short-term uses versus long-term productivity, etc. Public involvement and agency coordination is documented in Section 11.
- Sections 12-16: includes conclusions and recommendations, list of preparers, glossary, references, and an index.
- Appendices: There are a total of 13 appendices with more detailed technical information.

1.2 Study Authority

The Encinitas and Solana Beach Shoreline Feasibility Study was authorized by a May 13, 1993 Resolution of the House Public Works and Transportation Committee that reads as follows:

> *"Resolved by the Committee on Public Works and Transportation of the United States House of Representatives, That, in accordance with Section 110 of the River and Harbor Act of 1962, the Secretary of the Army, acting through the Chief of Engineers, is directed to make a survey to investigate the feasibility of providing shore protection improvements in and adjacent to the City of Encinitas, California, in the interest of storm damage reduction, beach erosion control, and related purposes."*

Additional authorization was given in an April 22, 1999 Resolution of the House Committee on Transportation and Infrastructure that reads as follows:

> *"Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, That the Secretary of the Army, in accordance with Section 110 of the River and Harbor Act of 1962, is hereby requested to conduct a study of the shoreline along the City of Solana Beach, San Diego County, California, with a view to determining whether shore protection improvements for storm damages reduction, environmental restoration and protection, and other related purposes are advisable at the present time."*

1.3 Integrated Study Purpose

Erosion of the beaches and coastal bluffs in the San Diego region has occurred at an increasing rate over the past several decades. As a result, wave-induced flooding and structural damages have increased significantly in the last 10 to 20 years from a combination of factors, and these incidents are projected to increase in the future based on the Coast of California Storm and Tidal Waves Study (CCSTWS) (USACE-LAD, 1991). Shoreline erosion has narrowed the beaches and depleted them of sand, thus increasing the vulnerability of coastal bluffs to erosion from waves. In addition, water infiltration from rainfall and landscape irrigation has contributed to bluff top erosion, and has been a factor in bluff failures in localized areas. These events have resulted in the loss of human life and significant damages to public and private property. During major storm events, waves and rocks have overtopped the revetments (structures made of placed quarry stone designed to protect the bluff toe from erosion by wave action) built to protect the low-lying areas, causing flooding and other damages to local businesses, including the closure of coastal Highway 101, an emergency route identified by the Department of Homeland Security.

Beaches are dynamic environments subject to seasonal movement of sand offshore (erosion) during the winter and onshore (accretion) during the summer. Sand moves within the littoral zone, which is bounded onshore by the beach and offshore by water depth, which typically is at -30 feet (ft) Mean Lower Low Water (MLLW) in the study area. Sand also is transported alongshore within the littoral zone during its offshore-onshore sedimentation cycle. Sand can be lost from the littoral zone by severe storms that carry sand offshore beyond the depths of littoral transport. Sand also becomes lost when transported north or south of the study area to the Carlsbad and La Jolla submarine canyons, respectively, which act as sediment sinks.

Historically, sand that was seasonally lost from the littoral zone was naturally replenished by river-borne sand carried to the coastal zone during high flow conditions, and to a lesser extent by sediment added to the shoreface by erosion of coastal bluffs. Over the last 50 years, urban development in San Diego County has hindered natural sediment conveyance to the coastal zone. Rivers and streams have been altered, and in some cases channelized, reducing the load of sand-sized material conveyed by the stream channels. Dams slow stream flow velocities and reduce the capacity of streams to convey sand to the coastal zone, and sand mining activities also alter stream hydrology and limit downstream movement of sand. As sediment loads have become trapped within the watershed, there have been significant reductions in coastal sediment supply and a trend of net depletion of San Diego beaches. In addition, severe storm events since the 1980s have exacerbated sand loss from the littoral system and have increased the effects of wave attack on bluffs.

Coastal structures have been constructed by cities, residents, and business owners to protect property, whose vulnerability has increased with increased beach erosion. A variety of methods and materials have been historically used to address shoreline erosion, ranging from sand tubes, bluff notch filling, rock riprap revetment, and seawalls. Approximately half of the coastline along the Cities of Encinitas and Solana Beach has been armored to some degree in response to bluff failures, wave damage, and coastal flooding over the last couple of decades.

1.4 Study Scope

The Encinitas and Solana Beach Feasibility Study is a coastal storm damage reduction study designed to analyze alternatives that improve public safety and provide protection of state and city owned lands, roads, and infrastructure.

This Integrated Report will:

1) Describe existing and future without-project conditions of the study area and identify problems and opportunities to reduce storm damages, improve public safety, increase recreation opportunities, and protect the environment.

2) Formulate and evaluate an array of alternatives and recommend the one that most effectively addresses these problems and complies with local, state, and Federal laws and regulations. The Planning Principles and Guidelines (P&Gs) directs the studies of major water projects by Federal water resource development agencies. The P&Gs direct Federal agencies to consider, during plan formulation, four accounts which include National Economic Development (NED), Regional Economic Development (RED), Other Social Effects (OSE), and Environmental Quality (EQ) are used to evaluate the plans. These four accounts quantify (respectively) benefits to the national economy, the regional economy, and the environment.

3) Evaluate the potential effects of implementing each of the alternatives and identify mitigation measures needed to avoid, minimize, rectify, reduce or compensate for those effects.

1.5 Project Background

This study was initiated in September 1999, in response to *Public Law 106-60 (H.R. 2605), the Energy and Water Development Act of 2000*. This act provided funds to conduct the reconnaissance study of the coastal bluff erosion problem at the Cities of Encinitas and Solana Beach, California, to determine whether there was a Federal interest in coastal storm damage reduction for the study area. The *Encinitas Shoreline, San Diego County, California*, *905(b) Reconnaissance Report* U.S. Army Corps of Engineers, was completed in September 2000 and found that there was federal interest to study the feasibility of solutions to coastal erosion problems in Encinitas and Solana Beach.

The feasibility phase of this study was initiated in 2000, when USACE signed a Feasibility Cost Sharing Agreement (FCSA) with the Cities of Encinitas and Solana Beach as non-Federal sponsors. Cost of the feasibility phase of the study is shared equally between USACE and the non-Federal Sponsors.

The feasibility study produced a public draft EIS/EIR in 2005, but did not finalize that document. Based upon the comments provided during the public involvement processes, the Project Delivery Team (PDT) revisited the inventory of conditions, problems and opportunities in the study area and reformulated the project alternatives. This Integrated Report presents the revised assessment of existing and future without project conditions, the reformulation and reevaluation of alternatives and the tentatively recommended plan.

1.6 History of Investigation

The Energy and Water Development Act for Fiscal Year of 2000 (Public Law 106-60) provided funds in the amount of $100,000 to conduct the reconnaissance phase of the coastal bluff erosion problem at the Cities of Encinitas and Solana Beach, California, including investigating opportunities for the ecosystem restoration of San Elijo Lagoon. The reconnaissance analysis (Section 905 (b), WRDA 96), initiated on 28 March 2000, found that there is a Federal interest in continuing the study into the feasibility phase.

Since the reconnaissance analysis, the lagoon restoration and the coastal storm damage reduction investigations were split into two separate feasibility studies. This document describes the findings and recommendations for coastal storm damage reduction.

In September 2001 a NEPA Notice of Intent (NOI) and CEQA Notice of Preparation (NOP) were issued by the USACE and the Cities in conjunction with a public scoping meeting in October 2001. Following the initiation of the NEPA and CEQA processes and required public notices, work was initiated on a draft joint EIS/EIR and a draft document was released for public review in 2005. Based on comments received on the EIS/EIR during the public review period, the USACE and the Sponsor began to reformulate the study in 2007.

Between 2007 and 2012 the project description, assessment methodologies, and alternatives underwent thorough review and evaluation. Based in part on regulatory changes and the USACE Guidance on sea level rise (2009), San Diego Association of Governments' (SANDAG) Regional Beach Sand Project (RBSP) post-construction monitoring results, offshore borrow site investigations, revisions to the bluff erosion model and pre-project baseline physical conditions, additional interim work was required to ensure that the project was being designed in such a way that it would be resilient to uncertain future conditions and responsive to concerns expressed by the public and regulatory agencies in their comments on the 2005 Draft EIS/EIR.

A new NOI and new NOP were released to the public in April 2012 and two CEQA public scoping meetings were locally held in May 2012. Copies of the NOI and NOP, Public Scoping meeting materials and all written public comments received during the 30-day public review period are contained in the 2012 CEQA *Public Scoping Report* which is included in Appendix A of this Integrated Report.

This Integrated Report represents the culmination of effort undertaken by the Cities and the USACE since the prior EIS/EIS was issued.

1.7 Prior Studies, Reports, and Existing Projects

There have been numerous studies and projects along the shoreline of the Cities of Solana Beach and Encinitas by the USACE and other entities.

1.7.1 USACE Studies and Reports

Previous USACE studies, reports and projects are listed below.

1) *Coastal Cliff Sediments, Coast of California Storm and Tidal Wave Study, San Diego Region*, Corps of Engineers, 1987 and 1988. The report documents erosion of the coastal bluffs along Leucadia, Encinitas and Cardiff. Severe beach and cliff erosion is documented at numerous locations during the stormy winters of 1978, 1980, and

especially 1983. The sediment yield resulting from the bluff erosion is estimated at three bluff locations, San Onofre, Camp Pendleton and Torrey Pines.

2) *Sediment Budget Report, Oceanside Littoral Cell*, *Coast of California Storm and Tidal Wave Study, San Diego Region,* Corps of Engineers, 1990. The report summarizes shoreline changes, sediment volume changes and historical sediment budget within the Oceanside Littoral Cell. It concludes that the Mean Sea Level (MSL) shoreline was relatively stable between 1933 and 1988 in the Leucadia through Cardiff reach.

3) *State of the Coast Report, Coast of California Storm and Tidal Wave Study, San Diego Region, Main Report*, Corps of Engineers, 1991. The report suggests that the condition of the beaches in the future will be governed by cycles of accretion and erosion similar to those of the past 50 years. However, there will be accelerated trends toward erosion because of the reduction in fluvial delivery due to impoundment by dams and river mining, along with jetties of Oceanside Harbor interrupting longshore sediment transport, and the increasing rate of sea level rise.

4) *Encinitas Shoreline Reconnaissance Report, San Diego County, California*, U.S. Army Corps of Engineers, March 1996. The findings indicate that erosion of the Encinitas Bluffs is caused by wave action against the bluff toe, resulting in bluff instability and failure of the upper bluff. The most critical reach has narrow or nonexistent beaches, steep coastal bluffs and private residences located close to the bluff top edge. Twelve alternatives, including beachfill, beachfill with groins, seawalls, shotcrete walls, revetments, and cobble berms are evaluated. Studies indicate that toe protection alone would provide some benefits, but that major damages would still result from upper slope instability. The reconnaissance report concluded that there was no Federal interest in proceeding to a feasibility phase study because of the lack of an economically justified plan.

5) *Encinitas Shoreline, San Diego County, California*, *905(b) Reconnaissance Report* U.S. Army Corps of Engineers, September 2000. This document revisits the problems explored in the 1996 Reconnaissance report in view of accelerating erosion and heightened public safety issues. The local sponsor originally requested that the restoration of San Elijo Lagoon be included in any Feasibility Study, and that Solana Beach be added to the study area as a second local sponsor.

6) *Encinitas and Solana Beach Shoreline Feasibility Study Environmental Impact Statement/Environmental Impact Report* (August 2005) - A draft joint Environmental Impact Statement (EIS) and Environmental Impact Report (EIR) was released for public review in 2005. Based on comments received on the EIS/EIR during the public review period, the USACE and the Cities began to reformulate the study in 2007.

7) *Encinitas and Solana Beach Shoreline Feasibility Study, Draft Feasibility Report (August 2005)* – This separate feasibility report was written to accompany the Joint EIS/EIR document that was released for public review in 2005.

8) Fletcher Cove Reef Conceptual Design Report, City of Solana Beach, California, November 2009. A coastal engineering study was performed to develop a conceptual design for a sand retention reef at Fletcher Cove, Solana Beach, California that could be used in conjunction with ongoing and planned beach replenishment projects to optimize their efficiency and effectiveness. The study has been conducted under the USACE Regional Sediment Management (RSM) Program, managed by the Engineering

Research and Development Center (ERDC). The primary goal of the study was to develop a concept-level optimal design that would (a) create a salient to reduce shoreline erosion by providing a wider beach and (b) minimize the potential for adverse shoreline changes upcoast and downcoast.

1.7.2 Other Studies and Reports

The following reports from consultants and public entities have been reviewed as part of this study. This list contains only the reports that were most relevant and useful to the Feasibility Study; a comprehensive list may be found in the bibliography.

1) *Shoreline Erosion Evaluation, Encinitas Coastline, San Diego County, California*, Group Delta Consultants, 1993. This report details the results of a comprehensive study to evaluate variations in shoreline erosion susceptibility in the Encinitas area. The report documents historical changes of shoreline and climate within the study area. The long-term marine erosion as well as the subaerial erosion of the bluffs is estimated to range from 0.0303 to 0.0365 meter/year (0.1 to 0.12 ft/year) within the Stone Steps area.

2) *A Technical Report on Historical Marine Process within the City of Encinitas*, City of Encinitas, 1994. This report presents the findings of an investigation of geotechnical conditions and historical erosion. It presents estimates of seacliff retreat rate and shore platform down wearing, and suggests general coastal erosion remedies such as mitigation alternatives, planning options and policy recommendations.

3) *Shoreline Erosion Assessment and Atlas of the San Diego Region, Volumes I & II*, California Department of Boating and Waterways and San Diego Association of Governments, 1994. This report presents the findings of a study assessing shoreline erosion and recommends shore and beach management tactics within San Diego County. From Oceanside to La Jolla, the report recommends that measures such as artificial beach enhancement and hard structures for beach stabilization be further evaluated.

4) *Draft Encinitas Comprehensive Plan to Address Bluff and Beach Recession*, City of Encinitas, 1995. The draft report addresses the criteria for the implementation of beach and bluff stability measures. The plan provides technical merits for minimum setback requirement at the bluff top, various shore/bluff protection alternatives, upper bluff stability, and the aesthetic aspects of any shore protective device. The comprehensive plan provides the standard for local policy to be implemented for comprehensive bluff stability and beach erosion prevention measures.

5) *Shoreline Erosion Study – North Solana Beach, California*, Group Delta Consultants, August 1998. This document presents an evaluation of shoreline erosion currently affecting the coastal bluffs within the northern portion of Solana Beach. It addresses the geotechnical aspects of shoreline erosion and provides a technical basis for any proposed shoreline and bluff protection measures.

6) *Protection of Highway 101* – City of Encinitas (Moffatt, Nichol), Dec. 1998. This document provides environmental, civil, and geotechnical analyses for existing conditions of the shoreline at Cardiff, where Hwy 101 is frequently closed due to wave attack during storm events. It formulates and assesses an array of alternatives to protect Hwy 101, including beach replenishment, structural protection, and storm drain improvements.

7) *Environmental Impact Report/Assessment (and Shoreline Morphology Study) for the San Diego Regional Beach Sand Project,* San Diego Association of Governments (SANDAG), June 2000. This document presents the environmental impacts of two different beach nourishment alternatives covering up to 13 receiver sites in San Diego County, including three within the study area. It includes extensive data on environmental resources in the study area.

8) *Shoreline Morphology Study – Appendix C of the SANDAG EIR,* SANDAG/KEA Environmental, March 2000. This document models the shoreline areas impacted by the Regional Beach Sand Project and predicts the general behavior and movement of the sediment that is placed at the receiver sites and projects the study area beach morphology.

9) *Observations on the Status of Biological and Physical Intertidal Resources Along the Coastline of Encinitas,* City of Encinitas, March 2000. This document (whose title is sufficiently descriptive of its scope) was produced to address concerns about impacts on sensitive nearshore environments from any beach nourishment activity. It includes detailed information on intertidal and nearshore habitats in portions of the study area.

10) *SANDAG Post construction monitoring studies* – (April 2005)- For each year between 2001-2005, an annual report presented the findings of the SANDAG Regional Beach Monitoring Program, whose general objective was to document changes in the condition of the shorezone, thereby providing a basis for evaluating the impacts of natural events and human intervention. The focus of the annual report was to monitor the fate of nourishment material placed at twelve receiver beaches under SANDAG's Regional Beach Sand Project (RBSP I). Each year between 2001-2005, a supplemental post-construction monitoring report was prepared that presented post-construction monitoring surveys for marine biological resources conducted since implementation of RBSP I, including rocky intertidal habitat, shallow subtidal habitat, kelp forest habitat, and lobster monitoring. The monitoring program has enabled enhanced understanding of seasonal, annual, and multi-year patterns of species abundance dynamics along the San Diego County coastline.

*11) SANDAG Regional Beach Sand Project II – Re*gional Sand Beach Placement II (RBSP II) is a local, sand nourishment project organized by the San Diego Area Governments (SANDAG) and funded by California Department of Boating and Waterways, the region's coastal cities, and SANDAG. RBSP II occurred in both study area communities in Fall of 2012, three years before the USACE project, and is assumed to be a one-time occurrence. RBSP II is considered part of the without project conditions.

1.7.3 Existing USACE Projects

<u>Oceanside Harbor</u>

Oceanside Harbor, approximately 10 miles north of the study area, is dredged approximately once a year as part of an ongoing USACE operations and maintenance program. Approximately 175,000 cy of material is bypassed and placed on the adjacent beaches south of the harbor annually. The effects of the nourishment are not easily discernible more than a few miles from the placement site, and do not appear to increase beach widths in Encinitas or Solana Beach.

1.7.4 Other Existing Coastal Structures/Projects

Man-made structures have been constructed by cities, residents, and business owners to protect coastal structures whose vulnerability has increased with increased beach erosion. A variety of methods and materials have been used, including bluff notch (sea cave) filling, rock riprap revetment, seawalls, and concrete-based facing (shotcrete) of bluff sections. Over the last couple of decades, approximately half of the coastline in the study area has been armored to some degree in response to bluff failures, wave damage, and flooding. These measures have exhibited a wide range of effectiveness and design life.

1.7.5 SANDAG Shoreline Preservation Strategy/Regional Beach Sand Projects

In response to public concerns about erosion, SANDAG worked with member cities and the County to prepare the Shoreline Preservation Strategy for the San Diego Region (SANDAG 1993). The Shoreline Preservation Strategy describes a variety of potential solutions to erosion problems, including beach replenishment, structures (e.g., groins) to retain sand, additional structures (e.g., seawalls, sand berms) to protect property, and policies and regulations (e.g., bluff top building setbacks, bluff top irrigation controls) to minimize risk to structures. A total of up to 30 million cy of sand was recommended to initially rebuild San Diego beaches, which would then be followed by smaller volume sand maintenance projects. The need for further studies was identified before site-specific locations for additional man-made structures could be recommended.

As part of the Shoreline Preservation Strategy, SANDAG implemented the San Diego Regional Beach Sand Project (RBSP) in 2001 and placed 2.1 million cy of sand on 12 San Diego County beaches ranging from Oceanside to Imperial Beach. Four of the beaches were located within the study area -- three in Encinitas and one in Solana Beach.

While the SANDAG RBSP project has contributed to shoreline protection, the protection is localized and was predicted to last from one to five years based on natural processes of coastal erosion and littoral transport (Moffatt & Nichol 2000). As SANDAG-placed sands are transported through the littoral system, localized benefits to beaches shifted along the coast until sands were lost from the system. It was predicted that benefits to the beaches would not be discernible five years after sand placement. A five-year sand monitoring program produced data that was used to determine the effectiveness of the project. The results indicated that for some beaches, including Solana Beach, the sand remained in the system for more than 5 years.

SANDAG is currently implementing RBSP in fall of 2012. The project is smaller in size (in terms of both volume to be placed and the geographic extent) to the first RBSP (RBSP I) as fewer cities were able to financially participate due to the sustained economic downturn. However, the cities of Encinitas and Solana Beach are participating and will obtain approximately the same volume of sand on their beaches as was placed in 2001.

Current local policies and state regulations encourage replenishing beaches with sand as a “soft” and preferable means to shoreline protection in order to protect the coast from erosion. Section 30235 of the California Coastal Act states:

> *Revetments, breakwaters, groins, harbor channels, seawalls, cliff retaining walls, and other such construction that alters natural shoreline processes shall be permitted when required to serve coastal-dependent uses or to protect existing structures or public beaches in danger from erosion, and when designed to eliminate or mitigate adverse impacts on local shoreline sand supply*

This and other studies have helped in the formulation and fine tuning of subsequent shoreline protection strategies.

1.7.6 Maintenance Dredging and Bypassing

Other smaller sand replenishment projects routinely occur as a result of maintenance dredging of Batiquitos and Agua Hedionda Lagoons and sand bypassing of Oceanside Harbor. The bypassing and maintenance dredging from flood shoals at various lagoons do not increase beach width in the long term, but only maintain the status quo because of a deficient sediment budget. Without these activities, the downcoast beaches would be further depleted due to sand being trapped by the jetties or in the lagoon entrance channels. The sediment bypassing program at Oceanside Harbor was implemented as a consequence of shoreline erosion occurring downcoast of the harbor after the jetty construction was completed.

1) San Dieguito Lagoon, located approximately 0.5 miles south of the southern boundary of Solana Beach, has only occasional minor maintenance dredging to open the mouth of the lagoon, which has no impact on the study area beaches. This is not to be confused with the recontouring of the much larger San Dieguito Lagoon, both east and west of Interstate 5 designed to increase tidal flushing and therefore improve biological habitats.

2) Batiquitos Lagoon, which is located immediately north of the study area, requires regular maintenance dredging and sand placement since its restoration in 1995-1996 -- approximately 118,000 cy of sand was dredged and placed on South Ponto Beach, just south of the lagoon, in 2011-2012.

3) Agua Hedionda Lagoon, which is located approximately 4 miles north of the study area, is dredged every one to three years depending upon sedimentation rate and volume, and sands are placed on Carlsbad beaches north and south of the lagoon. Approximately 500,000 cy of sand was placed on Carlsbad beaches in 2010-2011.

4) Oceanside Harbor, which is located approximately 10 miles north of the study area, bypasses approximately 230,000 cy of sand to beaches south of the harbor each year.

These maintenance projects contribute to wider beaches in Oceanside and Carlsbad, but while incrementally adding small amounts of sand to the regional sand transport system, that protection does not appear to extend beyond the shoreline of those cities. These maintenance projects have little potential to significantly affect beaches within the Encinitas and Solana Beach shoreline. The small volumes of sand placed on the beach from maintenance of Batiquitos Lagoon would be expected to have only limited influence on the beach at the northern end of the study area and would have no discernible effect further downcoast. Dredging of the entrance channel at San Elijo Lagoon places anywhere from 25,000 to 40,000 cy per year onto the downcoast beaches, having little or no long term effect on the beach width.

1.8 <u>Study Area and Environmental Setting</u>

1.8.1 Location and Description

The Encinitas and Solana Beach shoreline study area is located along the Pacific Ocean in the Cities of Encinitas and Solana Beach, in San Diego County, California. Encinitas is approximately 10 miles south of Oceanside Harbor, and 17 miles north of Point La Jolla, as shown in **Figure 1.8-1**. The Encinitas portion of the shoreline is about 6 miles long and is bounded on the north by Batiquitos Lagoon and on the south by San Elijo Lagoon. The 4,920-ft-long southernmost segment of the Encinitas shoreline is a low-lying barrier spit fronting the San Elijo tidal lagoon.

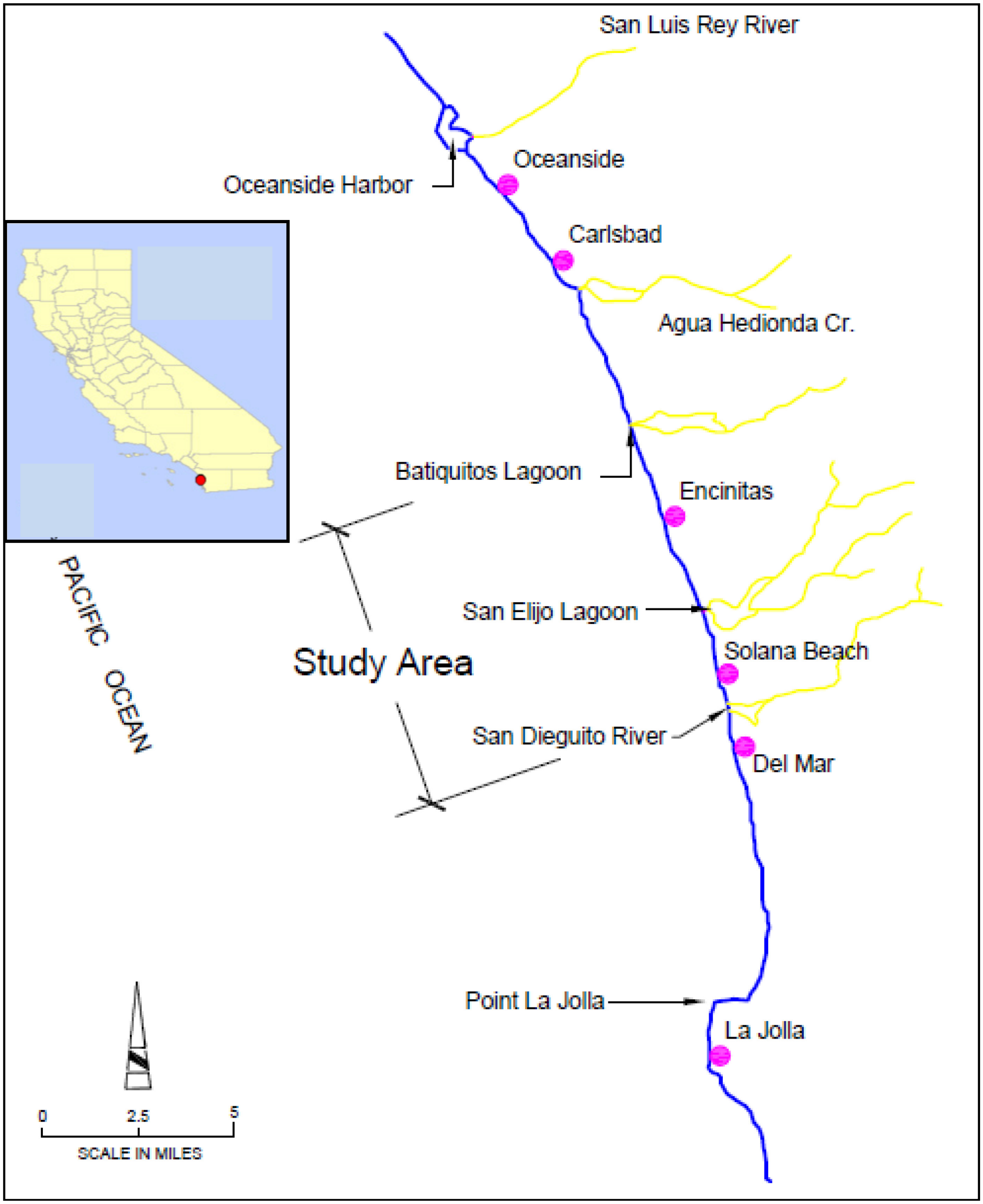

Figure 1.8-1 Location Map

Immediately south of Encinitas is the City of Solana Beach, which is bounded by San Elijo Lagoon to the north and on the south by the City of Del Mar. It is approximately 17 miles south of Oceanside Harbor, and 10 miles north of Point La Jolla. Solana Beach's portion of the shoreline is about 1.6 miles long. Nearly all of the shoreline in the study area (7.7 miles total), except the shoreline reach at Cardiff, consists of narrow sand and cobble beaches fronting nearshore bluffs.

To better analyze the coastal bluff and shoreline morphology as well as oceanographic conditions, the entire study area was divided into nine geographical areas called reaches. The distinction between reaches is based on differences in seacliff geology, topography, coastal development and beach conditions. For the study area, narrow to medium sized is defined as in the range of 50 – 150 ft width, and coastal bluffs are defined as approximately 50 ft and higher from toe (base) to top. The locations and limits of each of the nine study reaches are shown in **Table 1.8-1** and illustrated in **Figure 1.8-2**.

Table 1.8-1 Study Area Reaches

Reach	Range		Approx. Length (mi)
	From	To	
1	Encinitas City Limit	Beacon's Beach	1.1
2	Beacon's Beach	700 Block, Neptune Ave.	0.3
3	700 Block, Neptune Ave.	Stone Steps	0.5
4	Stone Steps	Moonlight Beach	0.5
5	Moonlight Beach	Swami's	1.0
6	Swami's	San Elijo Lagoon Entrance	1.1
7	San Elijo Lagoon Entrance	Table Tops	1.2
8	Table Tops	Fletcher Cove	0.8
9	Fletcher Cove	Solana Beach City Limit	0.8

<u>Reach 1 - Encinitas</u>

The northernmost shoreline segment extends from the Encinitas boundary to Beacon's Beach (**Figure 1.8-3** and **Figure 1.8-4**) and is approximately 1.1 miles in length. Reach 1 can be characterized as having a narrow to medium sized beach backed by coastal bluffs. The bluff top is densely developed with residential structures varying from multiple-family residences to single family homes. Leucadia State Beach is located within Reach 1. Land use along the bluffs is residential. Public parking areas are located at the northern and southern ends of Reach 1. A storm drain is located at the beach at Grandview Street. At the northern end of this reach are Pacific Coast Highway, public parking, and public access to South Carlsbad State Beach/Ponto Beach. In the central and southern parts of the reach residential development lines the top of the bluff, various drain and irrigation lines terminate in or lie along the face of the bluff, one public staircase at Grandview connects the bluff-top to the shore, and forty-nine private staircases connect the top of the bluff to the beach. This reach is protected by many small seawalls, crib walls, masonry block structures, and concrete structures placed at the bottom and on the face of the bluff.

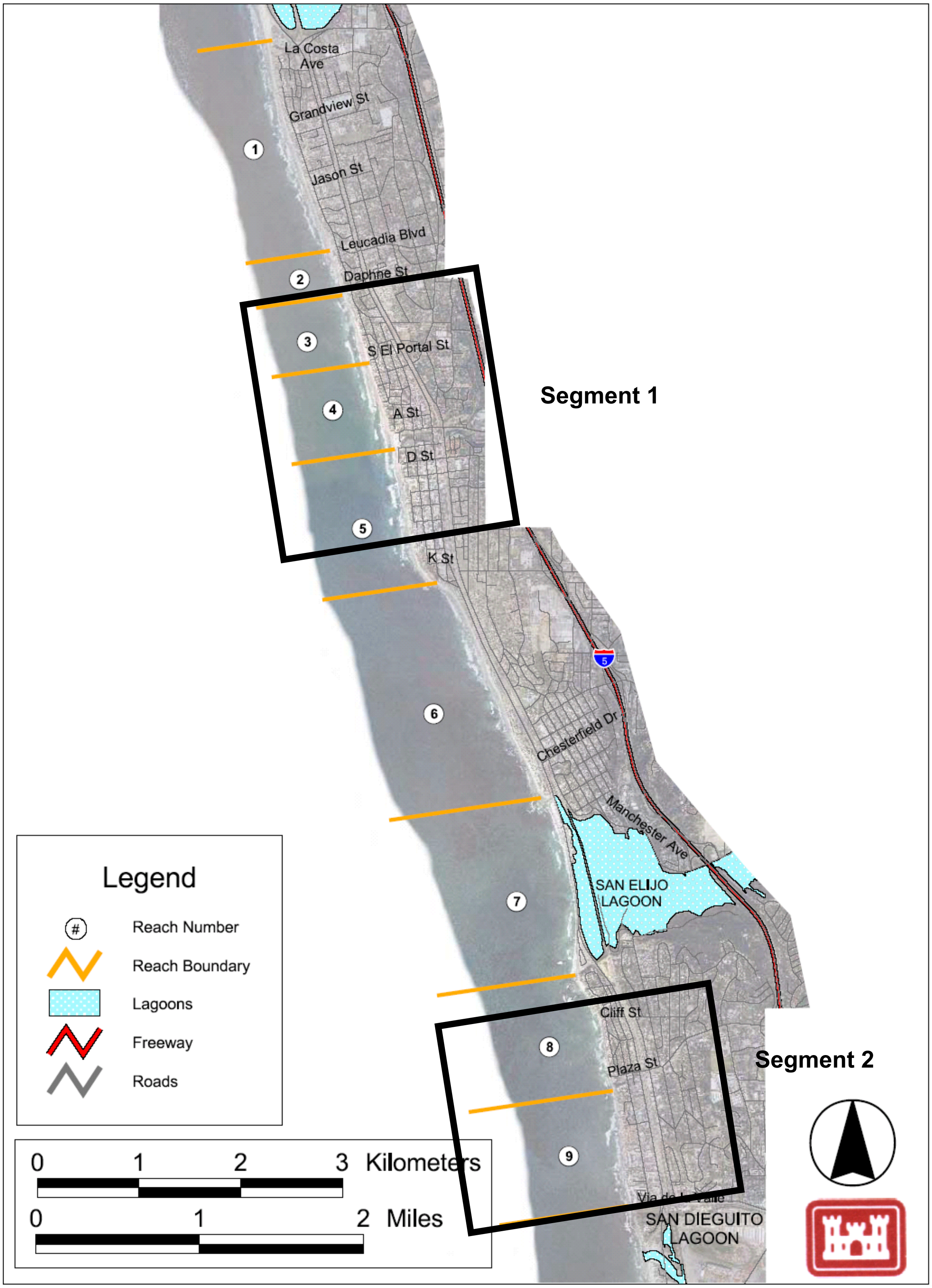

Figure 1.8-2 Project Location

The coastal bluffs were relatively stable because of the erosional resistance of the formation exposed at the base of the bluff, flatter upper bluff slope, vegetation cover and presence of a nearly continuous, naturally-occurring, protective cobble berm at the toe of the bluff. After the 1997-1998 El Nino season, the extent of the existing protective cobble berm was diminished. The narrow beach has been temporarily widened as a result of sand nourishment placed at Leucadia in 2001 under RBSP I.

Small notches in the base of the bluff developed in the mid-1990s but have subsequently been covered over by a sand berm. Approximately 18% of the properties located along the bluff top have instituted the use of seacliff toe protection measures in the form of privately constructed seawalls.

This reach is protected by many small seawalls, crib walls, masonry block structures, and concrete structures placed at the bottom and on the face of the bluff. Project alternatives were not proposed for this reach since the seacliffs along Reach 1 are comparatively stable because the bluff base is resistant to erosion, it has a relatively flatter upper bluff slope, vegetation cover, and presence of a continuous protective cobble berm.

Figure 1.8-3 Portion of Reach 1

Figure 1.8-4 Reach 1 Aerial

Reach 2 – Beacon's Beach to 700 Block, Neptune Avenue

The shoreline segment between Beacon's Beach and the 700 Block of Neptune Avenue (**Figure 1.8-5** and **Figure 1.8-6**) is approximately 0.3 miles in length and includes two inactive ancient faults, names the Beacons and Seawall Faults. The bluff top is densely developed with residential low-density private homes. Leucadia State Beach extends into Reach 2. At the northern end of the reach public parking spaces are at the immediate edge of the bluff. In the center and southern parts of the reach houses are at the immediate edge of the bluff and ten drain lines are on the bluff face. Public access to Leucadia State Beach/Beacon's Beach consists of parking at the top of the bluff and a switchback trail down the bluff; at least seven staircases exist for private access.

This reach can be characterized as having a narrow sandy beach backed by high, steep sea cliffs that consist of hard siltstone and claystone and extend approximately 80 to 100 ft. in height. The low bluff face of the southern section, south of 794 Neptune, represents an active landslide and is covered by a wide, thick zone of vegetation, extending approximately 40 to 60 ft up from the bluff base.

The upper bluff is highly unstable along this portion of the reach as severe landslides are evident throughout. Several homes located along the bluff edge have instituted emergency upper and lower bluff stabilization measures to prevent the further erosion of the bluff base and the associated landslides that ensue as a result. Such landslides could result in a catastrophic loss of entire structures. In addition, several bluff top seaward facing decks extend beyond the ledge of recent bluff collapses.

The beach was narrowed by more intense erosion during the 1982-1983 El Nino season. Sand eroded from the nearshore area during the El Nino and was deposited too far offshore to be transported back to the beach by waves during the subsequent summer. The sand replenishment from RBSP I at Leucadia has slightly widened the beach and formed a small protective berm at the bluff base. Within this reach, approximately one half of the bluff top properties are armored with a privately constructed seawall at the bluff base or a reinforced shotcrete wall on the upper bluff.

This reach is protected by a substantial crushed rock slope and private seawalls constructed in the middle of the reach. Since the upper bluff instability in this reach, is not caused by coastal storm damage, no alternatives were not proposed for this reach.

Figure 1.8-5 Portion of Reach 2

Figure 1.8-6 Reach 2 Aerial

Reach 3 – 700 Block, Neptune Avenue to Stone Steps

The shoreline segment between the 700 Block, Neptune Ave. and Stone Steps (**Figure 1.8-7** and **Figure 1.8-8**) is approximately 0.5 miles in length and is a narrow to medium beach backed by a high, steep sedimentary sandstone sea cliff, similar to that of Reaches 1 and 2. The bluff top is fully developed with residential homes along the entire length of this reach. This reach includes Encinitas Beach Park. Throughout the reach houses are at the immediate edge of the bluff. Within Reach 3 is Stonesteps beach with public access consisting of a concrete and wooden staircase surrounded by shotcrete; at least 13 staircases exist for private access. The northern half of this reach is protected by many substantial sea walls of different construction and some areas of riprap and gabion baskets. The southern half of this reach is generally protected by long, low seawalls at the base of the bluff, and some soil nails.

The beach is at a lower elevation in this reach than that in Reaches 1 and 2. Coastal bluffs are comprised of the slightly more erodible Santiago or Delmar Formations. There are several bluff failure areas and a wave cut notch, ranging from 2 to 6 ft deep, extends along the entire reach where seawalls are absent. The upper bluff, comprised of weakly cemented sandstone, is oversteepened along much of this reach, where seawalls are present and where heavy vegetation is present on the bluff face.

The beach is much narrower here compared to Reaches 1 and 2. As a result, privately constructed seawalls have been instituted to protect the majority of the homes located along the edge of the bluff. Along the northern section of the reach, a combination of seawalls and upper bluff retention structures have been built with little consideration for aesthetics. Some of these upper bluff stabilization techniques include shotcrete walls, as well as vegetated terracing. Within the southern portion of this reach south of 560 Neptune Ave., several sections of 15-ft seawalls were constructed after 1996 when this area experienced severe erosion at the toe of the bluff.

Reach 3 was evaluated for project alternatives because of the substantial number of unprotected parcels and the propensity for continued episodic bluff collapse.

Figure 1.8-7 Portion of Reach 3

Figure 1.8-8 Reach 3 Aerial

Reach 4 – Stone Steps to Moonlight Beach

The shoreline section between Stone Steps and Moonlight Beach (**Figure 1.8-9** and **Figure 1.8-10**) is approximately 0.5 miles in length. Reach 4 includes Seaside Gardens Park and a parking area at the northern end of Moonlight State Beach. Adjacent land uses are primarily residential. Five storm drains occur at Moonlight Beach, three convey flows from Cottonwood Creek, and two are from residential neighborhoods. Throughout the reach houses are at the immediate edge of the bluff and Rosetta Street, A Street, and C Street dead-end at the bluff edge. Two small drains lines are on the face of the bluff and two private stairways connect the top of the bluff to the beach. Public access to Moonlight Beach consists of a parking lot, separate drop-off area, and additional parking on C Street, a paved pedestrian ramp to beach level, and walkway along the beach. This reach is protected by small, scattered seawalls in the northern and central part of the reach and by significant riprap placements between Sylvia Street and Moonlight Beach.

Similar to the physical characteristics and urban development of Reaches 1 through 3, the narrow sandy beach along much of this reach is backed entirely by the more erodible Torrey Sandstone. The bluff top ranges in height from approximately 30 ft in the southern portion of the reach, adjacent to Moonlight Beach, and quickly transitions to approximately 80 to 100 ft. Along the entire reach, except for the southern portion of the reach immediately adjacent to Moonlight Beach, an approximate 2 to 4-ft notch exists at the base of the bluff where protection measures have not been instituted. The existence of this lengthy notch coupled with the already oversteepened upper bluff zone increases the probability of future bluff failures, some of which could be catastrophic. It was along this coastal segment where a bluff failure resulted in the loss of a human life in 2000.

Within the northern section, two small sections of bluff base are armored with seawalls that were constructed after 1996. Notch fills are also present at some locations along the reach. Some of the notch fills appear to have been structurally compromised as the bluff has since eroded out from behind them. Within the southern portion adjacent to Moonlight Beach, two patches of non-engineered revetment, probably constructed after the 1982-1983 El Nino season, protect the bluff toe.

The beach narrows in the northern portion of Reach 4 and gradually widens toward Moonlight Beach. The sandy pocket beach that delineates Moonlight Beach is backed by a floodplain that gradually transitions into a cliff formation. Recreational facilities such as a lifeguard building and restrooms are located within the floodplain. The low lying plain and the associated beach located at Moonlight Beach are highly subject to wave attack during large storm events. During these events, the back beach is subject to flooding and structures are susceptible to damage, as was the case during the winter of 1982-83. As a mitigation measure, the City of Encinitas annually constructs a protective temporary sand berm during the winter months to prevent flooding and potential damage to public facilities. This berm is built approximately 10 ft high and 600 ft long on the back beach area to protect the recreational facilities there from inundation during large wave/storm events.

Along the entire reach, except for the southern portion of the reach immediately adjacent to Moonlight Beach, an approximate 2 to 4- foot notch exists at the base of the bluff where notch protection measures have not been instituted. The prevalent notch development coupled with the already over-steepened upper bluff zone is prone to future bluff failures, some of which could be catastrophic. Consequently, Reach 4 was evaluated for project alternatives.

Figure 1.8-9 Portion of Reach 4

Figure 1.8-10 Reach 4 Aerial

Reach 5 – Moonlight Beach to Swami's

The shoreline segment extending from Moonlight Beach to Swami's (**Figure 1.8-11** and **Figure 1.8-12**) is approximately 1.0 mile in length and contains a narrow to nonexistent sandy beach with a very thin sand lens backed by the predominant high, steep coastal bluffs representative of the Encinitas shoreline. The development along the bluff top consists of high-density residential structures and the Self Realization Fellowship (SRF) property (Swami's) is located at the southern boundary of the reach and consists of two parks on the bluffs, H Street and I Street Viewpoint Parks, and provides public access and viewing areas on the bluffs. Several fences and drain lines lie on the face of the bluff. Public access to D Street Beach consists of benches on the top of the bluff and a wooden staircase leading from the top of the bluff to the beach; there are two staircases for private access.

The bluff ranges in height from approximately 30 to 80 ft and is comprised of different formations. The northern one-third section is comprised of Torrey Sandstone, while the remaining section is comprised of the Del Mar formation, which is slightly more resistant to wave abrasion. Exposures of this formation occur as slopes are gentle and too weak to support steep slopes. In addition, groundwater percolates through the porous weakly cemented sandstone with evidence of groundwater seepage prevalent along the low-lying rock face from approximately E Street south.

Historically, the beach within this reach has been narrow and low in elevation. Even after RBSP I was completed, the beach was still in a denuded condition. Only several small patches of cobble berm exist in certain sections of the reach. As a result, wave attack and tidally induced notching have impacted the base of the bluff. In specific locations these notches are rather large, extending as deep as 8 ft or more and ranging in height from approximately 10 to 15 ft. These large notches continue to differentially erode and at times form seacaves that are often large enough to crawl, and sometimes walk, into. Due to the deteriorated nature of the bluff face along this reach, numerous bluff failures have occurred in the last few years.

No bluff toe protective devices have been recently constructed within this reach; however, a long revetment structure is present at the SRF property providing bluff slope protection. The bluff at the SRF has had a long history of slope stability problems, as the area is highly susceptible to landslides. Following the severe winter of 1941, the original SRF Temple, which had been built 30 ft from the edge of the cliff, collapsed onto the beach below as a result of a massive landslide (Kuhn and Shepard, 1984).

Large notches form seacaves that are often large enough to crawl and sometimes walk into. Due to the deteriorated nature of the bluff face along this reach, numerous bluff top failures have occurred in the last few years. As a result Reach 5 was evaluated for project alternatives.

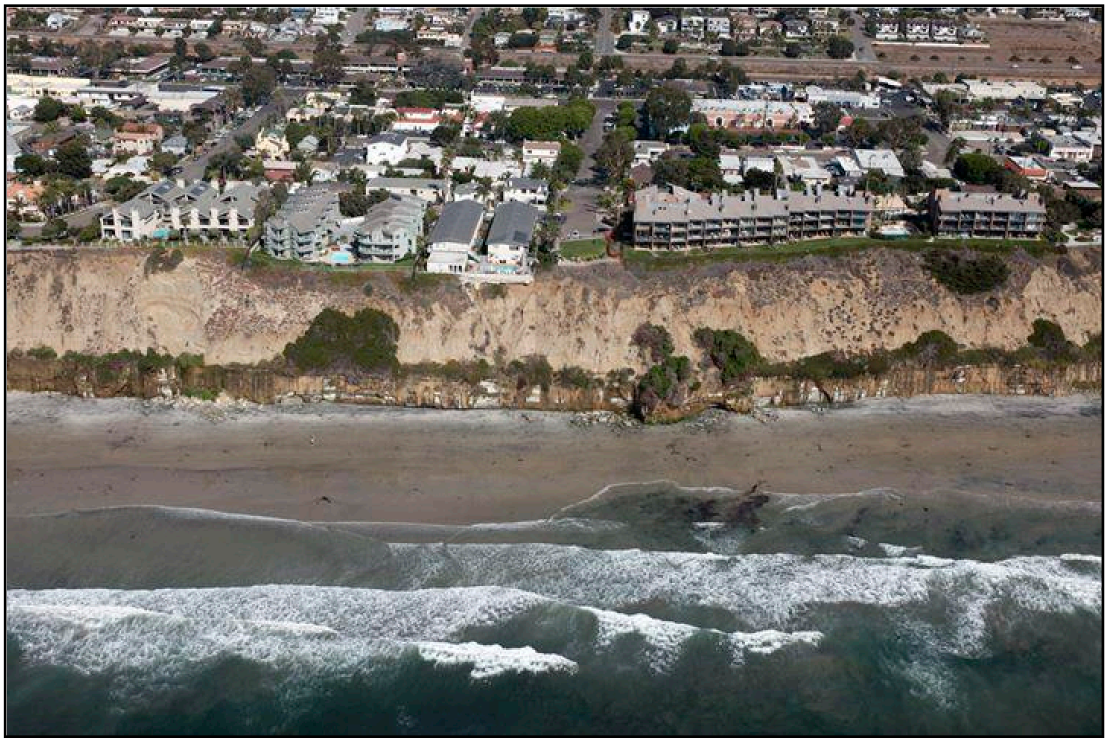

Figure 1.8-11 Portion of Reach 5

Figure 1.8-12 Reach 5 Aerial

Reach 6 – Swami's to San Elijo Lagoon Entrance

The shoreline segment between Swami's and San Elijo Lagoon (**Figure 1.8-13** and **Figure 1.8-14**) is approximately 1.1 miles in length and can be characterized by its narrow beach, varying presence of cobble on the beach, lower relief along the bluff, and relatively low density development. In the northern part of the reach, Sea Cliff County Park, public parking, a concrete and wood public staircase to Swami's Beach, and some residences are at the edge of the bluff; in the central and southern parts of the reach, Highway 101/County Highway S21 and San Elijo State Beach are at the edge of the bluff. These parks provide parking and visitor facilities such as restrooms and picnic tables. A 171-unit campground is located adjacent to the beach at San Elijo State Beaches well as park support buildings and restrooms, parking, a paved access ramp to the beach, and 6 staircases to the beach. Two storm drains exist at Swami's Beach, one pipe drains between Swami's and San Elijo State Beach, and one pipe drains at the north end of the State Beach.

The narrow beach is backed by coastal bluffs ranging in height from approximately 60 to 80 ft in the northern portion of the reach dropping down to less than 3 ft in height at the Lagoon entrance. The coastal bluffs within this reach are in varying states of stability with the lower portion of the coastal bluffs comprised of the Del Mar Formation. Groundwater seeps and springs are common, particularly in the northern and middle section of the coastal bluffs near Sea Cliff Park, and these occur in areas of poor slope stability. A 300-ft length of bluff collapsed in this reach in 1958, destabilizing State Highway 101. The Highway was subsequently narrowed from two lanes to one lane in each direction. This area was stabilized with improved drainage in 1961 with a rock revetment embankment to protect the highway from future storm and tidal impacts.

In the area where Highway 101 is the nearest structure to the edge of the bluff, it is protected by extensive riprap revetment. Likewise all San Elijo State Beach ramps and staircases, except the southernmost staircase, are protected by extensive riprap. Also in the San Elijo State Beach some areas at the top of the bluff, generally near the tops of staircases, are protected by mechanically stabilized earth. Although a small number of private homes occupy the northern end, most of the reach segment contains the Highway 101 right-of-way and the San Elijo State Beach. A robust rock revetment was installed to protect the highway from future storm and tidal impacts in 1961. The southern portion of the reach is backed by the San Elijo State Beach Campground and contains non-engineered riprap that protects five beach access points. Given the protective features already in place and the small number of structures, Reach 6 was not evaluated for project alternatives.

Figure 1.8-13 Portion of Reach 6

Figure 1.8-14 Reach 6 Aerial

Reach 7 – San Elijo Lagoon to Table Tops

The low lying shoreline segment extending from San Elijo Lagoon to Table Tops (**Figure 1.8-15** and **Figure 1.8-16**) is approximately 1.2 miles in length and separates the Pacific Ocean from the San Elijo Lagoon. Development at the northern end of this reach includes three popular restaurants with vehicle parking and the right-of-way for Highway 101 are protected by riprap. Reach 7 also includes Cardiff State Beach with associated parking lots and visitor facilities at the north and south ends of the beach is protected by riprap in certain sections.

Since this reach possesses a narrow sandy and cobble spit beach backed by Highway 101, which is protected by a non-engineered rock and concrete rubble revetment, it was evaluated for coastal storm surge (flooding) damages rather than coastal/bluff erosion. The combination of natural shoreline and artificial shoreline protection along this reach results in reduced exposure to storm-induced wave damage and flooding. However, the close proximity of the restaurants to the water's edge has rendered and will continue to render them susceptible to periodic episodes of inundation and structural damage. Severe storms also cause flooding along Highway 101. For the most part, this is limited to partial lane closures for limited time periods; however, the most severe storms often result in damage to restaurants west of Highway 101 and complete road closure for several days due to coastal flooding and the time required to remove debris from the roadway.

Reach 7 was evaluated for damages from storm surge inundation and not bluff/coastal erosion as the majority of the reach is protected by natural and artificial shore protections such as rip rap revetment. Damages in this reach are categorized as clean-up costs (debris removal from Old Highway 101 and clean-up costs to the three restaurant interiors), damage costs to the three restaurant interiors, and traffic delay costs that are incurred when Old Highway 101 is closed due to debris in the roadway and clean up operations.

Since Reach 7 is protected by natural and artificial shore protection and does not experience severe coastal storm damage similar to other reaches, detailed project alternatives were not evaluated.

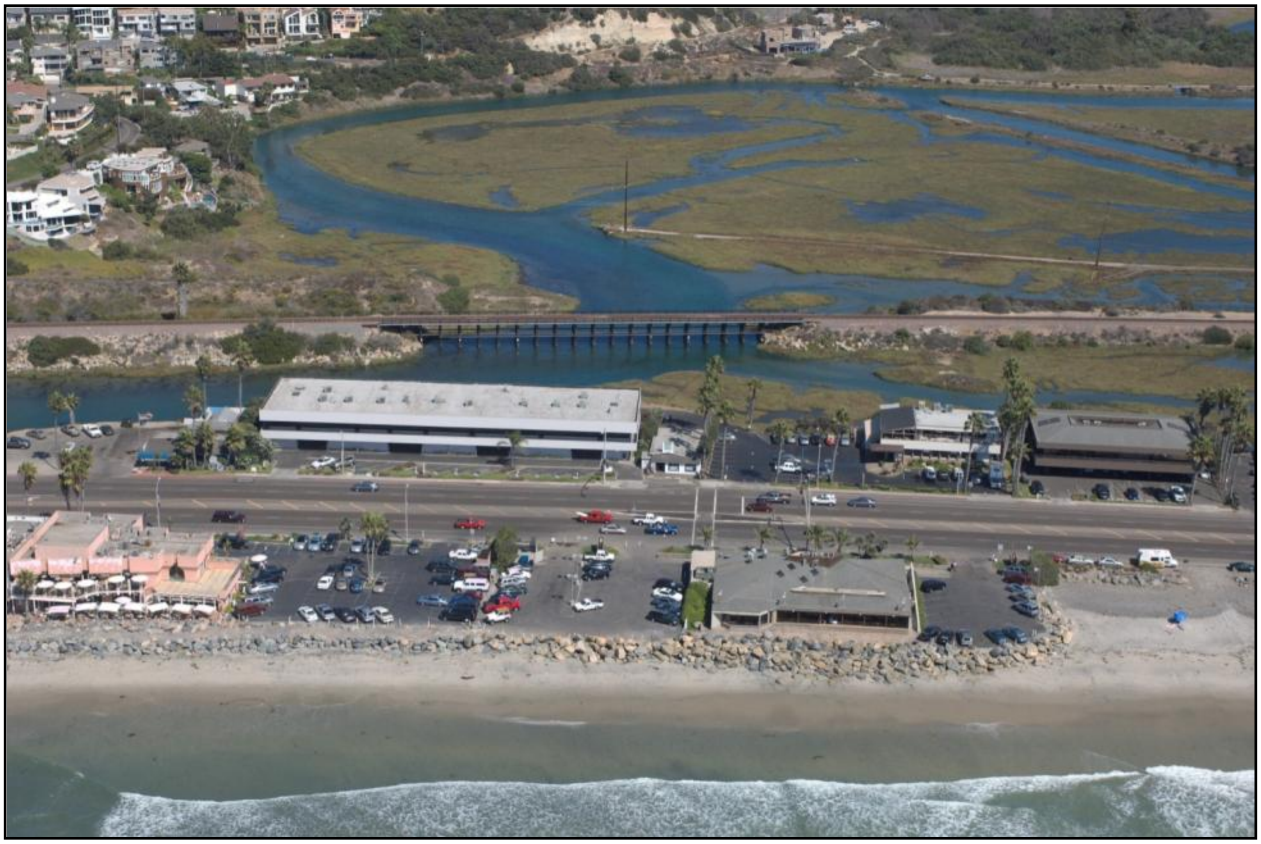

Figure 1.8-15 Portion of Reach 7

Figure 1.8-16 Reach 7 Aerial

Reach 8 – Table Tops to Fletcher Cove

The shoreline segment between Table Tops and Fletcher Cove (**Figure 1.8-17** and **Figure 1.8-18**) is approximately 0.8 miles in length and represents the northern reach located in the City of Solana Beach. The bluff top is fully developed throughout the reach with large multi-story private residences. Reach 8 includes Tide Beach Park and Fletcher Cove Beach Park with its community building, recreational facilities, rest rooms, lifeguard center and public parking. Many small pipes lie along the face of the bluff. Public access to the beach consists of a public staircase from Solana Vista Dr. in the northern half of the reach down to the beach and a public paved ramp at Fletcher Cove, near the end of Plaza St. at the southern end of the reach. The northern end of the reach is protected by a moderately sized seawall. There is also a large seawall just north of Solana Vista Dr. and several very large seawalls between Solana Vista Dr. and Estrella St.

The coastal bluffs are approximately 70 ft high and are comprised of Torrey Sandstone over the lower 10 to 15 ft of the cliff face with the remaining 63 ft comprised of poorly consolidated silty sandstone. The shoreline may be characterized as consisting presently of a narrow to non-existent sandy beach backed by high, wave cut coastal bluffs. In addition, small pockets of cobble exist in the back beach area at various locations. Fletcher Cove is located at the southern boundary of this reach and represents a 300 – ft long recessed “pocket” beach with good public access. Prior to the 1997-1998 El Nino season, the beach condition provided a buffer preventing the bluff face from being directly exposed to storm wave attack and only limited bluff erosion was reported. During the 1997-1998 winter months, sand was stripped away and the bluff face became directly exposed to wave abrasion. Severe toe erosion subsequently developed and bluff failures have been continuously reported since. Presently, notches on the order of 4 to 8 ft and large seacaves are present in the lower bluffs along this reach.

Several bluff top residences have instituted lower bluff stabilization measures to protect against the impingement of waves and tides. These stabilization measures include concrete seawalls, some of which have employed the use of textured artistic surfaces, and range in height from 3 to approximately 15 ft. Concrete notch infills were designed to fill in the voids created by the abrasive forces of waves and tides. However, at several notch infill locations, erosion has since taken place in the lee of the infill resulting in the seepage of bluff sediment around the end of the infill. The existing notching at the base of the bluff, when combined with the over steepened upper bluff, is indicative of potentially catastrophic block failures.

The bluff top is fully developed throughout the reach with large multi-story private residences. The cliffs are approximately 80 feet high and presently the shoreline may be characterized as consisting of a narrow to non-existent sandy beach backed by high, wave cut cliffs. During the 1997-1998 winter months, sand was stripped away and the bluff face became directly exposed to wave abrasion. Severe toe erosion subsequently developed and bluff failures have been continuously reported since that event. Presently, notches, on the order of 4 to 8 feet, and large seacaves exist throughout the lower bluff region. Consequently, Reach 8 was evaluated for project alternatives.

Figure 1.8-17 Portion of Reach 8

Figure 1.8-18 Reach 8 Aerial

Reach 9 – Fletcher Cove to Solana Beach Southern City Boundary

The shoreline segment between Fletcher Cove and the southern boundary of Solana Beach (**Figure 1.8-19** and **Figure 1.8-20**) is approximately 0.8 miles in length. The bluff top, ranging in height from approximately 62 to 80 ft, is fully developed with private residential houses, as well as over 900 multiple family town homes and/or condominiums. Reach 9 includes the southern end of Fletcher Cove Beach Park and North Seascape Surf Beach Park with one storm drain at each of the two Parks. The southern end of the reach is protected by large seawalls, reinforced earth walls, riprap placements, and concrete covered crib walls.

The coastal bluffs are comprised of exposures of Torrey Sandstone in the lower bluff and overlain by weakly consolidated sandstone layer which is prone to both sliding and block failure. The shoreline within this reach can presently be characterized as a narrow to non-existent sandy beach backed by high, steep coastal bluffs. Various small pockets of natural cobble berm exist in the southern half of the reach that provide limited protection to the bluff face. Similar to Reach 8, the bluffs within this reach are also susceptible to the repeated exposure of waves and tides because of the beach erosion that occurred during the 1997-1998 El Nino season. The notches range in depth from approximately 2 to 8 ft and fractures extend through the upper bluff above and adjacent to the deeper notches. Evidence of several landslides exists within the reach and a large block failure in the center of the reach occurred just prior to a February 6, 2002 field investigation. Seacaves, several of which extend as deep as 18 to 30 ft, are present in several areas at the southern portion of the reach. City marine safety personnel regularly advise beach users not to venture into the seacaves.

Several property owners have instituted stabilization measures in the form of seawalls, rock revetments, and notch infills to protect the base of the bluff from eroding. However, the cliff face has eroded behind older constructed notch infills and plugs leaving these measures isolated by as much as 3 to 4 ft. This is indicative of the fairly rapid and aggressive erosion of the bluff in this shoreline segment of the study area.

It is apparent that without corrective action, this reach will continue to have landslides and block failures. The beach provides almost no buffer between wave and tidal impacts and the base of the bluff, and as a result, the bluff face is subject to erosion during high tides and storm events. The bluff toe is exposed even during mid-tide levels. This ongoing exposure has resulted in the continued erosion of the bluff face and the associated recession of the upper bluff. It is expected that without corrective action, upper bluff recession will most likely accelerate in this reach as the upper bluffs equilibrate with the ongoing erosion occurring at the base of the bluff.

Repeated wave exposure has resulted in the continued erosion of the bluff face and the associated recession of the upper bluff. It is expected that without corrective action, the magnitude of the upper bluff recession will most likely accelerate in this reach until the upper bluffs have fully equilibrated with the ongoing erosion occurring at the base of the bluff. Reach 9 was evaluated for project alternatives.

Figure 1.8-19 Portion of Reach 9

Figure 1.8-20 Reach 9 Aerial

Del Mar Reach

This 1,510 ft stretch of shoreline lies immediately south of Solana Beach within the city of Del Mar and could benefit from soft-placement project alternatives, such as beach nourishment, evaluated for Reach 9. The beach width varies throughout the reach from 65 to 130 feet. There are functional and decorative fences and paved walkways at the edge of the bluff, three residential structures at varying distances from the bluff edge, and public access at the southern end. There are no coastal protection structures in this reach. This reach is included in the benefits calculations for soft-placement alternatives only.

1.8.2 Project Segment Delineation

Without project analysis and plan formulation was performed on all reaches; however, through that process only portions of reaches 3-5 and 8-9 were identified for viable alternatives primarily because of susceptibility to future bluff failures, the existence of viable alternatives to address this problem, and sufficient economic value to justify those alternatives. Segment 1 is a portion of the beach within the City of Encinitas city limits that extends approximately 7,800 ft from the 700 block of Neptune Avenue south to West H Street. Segment 2 is the majority of the beach within the City of Solana Beach city limits, approximately 7,200 ft long extending from the southern city limits north to Tide Park, close to the northern city limits of Solana Beach. These segments can be seen in **Figure 1.8-2**. The segments are the areas where alternatives have been developed to address the planning objectives, which will be discussed later. The environmental analysis herein looked at the segments and the surrounding areas for the purposes of evaluating the potential for impacts in the context of the location and setting as prudent for each topic and distinct from the larger Study Area.

Segment 1 includes 138 parcels and 112 structures which are mainly private residences located on the top of the bluff. There are some recreation amenities such as Moonlight Beach, a lifeguard building and restroom facilities located at the bottom of the bluff. Segment 2 includes 88 parcels and 81 structures located on the bluff top. This segment contains private residences and Fletcher Cove Beach Park (community building, recreational facilities, restrooms, lifeguard building and public parking).

1.8.3 Parking and Transit

The city of Encinitas has approximately 2,566 public parking spots including street-side parking within a reasonable walking distance of nine different public access locations.[2] The distance between public access points varies from one-tenth to three-quarters mile. The city of Solana Beach has approximately 2,061 public parking spaces including street-side parking within a reasonable walking distance of four public access points. If only half of these parking spaces are available to beach visitors, over 10,000 daily visitors could arrive by vehicle at each city, which exceeds the current and anticipated future demand.

The study area is also serviced by regular public transit. Buses travel up and down the coastline (north-south) making stops near public access points 28-31 times every day. Buses traveling between the study area and inland communities make between one and two dozen stops daily with limited service on weekends. The study area is also serviced by commuter rail service that

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[2] *ER 1165-2-130 states parking must be "located reasonably nearby" the project. No specific distance is given; however, we have determined a reasonable walking distance is less than 1/3 of a mile. With the exception Solana Beach transit parking (about 300 lots), street and public parking lots cited are typically 1/10 to ¼ mile from access points.*

connects downtown San Diego and the coastal communities in the northern half of the county. The commuter rail makes stops within two to three blocks of the two most popular public access points within the study area. In addition many individuals have been observed bicycling to the study area beaches and several thousand residents and visitors in the study area reside or stay within walking distance of public access points.

In sum the amount of parking is adequate to meet current and future peak demands, parking is located within reasonable walking distances from the access points, and if also taking into consideration visitation that is supported by modes other than car (buses, walking, bicycling, train), there is ample parking and other infrastructure to support projected recreation demand.

1.8.4 Access

Solana Beach has implemented Land Use Plan provisions consistent with the California Coastal Management Program to ensure that "the protection, provision, and enhancement of coastal public access and recreation of opportunities in the City of Solana Beach [is] consistent with goals, objectives, and policies of the California Coastal Act. The policies can be broadly summarized as: improving existing public access opportunities by supporting proposals to enhance access-ways; providing objectives, standards, and designated sites for locating visitor serving recreational facilities and commercial uses such as hotels and motels; development of enhanced signage program to better identify public access and use opportunities; identifying and seeking removal of any unauthorized physical development, including signs and fences on the beach, which inhibit public use of public beach areas and state tidelands; and protecting existing and future parking availability near the shoreline and trail-access ways throughout the city."

Similarly, Encinitas has proposed a draft Comprehensive General Use Plan that includes a Local Coastal Program (LCP) consistent with the California Coastal Management Program. "The goals of the LCP are to protect, maintain and enhance the Coastal Zone environment; ensure balanced utilization and conservation; maximize public access to and along the coast; prioritize coastal dependent and related development; and encourage coordinated state and local initiatives to implement beneficial programs and other educational uses."

The cities are required by these Land Use Provisions and have intended for their beaches to be accessible to the public despite the unique challenges from bluff-top coastlines. Since public access to the beach along these coastal bluffs generally requires construction of stairways, often armored, on stable portions of the bluff, the paramount consideration and constraint is locating and obtaining easements to construct these stairways in a manner that allows visitors a safe descent to the beach. For this purpose the cities maintain eight public access points along the bluff-top to allow for safe descent to the beach. Two of these are within Segment 1 (Stonesteps and D-street) and three are within Segment 2 (Tide Beach, Seascape Surf, and Del Mar Shores). In addition Segment 1 includes one public access point at beach level (Moonlight) and Segment 2 includes two access points at beach level (San Elijo State Park and Fletcher Cove). Segment 1 includes good public access and sufficient parking but the northern portion of the tentatively selected plan extends approximately 0.4 miles from the nearest public access point. The southern end of Segment 2 extends 0.5 miles from the nearest public access point. The distance between all public access points within Segment 2 is approximately 0.4 miles or less.

In the study area beach visitors have been routinely observed recreating throughout the study area and specifically more than ¼ mile from an access point. This can be partly attributed to the extensive urbanization along the coastline and large number of tourists. Beaches can become crowded throughout the summer and fall causing some beach visitors to walk the extra distance to enjoy open spaces for recreation. Others observed long distances from access points are taking beach walks or seeking out favored surfing and snorkeling spots among other reasons.

Although there are some locations along the project area where the distance between access points is somewhat greater than what the regulation construes to be the effective limit for public use: 1) the Cities have made every effort possible to provide as much beach access as possible given the geographical/physical constraints of the study area and; 2) the effective public use radius as cited in the regulation does not reflect the actual effective radius of public use in the Study Area, as significant recreation occurs throughout both of the Study Area segments, including those portions that exceed the referenced limits. The study is requesting a policy waiver on the issue for the ¼ mile limit on access points to ASA-CW to ensure cost-share apportionment will not be adjusted.

1.8.5 Physical Characteristics

Regional Topography

The study area is located within the coastal plain of the Peninsular Ranges geomorphic province of southern California. This Province is characterized by a flat coastal plain with steep sloped hills and a series of northwest to southwest trending elongate mountain ranges dissected by faults and separated from one another by alluvial valleys. The coastal plain consists of marine and non-marine terraces dissected by coastal lagoons. Elevations range from sea level to approximately 100 ft at the tops of the coastal bluffs.

Terrestrial topographic data was obtained from two sources. Both an aerial photogrammetric survey and an aerial Light Detection and Ranging (LIDAR) survey were conducted as part of this study. Topographic maps compiled from the data allowed detailed information to be collected of the beach, shoreline structures, and blufftop ground elevations.

Regional Bathymetry-Nearshore Profile

Representative cross shore beach profiles developed as part of the RBSP I and II substantiate previously known trends. The nearshore slope is generally parallel to the shoreline, with a consistent slope. On average, the shoreline is characterized by an approximate beach face slope of 45:1 (horizontal to vertical), extending from the base of the coastal bluffs to about -10 ft MLLW. The nearshore slope extending seaward to approximately the -40-ft elevation contour is about 70:1. The beach face and nearshore slopes at Leucadia in the City of Encinitas are steeper than those to the south.

1.8.6 Geologic Characteristics

Geologic units above the Encinitas and Solana Beach coastal bluffs include dune sands and marine terrace deposits that form the sloping upland above the coastal bluffs and three older Eocene bedrock geologic units. The sequence of formational material from north to south of the Encinitas segment is the Santiago, Torrey Sandstone and Delmar Formations. Within the Solana Beach area, the geological units exposed are the Delmar formation on the northern segment and the Torrey Sandstone on the southern portion.

The bluff-capping units overlie a wave-cut abrasion platform that was formed on the Eocene bedrock approximately 125,000 years ago when sea level was 20 ft higher (Lajoie etal, 1992).

The sloping, upper portion of the Encinitas and Solana Beach bluffs is comprised predominantly of late Pleistocene, moderately-consolidated, silty-fine sands. Sand dune deposits locally cap the coastal terrace.

Extending seaward from the bluffs, a shore platform extends 500 to 900 ft at a slope of 1.25 degrees to a depth of 12 ft, the slope then increases to 1.75 degrees extending to depths of over 60 ft. This surface is an active wave-cut abrasion platform. The platform is underlain Eocene-age claystone, shale, and sandstone bedrock formations that are partially exposed in the coastal bluffs. Gentle folding of the bedrock caused the bedrock sequence to dip to the northwest by a few degrees. As a result, the exposure of individual bedrock formations in the shore platform are located southerly of their position in the coastal bluffs. Where the less competent Torrey Sandstone is exposed on the platform, greater water depths are present in the nearshore portion of the beach profile.

1.8.7 Seismicity

The geologic structure of the Encinitas and Solana Beach region is the result of faulting and folding in the current tectonic regime, which began approximately five million years ago when the Gulf of California began to open in association with renewed movement on the San Andreas fault system (Fisher and Mills, 1991). The localized folding and faulting of the Eocene-age formations were produced by the active tectonic setting. The contact between formations are locally offset by active faults. Reach 1 includes the inactive ancient Beacons and Seawall Faults.

The study area is located in a moderately-active seismic region of Southern California that is subject to significant hazards from moderate to large earthquakes. Ground shaking resulting from an earthquake can impact the Encinitas and Solana Beach study area. The estimated peak site acceleration for the maximum probable earthquake is approximately 45 percent of the gravitational acceleration (0.45g) from a magnitude 6.9 earthquake on the Rose Canyon fault zone, which is 2.5 miles from the study reaches.

1.8.8 Climate

The Encinitas and Solana Beach coastal region has a semi-arid Mediterranean type climate that is maintained through relatively mild sea breezes over the cool waters of the California current. Winters are usually mild with rainfall totals around the coast averaging approximately 10 to 20 inches per year. The rainfall increases in the inland areas ranging from approximately 20 to 60 inches per year in the coastal mountains. **Table 1.8-2** presents the climate summary at an adjacent meteorological station (Station Number 046377 at Oceanside Marina).

Typically, the wind climate in the offshore area within 50 to 100 miles of Encinitas and Solana Beach is characterized by northwesterly winds averaging between 10 to 30 miles per hour. The predominant winds within the coastal region during October through February are from the east-northeasterly direction, while the winds during March through September are from the west-northwesterly direction. Average wind velocities during the summer and winter months along the coast range approximately between 5 and 7 miles per hour, respectively. Variations from the typical wind speeds and directions occur during occasional winter storms in which wind strength and direction may vary and during Santa Ana conditions when winds are usually strong from the northeast.

Table 1.8-2 Monthly Climatic Summary at Oceanside Marina

Month	Ave. Max. Temperature (F^O)	Ave. Min. Temperature (F^O)	Ave. Total Precipitation (in)
Jan	63.9	44.5	2.18
Feb	64.0	47.6	1.98
Mar	64.0	47.4	1.83
Apr	65.4	50.3	0.96
May	66.8	54.7	0.22
Jun	68.7	58.2	0.09
Jul	72.5	62.1	0.03
Aug	74.5	63.3	0.08
Sep	74.1	60.9	0.28
Oct	71.8	55.7	0.30
Nov	68.3	48.8	1.10
Dec	65.1	44.6	1.24

<u>Southern Oscillation El Nino (SOEN) Events</u>

Southern Oscillation El Nino (SOEN) events are global-scale climatic variations with a duration lasting for approximately 2 to 7 years. They represent an oscillatory exchange of atmospheric mass as manifest by a decrease in sea surface pressure in the eastern tropical Pacific Ocean, a decrease in the easterly trade winds, and an increase in sea level on the west coast of North and South America (USACE, 1986). The interaction between the atmospheric and oceanic environment during these events drive climatic variations that can result in significant modifications of wave climate along the world's coasts.

The severe winter seasons of 1982-1983 and 1997-1998, which produced some of the most severe storms to impact the Encinitas and Solana Beach coast, were the result of intense SOEN events. The atmospheric disturbance associated with these two events caused abnormally warm water temperatures, a reversal of the westerly trade winds, and increased the monthly mean sea levels by as much as 0.42 ft in 1982-1983 season and 0.52 ft in 1997-1998 season at La Jolla, San Diego (Flick, 1998).

<u>Long Term Climatic History</u>

Historically, the climate in Southern California alternates in cycles between typical and extreme conditions. For example, the cyclic drought climate observed in the early 1970's was followed by a severe stormy weather period in the late 1970's and early 1980's including the 1983 El Nino season. It is well known that a significant correlation does exist between the El Nino events and the occurrence of severe weather patterns involving larger storm waves along the coast of Southern California. In the past 50 years, the increase of more vigorous winter cyclones in North Pacific (Graham & Diaz, 2001) may be attributed to the observed modulation of El Nino events with steady repetitive occurrences. Due to the continuous trend of global warming, the intensity of each El Nino event and associated winter storms in Southern California is likely to increase. Consequently, the cyclic benign (draught) and severe (wet) weather patterns will be more intensified in the future as the acceleration of global warming continues.

1.8.9 Coastal Processes

Water levels within the surf zone consist of three primary factors: 1) astronomical tides, 2) storm surge and wave set-up, and 3) long-term changes in sea level. Each of these factors is briefly described in the following sections.

Tides

Tides along the southern California coastline are of the mixed semi-diurnal type. Typically, a lunar day (about 24 hours) consists of two high and two low tides, each of different magnitudes. A lower low tide normally follows the higher high tide by approximately seven to eight hours while the time to return to the next higher high tide (through higher low and lower high water levels) is usually approximately 17 hours. Annual tidal peaks typically occur during the summer and winter seasons following a solstice. The increased tidal elevations during the winter season can exacerbate the coastal impacts of winter storms.

Since tides have a spatial scale on the order of hundreds of miles, the prevailing tidal characteristics measured in La Jolla may be considered representative of the tidal elevations within the study area. The National Oceanic and Atmospheric Administration (NOAA) has established tidal datums at La Jolla in San Diego County for two tidal epochs of approximately 18 years in duration. The earlier tidal epoch covered the time period from 1960 to 1978 while the most recent tidal epoch covers the time period from 1983 to 2001. The tidal characteristics at the La Jolla tidal station for both of these tidal epochs are presented in **Table 1.8-3.**

Table 1.8-3 Tidal Characteristics at Scripps Pier in La Jolla, California

Datum Plane	Elevation, ft, MLLW	
	1960-1978 Epoch	1983-2001 Epoch
Highest observed water level	7.81*	7.65**
Mean Higher High Water (MHHW)	5.37	5.33
Mean High Water (MHW)	4.62	4.60
Mean Tide Level (MTL)	2.77	2.75
Mean Sea Level (MSL)	2.75	2.73
National Geodetic Datum – 1929 (NGVD)	2.56	2.29
Mean Low Water (MLW)	0.93	0.91
North American Vertical Datum -1988 (NAVD)	-	0.19
Mean Lower Low Water (MLLW)	0.00	0.00
Lowest observed water level (Dec. 7, 1933)	2.60	2.78

* on August 8, 1988
Source: NOAA, 2003
** on November 13, 1997

Storm Surge and Wave Setup

Storm surge results from storms that induce fluctuations in the wind speed and atmospheric pressure. Storm surge is usually fairly small on the west coast of the United States when compared to storm surge on the east and gulf coasts of the United States. The lower impact of storm surge on the west coast is due primarily to the relatively narrow continental shelf. It was estimated that the average increase in the water level resulting from storm surge effects ranges from approximately 0.3 to 0.5 ft within the San Diego coastal zone (USACE-LAD, 1991). The average positive tide residual usually occurs in a temporal scale of approximately six days; however, storm surges of significant magnitudes rarely continue for longer than two days.

Wave setup is the super-elevation of water levels that occur primarily in the surf zone where waves break as they approach a beach and reach their limiting wave steepness. The magnitude of the wave setup depends on the height of breaking waves occurring in the surf zone. The elevated water levels allow waves of increased magnitude to impinge onto the bluff face during a storm event.

Sea Level Rise (SLR)

Long-term changes in the elevation of sea level relative to the land can be engendered by two independent factors: (1) global changes in sea level, which might result from influences such as global warming, and (2) local changes in the elevation of the land, which might result from subsidence or uplift. The ocean level has never remained constant over geologic time, but has risen and fallen relative to the land surface. A trendline analysis of yearly Mean Sea Level (MSL) data recorded at La Jolla in San Diego County 1924 to 2006 indicates that the MSL upward trend is approximately 0.0068 feet per year, as shown in **Appendix B.**

According to the Intergovernmental Panel on Climate Change (IPCC), global average sea levels have risen approximately 0.3 to 0.8 ft over the last century and are predicted to continue to rise between 0.6 and 2.0 ft over the next century (IPCC, 2007). In a 2009 study performed by the Pacific Institute on behalf of the California State Coastal Conservancy (SCC) scientific data gathered from 1980 to 1999 suggests that global sea level rise has outpaced the IPCC predictions (Rahmstorf, 2007). Potential effects from this acceleration of sea level rise on coastal environments, such as erosion, net loss of shorefront, increased wetland inundation, and storm surge have the potential to displace coastal populations, threaten infrastructure, intensify coastal flooding, and ultimately lead to loss of recreation areas, public access to beaches, and private property.

Given the potential for substantial effects that sea level rise could have on coastal environments, both federal and state agencies have prepared guidance for incorporating sea level rise into the planning and design of projects and these guidance have been incorporated into the current analyses.

The Engineer Circular 1165-2-212 on sea level rise (USACE, 2011) provides USACE guidance for incorporating the potential direct and indirect physical effects of projected future sea level change in the engineering, planning, design, and management of USACE projects. The guidance states that potential sea level rise must be considered in every USACE coastal activity as far inland as the extent of estimated tidal influence. This guidance recommends a multiple scenario approach to address uncertainty and help develop better risk-informed alternatives. Planning studies and engineering designs should consider alternatives that are developed and assessed for the entire range of possible future rates of sea level rise. The alternatives should be evaluated using “low”, “intermediate”, and “high” rates of future sea level rise for both “with” and “without” Project conditions. The local historical rate of sea level rise should be used as the low rate. The intermediate rate of local mean sea level rise should be estimated using the modified Curve I from the National Research Council (1987). The high rate of local sea level rise should be estimated using the modified Curve III from the National Research Council report. This high rate exceeds the upper bounds of the 2007 IPCC estimates, thus allowing for the potential rapid loss of ice from Antarctica and Greenland. The sensitivity of alternative plans and designs to the rates of future local mean sea level rise should be determined. Design or operations and maintenance measures should be identified to minimize adverse consequences while maximizing beneficial effects. For each alternative sensitive to sea level rise, potential timing and cost consequences should be evaluated during the plan formulation process.

These USACE recommended curves as are shown in **Figure 1.8-21** exhibiting the high (Curve III), intermediate (Curve I), and low (local historical trend) estimates. The estimates were adjusted to a 2000 baseline for direct comparison with other sea level rise projections. The high and intermediate curves are based on the following formula.

$$SLR(t) = E_{local}\, t + bt^2$$

Where *SLR(t)* is the amount of sea level rise in meters from the 1986 baseline,
E_{local} is the historic trend at a local gage station per year,
b = 0.0001005 meters/year^2 is a constant for Curve III,
b = 0.0000236 meters/year^2 is a constant for Curve I, and
t is the year difference between 1986 and the subject year

The low sea level rise is represented by a trendline analysis of yearly MSL data recorded at La Jolla in San Diego County from 1924 to 2006. This indicates an upward trend of approximately 0.0068 ft per year, as described in the Coastal Engineering Appendix.

In addition to USACE guidance, various agencies within the State of California have released guidance for their respective projects. Governor Arnold Schwarzenegger issued Executive Order S-13-08 (Office of the Governor, 2008) to enhance the State's management of potential climate effects from sea level rise, increased temperatures, shifting precipitation and extreme weather events. There are directives for four key actions including:

1. Initiate California's first statewide climate change adaptation strategy that will assess the state's expected climate change impacts, identify where California is most vulnerable and recommend climate adaptation policies by early 2009;

2. Request the National Academy of Science to establish an expert panel to report on sea level rise impacts in California to inform state planning and development efforts;

3. Issue interim guidance to state agencies for how to plan for sea level rise in designated coastal and floodplain areas for new projects; and

4. Initiate a report on critical existing and planned infrastructure projects vulnerable to sea level rise.

Executive Order S-13-08 directs that, prior to release of the final sea level rise assessment report from the National Academy of Science, all California agencies that are planning construction projects in areas vulnerable to future sea level rise shall, for the purposes of planning, consider a range of sea level rise scenarios for the years 2050 and 2100 in order to assess project vulnerability and, to the extent feasible, reduce expected risks and increase resiliency to sea level rise. Sea level rise estimates should also be used in conjunction with appropriate local information regarding local uplift and subsidence, coastal erosion rates, predicted higher high water levels, storm surge and storm wave data.

Since release of Executive Order S-13-08, various California agencies have provided recommended sea level rise projections (California Climate Change Center, 2009a & 2009b; California State Coastal Conservancy, 2009; Coastal and Ocean Working Group of the California Climate Action Team, 2010; California Climate Action Team, 2010; California State Lands Commission, 2009; California Ocean Protection Council, 2011; California Department of Transportation, 2011), as summarized in and shown in **Figure 1.8-21**. Sea level rise projections from a year 2000 baseline are provided for the years 2030, 2050, 2070, and 2100. Projections for the years 2070 and 2100 include three ranges of values for low, medium, and high greenhouse gas emissions scenarios corresponding to IPCC greenhouse gas emissions scenarios. In **Figure 1.8-21**, the data points identified as "Coastal Commission" are the high range of the average of the models as recommended by the California Ocean Protection Council and repeated in **Table 1.8-4**.

Table 1.8-4 State of California Interim Guidance Sea Level Rise Projections

Year	Description	Average of Models, inches	Range of Models, inches
2030		7	5-8
2050		14	10-17
2070	Low	23	17-27
	Medium	24	18-29
	High	27	20-32
2100	Low	40	31-50
	Medium	47	37-60
	High	55	43-69

Projections from year 2000 baseline. Source: California Ocean Protection Council, 2011

Assuming that the Project base-year (i.e., year 0) is set to be in 2015, the resultant sea level rise at the end of the 50 year period of analysis will occur in 2065. The analysis for the years 2015 to 2065 would cover the year 2050; therefore, it would implicitly satisfy the California requirement. Additionally, in order to satisfy California requirements pursuant to Executive Order S-13-08, the Environmental Impact Statement/ Environmental Impact Report (EIS/EIR) should include a qualitative analysis for the year 2100. The projected sea level rise according to California projections in 2065 lies within the range of intermediate and high sea level rise scenarios per USACE guidance, so is captured by an analysis of the USACE sea level rise estimates. The observed sea level rise coincides with the low sea level rise scenario, as observed at the La Jolla NOAA tide gauge.

In response to Engineering Circular 1165-2-212 the PDT developed a White Paper to present the approach for addressing sea level rise for this study. For this feasibility study an analysis was performed on the high and low sea level rise scenarios to bracket. The results of the analysis indicated that the variation in consequences between the high and low sea level rise was modest. It was determined that an intermediate scenario would not provide a sufficient difference from low or high scenarios to trigger distinct alternative formulation or warrant additional analysis. Hence the USACE high and low sea level rise projections were used in the current study.

<u>Waves</u>

Waves that impinge on the shoreline, determine the movement of sediment and the associated impacts of coastal processes on the shoreline and nearshore environment. Essentially, waves are the driving force in generating the alongshore currents that are responsible for moving sand along the coast which results in changes to the shoreline configuration and morphology.

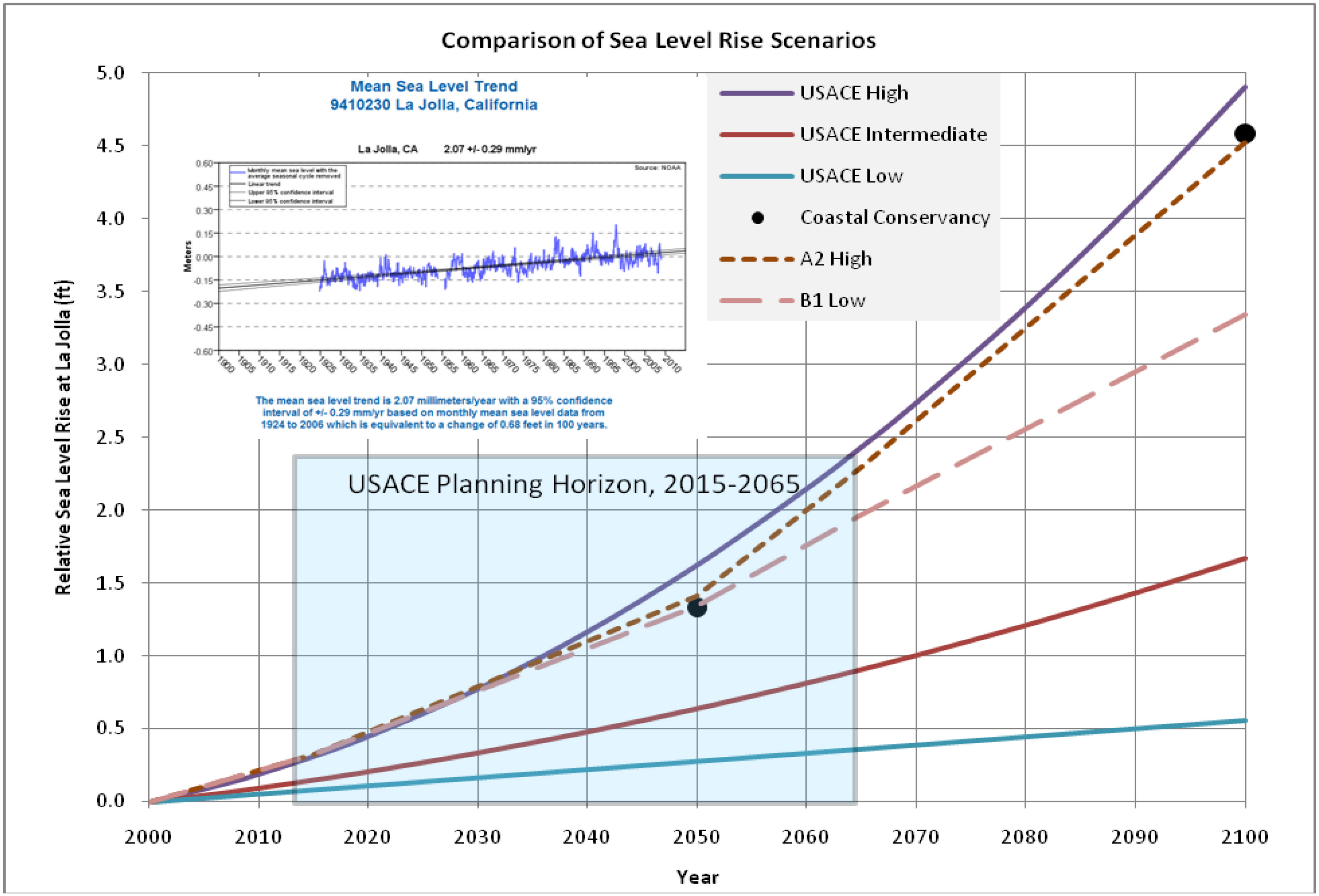


Figure 1.8-21 Sea Level Rise Curves

Wave Origin and Exposure

Wind-generated waves and swell within the study area are produced by six basic meteorological weather patterns. These include extratropical cyclone swells in the northern hemisphere in the Pacific Ocean, swells generated by northwest winds in the outer coastal waters, westerly seas and southeasterly sea seas, storm swells from tropical storms and hurricanes off the Mexican coast, and southerly swells originating in the southern Pacific Ocean. **Figure 1.8-22** illustrates these identified weather patterns and their associated wave propagating directions.

Extratropical Cyclone of the Northern Hemisphere: This weather pattern represents the category of the most severe waves reaching the California Coast. Northern hemisphere swell waves are usually produced by remote meteorological disturbances, including Aleutian storms, subtropical storms north of Hawaii, and strong winds in the eastern North Pacific Ocean. These produce north or northwest swell on the California Coast. Deep water significant wave heights rarely exceed 10 ft, with wave periods ranging from 12 to 18 seconds. Significant wave height is defined as the average height of the one-third highest waves within a wave train. During extreme northern hemisphere storms, wave heights may exceed 20 ft with periods ranging from 18 to 22 seconds.

Northwest Winds in the Outer Coastal Waters: One of the predominant wave sources along the study area is the prevailing northwest winds north and west of the southern California coastal waters. This is particularly true during the spring and summer months. Wave heights are usually low, less than 3 ft; but on occasion, with superposition of a strong surface high and an upper level trough, the northwesterlies increase, becoming strong from about Point Sal to San Nicolas Island. Moderate northwesterly winds will produce breaker heights of 4 to 6 ft, while strong events can generate breaking wave heights ranging from 6 to 9 ft with typical periods ranging from 6 to 10 seconds.

West to Northwest Local Winds: Westerly winds can be divided into two types: 1) temperature-induced sea breezes, and 2) gradient winds, both producing a west to northwest local sea. The former exhibits a pronounced seasonal and diurnal variation. The strongest sea breezes occur during the late spring and summer months, while the lightest sea breezes occur during December and January. The summer sea breeze usually sets in during the late morning and peaks in the mid-afternoon. In winter months, sea breeze conditions are limited to a few hours during early afternoon with a wind speed on the order of 10 knots. The summer sea breezes, on the other hand, will average about 15 knots and occasionally reach 20 knots or more. Gradient winds, lasting for a maximum duration of three days, are typically confined to the months of November through May with the peak occurring in March or early April. They usually occur following a frontal passage or with the development of a cold low pressure area over the southwestern United States. Under such conditions, waves generated by local winds combined with the northwest swell produce large waves that can potentially cause coastal damage within the region.

Pre-frontal Local Winds: The study area is vulnerable to storm conditions from strong winds blowing from the southeast to southwest along the coast prior to a frontal storm passage. These winds typically come from the south-southeast to south a short distance offshore. Wind generated waves, with peak wave periods of between 6 and 8 seconds, reach the shore with minimal island sheltering or refraction with directions coming from the southeast. Significant wave heights are generally in the range of 4 to 8 ft. Extreme wave heights are rare because the fetch and duration of these wind waves are short-lived.

Tropical Storm Swell: Tropical storms and hurricanes develop at low latitudes off the west coast of Mexico from June through October. These storms first move west as they depart mainland Mexico, then curve north and sometimes northeast before dissipating in the colder waters off Baja California. The swell generated by these storms usually does not exceed 6 ft in significant wave height. However, on rare occasions the offshore waters are warm enough to facilitate hurricane migration to more northern latitudes than usual. In September 1939, a hurricane passed directly over southern California generating recorded wave heights of 27 ft. This storm caused widespread damage along the coast.

Extratropical Cyclone of the Southern Hemisphere: From April through October, and to a lesser extent the remainder of the year, large South Pacific storms traversing between south latitude 40^o and 60^o from Australia to South America send south swell to the west coast of Central and North America. Typical southern hemisphere swell rarely exceeds 4 ft in height in deep water, but with periods ranging between 18 and 21 seconds, they can break at over twice that height when they reach the coast. The south swell also causes a reversal in the predominantly southward direction of littoral flow. During summer months, these waves dominate the littoral processes of the region driving alongshore currents northward as the northern-hemisphere swells are less frequent.

Figure 1.8-23 illustrates the wave exposure windows for the study area. The Channel Islands (San Miguel, Santa Rosa, Santa Cruz, and Anacapa), Santa Catalina Island, San Nicolas Island, and San Clemente Island provide some sheltering to the coastal region depending on the swell approach direction. The swell window, which is open to severe extratropical storms of the northern hemisphere, extends from approximately 277 to 284 degrees. The exposure window open to south swell and tropical storm swell extends from approximately 190 to 257 degrees. The study area is also open to west to northwest local sea and fre-frontal local sea from southwest to southeast.

Countless storms have impacted the southern California coast in the past. The waves adversely impacting the study area mainly are from extratropical winter storms that, when combined with spring high tides, can cause severe beach and bluff erosion. The 1982-1983 El Niño winter storms resulted in permanent beach sand loss along the Encinitas coast that subsequently had a detrimental impact to bluff stability as bluffs became directly exposed to storm wave attack. Accelerated bluff toe erosion occurred in Solana Beach after the already limited beach sand was completely stripped away during the 1997-1998 El Niño season.

Historical extreme storm events are identified and included in **Table 1.8-5** primarily on the basis of their capacity to generate damaging waves to the study area. This placed the emphasis on long period swells approaching from their respective exposure windows, dictated in large part by wave set orientations and the location of the offshore islands. Deep water wave characteristics of extreme storms have been hindcasted and measured in deep water. Pertinent hindcasted extratropical storm waves in deep water were selected to characterize the extreme deep water ocean wave conditions, as presented in **Table 1.8-5**.

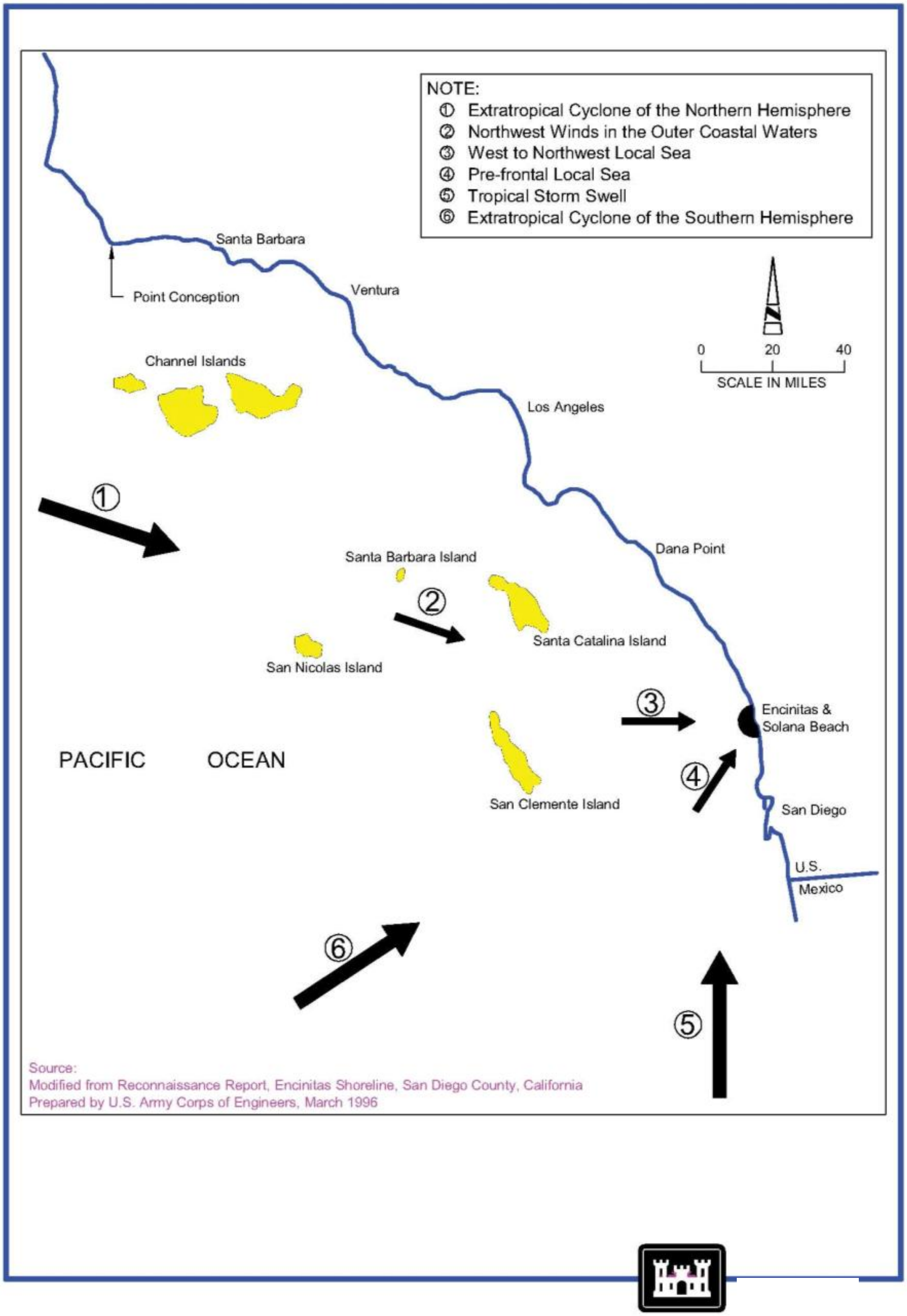


Figure 1.8-22 Meteorological Wave Origins Impacting Project Area

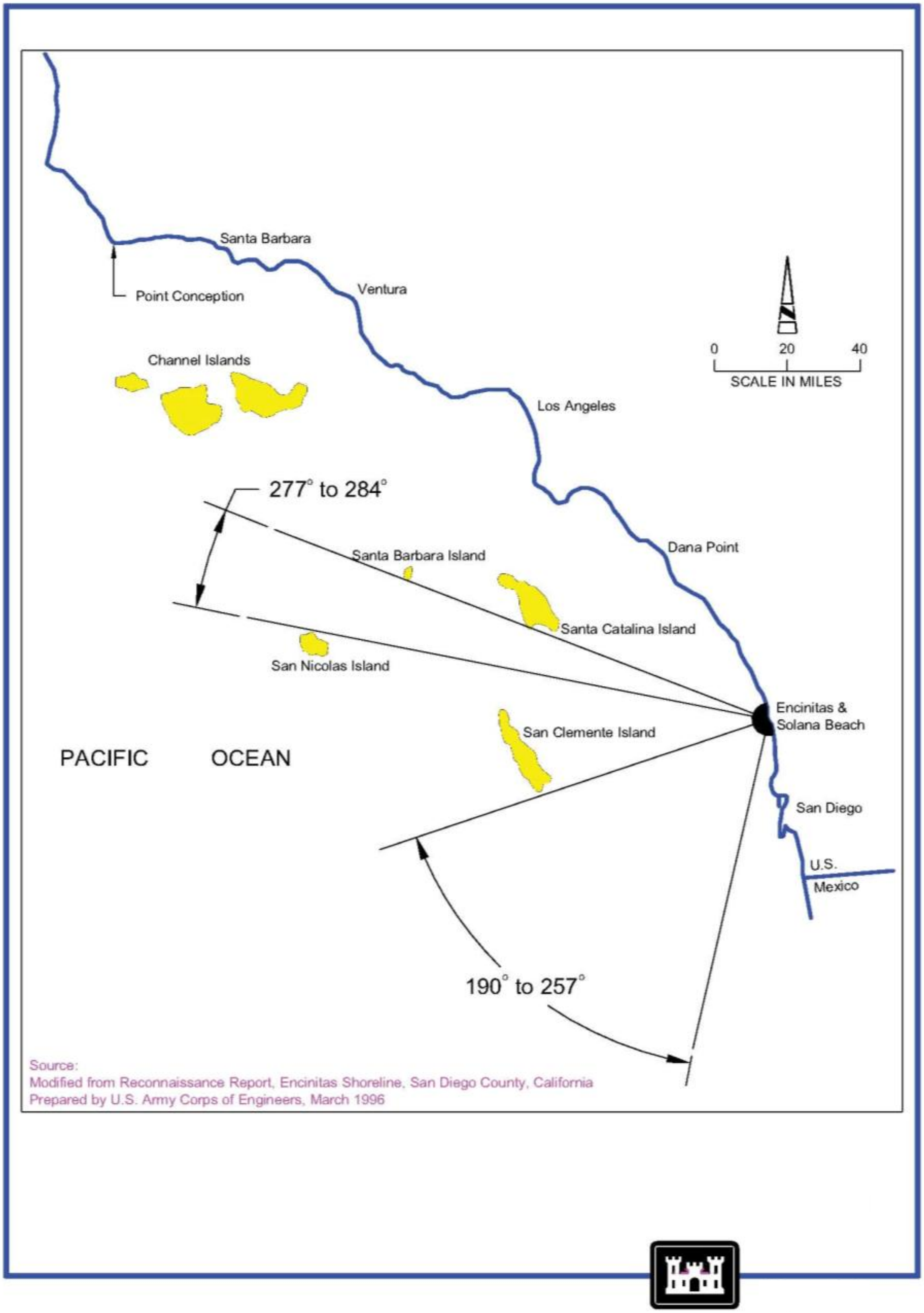


Figure 1.8-23 Wave Exposure Windows

Table 1.8-5 Hindcasted Extreme Extratropical Deep Water Wave Characteristics

Date of Storm	Significant Wave Height (ft)	Wave Period (sec)	Degree (min)	Date of Storm	Significant Wave Height (ft)	Wave Period (sec)	Degree (min)
12/31/79	17.4	16.9	286	3/1/91	16.4	12.7	277
2/17/80	17.8	12.7	254	2/11/92	14.8	12.7	269
2/20/80	21.4	15.3	265	1/18/93	14.4	10.5	241
1/22/81	18.2	16.9	277	2/9/93	14.2	15.3	277
1/29/81	19.4	12.7	275	1/5/95	18.1	8.7	288
12/1/82	22.3	12.7	298	1/11/95	16.5	13.9	280
1/27/83	22.9	15.3	287	2/3/95	14.1	16.9	278
2/13/83	19.4	16.9	278	3/12/95	19.3	15.3	273
3/2/83	30.3	16.9	270	2/1/96	13.8	10.5	257
12/3/85	18.6	15.3	286	12/7/97	13.2	9.5	229
2/1/86	17.7	16.9	282	1/30/98	21.7	16.9	287
2/16/86	24.7	16.9	258	2/1/98	16.9	16.9	279
3/11/86	22.2	16.9	286	2/4/98	23.0	16.9	280
3/5/87	13.4	13.9	267	2/7/98	19.3	13.9	266
12/17/87	17.0	16.9	283	2/18/98	22.5	16.9	282
1/18/88	32.3	13.9	290	2/21/00	17.5	12.7	280
2/4/91	14.8	16.9	277				

Nearshore Wave Characteristics

Deep water waves that enter the nearshore coastal portion of the study area are altered by offshore island sheltering, refraction, diffraction, and shoaling effects as they propagate towards the shoreline. The offshore islands, as illustrated in **Figure 1.8-23**, provide some sheltering from waves approaching from the deep ocean. As waves continue to propagate shoreward, the combined effects of refraction and shoaling must be accounted for when determining the nearshore wave characteristics.

Transformation of deep water ocean waves entering the nearshore coastal area of the study site was performed using a spectral back-refraction model (O'Reilly and Guza, 1991). The numerical model accounts for island sheltering, wave refraction and wave shoaling. **Table 1.8-6** shows the transformed nearshore extreme wave characteristics at Cardiff (Reach 7). These results were used to analyze historical trends in beach erosion and bluff retreat and to evaluate the effectiveness of alternatives. The representative nearshore station, where the hindcasted deep water wave characteristics were transformed to, is at 33^{o}0'30.5" N and 117^{o}17'3.9"W in a water depth of approximately 32.5 ft.

Table 1.8-6 Hindcasted Extreme Extratropical Nearshore Wave

Date of Storm	Significant Wave Height (ft)	Wave Period (sec)	Degree (min)	Date of Storm	Significant Wave Height (ft)	Wave Period) (sec)	Degree (min)
12/31/79	9.2	16.9	265	3/1/91	10.8	12.7	235
2/17/80	12.5	12.7	240	2/11/92	9.8	12.7	255
2/20/80	15.4	15.3	265	1/18/93	10.5	10.5	225
1/22/81	13.1	16.9	265	2/9/93	9.8	15.3	265
1/29/81	11.8	12.7	260	1/5/95	10.5	8.7	225
12/1/82	8.9	12.7	255	1/11/95	12.8	13.9	260
1/27/83	12.1	15.3	265	2/3/95	9.8	16.9	265
2/13/83	13.1	16.9	265	3/12/95	12.8	15.3	260
3/2/83	22.6	16.9	285	2/1/96	9.2	10.5	235
12/3/85	9.2	15.3	265	12/7/97	9.2	9.5	220
2/1/86	9.8	16.9	265	1/30/98	10.5	16.9	265
2/16/86	18.4	16.9	260	2/1/98	10.8	16.9	265
3/11/86	11.5	16.9	260	2/4/98	14.8	16.9	265
3/5/87	10.2	13.9	265	2/7/98	12.5	13.9	250
12/17/87	9.8	16.9	260	2/18/98	12.5	16.9	265
1/18/88	16.4	13.9	260	2/21/00	9.5	12.7	255
2/4/91	9.5	16.9	265				

Tsunamis

Tsunamis are long period waves caused by a large underwater disturbance such as an earthquake, volcanic eruption or landslide. Tsunamis cross the deep ocean as very long waves of low amplitude. Waves produced by tsunamis typically have a wavelength in excess of 100 miles with amplitude of 3 ft or more. The waves resulting from a tsunami can be significantly amplified by shoaling, diffraction, refraction, convergence, and resonance as they propagate towards the coast, namely due to the immense traveling wave speeds and lengths.

Historically, tsunamis have not significantly affected the study area. It is believed that local earthquake events will not produce underwater disturbances capable of generating significant tsunamis within this coastal region. Although historically tsunamis originating off the coasts of Chile and Alaska have threatened the southern California coastline, the impacts to the study area have been negligible. Investigations of the sediments above the banks of lagoons and estuaries in northern San Diego County indicate that substantial seismic events along local faults may have resulted in tsunamis more frequently than previously thought (Kuhn 2005). The frequency of events remains at a geologic scale. Therefore, the threat of coastal flooding resulting from tsunamis along the study area is considered low.

Currents

This section details the coastal and oceanographic currents affecting the water circulation patterns within the study area. These include currents offshore of the study area, alongshore currents (currents flowing parallel to the shoreline), and cross-shore currents (currents flowing perpendicular to the shoreline).

Offshore Currents

Offshore currents, including the California Current, the California Undercurrent, the Davidson Current, and the Southern California Countercurrent (also known as the Southern California Eddy), consist of major large-scale coastal currents, constituting the mean seasonal oceanic circulation with induced tidal and event specific fluctuations on a temporal scale of 3 to 10 days (Hickey, 1979).

The California Current

The California Current is the equatorward flow of water off the coast of California and is characterized as a wide, sluggish body of water that has relatively low levels of temperature and salinity. Peak currents with a mean speed of approximately 25 to 49 ft per minute occur in summer following several months of persistent northwesterly winds (Schwartzlose and Reid, 1972).

The California Undercurrent

The California Undercurrent is a subsurface northward flow that occurs below the main pycnocline and seaward of the continental shelf. The mean speeds are low, on the order of 10 to 20 ft per minute (Schwartzlose and Reid, 1972).

The Davidson Current

The Davidson Current is a northward flowing nearshore current that is associated with winter wind patterns north of Point Conception. The current, which has average velocities between 30 and 60 ft per minute, is typically found off the California coast from mid-November to mid-February, when southerly winds occur along the coast (Schwartzlose and Reid, 1972).

The Southern California Countercurrent

The Southern California Countercurrent is the inshore part of a large semi-permanent eddy rotating cyclonically in the Southern California Bight south of Point Conception. Maximum velocities during the winter months have been observed to be as high as 69 to 79 ft per minute (Maloney and Chan, 1974).

Alongshore Currents

Alongshore Currents are those nearshore currents that travel parallel to the shoreline extending throughout, and slightly seaward of, the surf zone. The alongshore currents in the coastal zone are driven primarily by waves impinging on the shoreline at oblique angles. The longshore sediment transport rate varies in proportion to characteristics of the regional wave climate and the directional predominance. The surf zone alongshore currents within the study area are nearly balanced between northerly and southerly flows and can attain maximum velocities of approximately 3 ft per second. Typically, summer swell conditions produce northerly drifting currents, while the winter swell from the west and northwest produce southerly alongshore currents. Overall, the persistence of the northerly drift occurs more frequently; but the greater wave energy associated with the winter storms generally results in a net southerly littoral drift.

Cross-shore Currents

Cross-shore currents exist throughout the study area, particularly at times of increased wave activity. These currents tend to concentrate at creek mouths and structures, but can occur anywhere along the shoreline in the form of rip currents and return flows of complex circulation. To date, no information is available that quantifies the velocities of these currents within the study area; however, studies have shown that the velocity of rip currents, in general, can exceed 6 ft per second (Dean and Dalrymple, 1999).

1.8.10 Littoral Processes

This chapter identifies the various sediment transport and littoral processes that are responsible for the movement of sediment along the coastlines of both the Cities of Encinitas and Solana Beach. Identifying the littoral processes and determining a realistic sediment budget for the project study locale requires an understanding of the quantification of sediment sources, sinks, and transport characteristics, the quantification and interpretation of past shoreline changes, as well as the shoreline response to artificial beach nourishment activities. The net rate of sand supply to a beach is one of the most important factors in determining the health of a given beach. The influx of sediment to the shoreline represents one element of the local sand budget while the loss of sediment represents the other. The difference between these two elements determines whether a beach is erosive or accretive. Knowing where the regional sand supply sources are and quantifying the contribution of each source is critical in fully understanding beach erosion issues such that viable strategic alternatives can be formulated and designed to alleviate them.

A littoral cell is defined as a geographically limited coastal compartment that contains sand inputs, sand outputs, and sand transport paths. The littoral cell is one of the most important concepts to utilize when analyzing the littoral processes of a coastal region. This is due to the fact that the geographic topography, the littoral sand supply, and the wave forcing are all inherent in its definition. Ideally, cells are isolated from each other to insure no exchange of sediment in either the upcoast or downcoast direction; thereby, simplifying the tracking of sand movement. However, in reality a proportion of sediment is typically transported between upcoast and downcoast cells. In instances where this occurs, it is important to quantify the net transport volume bypassed between adjacent cells.

Encinitas – Leucadia Subcell

The coastal zone of the project study area is located within the Encinitas – Leucadia subcell of the Oceanside Littoral Cell, which extends approximately 7.5 miles from the south jetty of the Batiquitos Lagoon entrance to the southern boundary of the City of Solana Beach, as illustrated in **Appendix B Figure 4.1-1.**. The encompassing Oceanside Littoral Cell is a 51-mile long coastal reach bounded on the north by Dana Point Harbor and the south by Pt. La Jolla. This littoral cell contains a wide variety of coastal features including coastal cliffs, headlands, beaches composed of sand and/or cobblestone, rivers, creeks, tidal lagoons and marshes, submarine canyons, man-made shore and bluff protection devices, and major harbor structures. Within the Encinitas-Leucadia subcell, the shoreline is mostly characterized as consisting of narrow sandy beaches backed by high seacliffs. During the past 20 years or so, the backshore and bluff tops of this subcell have experienced rapid residential and commercial development and artificial beach nourishment has been performed periodically at many locations as well.

Seasonal variations in beach width are typical within the Encinitas-Leucadia subcell. During the winter season, when the wave environment is energetic, sediment is transported from the beach area and is stored in an offshore bar formation. These sands then return to the beach throughout the summer when a more benign wave environment is present. During the Coast of California Storm and Tidal Waves Study for the San Diego County Region (CCSTWS-SD), beach profile data (USACE-LAD, 1991) indicated that the beaches experienced seasonal winter erosion in excess of 100 feet. A loss of beach width of this magnitude, when combined with the already narrow beaches, could lead to the seasonal disappearance of many of the sandy beaches within this subcell.

Historically, the net alongshore sediment transport in this region has been considered to be from north to south; however, recent increased wave activity from the south over the past 10 to 15 years has resulted in an increase in the northerly littoral transport, as compared with previous decades, thus decreasing the net flow of southerly littoral transport materials.

Shoreline Changes

Beach profiles within the study area have been surveyed along 15 transects. Historically, most surveys were performed through the Los Angeles District Army Corps of Engineers in support of beach erosion studies and the CCSTWS-SD. This effort resulted in data spanning from 1934 through 1989 at four distinct transects within the study area. These transects include (from north to south) CB-720, SD-670, SD-630, and DM-590 (USACE-LAD, 1991). In addition to the CCSTWS-SD transects, the City of Carlsbad sponsored spring and fall surveys along transect CB-720 from 1988 to 1996. From 1996 through the San Diego Association of Governments (SANDAG) Regional Beach Sand Project I (RBSPI) in 2001, the SANDAG has continued the surveying efforts initiated through CCSTWS-SD, with additional support from the Cities of Encinitas and Solana Beach.

Appendix B Table 4.2-1 presents the beach profile transect locations and their respective sponsors within the study shoreline, while **Appendix B Table 4.2-1** illustrates the survey transect locations in relation to the coastal zone of the study area and the nine established reach boundaries. The sporadic historical profiles range from 1934 to 1983. With the advent of the CCCSTWS-SD surveying efforts, beginning in 1984, surveys for each calendar year typically include a spring survey showing a depleted sand beach and a fall survey showing a well-developed sand beach. Each survey transect extends from the designated baseline to water depths of approximately 50 to 65 feet, MLLW. The complete plots of the surveyed profiles for each transect are presented in **Appendix BB**.

Mean Sea Level Beach Widths

The Mean Sea Level (MSL) beach widths were estimated from four of the CCSTWS-SD transects (CB-720, SD-670, SD-630, and DM-590) within the confines of the project study area of influence. The beach widths begin with the earliest known recorded survey performed in 1934 and extend through all survey efforts up until the year of 2001, which represents the comprehensive evolution of the MSL shoreline position for each respective transect.

The MSL beach width for the above referenced analyzed transects ranged between approximately 32 and 400 feet, respectively. The shoreline trends exhibited at Moonlight Beach (SD-670), Chart House (SD-630), and San Dieguito River (DM-590) appear to be comparable in both magnitude and seasonal variation while the MSL shoreline position at Batiquitos Beach (CB-720, the northernmost transect) is wider on a fairly consistent basis, although the seasonal variation follows a similar trend. The wider MSL shoreline trend of the Batiquitos Beach transect is consistent with the fact that the lagoon was once a historical fluvial contributor to Batiquitos Beach. As a result of urbanization and the completion of the Batiquitos Lagoon jetty construction in the 1990's, Batiquitos Beach is now a feeder beach where entrapped lagoon sediment is placed to ultimately nourish downcoast beaches. In fact, a portion of sediment dredged from the lagoon in 1998 and 2000 was placed on Batiquitos Beach.

With the exception of the Batiquitos Beach transect, the MSL shoreline position across the study area indicate widths range between approximately 65 and 200 feet. During depleted spring profile conditions, the MSL beach width typically ranges between 60 and 130 feet. When considering the gently sloping foreshore profile and the fact that high tide levels are several feet above the MSL elevation of +2.75 feet MLLW, the width of the dry beach above high tide is narrow to non-existent across a large proportion of the study area. Consequently, the toe of the coastal bluffs backing the sandy beach along most of the study area reaches are exposed to tidal and wave impacts over the potentially storm laden winter and spring months.

Mean Sea Level Shoreline Beach Widths from 1996 through 2009

The SANDAG and City of Encinitas sponsored transects that were surveyed during the spring of 1996 to 2009 were further analyzed in more detail to provide a better understanding of the more recent MSL shoreline fluctuations within the study area.

Appendix B Table 4.2-2 presents the MSL beach widths for each surveyed transect within the study area. Of particular note is the shoreline recession, and the associated shoreline rebound, exhibited after the El Nino season of 1997-98, which is evident in the Spring 1998 and the Fall 2000 MSL shoreline positions, respectively. Furthermore, the Spring 2001 MSL shoreline position represents the pre-nourishment condition prior to construction of the SANDAG Regional Beach Sand Project, and the Fall 2001 MSL beach width represents the initial post-nourishment monitoring survey.

From **Appendix B Figure 4.2-4** it is evident that the shoreline leading up to the 1997-98 El Nino event consisted of erosion ranging from approximately 65 feet followed by a subsequent rebound through the Spring 2000 survey. After the Spring of 2000, it appears as though the erosional trend has again resurfaced as almost all of the Spring 2001 MSL shoreline positions have migrated landward of their Spring 2000 locations. It is noted that at Moonlight Beach (SD-670), the City of Encinitas typically imports approximately 1,000 cubic yards to renourish the beach each spring (which may have been included in some of these surveys) and a rip rap revetment protects the Chart House (SD-630) transect, somewhat limiting the back beach shoreline position.

Moreover, it is interesting to note that at both Batiquitos Beach (CB-720) and Fletcher Cove (SD-600), the shoreline recovery exhibited after the passing of the 1997-98 El Nino season did not fully rebound to their respective Spring 1996 locations. Considering the fact that Batiquitos Beach acts as a feeder beach to the Encinitas and Solana Beach shoreline, sand deficits exhibited at this location typically results in the short-term accretion of downcoast beaches followed by a more substantial duration of erosion as the sediment supply from Batiquitos Beach becomes more depleted. The loss of beach width at Fletcher Cove in Solana Beach, approximately 20 feet since 1996, is also of particular concern as beach widths here are typically narrow to begin with and Fletcher Cove represents the main beach area in Solana Beach designed for recreational purposes.

From **Appendix B Figure 4.2-5** it is clear that the variation of the MSL shoreline position for the summer profiles within the project area are somewhat stable; although, the shoreline position eroded between 6 and 65 feet between the October 1996 and October 1997 surveys. Directly following the severe El Nino winter of 1997-98, the summer profile rebounded from the previous year approximately 66 feet. However, in the period ranging between October 1998 and October 2000, the shoreline position appears to have been in a recession by an average magnitude of approximately 15 feet per year. The relatively benign wave environment of the 2000-01 winter and summer seasons is evident as the summer profiles rebounded for all transects except for the Batiquitos Lagoon transect (CB-720).

Spatial shoreline fluctuations within the Encinitas and Solana Beach coastal zone were also analyzed. **Figure 4.2-4** illustrates the MSL shoreline position for each spring survey subsequent to, and including, the 1996 survey from Batiquitos Beach (CB-720) to the San Dieguito River (DM-590). The results indicate that the MSL beach width is rather narrow, as the MSL shoreline location along 95 percent of the study area ranges between 60 and 130 feet.

The annual spring fluctuation in the shoreline position between 1996 and 2001 was approximately 30 feet across the study area. In addition, it is interesting to note that the three transects exhibiting the narrowest MSL shoreline position are located at Beacon's Beach (SD-680), the Chart House in Reach 7 (SD-630), and Fletcher Cove (SD-600). Moreover, it may be inferred from the figure that the annual nourishment efforts performed by the City of Encinitas at Moonlight Beach (SD-670) have had a positive impact on the beach width in that location.

Finally, the entrapped sediment point source locations of both Batiquitos Beach and the San Dieguito River delta have exhibited wide fluctuations in the MSL shoreline position, comparatively speaking. For both transects (CB-720 and DM-590, respectively), the spring 1998 survey exhibited the most landward erosion followed by varying degrees of shoreline accretion leading up to the spring 2000 survey. Between the spring 2000 survey and the spring 2001 survey, the shoreline at both Batiquitos Beach and San Dieguito River delta eroded 7.5 and 83.0 feet, respectively. **Figure 4.2-6** essentially verifies that the shoreline erosion and accretion trends within the study area are directly related to the shoreline fluctuations and the nourishment activities occurring at these two entrapped sediment point source locations. Therefore, the health of the Encinitas and Solana Beach shoreline is dependent upon the magnitude of storm activity and the influx of sediment from both Batiquitos Beach and the San Dieguito River delta.

<u>Sediment Sources</u>

This section details the various sediment sources including river, stream and lagoon discharge, coastal bluff erosion, beach erosion, and artificial beach nourishment within the Encinitas-Leucadia subcell.

River, Stream and Lagoon Sediment Discharge

There are several river and lagoon sediment discharge points within the Encinitas-Leucadia littoral subcell. Moreover, numerous rivers and small streams discharge sediment into the surrounding Oceanside Littoral Cell as well. However, due to inland urbanization and the population growth of the region, the largest drainage basins are extensively regulated by the presence of dams and reservoirs; thereby, drastically limiting their coastal sediment delivery potential. It has been estimated that a fluvial delivery reduction of approximately 75 percent has occurred within the Oceanside Littoral cell as a result of these flood control restrictions

(California Department of Boating and Waterways (CDBW) and SANDAG, 1994). Fluvial delivery of sands and gravels between the Carlsbad submarine canyon and La Jolla was estimated to have decrease from 65,000 cy/yr to 5,000 cy/yr (USACE-LAD, 1991).

Three fluvial sources including the Batiquitos and San Elijo Lagoons, as well as the San Dieguito River are located within the study area or immediately adjacent to the study area. At Batiquitos and San Elijo Lagoons, it was estimated that the tributaries deliver approximately 820 and 6,900 cubic yards of sediment into the lagoon back basins, respectively (USACE-LAD, 1988). The current fluvial delivery is expected to be much less due to upland urbanization within the region. Furthermore, the delivered sediment settling in the backbay without migrating through the inlet areas does not provide any sand source to this littoral sub-cell. The maintenance dredging performed within the west and central basins of Batiquitos Lagoon and the inlet entrance at San Elijo Lagoon is primarily due to the entrapment of the tidalflood shoals developing in these areas. The volume of fluvial delivery to the project study area from the San Dieguito River was estimated to range from 620 to 13,000 cubic yards per year (Simons & Li, 1988 & 1985). Based upon the present drainage conditions resulting from urbanization and the associated construction of riverine control structures, the volume delivery would be at the low end of the estimated range.

Coastal Bluff Erosion

A large proportion of the steep coastal cliffs within the study area are geologically unstable due to the fact that most of them are comprised of sedimentary structures and not hard metamorphic and igneous rocks. However, a byproduct of coastal cliff failures resulting from the instability of the bluff is that sediment is directly supplied to the beach face; thereby, contributing a source of littoral sediment.

Previous estimates for the contribution of sediment from coastal bluff erosion differ; as failures are rather episodic in nature and the geological makeup of the cliffs vary depending upon their respective location within the project area. Based on literature review, the historical coastal cliff erosion rate within the project area range between approximately 0.2 and 0.4 feet per year. This corresponds to an erosion rate of approximately 20 to 40 feet per 100 years (AMEC, 2002 & USACE-LAD, 1996). Young and Ashford (2006) used airborne LiDAR to measure sea cliff retreat rates of 6 and 12 cm/yr for Leucadia and Solana Beach, respectively, with an average beach-sediment yield from the cliffs in the Oceanside littoral cell of 1.8 cubic meter/m-yr (0.8 cy/ft/yr).

The actual annual sediment contribution resulting from coastal cliff retreat may be estimated from the historic average bluff retreat rate, sand content of the bluff material, and the extent of any bluff toe protective devices. **Appendix B Table 4.3-1** presents the projected annualized volume of sediment contribution to the study area as well as the required information used to calculate the estimated volume.

The estimated annual volume of sediment contribution resulting from bluff erosion, presented in **Appendix B Table 4.3-1**, was calculated by multiplying the average retreat rate, bluff length, and bluff height for each reach. During the analysis, it was assumed that the bluff top would retreat and ultimately equilibrate to a more stable slope, as opposed to a total shearing off of the bluff face. As such, the estimated volumes were calculated accordingly. Once calculated, the volumes were adjusted to account for the percentage of sand within the bluff, as well as the percentage of existing toe protective devices.

The total estimated annual bluff retreat contribution of sediment for the entire study area is approximately 12,650 cubic yards per year. However, it should be noted that the sand percentages presented in **Table 1.8-7** includes a certain percentage of fine-grained material (e.g. less than 0.1 mm) that would most probably be suspended and carried offshore once exposed to wave and tidal activity. Fine-grained material could comprise as much as 10 to 20 percent of the sand percentages presented. It is noted that due to recent armoring at the bluff base, the annual sediment contribution from bluff erosion has been somewhat reduced.

Table 1.8-7 Estimated Annual Bluff Sediment Contribution

Reach	Average Retreat Rate (ft/yr)	Average Length of Bluff (ft)	Average Height of Bluff (ft)	Percent of Sand Content (%)	Percent of Toe Protective Device (%)	Annual Sediment Contribution (cy/yr)
1	0.25	6,500	65	69	18	1,100
2	0.36	1,800	90	67	45	400
3	1.20	580	90	78	70	1,200
4	1.0	2,500	80	79	10	2,800
5	0.56	5,200	90	61	30	2,100
6	0.62	5,800	80	50	60	1,100
7	N/A	N/A	N/A	N/A	N/A	N/A
8	1.0	3,500	80	79	50	1,900
9	1.0	4,100	75	78	50	2,100

Source: USACE-LAD, Appendix D, 2003

Artificial Beach Nourishment/Sand Bypassing

Artificial beach nourishment and sand bypassing have occurred on numerous occasions within the Encinitas-Leucadia subcell. In 1997, the Batiquitos Lagoon Enhancement Project was completed in order to restore the natural environmental lagoon habitat. This project placed about 1.8 MCY of sandy dredge material within the Encinitas-Leucadia subcell. In addition, on-going maintenance dredging of the lagoon for this ecosystem restoration project, has placed approximately 161,000 cubic yards of sand downcoast at Batiquitos Beach (SD-680). **Table 1.8-8** presents the volume of dredged material, as well as the placement quantity for each dredging cycle at Batiquitos Lagoon.

Table 1.8-8 Maintenance Dredging and Beach nourishment Volumes Near Batiquitos Lagoon

Year	Bypass Volume (yd^3)	Note
1994-1997	1,800,000	Lagoon Restoration
1999	6,000	Placed south of entrance
2000	4,000	Placed south of entrance
2001	45,000	Placed south of entrance
2007	66,000	Placed south of entrance
2009	40,000	Encinitas Resort Hotel

Source: Coastal Frontiers Corporation

The San Diego Association of Governments (SANDAG) Regional Beach Sand Project I (RBSPI) was constructed during the summer of 2001. This project resulted in the placement of approximately 600,138 cubic yards of beach nourishment sands within the Encinitas and Solana Beach project study area. **Table 1.8-9** presents the SANDAG RBSPI beach nourishment placement locations and quantities within the study area.

SANDAG's RBSPII is expected to place up to 2.3 million cubic yards of sand at 10 receiver sites in San Diego County, with 587,000 cubic yards proposed for the study area. **Table 1.8-9** show the RBSPII preferred Alternative 2-R beach nourishment locations and quantities within the study area (AECOM et. al, 2011).

Table 1.8-9 SANDAG Regional Beach Sand Project Nourishment Characteristics

Receiver Site	Reach	Volume cy	Fill Length ft
Batiquitos Beach	1	116,923	1,600
Leucadia Beach (Beacon's)	1/2	131,837	2,300
Moonlight Beach	4/5	105,211	1,200
Cardiff Beach	7	100,510	900
Fletcher Cove	8/9	145,657	1,900

Source: NCI, 2001

Table 1.8-10 RBSPII Nourishment Characteristics

Receiver Site	Reach	Volume (yd^3)	Nourishment Length (ft)
Batiquitos Beach	1	118,000	Identical to RBSPI
Leucadia Beach (Beacon's)	1/2	117,000	Identical to RBSPI
Moonlight Beach	4/5	105,000	Identical to RBSPI
Cardiff Beach	7	101,000	Identical to RBSPI
Solana Beach (Fletcher Cove)	8/9	146,000	Identical to RBSPI

Source: AECOM

Appendix B Figure 4.3-1 presents the pre-nourishment and 3-month post-nourishment MSL beach widths surveyed in May and October of 2001, respectively, as well as the previous October 2000 MSL beach width to better differentiate between the seasonal shoreline fluctuations and the beach nourishment accretions. A notable increase in MSL beach width is evident at Batiquitos Beach (CB-720), Beacon's Beach (SD-680), Moonlight Beach (SD-670), Cardiff Beach (SD-630), and Fletcher Cove (SD-600) between the pre-nourishment (May 2001) and the 3-month post nourishment (October 2001) surveys. Furthermore, the post nourishment (October 2001) shoreline position is seaward of that of the previous October 2000 survey for the entire study area. This figure illustrates the immediate benefits of beach nourishment within this shoreline segment.

A number of smaller scale localized nourishment projects have also been performed within the study area. The City of Encinitas provides an annual beach nourishment of approximately 1,000 yd^3 to Moonlight Beach each spring and the mouth of the San Elijo Lagoon is periodically dredged to maintain adequate tidal flushing on an as-needed basis. This typically results in approximately 5,000 yd^3 of material placed south of the Lagoon each episode. Moreover, since October 1986, the San Elijo Lagoon has supplied an approximate average annual bypassing volume of 14,860 cubic yards to the immediate downcoast adjacent shoreline. **Table 1.8-11** shows the annual volume of the past downcoast beach nourishment related to the maintenance of the San Elijo Lagoon entrance. A detailed log of each dredging episode is presented in **Appendix C2**. It should be noted that the sediment dredged at the lagoon entrance cannot be credited as a sediment source as the deposited sediment originates from the partial reduction of the natural longshore sediment transport and not from upland fluvial sources. In addition, in the spring of 1999, approximately 51,000 yd^3 of sand was placed at Fletcher Cove as a result of the Lomas Santa Fe Grade Separation Project (AMEC, 2002).

Table 1.8-11 Estimated Annual Volume Dredged From San Elijo Lagoon Entrance

Year	Annual Volume (yd^3)	Year	Annual Volume (yd^3)	Year	Annual Volume (yd^3)
1986	2,000	1995	6,000	2004	30,000
1987	4,000	1996	8,000	2005	17,000
1988	4,000	1997	31,000	2006	18,000
1989	3,000	1998	12,000	2007	19,000
1990	4,000	1999	17,000	2008	23,000
1991	4,000	2000	23,000	2009	19,000
1992	3,500	2001	23,000	2010	21,000
1993	7,500	2002	18,000		
1994	20,000	2003	32,000		

Source: San Elijo Lagoon Conservancy, 2002 and Coastal Frontiers Corporation, 2010

Beach Erosion

Beach erosion is typically associated with the landward migration of the shoreline and the associated reduction of dry beach width. The corresponding sediment losses on a beach can actually provide a sand source for downdrift beaches. Quantifying the magnitude of the sand volume fluctuations across each profile transect is critical in determining the rate of beach erosion within the study area, which thereby allows for an adequate representation of the associated sediment budget.

During the CCSTWS-SD investigation, it was estimated (USACE-LAD, 1991) that the beaches within the vicinity of the Encinitas-Leucadia subcell experienced an average retreat rate of 1.0 to 2.0 feet per year from 1940 to 1960, an average annual advance of 3.0 to 4.0 feet per year between 1960 and 1980, and an average retreat of 1.0 to 2.0 feet per year after 1980. These findings are consistent with the environmental characteristics and the human interventions that occurred along this littoral cell during their respective time periods.

In order to quantify the change in sand volume density across the project study area, the annual depleted spring MSL shoreline beach widths at Batiquitos Beach (CB-720), Beacon's Beach (SD-680), Moonlight Beach (SD-670), Chart House (SD-630), and Fletcher Cove (SD-600) were analyzed for the period ranging from 1996 to 2001. This period was chosen to illustrate the volumetric fluctuations occurring as a result of the 1997-98 El Nino event, as well as the intermediate-term volumetric fluctuations subsequent to the relative rebound of the MSL shoreline position after the spring 1998 survey.

The changes in volume density between relevant surveys at each above-referenced transect were analyzed by employing the volume change-to-shoreline advance or retreat ratio (V/S) developed during the CCSTWS-SD study (1991). A V/S value of one implies that there is one cubic yard of volume change for one-foot of beach advancement or retreat per lineal foot of shoreline. In the CCSTWS-SD analysis, the shoreline movements (S) were referenced to the MHHW location (+5.4 feet, MLLW) while the volume changes (V) were measured from the profile baseline location to various water depths. The V/S ratio for both all available data and extreme event data exclusively was estimated for all of the different shoreline reaches in San Diego County. Within the Encinitas-Leucadia sub-reach, the V/S ratio to reference depths of -10, -30 and -40 feet were between 0.222 to 0.463 cubic yards per foot for averaged long-term conditions and between 0.629 and 0.726 cubic yards per foot for short-term extreme events (USACE-LAD, 1991, Table 3-6).

Based on both the previous CCSTWS-SD surveys and the recent SANDAG surveys within the study area, the average depth of closure (or depth at which net sand movement in the cross-shore direction does not produce measurable depth change) is approximately -30 feet, MLLW. For this reason, the V/S ratio corresponding to this reference depth for the Encinitas-Leucadia sub-reach was employed. **Table 1.8-12** presents the results of the volumetric density changes across the Encinitas and Solana Beach project study area from Spring 1996 to Spring 2001.

Table 1.8-12 Estimated Average Annual Sediment Contribution Due to Beach Erosion/Accretion (1996 to 2001)

Transect	Location	Annual Cross-Sectional Volume (CY/ft/yr)	Annual Volume (CY/yr)
CB-720	Batiquitos Beach	-0.338	-1,500
SD-680	Beacon's Beach	+3.000	+22,000
SD-670	Moonlight Beach	+0.241	+2,400
SD-630	Chart House	+0.289	+3,000
SD-600	Fletcher Cove	-0.272	-1,900

The annual volumes presented in **Table 1.8-12** are based upon a V/S ratio of 0.222 cubic yards/foot for all available data. Shoreline advance is denoted by a plus (+) sign while shoreline retreat is represented by a minus (-) sign. Summing the estimated annual volumes calculated between 1996 and 2001 for the project study area yields a net beach accretion of 24,141 cubic yards per year. The beach accretion at Beacon's Beach (Transect SD-680) is probably due to the dispersive effect of the feeder beach that was established at Batiquitos Beach after the 2000 maintenance dredging at Batiquitos Lagoon, as stated in **Section 4.3**.

In order to assess the coastal erosion impacts resulting from the 1997-98 El Nino event, a similar set of calculations was performed from Spring 1996 to Spring 1998. **Table 1.8-13** presents the results of this analysis. The annual volumes presented in **Table 1.8-13** have been annualized for the interim 2-year (1996-1998) period of record and are based upon the extreme event V/S ratio of 0.629 cubic yards per foot. Summing the estimated annual volumes yields a net beach erosion of 68,315 cubic yards per year occurring over the storm laden 1997-98 El Nino event. However, it should be noted that surveys were not performed at Beacon's Beach (SD-680) until 1999; therefore, potential volumetric gains, resulting from the feeder beach at Batiquitos Beach, are not represented in this extreme event analysis.

Table 1.8-13 Estimated Average Annual El Nino Event Sediment Contribution Due to Beach Erosion/Accretion (1996 to 1998)

Transect	**Location**	**Annual Cross-Sectional Volume (cy/ft/yr)**	**Annual Volume (cy/yr)**
CB-720	Batiquitos Beach	-5.81	-42,500
SD-680	Beacon's Beach	no data	no data
SD-670	Moonlight Beach	-0.75	-10,700
SD-630	Chart House	+0.90	+10,100
SD-600	Fletcher Cove	-3.67	-25,400

Sediment Sinks

This section details the various sediment sinks located within the Encinitas and Solana Beach study area, which are ultimately responsible for the loss of sediment within the system. When sand enters into a sediment sink, the material is lost and will not return to the beach without some form of human intervention. For this reason, it is important to quantify the deficit imposed on the system. The sediment sinks located within the Encinitas-Leucadia subcell include entrapment caused by lagoons and offshore losses.

Lagoon Entrapment

As described previously, several lagoons and marshes exist along the Encinitas-Leucadia subcell, namely Batiquitos and San Elijo Lagoons and the San Dieguito River delta to the south. With the exception of small storm-induced overwash and the formation of small flood-tide deltas, the quantity of entrapped alongshore transported sediment updrift of the tidal entrances is not presently significant in this littoral subcell. However, due to sedimentation, the lagoon and river mouths are periodically dredged to ensure adequate tidal flushing; thereby, resupplying good quality beach sand to adjacent beaches.

Offshore Losses

The offshore transport of sediment typically results from large storms that carry sediment offshore through unusually large cross-shore currents. It is possible that the sediment has been deposited so far offshore that the sediment does not migrate back to the shoreline. The fact that the San Diego shoreline erosion began after 1983 probably demonstrates the above-described offshore sediment transport that resulted from the clustering extreme storms occurring during the 1982-1983 El Nino year.

Estimates of the actual quantity of sediment carried offshore by the processes defined above are difficult to quantify; however, it has been estimated that as much as 26,000 to 113,000 cubic yards of sand per year could be deposited offshore as a result of rip currents (Tekmarine, 1987). In addition, based on an extensive evaluation of bathymetric information obtained from survey data extending from 1934 to 1972 presented in CCSTWS-SD, it appears as though approximately 1,000,000 cubic yards of sediment has been deposited at water depths ranging from 30 to 120 feet offshore of the project study area (USACE-LAD, 1991). This correlates to an approximate annual offshore sand loss of approximately 25,650 cubic yards per year across the Encinitas and Solana Beach study area.

Alongshore Littoral Transport

This section summarizes the alongshore transport rate potential for the Encinitas-Leucadia subcell developed, in part, during the Coast of California Storm and Tidal Waves Study for San Diego County. As discussed previously, the net alongshore transport rate within the study area has been substantially impacted over the years through human intervention. Prior to 1978, these impacts were not readily noticeable due to the relatively benign wave climate extending from approximately 1945 through 1978. Coincidentally, this time period also corresponded with an unprecedented degree of coastal development along the Encinitas and Solana Beach study shoreline, as well as the entire San Diego County coastal region. This development included the rapid urbanization of coastal bluffs, the development of two harbors (Oceanside and Dana Point), one coastal power plant (Encinitas at Agua Hedionda Lagoon), and the construction of numerous groins, jetties, seawalls, and blufftop residences.

The benign wave environment heading into the late 1970's, coupled with the relatively large quantity of nourishment sands placed along the coast during the 1960's, yielded a somewhat healthy and stable regional shoreline until the early 1980's. The relatively mild and seasonably predictable wave climate of the uniform epoch of 1945 to 1978 was followed by a period of more variable and, at times, far more intense wave events. Most notably, these events occurred during the winters of 1979-80, 1982-83, and 1997-98. As stated previously, the winter of 1982-83 was particularly severe as a series of clustering storm events occurred. In addition, the yield of sediment from upland rivers and streams decreased dramatically due to the construction of dams and the concretization of flood control channels. Consequently, sand depletion alongshore the study shoreline area began after the 1982-1983 El Nino season.

Estimates suggest that an average net southerly littoral alongshore transport rate of between approximately 100,000 to 250,000 cubic yards per year occurred from 1945 to 1977 (Techmarine, 1987 & USACE-LAD, 1991). It was also estimated under the same study that from 1978 to the late 1980's, the net southerly transport rate decreased to between 0 and 40,000 cubic yards per year. The reduction of the net alongshore littoral transport is probably attributed to the increasing occurrence of the southerly swell pattern during the 1980's period or the historical wave data prior to 1978 did not fully comprise all wave patterns that include both the northwest and southerly swells. During a recent study, conducted by the City of Encinitas, for the relocation of the San Elijo Lagoon inlet, the average net southerly littoral transport potential at Cardiff was estimated to be 56,175 cubic yards per year, which was based upon wave climate data extending from 1978 to 1994 (Coastal Environments, 2001). It should be noted that the ability of these estimated rates to move sand is severely limited by the overall deficit of sand available for transport. Therefore, the natural alongshore transport potential in response to the regional oceanographic environment is not performing at its true capacity.

<u>Cross-Shore Littoral Transport</u>

The cross-shore transport of sand refers to the seasonal and episodic fluctuations of the beach profile as sands shift to equilibrate with the incoming wave environment. The offshore location where little net sediment transport occurs beyond is known as the depth of closure.

While the alongshore sediment transport is primarily due to the wave-induced alongshore current, the cross-shore sediment transport is a result of the water particle motions under the influence of waves and the formation of near shore circulation cells and rip currents. Seasonal shoreline changes are considered to be in response to the greater incidence of storms during winter and the associated seaward sand transport and storage in near shore bar formations (Dean and Dalrymple, 1999). With the increased wave heights associated with storms, the bar typically forms farther offshore and is larger in size. The larger offshore bar formation requires a greater volume of sediment, which is provided in part by erosion of the subaerial portion of the beach.

Evidence indicating the transport of sediment across the shore face within the study area is illustrated in the beach profile surveys. For the most part, the shapes of these beach profile surveys show the seasonal cross-shore sand fluctuation. In addition, possibly contributing to the cross-shore sand transport within the study area is the contribution of cross-shore currents that could transport sediment offshore during storm events. Cross-shore currents are essentially jets of water that emanate through the breaker line of the surf zone that have the ability to carry with them wave suspended sediment. It was estimated in the CCSTWS-SD study that as much as 25,650 cubic yards of sand could be lost each year within the study area as stated in **Section 4.4.2**.

Sediment Budget

The shoreline trends along the beach essentially dictate the conceptual sediment budget for the region of interest. If beaches are eroding the sediment budget has a net deficit of sand (i.e., more sediment is being lost than gained); however, if beaches are accreting, the sediment budget has a net surplus of sand (i.e., more sediment is being gained than lost). When beaches are stabilized and no net accretion or erosion is occurring along the shoreline, the sediment budget is balanced. In order to develop the sediment budget for the Encinitas and Solana Beach project study area, all of the sand inputs (sources), outputs (sinks), littoral transport paths, and storage capacities quantified in the previous sections have been compiled and combined.

Historical

Prior to 1940, the San Diego County coast experienced periods of relatively abundant sand supply following large sand injections from river floods due to the upland absence of channel concretization and damming. In addition, since the alongshore sediment transport was not disrupted by shore perpendicular coastal structures, the beaches within the Encinitas and Solana Beach coastal zone were relatively stable. Between 1960 and 1978, the effects of man-made coastal structures, namely at Oceanside Harbor and Agua Hedionda Lagoon, had a subtle impact on the stability of the coastal beaches within the project study area as the predominant storm and wave events during this period were fairly benign. However, from 1978 through to the present, a period during which extreme wave episodes have been well above average when compared to other periods over the past century, human intervention in the form of coastal structures and upstream dams on major rivers has had a profound impact on the now erosive nature of the beaches of Encinitas and Solana Beach. As a result, the average net transport rate was estimated to be between 40,000 and 56,175 cubic yards per year to the south in the project study area since the early 1980's (USACE-LAD, 1991& Coastal Environments, 2001). The CCSTWS (USACE – LAD, 1991) report estimates net transport alongshore into this sub-cell as 270,000 cy/yr for the two pre-1980 sediment budget time periods.

Present

The above referenced historical sediment budget quantities indicate that the health of the Encinitas and Solana Beach coastal region is largely dependent upon the wave climate and the degree of human intervention. It is evident from the analysis of the sediment budget that human activity within the influence of the coastal zone has had both negative and positive effects on the beach width within the study area. The negative impacts have been due primarily to poor watershed management practices and, to a lesser extent, the construction of Oceanside Harbor, which have significantly reduced the sand supply within the Encinitas and Solana Beach study area by curtailing both the flood waters and by disrupting the natural flow of the alongshore littoral transport. In order to mitigate the losses associated with the reduction in the delivery of sediment to the coastal zone, beach nourishment efforts have been instituted at several locations within the study area. These nourishment efforts have resulted in the placement of approximately 783,200 cubic yards of sand along the Encinitas/Solana Beach shoreline to date. The replenishment includes the regular sand-bypassing at Batiquitos Lagoon since 1998, annually imported material at Moonlight Beach for the past ten years, an opportunistic sand placement at Fletcher Cove, and the 2001 SANDAG RBSPI project.

Although these artificial nourishment efforts have had some positive effects, the sediment budget is currently in a net deficit, which is expected to continue into the future without some form of remediation. In fact, for the period ranging between 1996 and 2001, but prior to the SANDAG Regional Beach Sand Project, the project study area beaches exhibited a net deficit of approximately 9,767 cubic yards per year, assuming that the fluvial delivery from the San Dieguito River contributed to this subcell. The total sediment deficit within the project area was first derived by summing the total annual volumes for the fluvial contribution, coastal bluff contribution, and the artificial beach nourishment contribution, which yields a value of 33,900 cubic yards per year. It is noted that the by-passing volume at Batiquitos Lagoon in 2002 and the nourished material from the SANDAG Sand Project are not included in the computation as the beach profile comparison is from April 1996 to April 2001. The SANDAG Sand Project in the Encinitas/Solana Beach shoreline segment did not commence until June 2001. **Table 1.8-14** details the itemized sediment budget quantities over the course of this 5-year period.

Table 1.8-14 Encinitas and Solana Beach Sediment Budget Analysis (1996 to 2001)

Coastal Process Component	Estimated Annual Volume (cy/yr)
Fluvial Contribution	+621
Coastal Bluff Contribution	+12,700
Artificial Beach Nourishment/Sand Bypassing	+20,600
Total sand sources	+33,900
Net Beach Gain from 1996 to 2001	+24,200
Sediment Loss within Subcell	-9,700

Notes: + denotes gain and – implies loss

As a result of the sand deficient beaches, storm and wave events impinge directly upon the base of the bluffs causing them to erode and eventually fail. Over the years, numerous blufftop homeowners have constructed bluff stabilization structures in the form of seawalls to maintain the integrity of the bluffs, thereby protecting their homes. In addition, severe bluff failures resulting in a total shearing off of the bluff face are extremely dangerous to recreational beach users as well as the blufftop residents. In the year 2000, a severe block failure resulted in a fatality. For these reasons, it is important to mitigate for the loss of sediment that historically was present along the Encinitas and Solana Beach shoreline.

Future

The health of the Encinitas and Solana Beach shoreline is dependent upon the magnitude of storm activity and the influx of sediment from both Batiquitos Beach and the San Dieguito River delta. The Coast of California Storm and Tidal Waves Study for the San Diego County Region (1991) predicted that extensive damage and loss of property would occur over the next 50 years resulting from the loss of beach width and the associated coastal bluff retreat. With the fairly thin sand lens, measured in the nearshore and offshore zone (USACE-LAD, 1988), that is likely to be severely depleted during the winter season, it is almost certain that the bluff toe erosion will continue along the Cities of Encinitas and Solana Beach in the absence of protective beach sands at the base of the bluff. Furthermore, in Cardiff, without a moderate sandy beach fronting the restaurant buildings and Highway 101, the dwellings and highway are vulnerable to storm damage and wave overtopping. As a result, this coastal engineering analysis models the potential without project future erosion scenarios within each reach of the study area over the next 50 years.

1.9 Existing Economic Conditions

Existing economic conditions are used in the analysis of this study to compare current without project conditions to with project conditions. Economic analysis assists in plan formulation in determining the tentatively recommended plan. The following information is a summary of existing economic conditions within the study area. A more detailed analysis can be found in Appendix E.

1.9.1 Population

Table 1.9-1 summarizes pertinent information regarding income and effective buying power by household in the study area. Approximately 75-percent of workers in San Diego County are listed as private wage and salary workers. Government workers comprise another 16-percent while another 8.7-percent are self-employed in non-incorporated businesses. Less than one-percent (0.3%) is classified as unpaid family workers. Slightly more than 12-percent of the county population was living below the poverty level in 2009. As shown in **Table 1.9-1**, the per capita income and median household income in both study area municipalities are substantially higher than figures for the county and state.

Table 1.9-1 Income Levels by Household, 2009

Income Distribution	Encinitas	Solana Beach	San Diego County	California
Total Households	23,250	5,773	1,040,945	12,177,852
Less than $15,000	1,530	398	95,136	1,248,099
$15,000 – $24,999	1,245	528	90,109	1,141,560
$25,000 - $34,999	1,457	585	92,016	1,118,718
$35,000 – $49,999	2,420	594	133,991	1,541,545
$50,000 - $74,999	3,292	488	185,522	2,164,891
$75,000 or more	13,306	3,180	444,171	4,963,039

1.9.2 Structure Count/Valuation

Surveys of the study area, along the shoreline, show 328 separate parcels and 291 structures. Of these 291 structures two-thirds, or 193 structures, currently do not have private seawalls. Structure valuation is based on a complete visual survey of all structures in the study area to estimate structure quality and condition. Structure values were higher on average in Solana Beach (Segment 2) primarily because structure size tended to be larger. This larger structure size is primarily a result of the how the analysis was performed since all condominium and apartment complexes were evaluated at the structure level rather than at the individual unit level. Solana Beach has a relatively high share of medium to large condominium and apartment structures while Encinitas has a smaller share. In contrast, single family residential structures are of similar size among both communities. Structure values are roughly $400,000 on average in the study area, which can be attributed to good to excellent construction quality, minimal deferred maintenance and repair, and an average structure size of 2,500 square ft for single family residences and 13,700 square ft for condominium structures.

1.9.3 Setback Distance

Setback distance is the shortest distance between the structure and bluff edge. For undeveloped parcels it is the span of the parcel from bluff-top edge to the opposite end of the parcel. As erosional events occur, the setback distance shortens and the lost parcel area is determined during the modeling conducted to project future without project conditions. Setback distance varies considerably from as little as one foot between structure and bluff edge to as much as 756 ft. Parcels with small setback distances generally have seawalls with some exceptions. Parcels near the maximum setback distance are atypical and do not have seawalls. The typical setback distance is around 30 ft and a large share of structures are within 15-40 ft from the bluff edge.

Conditions Prompting Seawall Construction

All seawall permits must be evaluated and approved by the California Coastal Commission (CCC). The CCC administers the federal Coastal Zone Management Act in California. The CCC provided permitting information for all 48 seawall permit applications filed within the study area from 2000 to 2010. Of those 48 applications, 4 were denied, 2 were pending, 2 were withdrawn, and 6 were listed as "no objection" but without setback distance. The remaining 34 permits that were approved, had seawalls constructed, and had the setback distance listed on the permit. This analysis showed seawalls have been approved and built when setback distance was as great as 35 ft and as little as -1 ft indicating at least a portion of the structure had been undermined. Three quarters were constructed when the setback distance was between 6 and 25 ft. The average setback distance was 16.2 ft but with considerable variation. No distinction was made between Encinitas and Solana Beach (Segment 1 & 2) because the sample of 34 permits could not be divided into smaller subsamples while retaining statistical significance. As a result the information was used to develop a typical condition that prompts property owners to seek permits to construct seawalls across the study area. This analysis is further described in Appendix E.

1.9.4 Recreation

Recreation is an important component of the without project condition in comparison to the with project condition. Recreation analysis assesses without project recreation values by using the Unit Day Value (UDV) method outlined by ER1105-2-100 and IWR Report 86-R-4. Unit Day Values were assigned using the *Guidelines for Assigning Points for General Recreation*[3] and in consideration of expert opinions by local lifeguards from both cities and San Elijo State Park. Moonlight Beach in Encinitas hosts a significant share of the total recreation visits to the study area and has a large number of recreation facilities.

Recreation demand is met in the following manner. First, demand is met by visitations to the dry beach. These visitations are distributed among off peak days, peak weekdays, and peak weekends and are assigned unit day values based on the average level of crowding (square ft of dry beach per visitor). To derive the crowding level during the off-peak season, for instance, the total visitation demand during off-peak season is divided by the number of off-peak days to determine the average visitors per day. Then the average number of visitors per day is divided by the turnover rate to determine the average number of visitors on the beach during the course of the day. Finally, the beach area is divided by the average visitors on the beach to determine the level of crowding (square ft per visitor). The crowding level is not allowed to fall below 30

[3] EGM #11-03

square ft per person on the dry beach because previous USACE studies have indicated beach visitors prefer to transfer to another location at around this level of crowding. When there is excess demand that would lead to crowding beyond this cut-off.

Visitors transfer to the wet beach rather than go to an off-site dry beach because historical attendance patterns show visitations have occurred on wet beaches, particularly during the winter when the beach area is smaller due to seasonal variations. Once visitors transfer to the wet beach, the same process used on the dry beach is used to determine the level of crowding on the wet beach. However, since wet beach recreation is generally inferior to the opportunity for both dry and wet beach recreation, visits to wet beaches are given one fixed UDV that is below the minimum dry beach UDV. Finally, when overcrowding occurs on the wet beach, potential visitors transfer to an off-site beach.

The recreation analysis under without project conditions reveals that recreation values peak at around 2050 under low sea-level rise scenario for Reaches 3-5. This peak is due to the confluence of increasing recreation demand and minimum to moderate crowding levels. Throughout the remainder of the study period recreation values gradually fall because eroding beaches lead to higher crowding levels, which in turn cause UDV to decrease moderately and some visitors to transfer to offsite beaches. This same process occurs under the high sea-level rise scenario except earlier in the study period, around 2020, when recreation values peak. As expected, the beach erosion under high SLR scenario reduces recreation values sooner and more significantly.

Recreation values in Reaches 8-9 under the low SLR scenario continue to increase gradually during the period of evaluation with the increase in demand. Historically, much of the recreation has occurred on wet beaches in this area and consequently we do not see the drop in recreation values associated with a shift from recreation on a dry beach to recreation on a wet beach.

2 NEED FOR AND OBJECTIVES OF PROPOSED ACTION

2.1 Purpose and Need

The purpose of the Encinitas-Solana Beach Coastal Storm Damage Reduction Project is to effectively reduce risks to public safety and economic damages associated with bluff erosion and to restore beaches along the shorelines of the cities of Encinitas and Solana Beach.

The need for the proposed action is that ongoing bluff erosion and storm surge along unprotected shorelines will result in structural damages and threats to public safety, infrastructure damages, and catastrophic damage to occupied buildings; and ongoing beach erosion will also result in reduced recreational use of beaches. In addition to real estate damages to occupied residences caused by bluff retreat, continued erosion would threaten public infrastructure, including roads and utilities, land loss, continued private seawall construction, and public and private structure loss. Based on the findings from the without project conditions analysis, approximately 2.9 miles of the study area was determined to have sufficient economic damages and suitable coastal characteristics to justify construction of project alternatives.

Continued bluff erosion and narrowing of the beach also presents a threat to public safety because of potential bluff collapse that would present a hazard to visitors because of continued wave attack on the base of the bluff and proximity of visitors to the bluff on a narrow beach.

2.1.1 Problems

PROBLEM STATEMENT: The Encinitas - Solana Beach shoreline has narrow beaches with coastal bluffs exposed to crashing waves, particularly during the winter storm season. As sea levels rise, the bluffs will be even more exposed to crashing waves, which carve notches into the bluffs. Bluffs affected by these notches are then prone to episodic collapse. Consequently, public facilities and residential properties on the upper bluff experience land loss and damages to the property. In addition to this problem, the study area also has high demand for recreation while the narrow beach area combined with bluff failures represent a significant safety issue for those recreating.

Bluff Erosion and Public Safety

Bluff erosion is caused by wave action against the base of the bluff (see **Figure 2.1-2**) and/or water infiltration (rainfall and landscape irrigation) from above, undermining the bluff. Several structures have collapsed due to catastrophic bluff failure. **Figure 2.1-2** shows a bluff failure caused by bluff erosion in 1996.

Due to the nature of soil cementation and stress factors, these failures usually occur when the soil is drying out in the summer months, when there is little rainfall or wave activity but more people are crowded onto the narrow strip of eroded beach. This combination of high recreational user density and spontaneous catastrophic failure.

Erosion of the bluff toe occurs at the base of the bluff where waves impact, and results in a "notch" at the base of the bluff which can grow to many feet in depth. When this notch reaches a sufficient depth, the weight of the overhanging bluff exceeds the cohesive support of the soil, and the bluff collapses without warning. **Table 2.1-1** shows recent major bluff collapses in the study area.

Both communities have been subject to repeated bluff collapse resulting in property damage, large debris falling to the beach, and even loss of life. In the past decade numerous bluff failures have continued to occur and threaten public safety. Since the collapses are episodic, with little or no warning, city officials have displayed signs along the beach cautioning beach-goers to stay a safe distance from the base of the bluff at all times.

Both beaches are heavily utilized year-round—more than 2.8 million visits are expected in 2012 engineering analysis shows that most wave attacks to the toe of the bluff occur in the winter when sand volume at the beach is lowest. However, this is just a precursor to episodic bluff collapse, which can occur throughout the year and even during peak summer season when about 60% of all beach visits occur. To illustrate the danger to beach visitors and bluff-top residents, a list of major bluff failures is given in the following table. Note that these collapses cause significant safety issues because whenever recreation occurs near the base of the bluff, injury and death can and do occur.

As sand continues to depart from these beaches during the study period these conditions are expected to worsen, namely, less area to safely recreate away from the bluffs and increasingly frequent episodic events earlier in the study period (before a majority of unprotected parcels have constructed seawalls).

In 2000, a woman as killed in a bluff collapse while sitting on the beach in Leucadia and in 2002, a bluff collapse killed a woman near Stonesteps in Encinintas. Outside the study area, there were also fatalities. In 1995, a bluff collapse south of Del Mar killed two people and injured a third. In 2002, a man was killed in a seacave that collapsed in Carlsbad. In 2008, a man was killed by a bluff failure at Torrey Pines.

In addition, the Cities keep track of Bluff Safety Contacts which are counted when the lifeguards are required to inform beachgoers to either get out of the caves, away from bluff overhands or areas that are currently eroding for their safety. During this past summer 2012 (June through August), Encinitas and Solana Beach had 1700 and 2863, respectively. Although in the past there has been sufficient warning to evacuate structures on the blufftop before they were undermined and collapsed onto the beach, the potential exists for loss of life in this scenario.

Figure 2.1-1 Wave Attack on Bluff

Table 2.1-1 Recent Major Study Area Bluff Collapses

Date of Report	Latitude/ Longitude	Location	Brief Description
Jun 1996		Leucadia	A portion of a house in Leucadia was destroyed when an unstable sea cliff collapsed. Additional properties adjacent to the damaged home also were placed at risk and in need of emergency stabilization measures.
Jan 2000		Leucadia	A woman sitting on the beach was killed in a bluff collapse in Leucadia.
Jan 2001		Leucadia	Four bluff-top homes in Leucadia (south of Beacon's Beach) were deemed unsafe by the City of Encinitas due to unstable and cracked bluffs. Large rocks were piled at the base of the bluffs to protect the coastal bluffs from the current large surf and extreme tides.
Feb 2001		Leucadia	A bluff collapse destroyed a portion of the trail at Beacon's Beach off Neptune Avenue in Leucadia.
May 2001		Solana Beach	Part of a Solana Beach property fell away when a bluff gave way as a neighbor was trying to reinforce it by driving steel pilings the bluff. A concrete slab, part of a patio extension the neighbor was building, slid down toward the shore, taking with it a workman who had been standing on it. The bluff collapse also claimed part of an additional adjacent yard and rendered a portion of the house unsafe for occupancy. Owners of the three parcels obtained an emergency permit to build a 100-ft long, 35-ft high seawall to shore up the base of the bluff.
Jul 2002			About 80 tons of sandstone, rocks and boulders fell onto the beach as a 75 ft wide by 12 ft high section of bluff collapsed just south of Fletcher Cove Park. The collapse was the largest in a series of smaller bluff collapses along the study area.
8/5/2002	Lat: N 32 59.716 Long: W 117 16.538	325/327 Pacific (Kinzel/Greenberg)	Major bluff failure; 20 cu. yds, concrete patio overhanging bluff
8/27/2002	Lat: N 32 59.513 Long: W 117 16.470	N. side of Fletcher cove	Major bluff failure; Approx. 185 cu yds, active bluff failure, below community center
8/27/2002	Lat: N 32	N. side of Fletcher cove	Major bluff failure; Potential threat; Continuing bluff failure; Potential threat; In

Date of Report	Latitude/ Longitude	Location	Brief Description
	59.513 Long: W 117 16.470		excess of 2 cu. yds, request for chain link fence
8/29/2002	Lat: N 32 59.906 Long: W 117 16.640	Below 523-525 Pacific Ave., 200 yds N. of Tide Park Area	Major mid bluff failure; Potential threat; Approx 15'W X 8'H X 5'D of aluvium
9/6/2002	Lat: N 32 59.473 Long: W 117 16.453	S. Fletcher Cove	Major bluff failure; Potential threat; Approx. 3 cu. yds, below lifeguard headquarters/picnic area
9/19/2002	Lat: N 32 59.495 Long: W 117 16.471	10 yds N. of Fletcher Cove Dissipater	Major bluff failure; Potential threat; Approx. 4 cu. yd. boulders, aluvium, and iceplant debris cascaded onto the beach.
11/1/2002	Lat: N 32 59.753 Long: W 117 16.544	347 Pacific	Major bluff failure; Linear lower bluff failure 20' X 3' or 6 cu. yds of debris
11/1/2002	Lat: N 32 59.369 Long: W 117 16.465	205-245 S. Sierra	Major bluff failure; 5 cu. yds, continuation of failure which occurred 1/1/02
11/7/2002	Lat: N 32 59.896 Long: W 117 16.622	521 Pacific	Major lower bluff failure; Potential threat; Approx. 25' X 20' X 4' or 20 cu. yds of debris
11/12/2002	Lat: N 32 59.791 Long: W 117 16.561	371 Pacific	Major bluff failure; Potential threat; 10 cu. yds mid/upper bluff, continuation of already badly eroded area
12/3/2002	Lat: N 32 59.711 Long: W 117 16.533	325 Pacific	Major bluff failure; Potential threat; 10 cu. yds of earthen debris and concrete; Posts, concrete footings, and other wooden retaining devices precarious; Continuation of already badly eroded area.
2/5/2003	Lat: N 32 59.934 Long: W 117 16.622	523/525 Pacific	Major bluff failure; Potential threat; Approx. 3 cy, in and around existing sea cave plugs, large portion of bluff un-supported and in danger of collapse.

Date of Report	Latitude/ Longitude	Location	Brief Description
2/6/2003	Lat: N 32 59.507 Long: W 117 16.471	Fletcher Cove	Major bluff failures; 2 failures in close proximity north side of Fletcher Cove, approx. 7 and 6 cu. Yds
2/6/2003	Lat: N 32 59.292 Long: W 117 16.445	Surfsong Condos at 205-245 Sierra	Major bluff failure; 3rd Major failure 100 yards south of previously reported area; 3 cu. yd. of solid sandstone composition, debris and boulders.
3/5/2003	Lat: N 32 58.991 Long: W 117 16.387	Seascape I Condos	Major bluff failure; 96 cu. yds north of private stairway
3/5/2003	Lat: N 32 59.423 Long: W 117 16.474	135 S. Sierra	Major bluff failure; Approx. 100' X 72' X 35', S. of Fletcher Cove; Adjacent to existing sea cave plug
11/4/2003	Lat: N 32 59.511 Long: W 117 16.469	N. side of Fletcher cove	Major bluff failure; N. of cove, water flowing mid-bluff.
3/1/2004	Lat: N 32 59.348 Long: W 117 16.435	Surfsong Condos at 205-245 Sierra	Major bluff failure; Upper and lower bluff failure over 2 cu. yds, dangling posts/rope.
6/14/2004	Lat: N 32 59.779 Long: W 117 16.551	Scism Seawall	Major, potential threat from overhang patio. Signs posted.
6/28/2004	Lat: N 32 59.759 Long: W 117 16.551	Scism Seawall	Major and minor failures, approx. 15' X 6' X 4' south of seawall
6/28/04 & updated 07/21/2004	Lat: N 32 59.759 Long: W 117 16.551	S. of Scism Seawall	Major bluff failure; Directly S. of other failures, approx. 15' X 6' X 4'. Potential threat from overhang patio. Signs posted. Geosoils report on file. On or about 6/30, contractor removed wall and concrete deck that had become undermined. 7/6, u-channel posts and "Bluff Warning" signs installed

Date of Report	Latitude/ Longitude	Location	Brief Description
Jul 2004			Major bluff failure; Directly S. of other failures, approx. 15' X 6' X 4'. Potential threat from overhang patio. Signs posted On or about 6/30, contractor removed wall and concrete deck that had become undermined. 7/6, u-channel posts and "Bluff Warning" signs installed.
9/2/2004	Lat: N 32 59.781 Long: W 117 16.555	N. Scism Seawall	Major bluff failure; Additional debris to existing failure site N. of Scism Seawall
9/11/2004		50 yards S. of S. Border (Del Mar Jurisdiction)	Major failure/additional to existing slide area
9/29/2004	Lat: N 32 59.765 Long: W 117 16.553	341, 347, 355 Pacific	Major bluff failure; About 6'H X 20'W X150'L, lower bluff between two seawalls, covered or destroyed 5-6 signs posted at toe of bluff
10/25/2004		South of Surfsong seawall in current construction area	Major failure/debris from previous failure on 10/22 broke through retaining wall and fell to beach
11/2/2004	Lat: N 32 59.327 Long: W 117 16.448	Surfsong/Soil Engineering seawall construction	Major bluff failure; Approx. 6' X 5' X 3', Initial failure was contained by protective shoring and fence system; subsequent bluff failure resulted in damage to shoring system.
11/2/2004, 11/30/2004, and 12/13/2004	Lat: N Long: W	365 N. Pacific	Major bluff failure; Potential threat; 2' X 8-10' portion of block wall separated from patio, large upper bluff failure, undermined a portion of concrete patio adjacent to rear of home.
11/2/2004, 11/30/2004, and 12/13/2004	Lat: N 32 59.928 Long: W 117 16.558	30 yards S. of Northern City limit	Major bluff failure; Approx. 22' X 5' X 3', bluff debris along with length of black pip, portion of fence dangling.
11/4/2004 and 11/30/2004	Lat: N 32 59.512 Long: W117 16450	Below Community Center	Major bluff failure; Upper bluff failure N. of Cove, area at top closed due to undermined fence along edge. Fence to be relocated and bench will be removed from outlook point, SW of Community center building.
4/4/2005	Lat: N 32 59.588 Long W 117 16.518	Below 215 Pacific	Major bluff failure; Although a large amount of material was deposited on the beach, it occurred from a localized area. Surrounding bluff does not appear in imminent danger of further failure.

Date of Report	Latitude/ Longitude	Location	Brief Description
Jun 2005			Major Upper bluff failure 2 cy or more witnessed by lifeguard personnel.
Aug 2005		North of Seascape Sur access	Major bluff failure; Potential threat; North of Seascape Sur access at reoccurring failure site.
6/21/2006	W 117 16.560	South of Tide Beach	Major Upper bluff failure 2 cu. yd or more witnessed by lifeguard personnel.
6/28/2006	Lat: N 32 59.783 Long: W 117 16.560	357, 365, 423 Pacific	Major bluff failure; deck/fence not sufficiently undermined to be a problem at this time
8/23/2006	Lat: N 32 59.182 Long: W 117 16.409	347-459 S. Sierra Ave	Major bluff failure; Potential threat; North of Seascape Sur access at reoccurring failure site; Geotechnical attached
1/2/2007		233 S. Helix (Surfsong)	Potential significant failure below Surfsong and north of their seawall
7/23/07 & 8/8/2007	Below address	675 S. Sierra	Significant failure.
8/23/2007	Lat: N 32 50 621 Long: W 117 16 514	235-241 Pacific	Major bluff failure; pre-existing failure site.
5/14/2009	Lat: N 32 50 621 Long: W 117 16 514	235-241 Pacific	Major bluff failure; pre-existing failure site.
1/4/2010		325 S. Sierra	Debris from private access staircase scattered across 1/2 mile of Beach - referred to Code Enforcement.
3/11/2010		20 yards north of Seascape Public Stairs	Major bluff failure, photos taken, caution tape placed. On 3/12/2010 confirmed that the issue was resolved to satisfaction of Engineering Department.
3/15/2010	N 32 59.461, W 11716.451	Below Marine Safety building	Major bluff failure, photos taken, caution tape placed. On 3/17/2010 confirmed that the issue was resolved to satisfaction of Engineering Department.
Approx 4/2010		Below Fletcher Cove Community Center	300-350 cy detached from lower bluff, fell to beach.

7/10/10	20 yards N of SBTC	20 yards N. of S. end of SB&T Club	Minor bluff failure, photos taken. Existing signage to be maintained by Marine Safety.
Aug 2010		end of E Street	Lifeguards and firefighters rescued an injured man who was found on the beach at the bottom of a 30-ft cliff at the end of E Street. He fell off from top and suffered fractures to his legs. The victim probably rolled the first sloped 60 or 70 ft before the 30-ft vertical drop-off. Signs warn visitors of the unstable coastal bluffs.
Dec 2010			A bluff collapsed across two parcels damaging the existing seawall at the bluff base.
Jan 2011		southbound portion of San Elijo Avenue at Dublin Drive and Cornish Drive	The southbound portion of San Elijo Avenue at Dublin Drive and Cornish Drive closed because of bluff collapses in mid-December leading to approximately 30 days of partial road closure.
1/1/2011		180 Del Mar Shores Terrace	Major bluff failure (2 cy or more). On 2/9/11 City staff member, Dan Goldberg confirmed the reported issue had been resolved to the satisfaction of the Engineering Department. The area at that time was reported as "currently appears stable. Marine Safety should continue to monitor the area and report any changes to the Engineering Department".
12/20/2011	South city border at Border Avenue	South city border at Border Avenue	Minor bluff failure that occurred next to reinforced upper bluff at the south end of the Del Mar Beach Club at the very south end of the city. Although there is a public view point above the location of this bluff failure, the fence that designates the end of the public view point is well back from the edge of the bluff and is not threatened.
4/7/2012	N 32 59. 457, W 117 16. 465	South side of lower bluff at Fletcher Cove	This bluff failure continues the recent history of failures in Fletcher Cove. Due to recent low sand levels, the area of the recent failure leaves an overhang that may attract beach users. Lifeguards should continue to warn beach users to stay away from the bluffs, especially where there is an overhang. Additionally, immediately landward of this failure, there is a hole approximately 3' in diameter and approximately 5' deep (into the bluff). Since the sand levels are down, this area should be constantly monitored to keep beach users from entering the hole. Also took photos of the north side of Fletcher Cove for documentation of the ongoing bluff erosion problem there.

Source: USACE 2012b & City of Solana Beach 2012b

Figure 2.1-2 Example of Bluff Failure Damage

Figure 2.1-3 Example of Potential Structural Damage

Figure 2.1-4 Example of Structural Damage

Figure 2.1-5 Notch and Cave Formation

Bluff Erosion and Infrastructure

The impending threat of bluff failure has forced many private homeowners to build seawalls to protect the base (toe) of the bluff. A permit is required from the California Coastal Commission (CCC) to build any shore protection structures. Although the CCC normally has discretionary authority to grant permits in the coastal zone, it is usually required by State law to grant emergency permits if the applicant can demonstrate “imminent” damage. Permits for seawalls have been granted to protect existing structures, but the Coastal Act prohibits new construction that requires protective devices for erosion control that substantially alter landforms along bluffs. The existing legal framework may have acted to encourage some homeowners to wait until damage to their home is “imminent,” and obtain an emergency permit from the CCC.

The erosion trend will continue to accelerate in the future if protective measures are not provided to buffer or prevent exposure of the toe of the bluff to wave attack.

Beach Erosion and Recreation

Beach recreational use is directly related to beach width. Not only does beach erosion decrease available “towel space” but it also cuts off access to other “pocket” beaches that are accessible only by walking along the shoreline. Even if these pocket beaches do not erode away, loss of adjacent beach means that there is no access to them except at lower tides or during calm wave conditions.

2.1.2 Opportunities

Opportunities exist to reduce the risk to public safety and damage to infrastructure and private property, as well as improve the recreational use of the beach. There are two major engineering methods, soft-structural and hard-structural, to increase shore protection. The soft-structural method includes beach fills, sand scraping, or sand bypassing/recycling. Hard structures consist of the sand retention features that impede alongshore sand movement (e.g., groins, jetties, artificial reefs, or detached breakwaters), and storm-protective features, which directly prevent shoreline or upland erosion (e.g., coastal armoring, seawalls or revetments).

2.2 Planning Process, Planning Objectives, and Alternative Formulation

This Integrated Report describes the development and analysis of alternatives for each Segment that addresses the identified problems and opportunities. The alternatives are evaluated for their effectiveness, impacts and costs, and the tentatively recommended plan is identified.

2.3 National Objectives

Federal and Federally-assisted water and related planning activities attempt to achieve increases in National Economic Development (NED), while preserving environmental resources consistent with established laws and policies. Contributions to NED are increases in the net value of the national output of goods and services, expressed in monetary units. The NED objective is differentiated from Regional Economic Development (RED) benefits, which only apply to a given region, and may be produced at the expense of another region in the U.S. NED benefits accrue nationally for a net gain in Gross Domestic Product. They represent return on the investment of Federal funds, and are a useful tool in comparing the efficiency and effectiveness of alternative projects on a nationwide basis. Plans are formulated to take advantage of opportunities in ways that contribute to the NED objective. In accordance with ER 1105-2-100, it is USACE policy to provide Federal assistance in the prevention or reduction of damages caused by wind and tidal generated waves and currents along the Nation's shoreline.

The standard period of analysis is based on a 50 year functional project life. Damages (which may be financial costs or actual structural/infrastructure damages) and lost opportunities (recreational, etc.) are projected for the future without project and for the future with an array of different alternatives. The benefits of each alternative are expressed in dollar amounts of damages prevented and opportunities preserved or created.

2.4 Planning Objectives and Criteria

Based on the analysis of the identified problems and opportunities and the existing conditions of the study area, planning objectives were identified to direct formulation and evaluation of alternative plans. These were established as objectives for the proposed action.

- Reduce coastal storm damages to property and infrastructure along the study area shoreline and the bluff top, prior to the need for emergency action, throughout the period of analysis.

- Improve public safety in the study area by reducing the threat of life-threatening bluff failures caused by wave action against the bluff base, throughout the period of analysis.

- Reduce coastal erosion and shoreline narrowing to improve recreational opportunities for beach users within the study area throughout the period of analysis.

Alternatives are formulated to allow comparison of different responses to the problem and to identify the alternative that maximizes storm damage reduction and while ensuring the value of the benefits are greater than the costs of the project (Appendix E). Improvements to recreational opportunities resulting from any alternative are considered incidental to the main objective of reducing storm damages. All alternatives must undergo both NEPA and CEQA review processes. The purpose of NEPA and CEQA is to identify and present information about any potentially significant environmental effects of the alternatives and the tentatively recommended plan.

2.4.1 Criteria

Plans are compared using four formulation criteria suggested by the U.S. Water Resources Council. These criteria are;

1. Completeness - Completeness is a determination of whether or not the plan includes all elements necessary to achieve the objectives of the plan. It is an indication of the degree that the outputs of the plan are dependent upon the action of others.

2. Effectiveness – All of the plans in the final array provide some contribution to the planning objectives. Effectiveness is defined as a measure of the extent to which a plan achieves its objectives.

3. Efficiency – All of the plans in the final array provide net benefits. Efficiency is a measure of the cost effectiveness of the plan expressed in net benefits.

4. Acceptability – All of the plans in the final array must be in accordance with Federal law and policy. The comparison of acceptability is defined as acceptance of the plan to the local sponsors and the concerned public.

2.5 Plan Formulation Process

Plan Formulation can be broken down into a six step process:

1. Identify Problems and Needs
2. Inventory and Forecast Conditions
3. Formulate Alternative Plans
4. Evaluate Alternative Plans
5. Compare Alternative Plans
6. Select a Tentatively Recommended Plan

This process is a structured approach to problem solving which provides a rational framework for sound decision making. The six-step process is used for all planning studies conducted by the USACE.

The sections below first provide an introduction to plan formulation constraints, and environmental requirements. Section 3 will introduce the preliminary alternatives and measures considered. These measures are then screened and developed into project alternatives for full analysis. A tentatively recommended plan is finally identified which best meets the stated objectives and constraints.

2.6 Planning Constraints and Considerations

Unlike planning objectives that represent desired positive changes, planning constraints represent restrictions that should not be violated. The constraints identified include those public concerns that if violated by an alternative plan would result in the plan not being acceptable to most public interests. It also includes those aspects of the study area generally regulated by government agencies that if adversely impacted would result in the plan being unimplentable. In general, the planning process needs to consider measures to avoid or mitigate any significant adverse impacts associated with the planning constraints.

Engineering and Physical Constraints. The tentatively recommended plan presented should be complete and sound, and in sufficient detail to allow development of engineering plans and specifications.

Economic Constraints. Any potential project that is in the Federal interest must display feasibility by satisfying benefit-cost (B/C) criteria. Generally, this ratio must be greater than one to allow Federal participation in continued study and any project proposal. For Environmental Restoration projects, an incremental analysis must be performed to compare cost effectiveness of the alternatives.

Financial Constraints. The sponsoring agency is required to show their ability and willingness to fund their share of any recommended project as required by the Principals and Guidelines.

U.S. Army Corps of Engineers Constraints. The feasibility study must comply with USACE regulations and requirements.

Environmental Resource and Agency Constraints. Applicable environmental requirements must be met for a feasibility level study. Environmental acceptability must be ascertained; adverse impacts should be avoided if possible or minimized, if avoidance is not possible. An Environmental Impact Statement (EIS) is included with this Report.

Local Constraints (Public Acceptability). The alternative options and plans should be acceptable to the local residents, agencies, organization, and the non-Federal sponsor(s), as well as the interested State and Federal agencies. The local sponsors have indicated that they are substantially guided by public input and cannot support any recommendation that meets with public opposition. Unimplementable plans include any visible offshore structure and any structure that significantly impedes beach access, such as rock revetments.

The planning constraints specific to this study are:

1. No adverse impacts to the aesthetics along the shoreline.
2. Maintain Public Access to the beach.
3. Preserve the recreational opportunities within the study area.
4. Preserve the environmental resources within the study area.

2.7 Without Project Scenarios – Retreat and Armoring Scenarios

It is important to define the future without project conditions for the project area in order to determine the benefits of the proposed alternatives. The assumption is made that existing seawalls will continue to be maintained, and in accordance with State law, private homeowners, and the cities in order to protect vital infrastructure, will continue to be granted permits to build new ones. There are two scenarios that were modeled that would ultimately lead to the without project condition that would result in most of the shoreline being armored within 20 to 30 years. The two scenarios that were modeled (for more information on modeling, see **Appendix B** and **Appendix E**) to simulate two distinct behaviors to episodic bluff failure were *Retreat Scenario* and *Armoring (Seawall) Scenario*.

The *Armoring* and *Retreat Scenarios* model two mutually exclusive behavior patterns to impending bluff collapse. It is expected that each parcel owner will follow one of these two patterns: either armor the parcel with a seawall to prevent structure collapse or fail to armor the parcel and allow structure collapse. However we do not know which behavior pattern each individual parcel owner would follow under without project conditions. A weighting scheme for armoring and retreat for all of the property owners was developed and used to determine the overall without project condition.

2.7.1 Retreat Scenario

For financial, personal, regulatory, or other reasons some owners will not build seawalls before their structures are rendered uninhabitable from bluff-top collapses. This behavior is captured under the *Retreat Scenario*, where all owners do not build seawalls in time to protect their structures. Under this scenario, when episodic bluff failure occurs, first staircases are lost, if present, then land near the bluff-top edge is lost. Repeated bluff failures could undermine the structure. If that happens, the structure value and a portion of the contents inside are lost, the structure is demolished, and land loss continues. Eventually additional episodic bluff failures could threaten major public infrastructure and this would lead to publically financed seawall construction and maintenance since both cities would seek out emergency seawall permits and seek funding to construct public seawalls rather than incur the costs and disruptions of a “true” retreat scenario (financial costs and disruptions necessary to relocate buried and above-ground utility lines, loss of public roadways, and additional demands to acquire and relocate residences interior to the existing bluff-top parcels.)

2.7.2 Armoring (Seawall)

The *Armoring Scenario* assumes that homeowners will be able to build seawalls before their structures are rendered uninhabitable. Under this scenario, when episodic bluff failure occurs, first staircases are lost, if present, then land near the bluff-top edge is lost. Before the structure can be undermined by repeated bluff failures, a seawall is constructed and maintained by the parcel owner.

3 ALTERNATIVES

3.1 Plan Formulation

Alternative plans were formulated to meet planning objectives and avoid planning constraints, following an iterative six-step planning process, and using prior and new information developed for this feasibility study. This USACE planning process is based on principles, standards and procedures that guide water resources development at the national level and are articulated in the Principles and Guidelines (P&G). The USACE planning process involves this six-step iterative approach to plan formulation and evaluation, as defined in USACE planning guidance ER 1105-2-100:

- Specification of the water and related land resource problems and opportunities (relevant to the planning setting) associated with Federal objectives and specific state and local concerns.
- Inventory, forecast, and analysis of water and related land resource conditions within the planning area relevant to the identified problems and opportunities.
- Formulation of alternative plans.
- Evaluation of the effects of alternative plans.
- Comparison of alternative plans.
- Selection of a tentatively recommended plan based upon the comparison of alternative plans. (Department of the Army 2000; P&G Section III 1.3.2(a)).

As more information becomes available during the study process prior steps are often reviewed and revised as many times as required to arrive at the best plan. The culmination of the iterative process is the identification of a tentatively recommended plan.

According to CEQ Regulations 40 CFR 1502.14 for the purposes of NEPA with regards to alternatives including the proposed action, the analysis shall:

- Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated.
- Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits.
- Include reasonable alternatives not within the jurisdiction of the lead agency.
- Include the alternative of no action.
- Identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such a preference.
- Include appropriate mitigation measures not already included in the proposed action or alternatives.

In addition, compliance with the requirements of CEQA Guidelines §15126.6 (a):

“An EIR shall describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives. An EIR need not consider every conceivable alternative to a project. Rather it must consider a reasonable range of potentially feasible alternatives that will foster informed decision making and public participation. An EIR is not required to consider alternatives which are infeasible. The lead agency is responsible for selecting a range of project alternatives for examination and must publicly disclose its reasoning for selecting those alternatives. There is no ironclad rule governing the nature or scope of the alternatives to be discussed other than the rule of reason."

Under CEQA the EIR should also identify any alternatives that were considered by the lead agency but were rejected as infeasible during the scoping process and briefly explain the reasons underlying the lead agency's determination. Additional information explaining the choice of alternatives may be included in the administrative record. Among the factors that may be used to eliminate alternatives from detailed consideration in an EIR are: (i) failure to meet most of the basic project objectives, (ii) infeasibility, or (iii) inability to avoid significant environmental impacts.

Information developed previously (for the 2005 Feasibility Study and EIS/EIR) was also used to define and evaluate the range of alternatives contained in this Integrated Report. This USACE planning process is based on principles, standards and procedures that guide water resources development at the national level and are articulated in the Principles and Guidelines (P&G, approved by President Reagan in 1983),

Established as an intentionally iterative process, as more information was developed during the study process prior steps were often reviewed and revised as needed to ensure that the USACE and the Cities arrived at the best plan. The culmination of the iterative process is the identification of a tentatively Recommended Plan (Proposed Project / Proposed Action).

3.1.1 Management Measures

A management measure is defined as a feature or activity that can be implemented at a specific geographic site to address one or more of the planning objectives. An example of a measure that is considered a feature is some tangible structural element that requires construction or assembly on-site, such as a seawall. A measure can also be an activity that is considered a one-time or recurring action, such as beach nourishment or notchfills. The various combinations of measures are considered the building blocks of alternative plans and become more specific and better defined as planning progresses.

Management measures can be characterized as either dependent or independent. Independent measures are something that are stand alone, that can be implemented without the need for consideration of other measures. Dependent measures require another measure or measures to adequately address the problem. For this study, the following measures were reviewed.

Non-structural Measures:

1. Managed Retreat

Structural Measures:

1. Beach Nourishment
2. Breakwaters
3. Submerged Breakwater/Artificial Reef
4. Groins
5. Revetments Notchfills
6. Seawall

3.1.2 Alternatives and Measures

Alternatives are formed by developing one or more management measures (or actions) that address the study problems and satisfy the defined project objectives. For this Study, the USACE and the Cities went through several levels of alternatives screening to identify the tentatively recommended plan. The primary goal of this alternatives analysis was to identify those actions that could feasibly attain the planning objectives and would seek first to avoid, then minimize, or mitigate for potential significant effects on the environment. Preliminary screening of the plans narrowed the range of storm damage reduction alternatives by eliminating those plans that cannot be permitted, are technically or financially infeasible, or publically unsupportable due to opposition to any structure that has a visible impact or impact to sediment transport downcoast. Alternatives passing the preliminary screening were screened further into a secondary level screening. The secondary screening went through additional analysis and a process of further elimination, which resulted in the final array of alternatives. Each final alternative has received full feasibility level development, analysis, and comparison in this Integrated Report.

The following sections discuss the alternatives analyzed and indicate whether they were rejected or carried forward for further analysis in this Integrated Report. Because the identified need is to reduce storm damage along the shorelines of Encinitas and Solana Beach, the general location for each alternative is along the defined project area of Segments 1 and 2 in the cities of Encinitas and Solana Beach, respectively.

3.1.3 Future Without Project – No Action Alternative

USACE is required to consider the option of “No Action” or a Future without Project scenario as one of the alternatives in order to comply with the requirements of NEPA (40 CFR 1502.14(d)) and CEQA. (2012 State CEQA Guidelines §15126.2(e). The No Action alternative is necessary for comparing the costs and benefits of different alternatives, and is described previously in this report (section 2.7) and in Appendix E. It serves as the baseline by which other alternatives may be judged and compared to each other. This alternative is defined by no Federal project occurring. The assumption is made that existing seawalls will continue to be maintained, and in accordance with State law, private homeowners will continue to be granted permits to build new ones. Under this scenario, most of the shoreline will be armored within 20 or 30 years, but in an inefficient, piece-meal, uncoordinated process and only after significant loss of land. Assumptions, costs and impacts of this alternative are detailed in Appendix E.

As stated above, it is conservatively assumed that existing seawalls would be maintained. The CCC and the latest version of the City of Solana Beach Local Coastal Plan, identify that reviews of seawalls would occur at the end of the 20-year permit in order to renew the permit. The review could result in a determination to remove a seawall if the structures or properties protected by that device no longer exists. Whether any or how many seawalls could be removed over the life of the project is not known and would be speculative at this time because the determination would rely in the presence or absence of structures at the time of current seawall permit expiration.

Management of Subaerial Erosion and Groundwater Seepage

Subaerial processes both weaken the mechanical strength of materials behind the bluff face and contribute to runoff erosion on the surface of the bluff face. Along the study area shoreline, the rate of blufftop retreat caused by these processes is extremely low when compared to the rate caused by wave attack. The local sponsors have already implemented a regime of codes and ordinances to enforce Best Management Practices (including prohibitions on landscape irrigation within 100 ft of the bluff edge) to reduce runoff and infiltration that may impact slope stability, therefore this measure is part of the without project condition, and does not play a role in plan selection or NED analysis.

3.1.4 Future With Project

The initial array of alternative plans is included in the discussion below. Each of the alternatives was formulated to address the planning objectives while avoiding constraints based on public, PDT and Sponsors input.

<u>Non-Structural Alternatives</u>

Non-structural alternatives include revising management or maintenance practices, or acquiring real estate. Anything that achieves the project objectives without directly altering the physical environment is considered a nonstructural alternative. For this study, non-structural measures identified include Managed Retreat and Management of Subaerial Erosion.

Managed Retreat

Managed Retreat is a term commonly used to describe a policy that restricts or opposes efforts to protect the shoreline. It has been used to describe policies ranging from complete (active) removal of all shore protection structures and bluff top structures to (passive) simply not allowing new structures to be built. It also includes property acquisition and planned relocation of structures and infrastructure that would eventually be damaged or destroyed by bluff retreat, shoreline advance or storm surge inundation. Under this measure the cities would purchase property as part of the land acquisition.

This Alternative has been advocated by the Surfrider Foundation in their comments on the CEQA NOP issued in April 2012 (see Appendix A). According to the May 2012 Surfrider NOP comment letter (page 2):

“With respect to an Army Corps Project in Solana Beach in particular, a Managed Retreat Alternative involves temporary seawalls and nourishment in combination with an acquisition of property. The funding for property acquisition would come from a combination of Land Lease Fees for use and encroachment on Public Land with seawalls, Army Corps Shore Protection Funding and other Funding Mechanisms as outlined in the LUP Policy 4.36. Acquisition of blufftop property meets the USACE goals of Shoreline Protection in that the value of threatened structures will be preserved by buying blufftop property and removing structures at fair market value. Additionally, this alternative will create future parkland and preserve beaches in a state better suited for recreation access thus providing economic benefit on that side of the Corps Cost Benefit analysis.”

Under this scenario, public beach access, public roads including Highway 101, the NCTD railroad, the Fletcher Cove Community Center, Solana Beach Marine Safety Center, lifeguard facilities, public parking lots, State Parkland and all other structures would be acquired and removed or relocated so that coastal erosion could continue unabated along this highly urbanized/developed shoreline.

Acquiring private lands and converting these for public use could only be accomplished through acquisition of high cost real estate. The high cost of real estate would make this option not viable. In addition the analysis of land and structure damages under a managed retreat indicates that these damages are more than twice the cost of implementing a long-term shoreline protection program. There are no quantitative economic benefits that would enable this alternative to qualify for a federal interest since the benefit to cost ratio (BCR) would be less than one. **Table 3.1-1** shows the projected average annual damages from land loss and loss of blufftop structures.

Table 3.1-1 Example of Bluff Failure Damage

Reach	Structure Damages	Land Damages
1	-	$156,000
2	$79,000	$83,000
3	$219,000	$441,000
4	$674,000	$272,000
5	$762,000	$589,000
6	$13,000	*
7	*	$19,000
8	$248,000	$760,000
9	$1,206,000	$909,000
Total	**$3,201,000**	**$3,229,000**

*Reach 7 is predominantly low-lying lagoon area and damages are due to wave overtopping rather than episodic bluff collapse.

In this scenario, homeowners would have to be compensated for their property loss at fair market value due to outright acquisition or as a “regulatory taking”. The non-federal sponsors - the Cities of Encinitas and Solana Beach have indicated that they do not have the resources to provide this compensation on the scale required, and do not support a Managed Retreat Alternative. Although the Surfrider comment letter states that “Land Lease Fees” (which are currently collected at a rate of $1000 per linear foot of seawall for new seawalls) could be used to acquire properties and remove seawalls and bluff top structures, land lease fees collected by the CCC and the City of Solana Beach total less than one million dollars as of the date of this Integrated Report. The cost of this alternative makes it impracticable and infeasible.

<u>Structural Alternatives</u>

Structural alternatives were formulated to reduce coastal storm damage caused by wave attack to the base/toe of the exposed bluffs.

Beach Nourishment

Beach nourishment involves placement of compatible sand from upland sites or offshore borrow areas (beyond the depth of closure) to effectively create a shoreline protecting beach. The increased sand provides a buffer against short-term sediment losses so that storm waves and runup dissipate over the wider beach profile. Long-term losses and erosion of the existing beach as well as the additional sediment place through the initial placement of sediment are addressed through periodic renourishment.

Beach nourishment was formed as an alternative and analyzed to look at various sand placement intervals and beach widths in order to determine if this alternative is a viable alternative to adequately address the study objectives. Historical observations within Southern California indicate that a minimum beach width of approximately 200 ft is required to prevent a loss of the beach shoreface and berm during a severe winter season (USACE-LAD 2003). Oceanographic and bathymetric conditions in the study area are very similar to the coastal setting of Orange County. Based on this consideration, a minimum berm width of 50 ft was proposed for both shoreline cities. The design berm height and front-face slope follow the beach-fill dimensions that were employed in the SANDAG RBSP I and II projects (Noble Consultants, 2001).

- Public safety issues
- Extremely high construction and maintenance costs
- Potential impact on sediment transport on down coast littoral transport
- Potential impact on surfing due to alteration in wave conditions,
- Potential impact on aesthetics for a visible structure.
- Lack of support from the local sponsors and local community for any visible offshore structure.
- Lack of support from the resource agencies, specifically the CA Coastal Commission, which is the lead agency that upholds the Coastal Zone Management Act within California, for a structure that significantly impedes beach access and limits sediment availability to the system.

<u>*Design Methodology*</u>

The beachfill design parameters were determined by considering various combinations of beach-fill widths in 50 ft increments, from 50 ft to 200 ft in Encinitas and 400 ft in Solana Beach, and 2-16 year replenishment cycles. Each option has one combination of an initial beach width and a repetitive duration for the subsequent renourishment cycles. The optimal option is the one that yields the maximum net benefit. The USACE GENEralized Model for Simulating Shoreline Change (GENESIS) was used to predict the shoreline morphology over multiple years as waves redistribute sand after it is placed on the beach. This process, referred to as equilibration, results in an “equilibrated” profile that is different than the initial fill profile and evolves thru this adjustment process. The optimization consisted of finding the beach width and renourishment period for both cities that maximized the net benefits while avoiding or minimizing effects on sensitive nearshore habitat.

The linear extent of each receiver site was designed to maximize economic benefits while avoiding sensitive environmental resources. Reaches were limited to existing sandy beaches, avoiding rocky intertidal areas. Reaches also avoided entrances to nearby coastal lagoons (Batiquitos and San Elijo Lagoons). The distance between the receiver sites and lagoon mouths are far enough that no impacts are expected. Post construction monitoring will include monitoring of the lagoon entrances to confirm that the project does not result in any closure or restrictions to lagoon entrances. A lagoon sedimentation fee will be paid to offset the cost of dredging should the project result in closure or restrictions to lagoon entrances."

Beach Nourishment is carried forward into the NED analysis for protecting the shoreline. The approximate linear extent of the receiver site in each City is presented in **Figure 3.1-1** (Encinitas – Segment 1) and **Figure 3.1-2** (Solana Beach – Segment 2). The concept design is schematically illustrated in **Figure 3.1-3.**

In the study area, offshore sources have historically been used for several reasons which are discussed in detail below.

Figure 3.1-1 Encinitas Receiver Site Approximate Linear Extent

Figure 3.1-2 Solana Beach Receiver Site Approximate Linear Extent

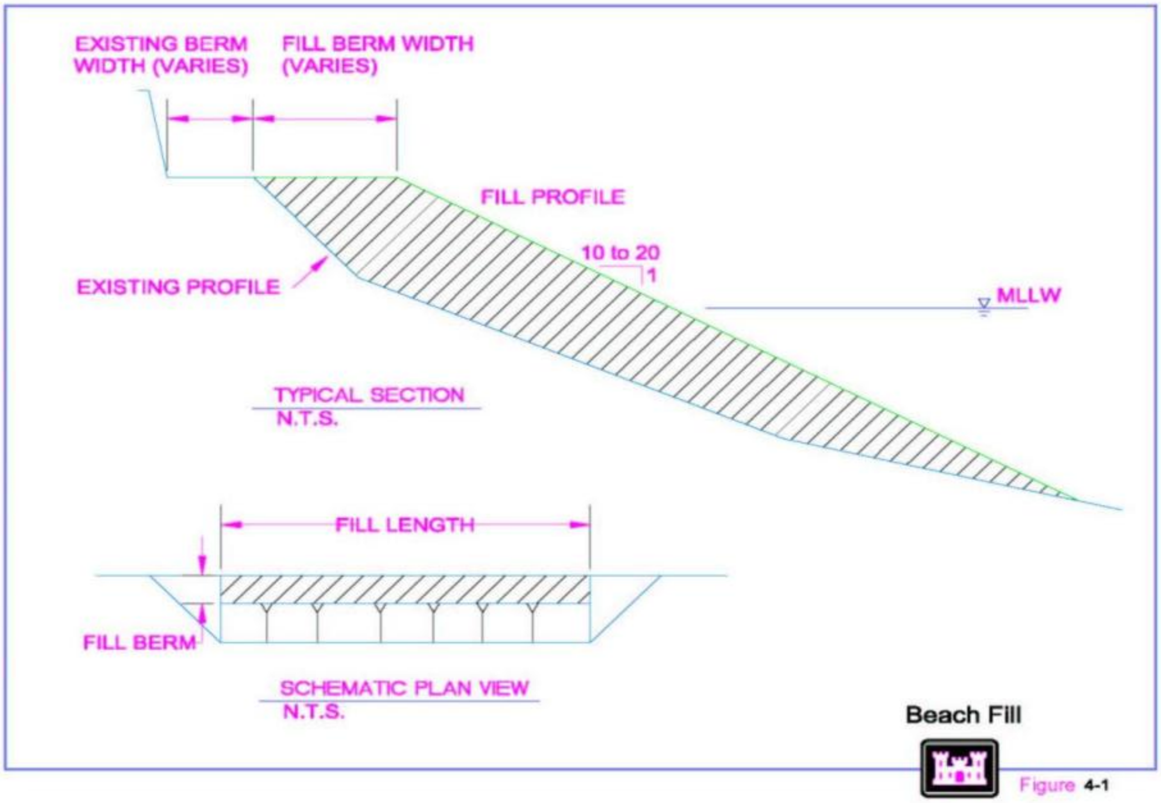


Figure 3.1-3 Typical Beach Nourishment Design

Offshore Borrow Sites

Prior offshore studies of the area conducted by USACE and other government agencies like SANDAG have identified at least three potential sources of sand suitable for use as an offshore borrow site. The term “borrow site” is a construction industry phrase used in this instance to identify the location from which sand is obtained for placement on the beach during a beach nourishment project. The approximate location of these sites is given in **Figure 3.1-4**, below. The Potential Offshore Borrow Sites in the study area investigated for the SANDAG RBSP II are designated SO-5, SO-6, and SO-7. This project also includes potential use of another site, designated MB-1, located offshore of Mission Beach, fifteen miles south of the study area, which RBSP II also investigated and proposed using. These borrow sites were identified based on compatibility with the existing beach material. The initial and renourishment volumes are available, but further investigations may be required during the PED phase to precisely quantify the amount of material at each borrow site suitable for beach replenishment and its location. Offshore Borrow Sites will be carried into the final array of alternatives. Appendix C and RBSP II contain detailed information on offshore borrow site investigations.

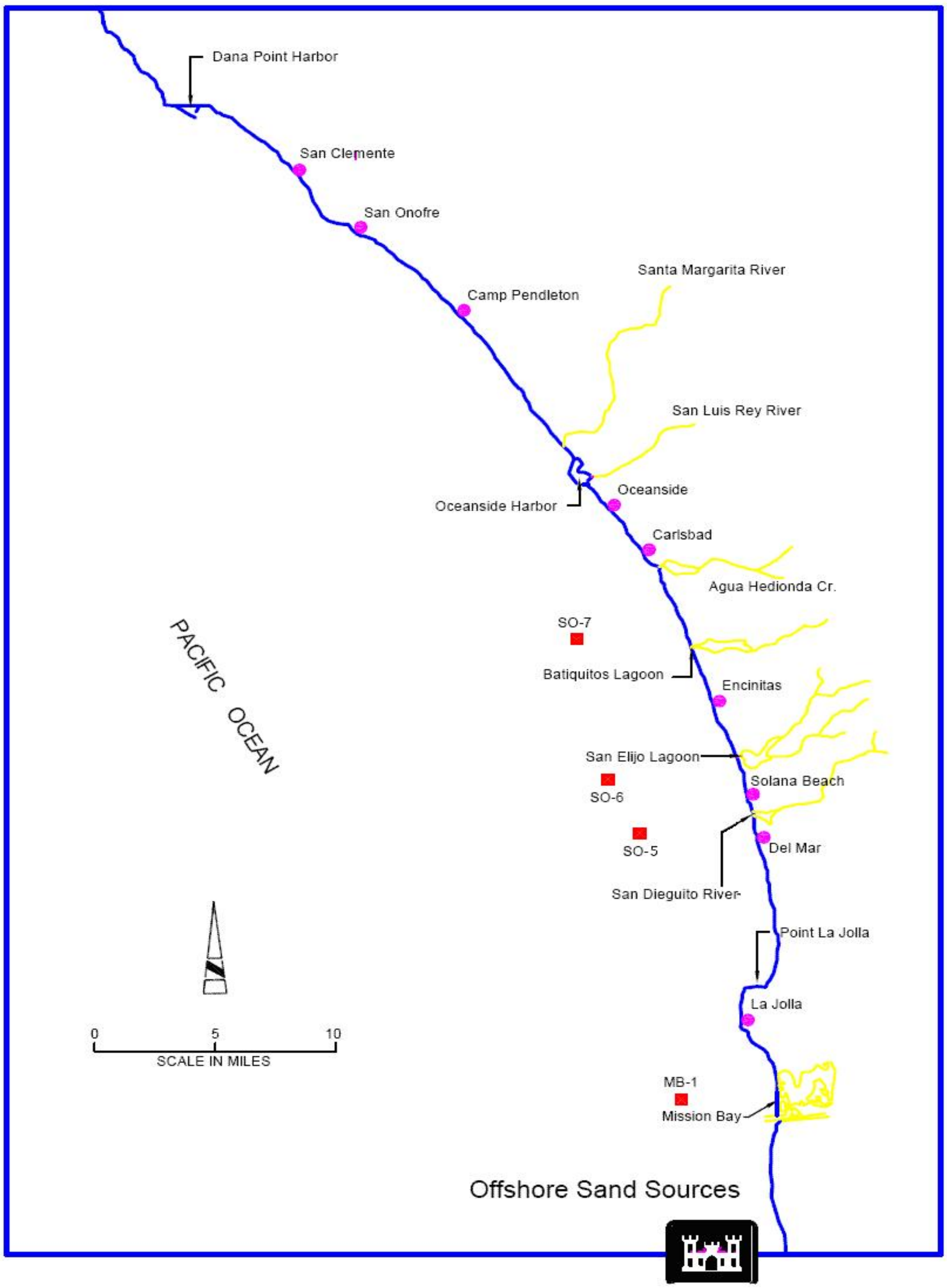


Figure 3.1-4 Regional Offshore Borrow Sites (not to scale)

Onshore Borrow Sites

Reservoir areas behind City of San Diego owned dams and the Nelson and Sloan quarry were investigated as potential sources of sand and beach replenishment material for this project in the 2005 EIS/EIS.

Several dams owned and maintained by the City of San Diego contain reservoirs with some low potential for use as beach replenishment material. The material is mostly too fine-grained for beach placement and is also located in environmentally sensitive areas behind the reservoirs of the dams, where any disturbance would constitute a major impact.

In 1980, there were a dozen sand mining operations near the study but they have all been closed for various environmental reasons or depletion of sand within the extent of the mine areas. The Nelson and Sloan quarry is located approximately 4-1/2 mi southeast of Imperial Beach, just north of the Mexico border and along the south boundary of the Tijuana River flood plain. The quarry has supplied previous USACE projects with rip-rap. Some potential for beach replenishment material exists within the quarry and the surrounding area, although the cost would be much higher than offshore sources due to the costs associated with transport Also, the amount of material that could be processed is not likely to meet the project needs for replenishment.

Phone conversations with local sand and gravel miners and suppliers indicate that any amount of beach suitable sand over 10,000 cy would be very hard to find in San Diego County. There is very little mining availability left within San Diego, and almost all of the sand used for concrete is imported. Some sand is barged up from Ensenada, Mexico into San Diego Harbor, and some is also imported from Riverside and San Bernardino Counties, but the cost averages around $35 per cubic yard due primarily to transportation costs.

Alternative sources for beach nourishment material include upland sources. The nearby San Elijo Lagoon Restoration Project (SELRP) is currently being designed and is beginning the environmental review process. As part of the restoration options being considered for SELRP sand dredging from within the lagoon is being evaluated. That sand may be suitable for beach nourishment. The potential volume of material that may be dredged is still under review but may provide sufficient suitable material to service this project. However, because the SELRP has not undergone review at this time and the volume of potential available sand has not been determined, this analysis does not consider use of SELRP material. If information becomes available that indicates SELRP could be a potential source of material for this project, then further review would be necessary. If the SELRP material is determined to be suitable for nourishment, and appropriate evaluation and permitting are completed, the material would be used as a substitute for the offshore sources, either in whole or in part. As discussed above under Cumulative Impacts, the obvious synergy and efficiency of using that material would be realized and the instance where SELRP material would be additive to material for this Coastal Storm Damage Reduction Project would not be expected and in fact would be avoided.

Although opportunities may occur for beneficial reuse of sand excavated from inshore construction sites in the study area as allowed under the existing Sand Compatibility and Opportunistic Use Program (SCOUP) permits in Solana Beach and Encinitas, in accordance with Engineering Regulation (ER) 1105-2-100, opportunistic projects are not considered a substantive source of sand to beaches in the study area under the No Action Alternative. ER 1105-2-100 also states that for a project to be considered, it must be under construction or fully funded and permitted. Opportunistic sand made available would be a supplemental input to the federal project, requiring no additional federal funding or authorization.

Because of the constraints, uncertainties, and significant costs, onshore borrow sites have not been carried forward into the final analysis in this Integrated Report.

Emergent Breakwaters

Breakwaters are concrete or rock structures built roughly parallel to the shore just beyond the breaker zone to absorb wave energy by stopping transmission or breaking the wave before it impinges on the beach. They can be permeable or solid, depending on desired amount of wave energy absorption vs. reflection.

This alternative was examined in the preliminary screening of alternatives. Preliminary cost estimates were developed by SANDAG for a 50 year life, 1,000 ft long breakwater, supplemented with enough beach replenishment to create a 17 acre beach in the lee of the breakwater (Moffat & Nichol 2000). The $33 million cost included 1.1 million cy of initial sand renourishment and an additional 620,000 cy on a 10 year nourishment cycle. Emergent breakwaters were considered in the development of the plan alternatives; however they were screened out of the final analysis contained in this study for several reasons;

- Emergent breakwaters interfere with safe navigation and recreation activities because the top of the structure is at times above the surface of the water.
- Extremely high construction and maintenance costs due to large volumes of armor rock needed and performing construction in the nearshore/surfzone.
- Potential increase in downcoast erosion due to sand retention limiting sediment transport.
- Emergent breakwaters have potential to interfere with nearshore wave conditions by dissipating the incoming wave energy and therefore impact surfing conditions.
- Potential impact on aesthetics due to a visible structure in the nearshore.
- Lack of support from the local sponsors and local community for a structure that includes any visible offshore structure or impact to downcoast littoral transport.
- Lack of support from the resource agencies, specifically the CA Coastal Commission, which is the lead agency that upholds the Coastal Zone Management Act within California, for a structure that significantly retains sediment and decrease sediment available to the system.

The concept design plan view for a breakwater is schematically illustrated in **Figure 3.1-6.**

Submerged Breakwater/Artificial Reef

Submerged artificial reef type designs come in many forms, but can be roughly broken into "soft" and "hard" designs.

In the soft designs, nearshore sand berms are constructed of dredged sand placed parallel to the beach in shallow water. The "soft" breakwater reduces incident wave height, and gradual onshore migration of the sediment can contribute to renourishment of the adjacent shoreline, provided the berm itself is stable enough to withstand the wave environment. However, this type of design is generally not suited for the type of wave environmentl in the study area because of the relatives small grain sizes available sand would not be stable when subjected to the wave induced bottom currents. Therefore, soft surmerged berms were not carried forward in the final analysis.

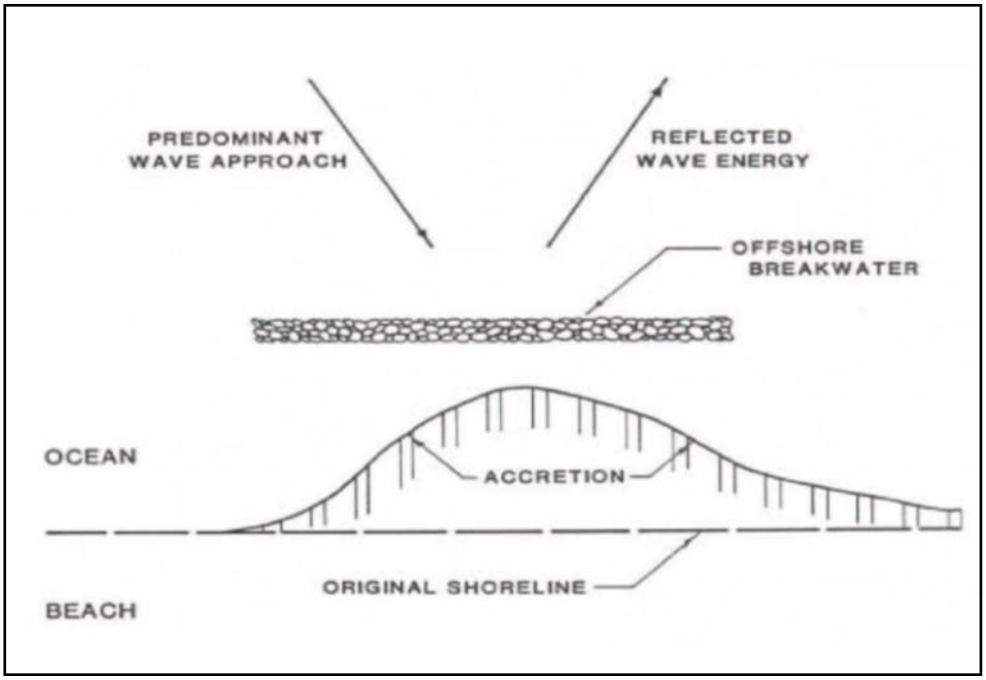
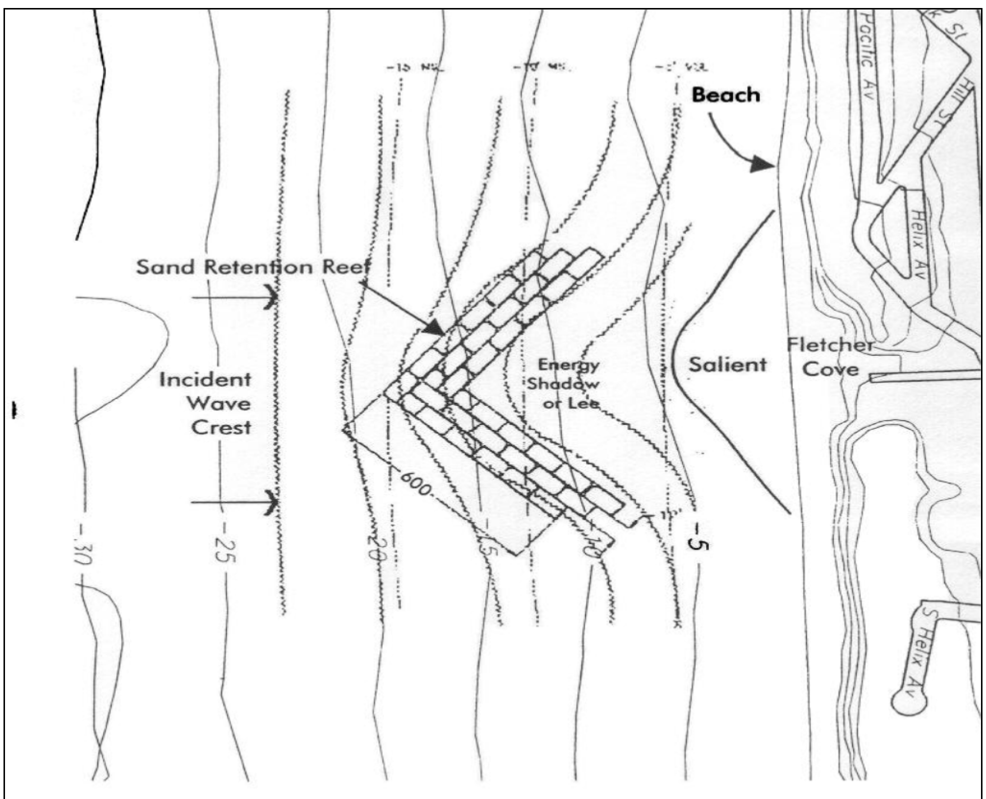


Figure 3.1-6 Typical Detached Breakwater (Plan View)

Both “soft” submerged breakwaters and “hard” submerged breakwaters which include “artificial reefs” were considered as an alternative during plan formulation. These structures reduce wave energy through breaking and dissipation. They are generally not as effective for retaining sand on the protected beach as emergent (surface piercing) breakwaters; however, these structures do not generally have as many adverse effects on surfing conditions as emergent structures. Under certain conditions, submerged breakwaters can enhance surfing conditions if the structures are designed for dual purposes. The “*SANDAG Beach Retention Strategy*“ states on page 18 of Appendix 4, “*To effect wave dissipation, (artificial) reefs are wide in the cross-shore direction. Large and especially irregularly shaped reefs refract waves, thereby altering their approach direction toward the shoreline. Structure-induced changes in the alongshore flux of smaller reefs are due primarily to an attenuation or dissipation of wave energy as it passes over the structure….. In this… condition, the (beach width) bulge is retained in dynamic equilibrium. Reefs for sand retention and surfing are generally located nearshore with a crest (plateau) elevation near MSL. These reefs are either shore connected or offshore, each behaving very different from the other. Submerged reefs rarely generate substantial adverse effects on neighboring beaches since they have little impact on the longshore littoral drift…*..”

Although much theoretical research has been done, real world data on the performance of artificial reefs as sand retention structures is only now becoming available, because few have been built. In addition, most of those were either in Florida or Australia, where conditions differ greatly from the Southern California coastline. Pratte’s Reef was constructed off El Segundo, California out of large geotube sand bags, but was too small and located too far offshore to have any noticeable impact on the shoreline (M&N, SANDAG, Oct 2000) and has since been removed. As discussed previously, another study, titled the “U.S. Army Corps of Engineers’ National Shoreline Erosion Control Demonstration Program” is an ongoing effort to find innovative ways of using coastal structures to reduce or prevent beach erosion. The main focus of that study is on submerged breakwater type structures. It is hoped that innovative concepts and designs can address issues with existing designs such as high costs, safety, effectiveness, and impacts on surfing. The conceptual design for an artificial reef is schematically illustrated in **Figure 3.1-7**. However, extremely high costs coupled with extremely high uncertainty of the performance of this measure, lack of support from the local sponsors have resulted in this measure being excluded from further consideration in this Integrated Report.

Another independent study has been commissioned by the USACE to evaluate artificial reef designs offshore from Solana Beach. The USACE and the City of Solana Beach have been working together since 2007 to develop the conceptual engineering design for an artificial reef located offshore from Fletcher Cove. The primary goal of the reef would be to retain sand, create a wider beach, and reduce direct wave attack on the City's coastal bluffs. Secondary but important goals of the project are to provide recreational opportunities and to restore biological resource values immediately offshore. The conceptual project is based on the multi-purpose conceptual reef planned for Ventura County (Oil Piers Reef). In April 2010, the USACE and the City completed the conceptual engineering design study for a submerged reef at Fletcher Cove. In January 2011, the City retained the firm of ASR to conduct a peer review of the techniques, methodologies and conclusions contained in the April 2010 report. In June 2011, the City retained Dr. Richard Seymour of Scripps Institution of Oceanography to independently evaluate both of the earlier technical reports. Copies of all three reports are available on the City of Solana Beach website at http://www.ci.solana-beach.ca.us/csite/cms/339.htm.



Source: Moffat & Nichol Engineers, 1999

Figure 3.1-7 (Conceptual) Typical Artificial Reef

Groins

Along-shore sand retention structures, such as groins and jetties, are constructed perpendicular to the shore to form fillets that can slow beach erosion by trapping sediment being moved by littoral transport. Most of the littoral drift occurs inshore of the normal breaker line under prevailing wave conditions (about the 7 to 10 ft depth contours on the Pacific coast). Hence, extension of sand retention structures beyond about MLLW is generally uneconomical (USACE, 1984).

The shore-perpendicular structures are generally utilized to preserve a minimum berm width and slow erosion rates so that renourishment, if combined with beach nourishment, will require lower volumes and less frequent occurrence, improving the overall effectiveness and efficiency of beach nourishment projects. Groins are often used if their cost is less than the cost savings grained from this reduction in nourishment volume, however, in this case the life cycle costs of construction groins are likely to exceed any savings in cost of renourishment. The amount of sand trapped by a shoreline-perpendicular structure depends on the permeability, height, and length of the structure and the amount of sand in the littoral system. As material accumulates on the updrift side of the structure, supply to the downdrift side is reduced. This results in local beach accretion on the updrift side of the structure and erosion for some distance downshore. After the beach near the structure adjusts to an "equilibrium" stage in accordance with the wave conditions, all littoral drift will pass the structure either directly over it or diverted around the seaward end of the structure.

Groins were considered as an alternative, but because of the potential adverse effects on downdrift beaches, groins and similar structures should be used only after careful consideration of the factors involved and should always incorporate a pre-fill component whereby the amount of sand that could be trapped by the structure is placed concurrent with structure construction thereby avoiding downdrift impacts. The concept design for groins is illustrated in **Figure 3.1-8.**

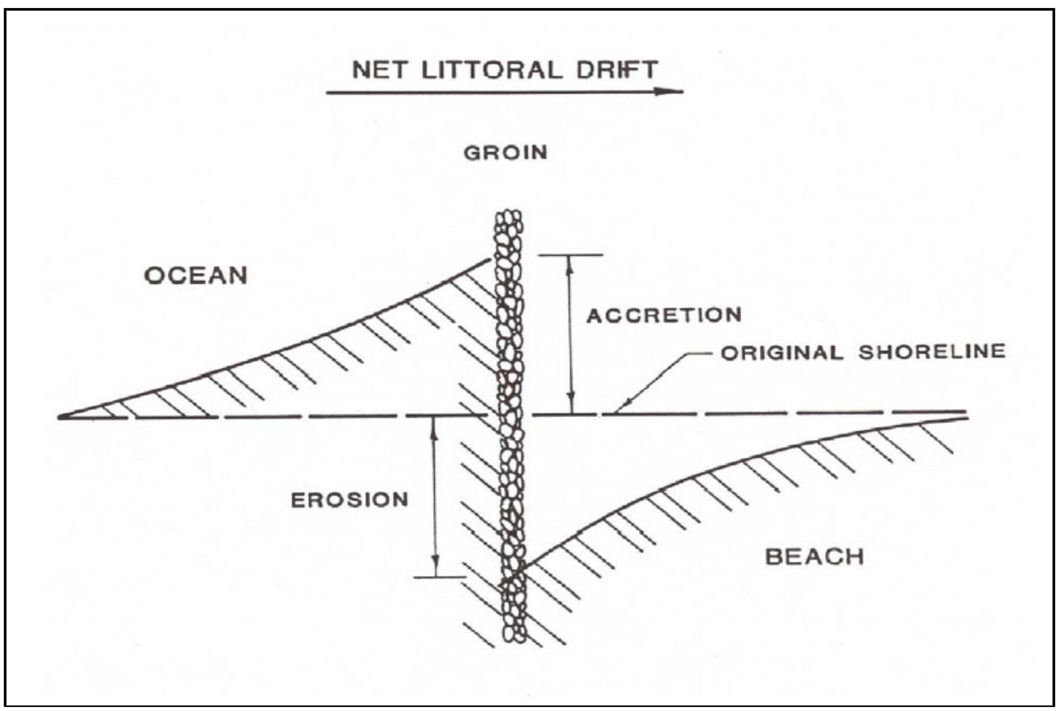


Figure 3.1-8 Typical Groin – Plan View

Groins were considered as an alternative but were not considered further in the study due to the following:

- Groin placement would be perpendicular to shore and would create a barrier to sediment transport, worsening downcoast erosion.
- Lack of support from the resource agencies, specifically the CA Coastal Commission, which is the lead agency that upholds the Coastal Zone Management Act within California, for a structure that significantly retains sediment and decrease sediment available to the system.
- Potential impacts to EFH due to lost habitat area occupied by construction footprints and /or turbidity impacts during rock placement in the nearshore.
- Potential impact to lateral beach access
- Potential impact on aesthetics due to a visible structure.
- Lack of support from the local sponsors and local community for a structure that includes any visible offshore structure or impact to downcoast littoral transport.
- Potential impact on surfing due to alteration in nearshore wave conditions,
- Groins could interfere with safe navigation and recreation because they would be placed perpendicular to shore and provide a barrier for water recreation use.

Structural Alternatives – Bluff Protection

Other structural measures to protect the shoreline include those placed directly at the toe of the bluff to protect it from wave attack.

Notchfill Only

Toe notches are concave features at the base of the bluff caused by erosion from continuous exposure to wave attack. A notchfill involves filling of sea caves and bluff toe notches with engineered concrete fill. This measure has proven to be an effective method of protecting the bluff toe when properly maintained. Notchfills effectively improve overall sea-cliff stability, prevent significant erosion of the cliff base, and provide vertical support of the overhang. This solution has been implemented in portions of the study area. Notchfills differ from seawalls in that they are not designed to protect the entire bluff face from constant wave attack, but only to stabilize the lower bluff and prevent collapse during occasional periods of wave exposure. As such, they are generally smaller and less conspicuous than seawalls.

Notchfill is considered as an alternative carried forward for analysis. This solution has been implemented at portions of Reaches 3 and 4. Notchfills have also been completed recently in Solana Beach comprised entirely of erodible or low strength concrete typically having unconfined compressive strengths on the order of 800 psi. These were placed entirely landward of the drip line without the use of reinforcing steel. The erodible notchfills were keyed a minimum of 1 to 2 ft into the bedrock shore platform, and loose or weathered material was removed from the notch or sea cave prior to the low-strength concrete. This measure is therefore carried forward for additional analysis.

The particular design for a notchfill is based on the geotechnical characteristics of the area and the size of the notch. The appropriate design and costs for each area are discussed in the following sections. The concept design is schematically illustrated in **Figure 3.1-8.**

Notchfills were carried forward into a secondary level of screening and additional analysis in this study but were eliminated from the final array of alternatives for several reasons:

- Notchfill-only alternatives do not provide sufficient reduction in coastal storm damage to meet the project objectives because only the areas with notchfill are protected while the areas without notchfills may continue to erode.
- Lack of support from the local sponsors and local community for an alternative that does not meet the project objectives, provide coastal storm damage reduction and increase public safety.

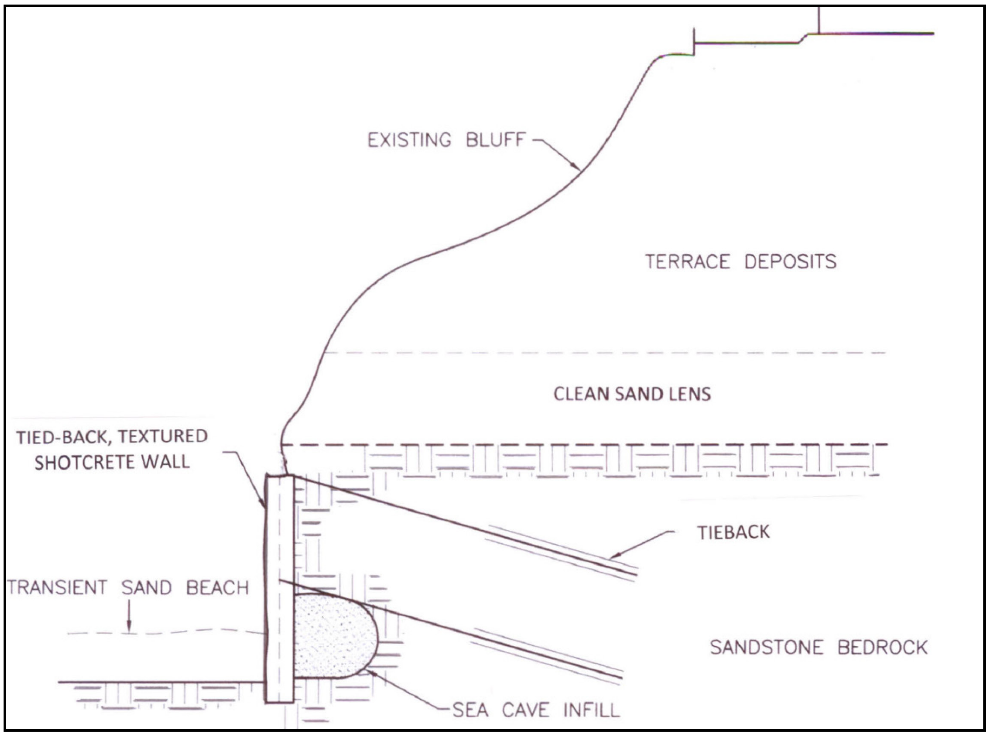


Figure 3.1-9 Schematic of Typical Notchfill

Hybrid- Beach Nourishment with Notchfill

This alternative is comprised of both the beach nourishment component and notchfill. As in the beach nourishment alternative increments of 50 ft beach widths with 2-16 year renrouishment intervals were analyzed in conjunction with a notchfill toe protection to determine the full benefits of this alternative and ensure that the maximum benefits were considered during the analysis.

Seawalls

Seawalls are solid structures designed to withstand the full force of storm waves without being overtopped or undermined. The structures protect the bluff from the direct forces associated with breaking waves and the indirect and destructive abrasive action caused by sand and cobble thrown into suspension against the bluff toe. The particular design selection for a seawall is based on the geotechnical characteristics of the area and the configuration of the bluff slope.

The Seawall alternative requires constructing a series of seawalls at the base of the bluff from 25 to 35 ft tall and extending across all unprotected/unarmored parcels in Encinitas and Solana Beach. The seawall would be continuous, if not continuous erosion would be exacerbated at unprotected parcels and threaten the stability of adjacent seawalls by eroding the bluff along the side and behind the existing structure. Seawalls were carried forward into a secondary level of screening and additional analysis in this study but were eliminated from the final array of alternatives for several reasons:

- Potential increase in downcoast erosion due to lack of bluff sediment available for transport and increase erosion at the ends of the seawall dues to potential wave refraction
- Lack of support from the resource agencies, specifically the CA Coastal Commission, which is the lead agency that upholds the Coastal Zone Management Act within California, for a structure that limits sediment availability to the system and may impact beach access.
- Lack of support from the local sponsors and local community for a structure that includes any visible vertical structure or impact to downcoast littoral transport because it hardens the shoreline.
- Potential impact on surfing due to alteration in nearshore wave conditions because of potential reflection off the seawall.
- Potential impact on aesthetics due to a visible structure with potential vertical height of +15 ft MLLW.

The appropriate design and cost for each area is developed in the following sections. A conceptual design is schematically illustrated in **Figure 3.1-9.**

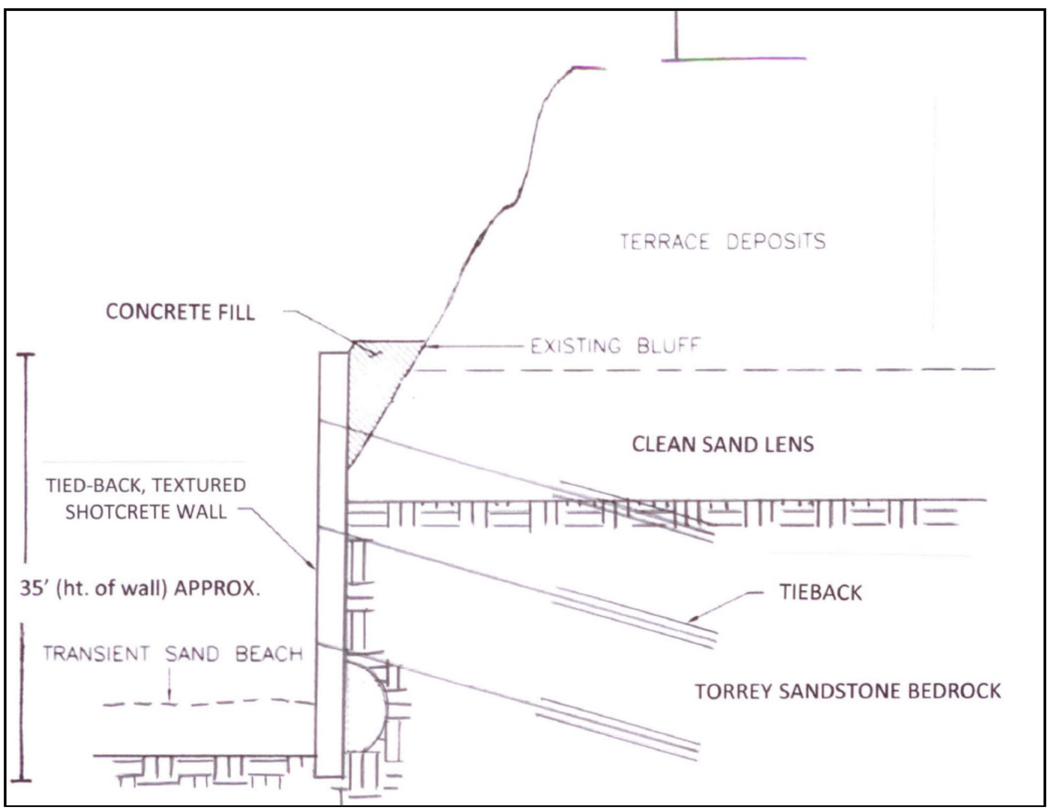


Figure 3.1-10 Schematic of Typical Seawall Design

Revetments

Revetments are structures made of placed quarry stone designed to protect the bluff toe from erosion by wave action. They are typically built of 3 to 5 ton stone over a layer of smaller stone over a base of fill. Revetments are generally effective if maintained, but their width requirements result in encroachment onto the beach.

At Solana Beach (reaches 8 and 9) there is a large lens of unconsolidated sand in the mid-bluff zone which is not present at Encinitas (reaches 1 through 7); therefore, any stabilization measure in Solana Beach must extend significantly higher up the bluff face than in Encinitas. For this reason, revetments are impractical in Solana Beach because their footprint would extend over 60 ft seaward from the bluff toe, which is a substantial impediment to coastal access and recreation. This consideration would not preclude the use of revetments in Encinitas, where the bluff geology may be more suitable. However, because of the reasons listed below, revetments were eliminated from further consideration as a shore protection measure:

Aesthetic Impacts - Revetment is less aesthetically pleasing than beach replenishment, notchfill, or seawall. The length of shoreline affected would have significant impacts on aesthetics throughout the study area. The aesthetic impacts caused by revetment would not be acceptable to the public.

Public Access Impacts - Revetments are difficult and hazardous for pedestrians to cross and impede access to the beach. In addition, they take up a significant portion of the beach width and impede alongshore access.

Recreation Impacts - Revetments would extend seaward up to 33 ft from the bluff toe in Encinitas and 66 ft from the bluff toe in Solana Beach. This would result in no beach in the winter and would severely limit available beach space in the summertime and would constitute a significant impact.

Major Issues Consistent with the Coastal Zone Management Act - The California Coastal Commission currently interprets the Coastal Act in such a way that favors almost any type of shore protection over rock revetment, especially in areas where there is a lot of public beach use and recreation. A Revetment project of this size would have very little chance of obtaining a Coastal Consistency Determination.

Public Opposition from Well Organized Groups - Local, well organized and well funded citizens groups including Surfrider have expressed strong opposition to revetments both in public meetings and in litigation. Any proposed project including revetment would encounter opposition from these groups

The conceptual design is schematically illustrated in **Figure 3.1-10.**

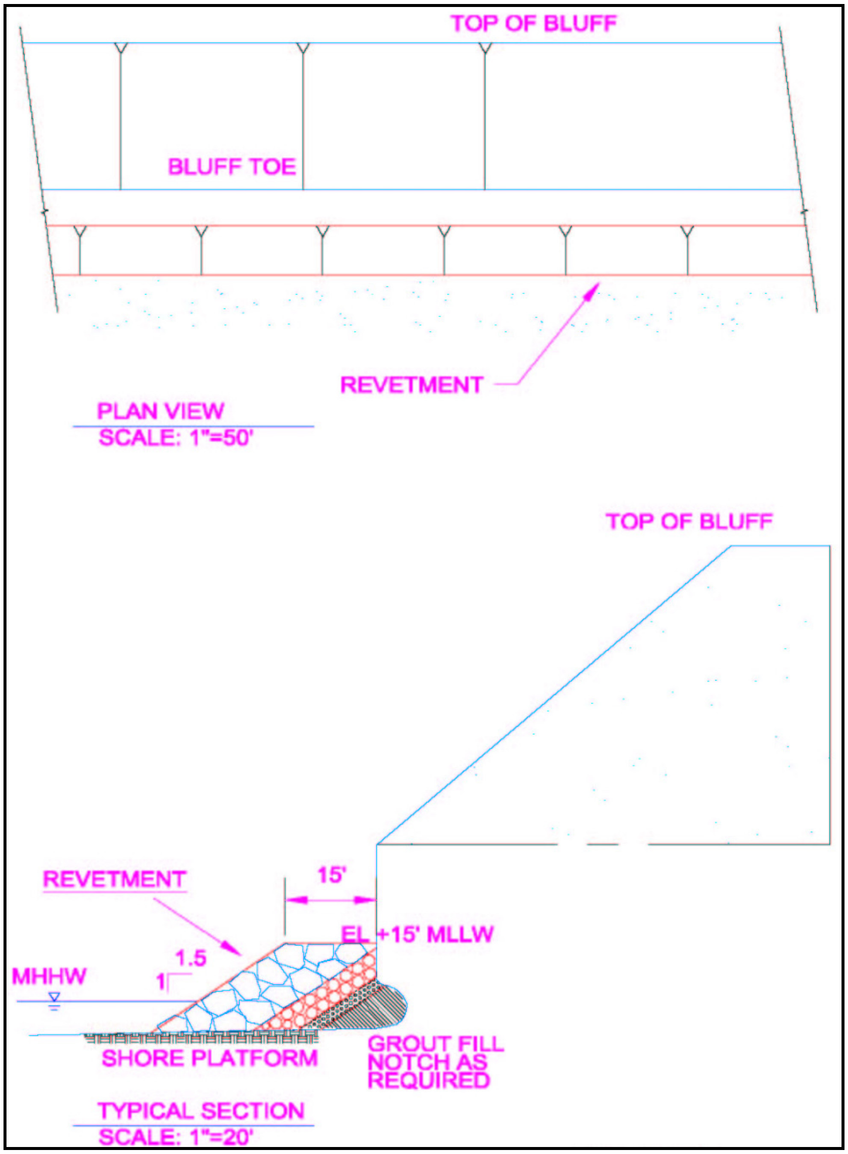


Figure 3.1-11 Schematic of Typical Revetment

3.1.5 Preliminary Screening of Alternatives

All alternatives went through a preliminary screening process. **Table 3.1-2** illustrates alternatives that were eliminated early in the process and those carried forward for additional analysis.

Preliminary screening eliminated the following alternatives:

- Managed Retreat
- Emergent Breakwaters
- Submerged Breakwater/Artificial Reef
- Groins
- Revetments

Plans are then compared using four formulation criteria suggested by the U.S. Water Resources Council. These criteria are;

- Completeness – Completeness is a determination of whether or not the plan includes all elements necessary to achieve the objectives of the plan. It is an indication of the degree that the outputs of the plan are dependent upon the action of others.
- Effectiveness – All of the plans in the final array provide some contribution to the planning objectives. Effectiveness is defined as a measure of the extent to which a plan achieves its objectives.
- Efficiency – All of the plans in the final array provide net benefits. Efficiency is a measure of the cost effectiveness of the plan expressed in net benefits.
- Acceptability – All of the plans in the final array must be in accordance with Federal law and policy. The comparison of acceptability is defined as acceptance of the plan to the local sponsors and the concerned public.

The objectives listed as 1-4 in **Table 3.1-2** are the same objectives listed earlier in the report, and are summarized below:

Objective 1: To protect public property and reduce storm related damages to residential, commercial, and public facilities along the bluffs and shoreline.

Objective 2: To address safety concerns associated with bluff failures.

Objective 3: To enhance recreational opportunities associated with the beach.

Objective 4: To preserve and protect environmental resources along the shoreline.

Table 3.1-2 Preliminary Screening of Alternatives

Alternative	Meets the Objective				Effective-ness	Acceptable	Economics	Status	Comment
	1	2	3	4	Is it effective?	Is it accepted publicly?	Is it Justified?		
No Action	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Carried Forward into Final Array	Carried Forward under NEPA Regulation Requirements
Managed Retreat	No	No	No	No	No	Not supported by sponsors	No	Eliminated from Further Analysis	An analysis was performed to determine the actual structural damages that would occur to unprotected parcels if a ban on new seawalls was implemented. Costs consist of blufftop structural damages and blufftop land loss damages. This analysis indicates that these damages are more than twice the cost of protection. In this scenario, homeowners would have to be compensated for their property loss as a “regulatory taking”. The local sponsors have indicated that they do not have the resources to provide this compensation on the scale required, and thus cannot support Managed Retreat.
Beach Nourishment at Various Increments	Yes	Yes	Yes	Yes	Yes	Yes	Some Alternatives are Justified	Carried Forward into Final Array	Analyzed at various increments from 50' beach width up to 400' beach width. Reduces storm damage impacts to bluffs, shoreline, and structures. Costs vary based on volume of material placement on the beach and renourishment interval.
Notchfills	Yes	Yes	No	No	Minimally	Possibly	No	Considered for Secondary Screening	The particular design for a notchfill is based on the geotechnical characteristics of the area and the size of the notch and is required to be designed with the same erosion rate of the bluff. The notchfill alternative was carried forward into a secondary level of screening, however it was not found to be economically justified and it was only minimally effective at storm damage reduction as a stand-along alternative, therefore not carried into the final array of alternatives.
Hybrid-Beach nourishment and notchfill	Yes	Yes	Yes	Yes	Yes	Yes	Some Alternatives are Justified	Carried Forward into Final Array	Analyzed at various increments of beach width with notchfill. Reduces storm damage impacts to bluffs, shoreline, and structures. Costs vary based on volume of material placement on the beach, renourishment interval, and cost of material for notchfills.

Alternative	Meets the Objective				Effectiveness	Acceptable	Economics	Status	Comment
	1	2	3	4	Is it effective?	Is it accepted publicly?	Is it Justified?		
Groins	Yes	Yes	No	No	No	Not supported by sponsors/ community	N/A	Eliminated from Further Analysis	Groins would entail extremely high costs, lack of public/sponsors support, severe impact on lateral beach access, potential impacts to downdrift beaches, and questions about effectiveness, because groins are not very effective in areas like the study area, with limited sand supply. This measure was screened out of the final analysis for the reasons cited above.
Seawalls	Yes	Yes	No	No	Yes	Possibly	No	Considered for Secondary Screening	The seawall alternative was carried forward into a secondary level of screening, however it was not found to be federally economically justified, therefore not carried into the final array of alternatives.
Revetment	Yes	Yes	No	No	Solana Beach-No; Encinitas-minimally	Not supported by sponsors/ community	N/A	Eliminated from Further Analysis	In Solana Beach there is a large lens of unconsolidated sand in the mid-bluff zone which is not present in Encinitas. Any stabilization measure in Solana Beach must therefore extend significantly higher up the bluff face than in Encinitas. For this reason, revetments are impractical in Solana Beach because their footprint would extend over 60 ft seaward of the bluff toe, which is an unallowable impediment to coastal access and recreation. Revetments may be effective in Encinitas, where the bluff geology may be more suitable. However, because of the following reasons revetments were eliminated from further consideration: consistency with Coastal Zone Management Act, public access impacts, aesthetic impacts, recreation impacts, and public opposition.

3.1.6 Secondary Screening

Secondary screening was used to conduct a more detailed analysis of potential alternatives, which included seawall, notchfill only, beach nourishment, and beach nourishment and notchfill (hybrid). For each alternative, the team established recreation benefits, determined the maximum preventable damages, and finally, determined the with-project benefits and costs. Using these analyses in conjunction with meeting the project objective, a decision to carry forward with the alternatives was determined.

The seawall alternative is a seawall constructed at the base of the bluff only for all unprotected parcels. The unprotected parcels the seawall would be constructed on are approximately 6,300 ft in Segment 1 and 4,300 ft in Segment 2. There are no recreation benefits from the seawall alternative. Seawall costs were determined and costs were subtracted from the benefits. The results showed that this alternative had a benefit to cost ratio less than 1.0 as required for federal economic justification, and was therefore eliminated from further consideration. In addition, due to the potential impact the seawall would have natural shoreline processes and its potential for the seawall to be considered inconsistent with the Coastal Zone Management Act, this alternatives was not carried forward.

The notchfill only alternative would provide minimal coastal storm damage reduction benefits and does not provide any additional protection with added sand in the system; therefore recreational benefits were not included in this alternative. In addition, the notchfill only alternative minimally improves life safety. The results showed that this alternative had a benefit to cost ratio less than 1.0 as required for federal economic justification and coupled with the minimal coastal storm damage reduction and life safety improvements was therefore eliminated from any further consideration.

The results of the analysis are presented in **Table 3.1-3**. Details of the analysis and results are described in Appendix E.

Table 3.1-3 Secondary Screening

Encinitas			**Solana Beach**		
Notchfill Alternative			***Notchfill Alternative***		
	Low SLR	**High SLR**		**Low SLR**	**High SLR**
Benefits	2,119,000	1,840,000	**Benefits**	797,000	1,336,000
Costs	2,252,000	2,252,000	**Costs**	1,535,000	1,535,000
Net Benefits	**($133,000)**	**($411,000)**	**Net Benefits**	**($738,000)**	**($198,000)**
BCR	0.94	0.82	**BCR**	0.52	0.87
Seawall Alternative			***Seawall Alternative***		
	Low SLR	**High SLR**		**Low SLR**	**High SLR**
Benefits	2,786,000	3,185,000	**Benefits**	2,826,000	3,527,000
Costs	4,845,000	4,845,000	**Costs**	3,837,000	3,837,000
Net Benefits	**($2,059,000)**	**($1,660,000)**	**Net Benefits**	**($1,011,000)**	**($310,000)**
BCR	0.58	0.66	**BCR**	0.74	0.92

The Beach nourishment and hybrid alternatives were analyzed and considered economically justified at various beach width increments, as the benefits exceeded the costs. These alternatives were carried forward into the final array of alternatives descried in the next section.

3.2 Final Array of Alternatives

The alternatives carried forward, beach nourishment and hybrid alternatives, meet the project needs and objectives. Due to the geographical separation and shoreline conditions of Segment 1 and Segment 2 between the study area of Encinitas and Solana Beach, alternatives for Encinitas were analyzed and justified independently of Solana Beach. The alternatives for Encinitas can pair with any of the alternatives for Solana Beach.

3.2.1 Beach Nourishment

The width of protective beach and its periodic re-nourishment period is optimized through an economic NED analysis discussed in Appendix E. Alternate widths were developed in 50-ft increments up to an increased width of 400-ft or until the analysis demonstrated a decline in net benefits. The effects of additional beach fill on reducing bluff top erosion is discussed in Section 6.6 of Appendix B. This analysis is in accordance with the USACE's planning guidelines to select an optimal beach width, and is further described in Chapter 12 of Appendix B. These optimal beach fills were based on the overall project net benefits and include details such as initial beach nourishment width and sand replenishment cycles. The design sand placement densities, or volume of sand placed per alongshore length (cy/ft) is based on the analysis of site specific beach profiles. The construction beach fill prism dimensions are typical for the California coasts with a crest height at +10 ft MLLW, foreshore slope of 15:1 (horizontal to vertical), and tapering to the back beach elevation ranging from about +12 to +18 ft above MLLW.

3.2.2 Hybrid – Beach Nourishment and Notch Fill

The cyclic variation of annual wave climate in a short time span (e.g., 4 to 7 years) may accelerate or slow down sediment loss during a particular replenishment cycle as compared to the average projection derived from historical observations or model simulations. As a consequence, there exists some risk that a protective beach may be eroded away before the next designated sand replenishment cycle is carried out. Under such conditions, the bluff base would again be vulnerable to direct wave attack. Bluff failure may be triggered from additional toe erosion, if a substantial toe notch has previously been developed. To prevent the bluff base from toe erosion during a short period in which the beach is almost or completely depleted, a hybrid plan combining notch fill and a beach fill with a narrower beach fill than a beach only plan is an alternative. The plan provides the flexibility of a required beach width necessary for bluff base protection.

3.2.3 Alternatives Considered for Full Evaluation

As mentioned in the previous sections, a full array of beach widths and renourishment cycles for both alternatives was considered from benefits and environmental consequences perspective as well as the ability to meet the planning objectives. The most viable and implementable plans are presented below and in the following parts of this Integrated Report to be considered for plan recommendation. A detailed analysis of NED benefits can be found in Section 5 of Appendix E. From this analysis, the range of alternatives was pared down to those listed below, and shown in **Table 3.2-1**.

The alternatives for Encinitas are:

- EN-1A Beach Nourishment (100-ft beach renourished every 5 years)
- EN-1B Beach Nourishment (50-ft beach renourished every 5 years)
- EN-2A Hybrid (100-ft beach renourished every 10 years and notchfill)
- EN-2A Hybrid (50-ft beach renourished every 5 years and notchfill)
- EN-3 No Action

The alternatives for Solana Beach are:

- SB-1A Beach Nourishment (200-ft/300-ft beach renourished every 13/14 years)
- SB-1B Beach Nourishment (150-ft beach renourished every 10 years)
- SB-1C Beach Nourishment (100-ft beach renourished every 10 years)
- SB-2A Hybrid (150-ft beach renourished every 10 years and notchfill)
- SB-2A Hybrid (100-ft beach renourished every 10 years and notchfill)
- SB-3 No Action

The period of analysis associated with all the alternative is 50 years (2015-2065).

3.2.4 Sea-Level Change Sensitivity Analysis

Each of the final alternatives is described under two conditions: 1) a low sea level rise prediction scenario; and 2) a high sea level rise prediction scenario. For each alternative, the high and low rates of sea level rise result in different predicted rates of erosion and subsequently the design of each alternative varies under the two scenarios. For example Alternative EN-1A has an initial nourishment placement of 680,000 cy for the low sea level rise scenario and 730,000 cy for the high sea level rise scenario. Descriptions provided herein apply to both the low and high sea level rise scenarios. Any differences in dredge and placement volumes or any component distinctions between the two scenarios are provided in the tables that accompany text and provided quantifications.

It is important to understand the potential consequences of the necessary design adaptation should either of the scenarios be realized. The current and historical trends for sea level rise that have been recorded, as described in Appendix B, align with the low sea level rise scenario predictions. Consequently it is the low sea level rise scenario design in each alternative that, at the time of writing this report, is the assumed 2015 ‘base scenario’ for design. Should high sea level rise scenario predictions become evident during the course of the project, adaption of the design to the high sea level rise scenario would be implemented. To achieve that adaption the higher renourishment volumes would be implemented if, or when, any recalibration of sea level indicated the high sea level rise scenario was in evidence. The descriptions herein and the analysis in Section 5.0 of this Integrated Report provide comparable levels of information such that the consequences of the alternatives under either scenario can be effectively considered and compared. As with each of the other alternatives, should the switch to high sea level rise be necessary during the life of the project, renourishment would simply implement the volumes for the high sea level rise scenario from the time the switch is made.

Table 3.2-1 Final Array of Alternatives

Encinitas (EN)		**Alternative EN - 1A: Beach Nourishment (100 ft; 5-yr cycle)**	**Alternative EN - 1B: Beach Nourishment (50 ft; 5-yr cycle)**		**Alternative EN-2A: Hybrid (100 ft; 10-yr cycle)**	**Alternative EN-2B: Hybrid (50 ft; 5-yr cycle)**	**Alternative EN -3: No Action**
Initial Placement Volume (cy)	High SLR	730,000	390,000		800,000	390,000	Assumes that the continued practice of emergency permitting for seawalls along the segment would continue.
	Low SLR	680,000	340,000		700,000	340,000	
Re-Nourishment Cycle	High SLR	5-yr	5-yr		10-yr	5-yr	
	Low SLR	5-yr	5-yr		10-yr	5-yr	
Added Beach MSL Width	High SLR	100 ft	50 ft		100 ft	50 ft	
	Low SLR	100 ft	50 ft		100 ft	50 ft	
Solana Beach (SB)		**Alternative SB - 1A: Beach Nourishment (200 ft; 13-yr cycle)**	**Alternative SB - 1B: Beach Nourishment (150 ft; 10-yr cycle)**	**Alternative SB-1C: Beach Nourishment (100 ft; 10-yr cycle)**	**Alternative SB-2A: Hybrid (150 ft; 10-yr cycle)**	**Alternative SB-2B: Hybrid (100 ft; 10-yr cycle)**	**Alternative SB-3: No Action**
Initial Placement Volume (cy)	High SLR	1,620,000	790,000	540,000	790,000	540,000	Assumes that the continued practice of emergency permitting for seawalls along the segment would continue.
	Low SLR	960,000	700,000	440,000	700,000	440,000	
Re-Nourishment Cycle	High SLR	14-yr	10-yr	10-yr	10-yr	10-yr	
	Low LSR	13-yr	10-yr	10-yr	10-yr	10-yr	
Added Beach MSL Width	High SLR	300 ft	150 ft	100 ft	150 ft	100 ft	
	Low SLR	200 ft	150 ft	100 ft	150 ft	100 ft	

3.3 Project Features Common to Action Alternatives

3.3.1 Offshore Borrow Sites

Under each alternative, implementation would involve use of the same borrow sites for sand. These borrow site have been previously defined and mined for prior beach replenishment activities including the RBSP I, and are identified as MB-1, SO-5 and SO-6.

Borrow site SO-6, shown in **Figure 3.3-1**, is located approximately 4,500 ft offshore from the San Elijo Lagoon at the southern end of Encinitas and SO-5 is located approximately 4,500 ft offshore of the San Dieguito River, south of Solana Beach, as shown in **Figure 3.3-2**. Borrow site MB-1 is located approximately 3,000 ft offshore from Mission Bay, and is shown on **Figure 3.3-3. Table 3.3-1** provides a summary of the volumes of sand available and surface areas for each of these borrow sites (Appendix B). A description of the characteristics of the material within the borrow sites is provided in Section 4.1 of this Integrated Report. The amount of material to be dredged from these borrow sites varies, both for initial nourishment and for periodic renourishment activities, with each alternative. Borrow sites SO-5 and SO-6 are identified as the primary sites. Material from borrow site SO-5, would be used for Segment 2 (Solana Beach) and material from borrow site SO-6 would be used for Segment 1 (Encinitas) until exhausted at which time SO-5 would provide material for both Encinitas and Solana Beach receiver sites. The volumes necessary for an array of combinations of Segment 1 and Segment 2 alternatives, under the high sea level rise scenario, exceed the total combined volumes of material available at borrow sites SO-5 and SO-6. Borrow site MB-1 would then be used as a supplemental source to contribute to the required volume of sand for alternatives under the high sea level rise scenario.

Table 3.3-1 Offshore Borrow Sites Summary

	MB-1	SO-5	SO-6
Volume Available (approximate)	5,800,000 cy	7,800,000 cy	1,300,000 cy
Surface Area	107 acres	124 acres	44 acres
Depth of the Dredge Cut (ft)	20	20	20
Depth of Borrow Site (MLLW)	-60 to -74 ft	-34 to -95 ft	-42 to -56 ft

Source: Appendix B.

1

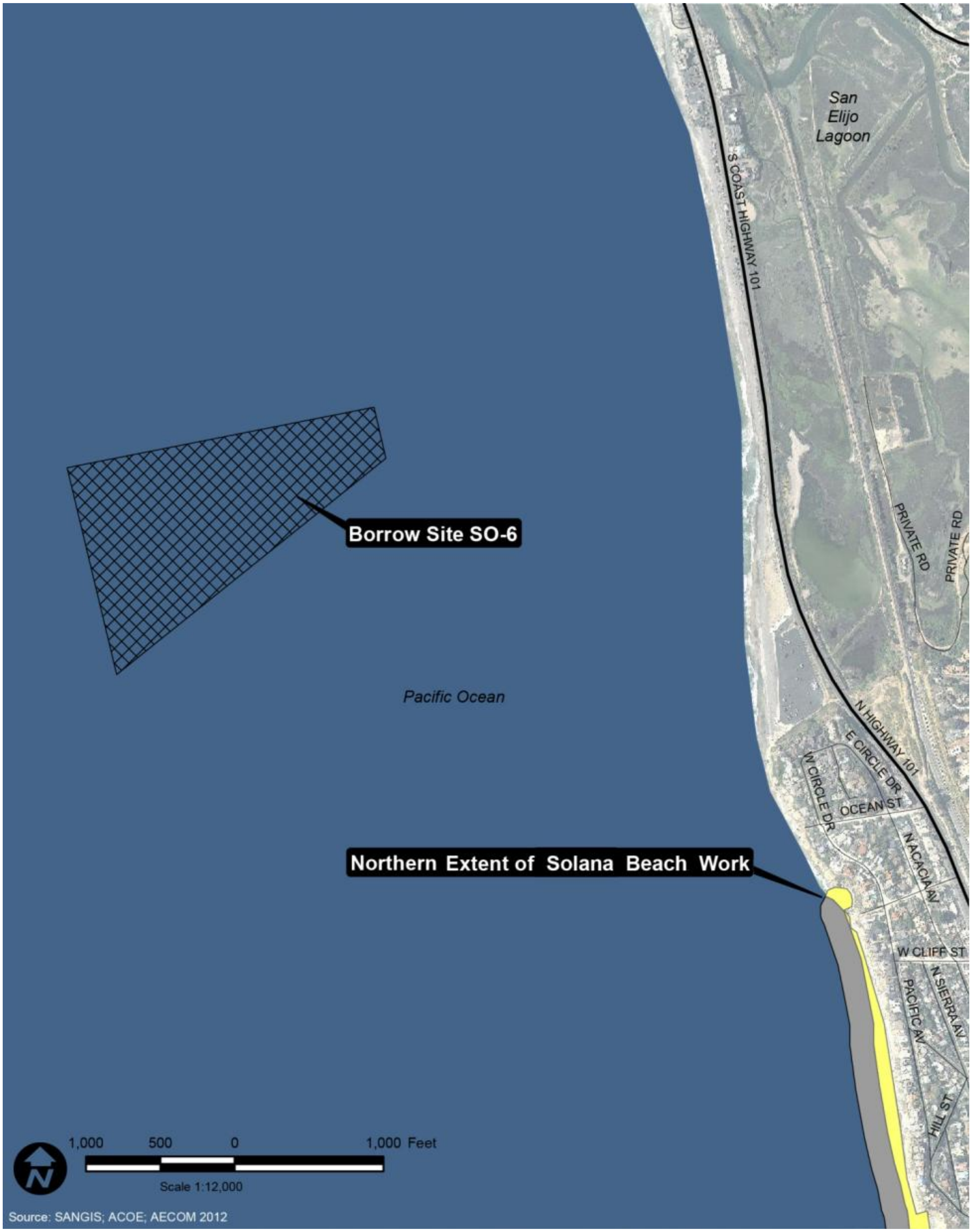


Figure 3.3-1 SO-6 Borrow Site Footprint (SANDAG 2000a)

Figure 3.3-2 SO-5 Borrow Site Footprint (SANDAG 2000a)

Figure 3.3-3 MB-1 Borrow Site Footprint (SANDAG 2000a)

3.3.2 Receiver Sites (Beaches)

Under each alternative, renourishment would occur at the identified receiver sites, as shown in **Figure 3.1-1** and **Figure 3.1-2**. The Encinitas receiver site is approximately 1.5 mi in length, extending from the 700 block of Neptune Avenue south to the approximate end of West H Street. The Solana Beach receiver site encompasses almost the entire shore of Solana Beach, approximately 1.4 mi, and stretches from Tide Park south to the southern city limit of Solana Beach, which is located at the western extent of Via de la Valle. As described for each alternative, the amount of material to be placed on the beaches varies, both for initial nourishment and for periodic renourishment activities. The intended width of beach within each of the receiver sites also varies amongst the alternatives. **Table 3.3-2** summarizes the existing conditions at the receiver sites.

Table 3.3-2 Receiver Sites Summary (Existing Conditions)

	Encinitas	Solana Beach
Beach length of receiver site (approximate)	7,800 ft	7,200 ft
Average existing beach width within receiver site [1]	110 ft	70 ft
[1] Average distance between the landward extent of the beach and the MSL position		

3.3.3 Types of Dredge Equipment

Under each of the alternatives evaluated the equipment for dredging and placement of dredged material would be selected from the following two types of dredges.

<u>Hopper Dredge</u>

The hopper dredge is a self-contained vessel that loads sediment from an offshore borrow site then moves to a receiver site for sand placement. The hopper dredge contains two large arms that have the ability to drag along the ocean floor and collect sediment. The drag heads are about 10 square ft. The hopper dredge moves along the ocean surface with its arms extended, passing back and forth in the designated borrow site until the hull is fully loaded with sediment. The hopper dredge can generally reach within approximately 0.5 mile of shore to offload. From this distance, the hopper dredge connects to a floating or submerged pump line from shore. The vessel then discharges a mixture of sediment and seawater onto the receiver site. Submerged lines would be sufficiently encased by large tractor tires to prevent abrasion of the ocean floor, reefs, or other seabed habitats. One hopper dredge would be required.

Monobuoy with Hopper

The hopper dredge requires a monobuoy to discharge its sand onto the beach. A monobuoy is a floating pipeline connection platform that is moored to the seafloor, and is used to interconnect with a steel sinker pipeline that carries the slurry along the seafloor to the beach. The monobuoy is generally anchored to the seabed at an appropriate depth and location to serve the project needs, depending on locations of sensitive resources and engineering considerations. For this project the monobuoy would be anchored in at least 25 ft of water, between 2,500 ft and 5,000 ft from shore. From one monobuoy location, sand can be pumped directly onshore and up to approximately 2,000 ft alongshore in either direction. Once this 4,000 ft (maximum) stretch of beach has been filled, the monobuoy is picked up and moved to the next fill zone.

Cutterhead Dredge

The cutterhead is a floating vessel equipped with a rotating cutter apparatus surrounding the intake end of the suction pipe. This dredge has the capability of pumping dredged material long distances to upland disposal areas. Costs increase for sources over approximately 16,000 ft from the receiver site, which means it would be likely considered for dredging at SO-6. The cutterhead dredge is usually equipped with two stern spud anchors used to hold the dredge in working position and to advance the dredge into the cut or excavating area. During operation, the cutterhead dredge swings from side to side alternately using the port and starboard spuds as a pivot. Cables attached to anchors on each side of the dredge control lateral movement. Forward movement is achieved by lowering the starboard spud after the port swing is made and then raising the port spud. The dredge is then swung back to the starboard side of the cut centerline. The port spud is lowered and the starboard spud lifted to advance the dredge. Floating pipeline is then connected from the barge to the beach.

One cutterhead dredge would be required, with one anchor tender vessel to move the spuds as needed and a crew boat to ferry crew and supplies to the rig from the shoreside support facility, most probably located at Oceanside.

Booster Pump with Cutterhead

For the cutterhead pipeline discharge, the pipe would be laid on the seafloor from SO-6 straight into shore, landing at Cardiff Beach. A booster pump, located on the beach, would be required to pump the slurry up or down coast from that point. The beach pipeline would be partially buried so it would not impede public access or present a hazard on the beach (except at the point of discharge).

3.3.4 General Description of Construction Activities

Onshore Placement

For both the hopper and cutterhead dredging methods, sand would be combined with seawater as part of the dredging process to produce a slurry. It would then be conveyed to the beach either via pipeline or a combination of hopper dredge and pipeline. Existing sand at each receiver site would be used to build a small, “L”-shaped berm to anchor the sand placement operations. The short side of the “L” is perpendicular to the shoreline and approximately the same width as the design beach for each receiver site. The long side is parallel to shore, at the seaward edge of the design beach footprint.

The slurry would be pumped onto the beach into the angle of the “L” between the berm and the bluff toe. This berm would reduce ocean water turbidity allowing all the sand to settle out inside the bermed area while the seawater is channeled just inside the long side of the berm until it reaches the open end where it would drain across the shore platform and into the ocean. As filling progresses the berm would be continuously extended to maintain its designed length.

As the material is deposited behind the berm, the sand would be spread using two bulldozers and one front-end loader to direct the flow of the sand slurry and form a gradual slope to the existing beach elevation. A crew of up to 10 people would be required for the beach work. The construction sequence is described in further detail below.

For each receiver site under any of the nourishment or hybrid (nourishment and notchfill) alternatives, berm construction may be adjusted from the design requirements during fill placement depending on actual field conditions. The measurements indicated for the width of the berms for each nourishment alternative are the initial placement widths. The berms would be subject to the forces of the waves and weather once constructed, and would eventually settle down to a natural grade for the beach. Nourishment alternatives herein are all designed to achieve a berm after two years of being reworked by ocean processes (waves, currents and winds), also referred to as the 2-year equilibrium, as this is the actual project state that would provide storm damage reduction.

Construction Sequence and Duration

Beach nourishment related activities (sand dredging, placement, and dispersal) would occur on a 24-hour, 7-day a week (24/7) basis, by operating three shifts per day. Beach operations would only occur during the day (12 hours). Approximately two days would be required to set up the pipeline leading from the dredge or monobuoy to the shoreline. The contractor would typically assemble two sets of pipeline to avoid delays associated with moving and setting up the pipelines as each section of sand placement is completed. Sand discharge would be continuous as long as the dredge is operating. Daily average production rate would be approximately 10,000 cy for the hopper dredge with pumpout, excluding site preparation and post dredge grooming and cleanup.

Construction Access and Staging Areas

Under each nourishment alternative, existing public beach access points would be used for the construction equipment and crew at Moonlight Beach in Encinitas. Beach access for the construction equipment and crew at Solana Beach would be provided at Fletcher Cove and potentially Cardiff State Beach parking lot north of the City of Solana Beach. Because the construction equipment would be used on a 24/7 basis, there would be only occasional need for a staging area. Should equipment need to be temporarily moved off the beach, it would be stored in parking lots at the access points. Any fueling or maintenance activities would occur at the staging areas, and the contractor would be required to provide and comply with a Spill Prevention, Control, and Containment (SPCC) plan for hazardous spill prevention and containment. Public parking areas are available for use by the construction crew. The dredge crew would park at the port of operations for the dredge.

Public Access

Under each nourishment alternative, construction would be carried out such that the only impacts to public beach access would occur at the point of discharge. Approximately 200 ft of beach would be inaccessible to the public around the discharge pipeline and berms. In addition, there would be intermittent restrictions on public access for approximately 200 ft on either side of this discharge zone. This space would be needed for maneuvering heavy equipment during construction of the temporary berms and for relocating discharge pipelines.

3.3.5 Additional Design Measures

Biological Monitoring

Construction activities are expected to occur throughout the calendar year. To ensure that no significant biological impacts occur as a result of the proposed project, biological monitoring will occur during construction. A detailed monitoring plan would be submitted to the appropriate resource agencies for review and comment during the USACE's Preconstruction Engineering and Design (PED) phase of the project. Nearshore underwater surveys would be conducted prior to construction and after construction to determine if any natural/biological resources/habitats have been adversely impacted to the project. If surveys indicate that the proposed project has adversely impacted biological/natural resources, those losses would be mitigated. Appendices H and M further detail the Monitoring and Mitigation Plans for the proposed project.

Should spawning and/or grunion eggs be encountered during construction of the berm, a second transverse would be constructed to close off a cell ahead of the beach section where spawning occurred. The cell would then be filled; the section of beach with grunion would be avoided and bypassed. Filling the new cell would commence downcoast with construction of a new transverse and berm. A boundary of 100 ft on both downcoast and upcoast directions around the grunion spawning area would be avoided for a minimum of one lunar month following the grunion spawning event.

Notchfill (for Hybrid alternatives only)

A photograph of a typical bluff toe notch/sea cave is shown on **Figure 3.3-4**. The design cross-section for an engineered notchfill is shown in **Figure 3.3-5**. The lower bluff protection is limited to filling notches or seacaves at the base of the bluff to stabilize the lower bluff, and does not include seawalls or mid or upper bluff stabilization measures.

Notchfill activities for each Segment would require approximately 10 to 15 trucks of concrete per day. The total volume of concrete required to fill notches in the bluff base would be determined by the specific site conditions at the time of project construction. However, based on an estimate of approximately 1 mile of bluff protection, approximately 6,000 cy of concrete would be needed, which would be provided by a cement truck in the work area. The quick-drying shotcrete gunite is spread using a high-pressured hose, and approximately 100 ft per day can be covered, assuming 8 cy of shotcrete can be produced in each cement truckload.

The filling of notches would need to occur during low tides. During low tides the area immediately in front of the notch is cleared of sand. The concrete is mixed with a quick dry additive, and a layer of the concrete approximately 6 inches thick is sprayed along an area of bluff with section lengths of approximately 100 ft and reaching heights up to 40 ft. The quick-drying concrete sprayed at the beginning of the area would be dry once the entire area has been sprayed, and an additional 6 inches would be sprayed on top of the first layer. This process would be repeated until the notch is filled and matches the face of the surrounding bluff. Approximately 1.0 cy of concrete is required per 3.3 ft of a 6-ft deep notch.

Figure 3.3-4 Typical Notch/Sea Cave Formation

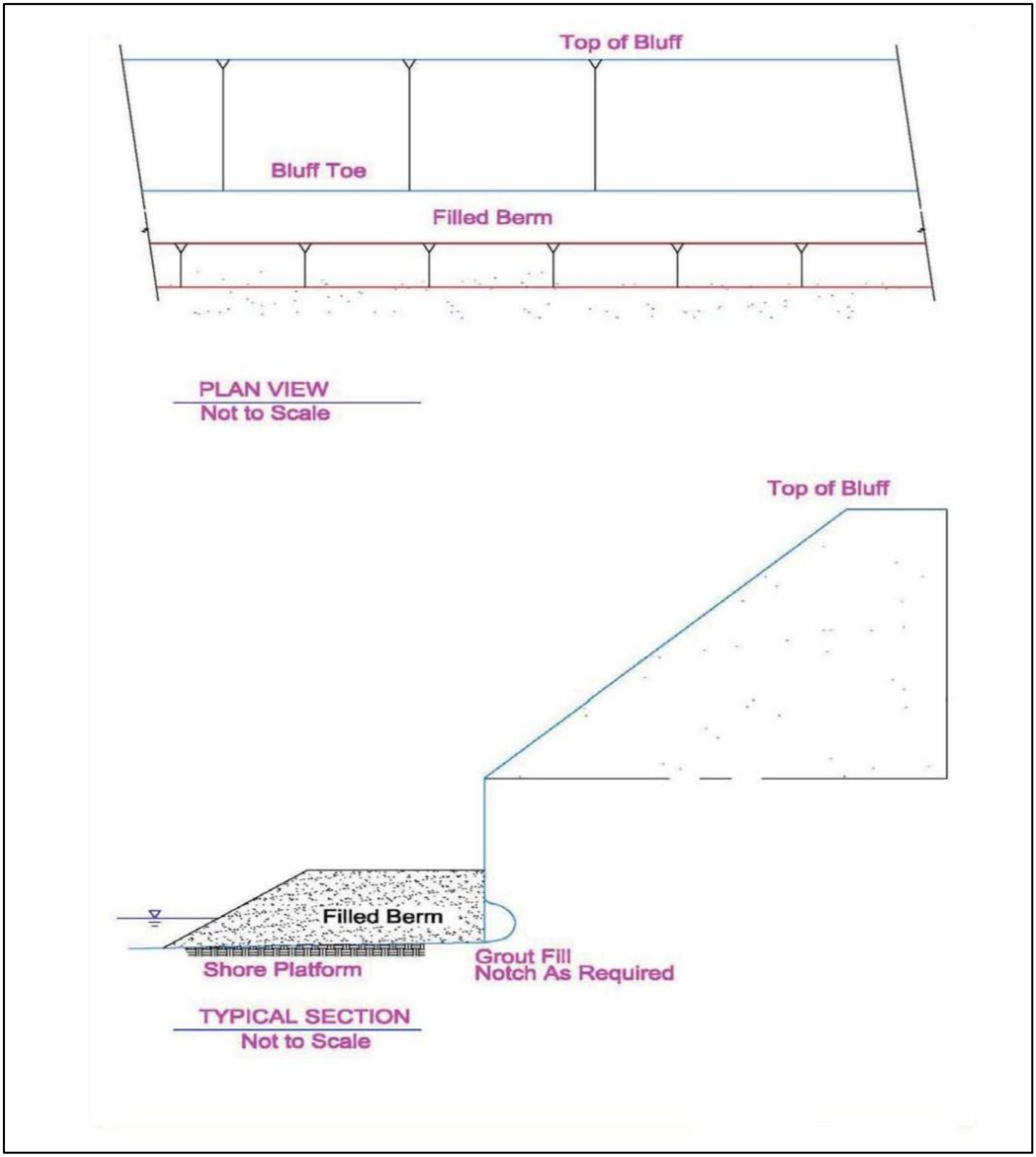


Figure 3.3-5 Cross Section Notch Fill (Hybrid Alternatives)

3.4 Final Alternatives

3.4.1 Alternative EN-1A –Beach Nourishment (100 ft; 5 Year Nourishment Cycle)

Alternative EN-1A (Encinitas), shown in **Figure 3.4-1**, involves sand nourishment within Segment 1 as the method of providing storm damage reduction. Under this alternative, sand would be dredged from offshore, beyond the depth of closure, using borrow sites SO-5, MB-1 and SO-6. That material would then be placed directly onto the receiver site within Segment 1. As presented in **Table 3.4-1**, under this alternative the designed additional beach width for Encinitas is 100 ft MSL, increasing the beach profile width to 210 ft (existing beach width plus additional proposed beach width), under the low sea level rise scenario. Renourishment would average every five years.

Table 3.4-1 Alternative EN-1A Beach Nourishment Summary

	Encinitas (EN)	
SLR Scenario	Low	High
Existing[1] MSL Beach Width [2]	110 ft	110 ft
Additional MSL width target	100 ft	100 ft
Total MSL Beach Width	210 ft	210 ft
Alongshore Length (Receiver Site)	7,800 ft	7,800 ft
Initial Borrow Volume[3]	820,000 cy	880,000 cy
Total Project 50-year Borrow Volume[3]	3,850,000 cy	4,840,000 cy
Initial Placement Volume [3]	680,000 cy	730,000 cy
Total Placement Volume[3]	3,200,000 cy	4,030,000 cy

[1]Average seasonal Post Equilibrium (2015) profile
[2]Landward beach limit to average MSL position
[3]Placement volume is approximately 20% less than initial borrow volume due to construction losses

<u>General Description of Activities</u>

Onshore Placement

The onshore placement of the material would be achieved in the manner described in Section 3.3.4, achieving a rectangular shaped berm. The long side is shore parallel, at the seaward edge of the design beach footprint. The long side is initially approximately 200 ft long and the short side is approximately 130 ft long. As filling progresses the berm is continuously extended to maintain its 200 ft length. In this way return water has to flow approximately 200 ft before returning to the ocean.

Construction Sequence and Duration

Table 3.4-2 summarizes the construction duration for this alternative for the initial placement. Construction activities are expected to occur throughout the calendar year.

Figure 3.4-1 Alternative EN-1A - Encinitas

Table 3.4-2 Alternative EN-1A – Initial Nourishment Schedule

	Low Sea Level	High Sea Level
Borrow Site Location	SO-6	SO-6
Initial Volume of Material to Be Dredged at Borrow Site	820,000 cy	880,000 cy
Duration of Dredge Operations (estimated 24-hour work days)[1]	82 days	88 days
Construction Duration (estimated days)[2]	103	109
Approximate Length of Receiver Site Closed per Day[3]	150-325 ft	150-325 ft
Note: [1] Based on a daily production rate of 10,000 cy –for hopper dredge with pumpout, excludes site prep and post dredge grooming and cleanup. [2] Includes approximately 2 weeks of site prep and mobilization and demobilization efforts.[3] Consistent with RBSP II estimations.		

Borrow Volumes

Section 3.3.1 discusses the borrow sites to be used for the alternatives. Material from borrow site SO-6 would be used for Encinitas until exhausted, at which time SO-5 would provide material. **Table 3.4-3** shows the volumes of material needed for initial placement as well as volume and expected timing of the renourishment intervals. The volumes given are approximately 10-20 percent higher than those required for beach fill to account for losses during construction operations.

Table 3.4-3 Source Volumes of Dredged Material (Alternative EN-1A) Encinitas

Year	Low SLR	High SLR
2015	820,000 cy	820,000 cy
2020	340,000 cy	820,000 cy
2025	340,000 cy	820,000 cy
2030	340,000 cy	820,000 cy
2035	340,000 cy	820,000 cy
2040	340,000 cy	820,000 cy
2045	340,000 cy	820,000 cy
2050	340,000 cy	820,000 cy
2055	340,000 cy	820,000 cy
2060	340,000 cy	820,000 cy
Total Borrow	**3,880,000 cy**	**4,840,000 cy**

Receiver Site

Sand placement would occur along 7,800 ft of the shoreline directly avoiding sensitive habitat, and the top of the berm would be constructed to an elevation of approximately +15 ft MLLW. It would be flat and approximately 210 ft wide at a slope of 10:1 (horizontal distance: vertical distance). As shown in **Table 3.4-4**, a total of approximately 3,200,000 cy would be placed in Segment 1 under the low sea level rise scenario, and 4,030,000 cy under the high sea level rise scenario over a 50-yr period. This table also provides the volumes of material to be placed on the beach at each of the periodic renourishment efforts, as well as the anticipated timing of that, under each of the sea level rise scenarios.

Table 3.4-4 Alternative EN-1A Placement Volumes

Project Year	Low SLR (cy)	High SLR (cy)
2015 (Initial Placement)	680,000	730,000
2020	280,000	340,000
2025	280,000	340,000
2030	280,000	350,000
2035	280,000	360,000
2040	280,000	370,000
2045	280,000	370,000
2050	280,000	380,000
2055	280,000	390,000
2060	280,000	400,000
Total Placement	**3,200,000**	**4,030,000**

3.4.2 Alternatives EN-1B– Beach Nourishment (50 ft; 5 Year Nourishment Cycle)

Alternative EN-1B, shown in **Figure 3.4-2**, is similar to EN-1A, but would have reduced volumes of sand dredged from borrow sites and placed on Segment 1. As with Alternative EN-1A, sediment would be used to reduce storm damages along the shoreline. Under this alternative, sand would be dredged from offshore, beyond the depth of closure, using borrow sites SO-5, MB-1 and SO-6. That material would then be placed directly onto the receiver site within Segment 1. As presented in **Table 3.4-5**, under this alternative the designed additional beach width is 50 ft MSL, increasing the beach profile width to 160 ft (existing beach width plus additional proposed beach width), under the low sea level rise scenario. Renourishment would average every five years.

Table 3.4-5 Alternative EN-1B Beach Nourishment Summary

Receiver Site	**Encinitas**	
SLR Scenario	Low SLR	High SLR
Existing MSL Beach Width [1]	110 ft	110 ft
Additional MSL width target	50 ft	50 ft
Total MSL Beach Width[2]	160 ft	160 ft
Alongshore Length (Receiver Site)	7,800 ft	7,800 ft
Initial Borrow Volume[3]	410,000 cy	470,000 cy
Total Project 50-year Borrow Volume4	2,790,000 cy	3,780,000 cy
Initial Placement Volume[4]	340,000 cy	390,000 cy
Total Placement Volume[4]	2,320,000 cy	3,150,000 cy

[1]Average seasonal Post Equilibrium profile
[2] Back beach limit to average MSL position
[3] Placement volume is up to 20% less than borrow volume due to expected construction losses.

<u>General Description of Activities</u>

Onshore Placement

The onshore placement of the material would be achieved in the manner described in Section 3.3.4, achieving a rectangular shaped berm. The long side is shore parallel, at the seaward edge of the design beach footprint. The long side is initially approximately 200 ft long and the short side is approximately 130 ft long. As filling progresses the berm is continuously extended to maintain its 200 ft length. In this way return water has to flow approximately 200 ft before returning to the ocean.

Construction Sequence and Duration

Table 3.4-6 summarizes the construction duration for this alternative for the initial placement. Construction activities are expected to occur throughout the calendar year.

Table 3.4-6 Alternative EN-1B - Initial Nourishment Schedule

	Low Sea Level	High Sea Level
Borrow Site Location	SO-6	SO-6
Initial Volume of Material to Be Dredged at Borrow Site	410,000 cy	470,000 cy
Duration of Dredge Operations (estimated 24-hour work days)[1]	41 days	47 days
Construction Duration (estimated days)[2]	62	68
Approximate Length of Receiver Site Closed per Day[3]	150-325 ft	150-325 ft
Note: [1] Based on a daily production rate of 10,000 cy –for hopper dredge with pumpout, excludes site prep and post dredge grooming and cleanup. [2] Includes approximately 2 weeks of site prep and mobilization and demobilization efforts.[3] Consistent with RBSP II estimations.		

Borrow Volumes

Section 3.3.1 discusses the borrow sites to be used for the alternatives. Material from borrow site SO-6 would be used for Encinitas until exhausted, at which time SO-5 would provide material. **Table 3.4-7** shows the volumes of material needed for initial placement as well as volume and expected timing of the renourishment intervals. The volumes given are approximately 10-20 percent higher than those required for beach fill to account for losses during construction operations.

Table 3.4-7 Source Volumes of Dredged Material (Alternative EN-1B) Encinitas

Year	Low Sea level Rise	High Sea Level Rise
2015 (initial)	410,000 cy	470,000 cy
2020	260,000 cy	330,000 cy
2025	260,000 cy	340,000 cy
2030	260,000 cy	350,000 cy
2035	260,000 cy	360,000 cy
2040	260,000 cy	370,000 cy
2045	260,000 cy	380,000 cy
2050	260,000 cy	390,000 cy
2055	260,000 cy	390,000 cy
2060	260,000 cy	400,000 cy
Total Borrow	**2,790,000 cy**	**3,780,000 cy**

Figure 3.4-2 Alternative EN-1B – Encinitas

Receiver Site

Sand placement would occur along 7,800 ft of the shoreline directly avoiding sensitive habitat, and the top of the berm would be constructed to an elevation of approximately +15 ft MLLW. It would be flat and approximately 160 ft wide at a slope of 10:1 (horizontal distance: vertical distance). As shown in **Table 3.4-8**, a total of approximately 2,320,000 cy would be placed in Segment 1 under the low sea level rise scenario, and 3,150,000 cy under the high sea level rise scenario over a 50-yr period. This table also provides the volumes of material to be placed on the beach at each of the periodic renourishment efforts, as well as the anticipated timing of that, under each of the sea level rise scenarios.

Table 3.4-8 Alternative EN-1B Placement Volumes

Project Year	Low SLR (cy)	High SLR (cy)
2015 (Initial Placement)	340,000	390,000
2020	220,000	280,000
2025	220,000	280,000
2030	220,000	290,000
2035	220,000	300,000
2040	220,000	310,000
2045	220,000	310,000
2050	220,000	320,000
2055	220,000	330,000
2060	220,000	340,000
Total Placement	**2,320,000**	**3,150,000**

3.4.3 Alternative EN-2A– Hybrid Plan - Beach Nourishment and Notchfill (100 ft; 10 Year Nourishment Cycle)

Alternative EN-2A, as shown in **Figure 3.4-3**, involves sand nourishment along Segment 1, similar to Alternative EN-1A, combined with the filling of bluff notches. Under this alternative, sand would be dredged from offshore, beyond the depth of closure, using borrow sites SO-5, SO-6, and MB-1. That material would then be placed directly onto the receiver site within Segment 1. As presented in **Table 3.4-9**, under this alternative the designed additional beach width is 100 ft, increasing beach profile width to 210 ft. Renourishment would average every ten years.

Alternative EN-2A consists of an engineered notchfill with concrete at the bluff base following placement of an additional 100-ft wide beach fill. The general notchfill design is described in Section 3.3.4. Beach replenishment activities for Alternative EN-2A would differ from Alternative EN-1A in Encinitas with a higher initial placement, though with a lower total 50 year placement. The volume of sand in each nourishment cycle would be higher, though nourishment would occur less often (ten year vs. a five year renourishment cycle).

Table 3.4-9 Alternative EN-2A Sand Placement Summary

Receiver Site	Encinitas EN-2A	
SLR Scenario	Low	High
Existing MSL Beach Width[1]	110 ft	110 ft
Additional MSL width target	100 ft	100 ft
Total MSL Beach Width[2]	210 ft	210 ft
Alongshore Length (Receiver Site)	7,800 ft	7,800 ft
Initial Borrow Volume[3]	840,000 cy	960,000 cy
Total Project 50-year Borrow Volume[3]	3,710,000 cy	4,700,000 cy
Initial Placement Volume [3]	700,000 cy	800,000 cy
Total Placement Volume[3]	3,090,000 cy	3,900,000 cy

[1]Average seasonal Post Equilibrium profile
[2] Back beach limit to average MSL position
[3] Placement volume is approximately 20% less than initial borrow volume

General Description of Activities

Onshore Placement

The onshore placement of the material would be achieved in the manner described in Section 3.3.4, achieving a rectangular shaped berm. The long side is shore parallel, at the seaward edge of the design beach footprint. The long side is initially approximately 200 ft long and the short side is approximately 130 ft long. As filling progresses the berm is continuously extended to maintain its 200 ft length. In this way return water has to flow approximately 200 ft before returning to the ocean.

Construction Sequence and Duration

Table 3.4-10 summarizes the construction duration for this alternative for initial construction. Construction activities are expected to occur throughout the calendar year.

Table 3.4-10 Alternative EN-2A - Initial Nourishment Schedule

	Low Sea Level	High Sea Level
Borrow Site Location	SO-6	SO-6
Initial Volume of Material to Be Dredged at Borrow Site	840,000 cy	960,000 cy
Duration of Dredge Operations (estimated 24-hour work days)[1]	84 days	96 days
Construction Duration (estimated days)[2]	180	180
Approximate Length of Receiver Site Closed per Day[3]	200 ft	200 ft
Note: [1] Based on a daily production rate of 10,000 cy –for hopper dredge with pumpout, excludes site prep and post dredge grooming and cleanup. [2] Includes approximately 2 weeks of site prep and mobilization and demobilization efforts.[3] Consistent with RBSP II estimations.		

Figure 3.4-3 Alternative EN-2A – Encinitas

Borrow Volumes

Section 3.3.1 discusses the borrow sites to be used for the alternatives. Material from borrow site SO-6 would be used for Encinitas until exhausted, at which time SO-5 would provide material. **Table 3.4-11** shows the volumes of material needed for initial placement as well as volume and expected timing of the renourishment intervals. The volumes given are approximately 10-20 percent higher than those required for beach fill to account for losses during construction operations.

Table 3.4-11 Source Volumes of Dredged Material (Alternative EN–2A) Encinitas

Year	Low SLR	High SLR
2015	840,000 cy	960,000 cy
2025	720,000 cy	880,000 cy
2035	720,000 cy	920,000 cy
2045	720,000 cy	950,000 cy
2055	720,000 cy	990,000 cy
Total Borrow	**3,710,000 cy**	**4,700,000 cy**

Receiver Site

Sand placement would occur along 7,800 ft directly avoiding sensitive habitat, and the top of the berm would be constructed to an elevation of approximately +15 ft MLLW, and would be flat and approximately 210 ft wide at a slope of 10:1 (horizontal distance : vertical distance). As shown in **Table 3.4-12**, a total of approximately 3,090,000 cy would be placed in Encinitas under the low sea level rise scenario, and 3,900,000 cy under the high sea level rise scenario. This table also provides the volumes of material to be placed on the beach at each of the periodic renourishment efforts, as well as the anticipated timing of that, under each of the sea level rise scenarios. The average renourishment interval is 10 years.

Table 3.4-12 Alternative EN-2A-Hybrid Encinitas Placement Volumes

Project Year	**Low SLR** (cy)	**High SLR** (cy)
2015 (Initial Placement)	700,000	800,000
2025	600,000	730,000
2035	600,000	760,000
2045	600,000	790,000
2055	600,000	820,000
Total Placement	**3,090,000**	**3,900,000**

3.4.4 Alternative EN-2B– Hybrid Plan - Beach Nourishment and Notchfill (50 ft; 5 Year Nourishment Cycle)

Alternative EN-2B, as shown in **Figure 3.4-4**, involves sand nourishment and notchfills along Segment 1 similar to Alternative EN-1B, except the notchfills have been added. Under this alternative, sand would be dredged from offshore, beyond the depth of closure, using borrow sites SO-5, SO-6, and MB-1. That material would then be placed directly onto the receiver site within Segment 1. As presented in **Table 3.4-13**, under this alternative the designed additional beach width is 50 ft, increasing the beach profile width to 160 ft. Renourishment would average every five years.

Alternative EN-2B consists of an engineered notchfill with concrete at the bluff base following placement of an additional 50-ft wide beach fill. The general notchfill design is described in Section 3.3.4.

Table 3.4-13 Alternative EN-2B Sand Placement Summary

Receiver Sites	EN-2B	
SLR Scenario	Low	High
Existing MSL Beach Width [1]	110 ft	110 ft
Additional MSL width target	50 ft	50 ft
Total MSL Beach Width[2]	160 ft	160 ft
Alongshore Length (Receiver Site)	7,800 ft	7,800 ft
Initial Borrow Volume[3]	410,000 cy	470,000 cy
Total Project 50-year Borrow Volume[3]	2,790,000 cy	3,780,000 cy
Initial Placement Volume [3]	340,000 cy	390,000 cy
Total Placement Volume[3]	2,320,000 cy[4]	3,150,000 cy

[1]Average seasonal Post Equilibrium profile
[2] Back beach limit to average MSL position
[3] Placement volume is 20% less than borrow volume

<u>General Description of Activities</u>

Onshore Placement

The onshore placement of the material would be achieved in the manner described in Section 3.3.4, achieving a rectangular shaped berm. The long side is shore parallel, at the seaward edge of the design beach footprint. The long side is initially approximately 200 ft long and the short side is approximately 130 ft long. As filling progresses the berm is continuously extended to maintain its 200 ft length. In this way return water has to flow approximately 200 ft before returning to the ocean.

Construction Sequence and Duration

Table 3.4-14 summarizes the construction duration for this alternative for the initial placement. Construction activities are expected to occur throughout the year.

Table 3.4-14 Alternative EN-2B - Initial Nourishment Schedule

	Low Sea Level	High Sea Level
Borrow Site Location	SO-6	SO-6
Initial Volume of Material to Be Dredged at Borrow Site	410,000 cy	470,000 cy
Duration of Dredge Operations (estimated 24-hour work days)[1]	41 days	47 days
Construction Duration (estimated days)[2]	180	180
Approximate Length of Receiver Site Closed per Day[3]	200 ft	200 ft
Note: [1] Based on a daily production rate of 10,000 cy –for hopper dredge with pumpout, excludes site prep and post dredge grooming and cleanup. [2] Includes approximately 2 weeks of site prep and mobilization and demobilization efforts.[3] Consistent with RBSP II estimations.		

Borrow Volumes

Section 3.3.1 discusses the borrow sites to be used for the alternatives. Material from borrow site SO-6 would be used for Encinitas until exhausted, at which time SO-5 would provide material. **Table 3.4-15** shows the volumes of material needed for initial placement as well as volume and expected timing of the renourishment intervals. The volumes given are approximately 10-20 percent higher than those required for beach fill to account for losses during construction operations.

Table 3.4-15 Source Volumes of Dredged Material (Alternative EN-2B) Encinitas

Year	Low Sea level Rise	High Sea Level Rise
2015 (initial)	410,000 cy	470,000 cy
2020	260,000 cy	330,000 cy
2025	260,000 cy	340,000 cy
2030	260,000 cy	350,000 cy
2035	260,000 cy	360,000 cy
2040	260,000 cy	370,000 cy
2045	260,000 cy	380,000 cy
2050	260,000 cy	390,000 cy
2055	260,000 cy	390,000 cy
2060	260,000 cy	400,000 cy
Total Borrow	**2,790,000 cy**	**3,780,000 cy**

Receiver Site

Sand placement would occur along 7,800 ft of the shoreline directly avoiding sensitive habitat, and the top of the berm would be constructed to an elevation of approximately +15 ft MLLW. It would be flat and approximately 160 ft wide at a slope of 10:1 (horizontal distance: vertical distance). As shown in **Table 3.4-16**, a total of approximately 2,320,000 cy would be placed in Segment 1 under the low sea level rise scenario, and 3,150,000 cy under the high sea level rise scenario over a 50-yr period. This table also provides the volumes of material to be placed on the beach at each of the periodic renourishment efforts, as well as the anticipated timing of that, under each of the sea level rise scenarios.

Table 3.4-16 Alternative EN-2B Placement Volumes

Project Year	Low SLR (cy)	High SLR (cy)
2015 (Initial Placement)	340,000	390,000
2020	220,000	280,000
2025	220,000	280,000
2030	220,000	290,000
2035	220,000	300,000
2040	220,000	310,000
2045	220,000	310,000
2050	220,000	320,000
2055	220,000	330,000
2060	220,000	340,000
Total Placement	**2,320,000**	**3,150,000**

Figure 3.4-4 Alternative EN-2B – Encinitas

3.4.5 Alternative SB-1A –Beach Nourishment (200 ft; 13 Year Nourishment Cycle)

Alternative SB-1A (Solana Beach), shown in **Figure 3.4-5**, involves sand nourishment on within Segment 2 as the method of providing storm damage reduction. Under this alternative, sand would be dredged from offshore, beyond the depth of closure, using borrow sites SO-5 and MB-1. That material would then be placed directly onto the receiver site within Segment 2. As presented in **Table 3.4-17**, under this alternative the designed additional beach width is 200 ft, increasing the beach profile width to 270 ft (existing beach width plus additional proposed beach width), under the low sea level rise scenario. Alternative SB-1A includes an increased beach width of up to 300 ft under the high sea level rise scenario. Adaptation to this high sea level scenario design would involve a onetime additional increase of renourishment sand to increase beach width to 300 ft. As with each of the other alternatives, should the switch to high sea level rise be necessary during the life of the project, renourishment would simply implement the volumes for the high sea level rise scenario from the time the switch is made. Renourishment would average every 13 years.

Table 3.4-17 Alternative SB-1A Sand Placement Summary

Receiver Site	**Solana Beach (SB)**	
SLR Scenario	Low	High
Existing[1] MSL Beach Width [2]	70 ft	70 ft
Additional MSL width target	200 ft	300 ft
Total MSL Beach Width	270 ft	370 ft
Alongshore Length (Receiver Site)	7,200 ft	7,200 ft
Initial Borrow Volume[3]	1,180,000 cy	1,970,000 cy
Total Project 50-year Borrow Volume[3]	2,670,000 cy	4,850,000 cy
Initial Placement Volume [3]	960,000 cy	1,640,000 cy
Total Placement Volume[3]	2,210,000 cy	4,040,000 cy

[1]Average seasonal Post Equilibrium (2015) profile
[2]Landward beach limit to average MSL position
[3]Placement volume is approximately 20% less than initial borrow volume due to construction losses

General Description of Construction Activities

Onshore Placement

The onshore placement of the beach nourishment material would be achieved in the manner described in Section 3.3.4, achieving an “L” shaped berm. The long side of the berm under is designed initially to be approximately 200 ft long and the short side is approximately 230 ft long. As filling progresses the berm is continuously extended to maintain its 200 ft length. In this way return water would flow approximately 200 ft before returning to the ocean.

Figure 3.4-5 Alternative SB-1A – Solana Beach

Construction Sequence and Duration

Table 3.4-18 summarizes the construction duration, with construction activities expected to occur throughout the calendar year.

Table 3.4-18 Alternative SB-1A - Initial Nourishment Schedule

	Low Sea Level	High Sea Level
Borrow Site Location	SO-5	SO-5
Initial Volume of Material to Be Dredged at Borrow Site	1,180,000 cy	1,970,000 cy
Duration of Dredge Operations (estimated 24-hour work days)[1]	118 days	197 days
Construction Duration (estimated days)[2]	139	218
Approximate Length of Receiver Site Closed per Day[3]	200 ft	200 ft
Note: [1] Based on a daily production rate of 10,000 cy –for hopper dredge with pumpout, excludes site prep and post dredge grooming and cleanup. [2] Includes approximately 2 weeks of site prep and mobilization and demobilization efforts.[3] Consistent with RBSP II estimations.		

Borrow Volumes

Section 3.3.1 discusses the borrow sites to be used for the alternatives. Borrow site MB-1 would be used for Solana Beach when SO-5 is exhausted under the high sea level rise scenario over the life of the project but would not be used for initial borrow activities. **Table 3.4-19** shows the volumes of material needed for initial placement as well as volume and expected timing of the renourishment intervals. The volumes given are approximately 10-20 percent higher than those required for beach fill to account for losses during construction operations.

Table 3.4-19 Source Volumes of Dredged Material (Alternative SB-1A) Solana Beach

Year	Low SLR	High SLR
2015	1,180,000 cy	1,970,000 cy
2028/2029	500,000 cy	960,000 cy
2041/2043	500,000 cy	1,020,000 cy
2054/2057	490,000 cy	900,000 cy
Total Borrow	**2,670,000 cy**	**4,850,000 cy**

Receiver Site

Sand placement would occur along 7,200 ft of the shoreline directly avoiding sensitive habitat, and the top of the berm would be constructed to an elevation of approximately +15 ft MLLW. The berm would be flat and approximately 270 ft wide in a low sea level rise scenario and approximately 370 ft wide in a high sea level scenario. The beach fill would then naturally slough seaward at a slope of 10:1 (horizontal distance: vertical distance). As described in **Table 3.4-20**, a total of approximately 2,210,000 cy would be placed in Segment 2 under the low sea level rise scenario, and 4,040,000 cy under the high sea level rise scenario over a 50-yr time period. This table also provides the volumes of material to be placed on the beach at each of the periodic renourishment efforts, as well as the anticipated timing of that, under each of the sea level rise scenarios.

Table 3.4-20 Alternative SB-1A Placement Volumes

Project Year	Low SLR (cy)	High SLR (cy)
2015 (Initial Placement)	960,000	1,640,000
2028[1]/2029[2]	420,000	800,000
2041[1]/2043[2]	420,000	850,000
2054[1]/2057[2]	410,000	750,000
Total Placement	2,210,000	4,040,000

[1]13 year renourishment interval
[2]14 year renourishment interval

3.4.6 Alternative SB-1B– Beach Nourishment (150 ft; 10 Year Nourishment Cycle)

Alternative SB-1B, shown in **Figure 3.4-6**, would have reduced volumes of sand dredged from borrow sites and placed on the receiver sites as compared to SB-1A. The smaller volume also reduces the footprint in an effort to reduce potential environmental impacts. As with Alternative SB-1A, beach nourishment would be used to reduce storm damages along Segment 2. Sand would be dredged from previously surveyed and mined offshore sites (designated SO-5 and MB-1) and placed directly onto Segment 2. The reduced volume and footprint does reduce the level of storm damage reduction in comparison with the SB-1A Alternative. As presented in **Table 3.4-21**, under this alternative the designed additional beach width is 150 ft, increasing the beach profile width to 220 ft (existing beach width plus additional proposed beach width), under the low sea level rise scenario.

Table 3.4-21 Alternative SB-1B – Sand Placement Summary

Receiver Site	**Solana Beach**	
SLR Scenario	Low SLR	High SLR
Existing MSL Beach Width [1]	70 ft	70 ft
Additional MSL width target	150 ft	150 ft
Total MSL Beach Width[2]	220 ft	220 ft
Alongshore Length (Receiver Site)	7,200 ft	7,200 ft
Initial Borrow Volume[3]	860,000 cy	970,000 cy
Total Project 50-year Borrow Volume4[3]	2,260,000 cy	3,180,000 cy
Initial Placement Volume[3]	700,000 cy	790,000 cy
Total Placement Volume[3]	1,870,000 cy	2,630,000 cy

[1]Average seasonal Post Equilibrium profile
[2] Back beach limit to average MSL position
[3] Placement volume is up to 20% less than borrow volume due to expected construction losses.

Figure 3.4-6 Alternative SB-1B – Solana Beach

General Description of Activities

Onshore Placement

The onshore placement of the material would be achieved in the manner described in Section 3.3.4, achieving a rectangular shaped berm. The long side is shore parallel, at the seaward edge of the design beach footprint. The long side is initially approximately 200 ft long and the short side is approximately 230 ft. As filling progresses the berm is continuously extended to maintain its 200 ft length. In this way return water has to flow approximately 200 ft before returning to the ocean.

Construction Sequence and Duration

Table 3.4-22 summarizes the construction duration for this alternative for the initial placement. Construction activities are expected to occur throughout the year.

Table 3.4-22 Alternative SB-1B - Initial Nourishment Schedule

	Low Sea Level	High Sea Level
Borrow Site Location	SO-5	SO-5
Initial Volume of Material to Be Dredged at Borrow Site	860,000 cy	970,000 cy
Duration of Dredge Operations (estimated 24-hour work days)[1]	86 days	97 days
Construction Duration (estimated days)[2]	107	118
Approximate Length of Receiver Site Closed per Day[3]	200 ft	200 ft

Note: [1] Based on a daily production rate of 10,000 cy –for hopper dredge with pumpout, excludes site prep and post dredge grooming and cleanup. [2] Includes approximately 2 weeks of site prep and mobilization and demobilization efforts.[3] Consistent with RBSP II estimations.

Borrow Volumes

Section 3.3.1 discusses the borrow sites to be used for the alternatives. Borrow site MB-1 would be used for Solana Beach when SO-5 is exhausted under the high sea level rise scenario over the life of the project but would not be used for initial borrow activities. **Table 3.4-23** shows the volumes of material needed for initial placement as well as volume and expected timing of the renourishment intervals. The volumes given are approximately 10-20 percent higher than those required for beach fill to account for losses during construction operations.

Table 3.4-23 Source Volumes of Dredged Material (Alternative SB-1B) Solana Beach

Year	Low SLR	High SLR
2015	860,000 cy	970,000 cy
2025	350,000 cy	500,000 cy
2035	350,000 cy	530,000 cy
2045	350,000 cy	570,000 cy
2055	350,000 cy	600,000 cy
Total Borrow	**2,260,000 cy**	**3,180,000 cy**

Receiver Site

Sand placement would occur along 7,200 ft of the shoreline directly avoiding sensitive habitat, and the top of the berm would be constructed to an elevation of approximately +15 ft MLLW. The berm would be flat and approximately 220 ft wide. The beach fill would then naturally slough seaward at a slope of 10:1 (horizontal distance: vertical distance). As described in **Table 3.4-24**, a total of approximately 1,870,000 cy would be placed in Segment 2 under the low sea level rise scenario, and 2,630,000 cy under the high sea level rise scenario over a 50-yr time period. This table also provides the volumes of material to be placed on the beach at each of the periodic renourishment efforts, as well as the anticipated timing of that, under each of the sea level rise scenarios.

Table 3.4-24 Alternative SB-1B Placement Volumes

Project Year	Low SLR (cy)	High SLR (cy)
2015 (Initial Placement)	700,000	790,000
2025	290,000	420,000
2035	290,000	440,000
2045	290,000	470,000
2055	290,000	500,000
Total Placement	1,870,000	2,630,000

3.4.7 Alternative SB-1C – Beach Nourishment (100 ft; 10 Year Nourishment Cycle)

Alternative SB-1C, as shown in **Figure 3.4-7**, would have reduced volumes of sand dredged and placed on the receiver site in Solana Beach, also reducing the footprint in an effort to reduce or minimize potential environmental impacts. As with Alternatives SB-1A and SB-1B, only beach nourishment would be used to reduce storm damages. Sand would be dredged from previously surveyed and mined offshore sites (designated as SO-5 and MB-1) and placed directly onto Segment 2. The reduced volume and footprint does reduce the level of storm damage reduction in comparison with the SB-1A Alternative. As presented in **Table 3.4-25**, under this alternative the designed additional beach width is 100 ft, increasing the beach profile width to 170 ft (existing beach width plus additional proposed beach width).

Table 3.4-25 Alternative SB-1C Sand Placement Summary

Receiver Site	**Solana Beach**	
SLR Scenario	Low	High
Existing MSL Beach Width [1]	70 ft	70 ft
Additional MSL width target	100 ft	100 ft
Total MSL Beach Width[2]	170 ft	170 ft
Alongshore Length (Receiver Site)	7,200 ft	7,200 ft
General Location	Almost entire city limits	
Initial Borrow Volume[3]	550,000 cy	660,000 cy
Total Project 50-year Borrow Volume	1,790,000 cy	2,700,000 cy
Initial Placement Volume [3]	440,000 cy	540,000 cy
Total Renourishment Volume	1,470,000 cy	2,230,000 cy[4]

[1]Average seasonal Post Equilibrium profile
[2] Back beach limit to average MSL position
[3] Placement volume is 20% less than initial borrow volume

General Description of Activities

Onshore Placement

The long side of the berm would be parallel with the shore, at the seaward edge of the design beach footprint. The long side is initially approximately 200 ft long. The short side is approximately 130 ft long. As filling progresses the berm is continuously extended to maintain its 200 ft length. In this way return water has to flow approximately 200 ft before returning to the ocean.

Construction Sequence and Duration

Table 3.4-26 summarizes the construction duration for this alternative for the initial placement. Construction activities are expected to occur throughout the calendar year.

Table 3.4-26 Alternative SB-1C - Initial Nourishment Schedule

	Low Sea Level	High Sea Level
Borrow Site Location	SO-5	SO-5
Initial Volume of Material to Be Dredged at Borrow Site	550,000 cy	660,000 cy
Duration of Dredge Operations (estimated 24-hour work days)[1]	55 days	66 days
Construction Duration (estimated days)[2]	76	87
Approximate Length of Receiver Site Closed per Day[3]	200 ft	200 ft

Note: [1] Based on a daily production rate of 10,000 cy –for hopper dredge with pumpout, excludes site prep and post dredge grooming and cleanup. [2] Includes approximately 2 weeks of site prep and mobilization and demobilization efforts.[3] Consistent with RBSP II estimations.

Figure 3.4-7 Alternative SB-1C – Solana Beach

Borrow Volumes

Section 3.3.1 discusses the borrow sites to be used for the alternatives. Borrow site MB-1 would be used for Solana Beach when SO-5 is exhausted under the high sea level rise scenario over the life of the project but would not be used for initial borrow activities. **Table 3.4-27** shows the volumes of material needed for initial placement as well as volume and expected timing of the renourishment intervals. The volumes given are approximately 10-20 percent higher than those required for beach fill to account for losses during construction operations.

Table 3.4-27 Source Volumes of Dredged Material (Alternative SB-1C) Solana Beach

Year	Low SLR	High SLR
2015	550,000 cy	660,000 cy
2025	310,000 cy	460,000 cy
2035	310,000 cy	490,000 cy
2045	310,000 cy	530,000 cy
2055	310,000 cy	560,000 cy
Total Borrow	**1,790,000 cy**	**2,700,000 cy**

Receiver Site

Sand placement would occur along 7,200 ft of the shoreline directly avoiding sensitive habitat, and the top of the berm would be constructed to an elevation of approximately +15 ft MLLW. The berm would be flat and approximately 170 ft wide. The beach fill would then naturally slough seaward at a slope of 10:1 (horizontal distance: vertical distance). As described in **Table 3.4-28**, a total of approximately 1,470,000 cy would be placed in Segment 2 under the low sea level rise scenario, and 2,230,000 cy under the high sea level rise scenario over a 50-yr time period. This table also provides the volumes of material to be placed on the beach at each of the periodic renourishment efforts, as well as the anticipated timing of that, under each of the sea level rise scenarios.

Table 3.4-28 Alternative SB-1C Placement Volumes

Project Year	Low SLR (cy)	High SLR (cy)
2015 (Initial Placement)	440,000	540,000
2025	260,000	380,000
2035	260,000	410,000
2045	260,000	440,000
2055	260,000	470,000
Total Placement	1,470,000	2,230,000

3.4.8 Alternative SB-2A – Hybrid - Beach Replenishment and Notchfill (150 ft; 10 Year Nourishment Cycle

Alternative SB-2A, shown in **Figure 3.4-8**, involves sand nourishment along Segment 2, similar to SB-1B, combined with the filling of bluff notches. Under this alternative, sand would be dredged from offshore, beyond the depth of closure, using borrow sites SO-5 and MB-1. That material would then be placed directly onto the receiver site within Segment 2. As presented in **Table 3.4-29**, under this alternative the designed additional beach width is 150 ft, increasing the beach width to 220 ft. Renourishment would average every ten years. This alternative also consists of an engineered notchfill with concrete at the bluff base following placement of an additional 150-ft wide beach fill. The general notchfill design is described in Section 3.3.4.

Beach replenishment activities for Alternatives SB-2A would differ from Alternative SB-1A in Solana Beach with approximately 25% (low sea level rise) or 50% (high sea level rise) lower initial placement, approximately 15% (low sea level rise) or 35% (high sea level) lower total 50 year placement. The volume of sand in each nourishment cycle would be less, though more often (ten year vs. a 13 or 14 year cycle).

Table 3.4-29 Alternative SB-2A – Hybrid Sand Placement Summary

Receiver Site	**Solana Beach SB-2A**	
SLR Scenario	Low	High
Existing MSL Beach Width[1]	70 ft	70 ft
Additional MSL width target	150 ft	150 ft
Total MSL Beach Width[2]	220 ft	220 ft
Alongshore Length (Receiver Site)	7,200 ft	7,200 ft
Initial Borrow Volume[3]	860,000 cy	970,000 cy
Total Project 50-year Borrow Volume[3]	2,260,000 cy	3,180,000 cy
Initial Placement Volume[3]	700,000 cy	790,000 cy
Total Placement Volume[3]	1,870,000 cy	2,630,000 cy

[1] Average seasonal Post Equilibrium profile
[2] Back beach limit to average MSL position
[3] Placement volume is approximately 20% less than initial borrow volume

<u>General Description of Activities</u>

Onshore Placement

The onshore placement of the material would be achieved in the manner described in Section 3.3.4, achieving a rectangular shaped berm. The long side is shore parallel, at the seaward edge of the design beach footprint. The long side is initially approximately 200 ft long and the short side is approximately 230 ft. As filling progresses the berm is continuously extended to maintain its 200 ft length. In this way return water has to flow approximately 200 ft before returning to the ocean.

Figure 3.4-8 Alternative SB-2A – Solana Beach

Construction Sequence and Duration

Table 3.4-30 summarizes the construction duration for this alternative for the initial placement. Construction activities are expected to occur throughout the calendar year.

Table 3.4-30 Alternative SB-2A - Initial Nourishment Schedule

	Low Sea Level	High Sea Level
Borrow Site Location	SO-5	SO-5
Initial Volume of Material to Be Dredged at Borrow Site	860,000 cy	970,000 cy
Duration of Dredge Operations (estimated 24-hour work days)[1]	86 days	97 days
Construction Duration (estimated days)[2]	180	180
Approximate Length of Receiver Site Closed per Day[3]	150-325 ft	150-325 ft
Note: [1] Based on a daily production rate of 10,000 cy –for hopper dredge with pumpout, excludes site prep and post dredge grooming and cleanup. [2] Includes approximately 2 weeks of site prep and mobilization and demobilization efforts.[3] Consistent with RBSP II estimations.		

Borrow Volumes

Section 3.3.1 discusses the borrow sites to be used for the alternatives. Borrow site MB-1 would be used for Solana Beach when SO-5 is exhausted under the high sea level rise scenario over the life of the project but would not be used for initial borrow activities. **Table 3.4-31** shows the volumes of material needed for initial placement as well as volume and expected timing of the renourishment intervals. The volumes given are approximately 10-20 percent higher than those required for beach fill to account for losses during construction operations.

Table 3.4-31 Source Volumes of Dredged Material (Alternative SB-2A) Solana Beach

Year	Low SLR	High SLR
2015	860,000 cy	970,000 cy
2025	350,000 cy	500,000 cy
2035	350,000 cy	530,000 cy
2045	350,000 cy	570,000 cy
2055	350,000 cy	600,000 cy
Total Borrow	**2,260,000 cy**	**3,180,000 cy**

Receiver Sites

Sand placement would occur along 7,200 ft of the shoreline directly avoiding sensitive habitat, and the top of the berm would be constructed to an elevation of approximately +15 ft MLLW. The berm would be flat and approximately 220 ft wide. The beach fill would then naturally slough seaward at a slope of 10:1 (horizontal distance: vertical distance). As described in **Table 3.4-32**, a total of approximately 1,870,000 cy would be placed in Segment 2 under the low sea level rise scenario, and 2,630,000 cy under the high sea level rise scenario over a 50-yr time period. This table also provides the volumes of material to be placed on the beach at each of the periodic renourishment efforts, as well as the anticipated timing of that, under each of the sea level rise scenarios.

Table 3.4-32 Alternative SB-2A Placement Volumes

Project Year	Low SLR (cy)	High SLR (cy)
2015 (Initial Placement)	700,000	790,000
2025	290,000	420,000
2035	290,000	440,000
2045	290,000	470,000
2055	290,000	500,000
Total Placement	1,870,000	2,630,000

3.4.9 Alternative SB-2B – Hybrid - Beach Replenishment and Notchfill (100 ft; 10 Year Nourishment Cycle

Alternative SB-2B, shown in **Figure 3.4-9**, is similar to Alternative SB-2A with notchfills but with a reduced volume of sand dredged and placed on Segment 2, to reduce the footprint in an effort to further minimize potential environmental impacts. Under this alternative, sand would be dredged from offshore, beyond the depth of closure, using borrow sites SO-5 and MB-1. That material would then be placed directly onto the receiver site within Segment 2. As presented in **Table 3.4-33**, under this alternative the designed additional beach width is 100 ft, increasing the beach width to 170 ft. Renourishment would average every ten years. This alternative also consists of an engineered notchfill with concrete at the bluff base following placement of an additional 100-ft wide beach fill. The general notchfill design is described in Section 3.3.4.

Table 3.4-33 Alternative SB-2B Sand Placement Summary

Receiver Sites	**SB - Solana Beach**	
SLR Scenario	Low	High
Existing MSL Beach Width [1]	70 ft	70 ft
Additional MSL width target	100 ft	100 ft
Total MSL Beach Width[2]	170 ft	170 ft
Alongshore Length (Receiver Site)	7,200 ft	7,200 ft
Initial Borrow Volume[3]	550,000 cy	660,000 cy
Total Project 50-year Borrow Volume[3]	1,790,000 cy	2,700,000 cy
Initial Placement Volume [3]	440,000 cy	540,000 cy
Total Placement Volume[3]	1,470,000 cy	2,230,000 cy

[1]Average seasonal Post Equilibrium profile
[2] Back beach limit to average MSL position
[3] Placement volume is 20% less than borrow volume

<u>General Description of Activities</u>

Onshore Placement

The long side of the berm would be parallel with the shore, at the seaward edge of the design beach footprint. The long side is initially approximately 200 ft long. The short side is approximately 130 ft long. As filling progresses the berm is continuously extended to maintain its 200 ft length. In this way return water has to flow approximately 200 ft before returning to the ocean.

Figure 3.4-9 Alternative SB-2B – Solana Beach

Construction Sequence and Duration

Table 3.4-34 summarizes the construction duration for this alternative for the initial placement. Construction activities are expected to occur throughout the calendar year.

Table 3.4-34 Alternative SB-2B - Initial Nourishment Schedule

	Low Sea Level	High Sea Level
Borrow Site Location	SO-5	SO-5
Initial Volume of Material to Be Dredged at Borrow Site	550,000 cy	660,000 cy
Duration of Dredge Operations (estimated 24-hour work days)[1]	55 days	66 days
Construction Duration (estimated days)[2]	180	180
Approximate Length of Receiver Site Closed per Day[3]	150-325 ft	150-325 ft
Note: [1] Based on a daily production rate of 10,000 cy –for hopper dredge with pumpout, excludes site prep and post dredge grooming and cleanup. [2] Includes approximately 2 weeks of site prep and mobilization and demobilization efforts.[3] Consistent with RBSP II estimations.		

Borrow Volumes

Section 3.3.1 discusses the borrow sites to be used for the alternatives. Borrow site MB-1 would be used for Solana Beach when SO-5 is exhausted under the high sea level rise scenario over the life of the project but would not be used for initial borrow activities. **Table 3.4-35** shows the volumes of material needed for initial placement as well as volume and expected timing of the renourishment intervals. The volumes given are approximately 10-20 percent higher than those required for beach fill to account for losses during construction operations.

Table 3.4-35 Source Volumes of Dredged Material (Alternative SB-2B) Solana Beach

Year	Low SLR	High SLR
2015	550,000 cy	660,000 cy
2025	310,000 cy	460,000 cy
2035	310,000 cy	490,000 cy
2045	310,000 cy	530,000 cy
2055	310,000 cy	560,000 cy
Total Borrow	**1,790,000 cy**	**2,700,000 cy**

Receiver Sites

Sand placement would occur along 7,200 ft of the shoreline directly avoiding sensitive habitat, and the top of the berm would be constructed to an elevation of approximately +15 ft MLLW. The berm would be flat and approximately 170 ft wide. The beach fill would then naturally slough seaward at a slope of 10:1 (horizontal distance: vertical distance). As described in **Table 3.4-36**, a total of approximately 1,470,000 cy would be placed in Segment 2 under the low sea level rise scenario, and 2,230,000 cy under the high sea level rise scenario over a 50-yr time period. This table also provides the volumes of material to be placed on the beach at each of the periodic renourishment efforts, as well as the anticipated timing of that, under each of the sea level rise scenarios.

Table 3.4-36 Alternative SB-2B Placement Volumes

Project Year	Low SLR (cy)	High SLR (cy)
2015 (Initial Placement)	440,000	540,000
2025	260,000	380,000
2035	260,000	410,000
2045	260,000	440,000
2055	260,000	470,000
Total Placement	1,470,000	2,230,000

3.4.10 Alternatives EN-3 and SB-3- No Action Alternative

The No Action Alternative (future without project condition) serves as the baseline by which other alternatives may be judged and compared. Because a federal permit must be issued for any activities within USACE jurisdiction, the No Federal Action Alternative is equivalent to the No Action Alternative. Existing conditions and practices would continue throughout the future.

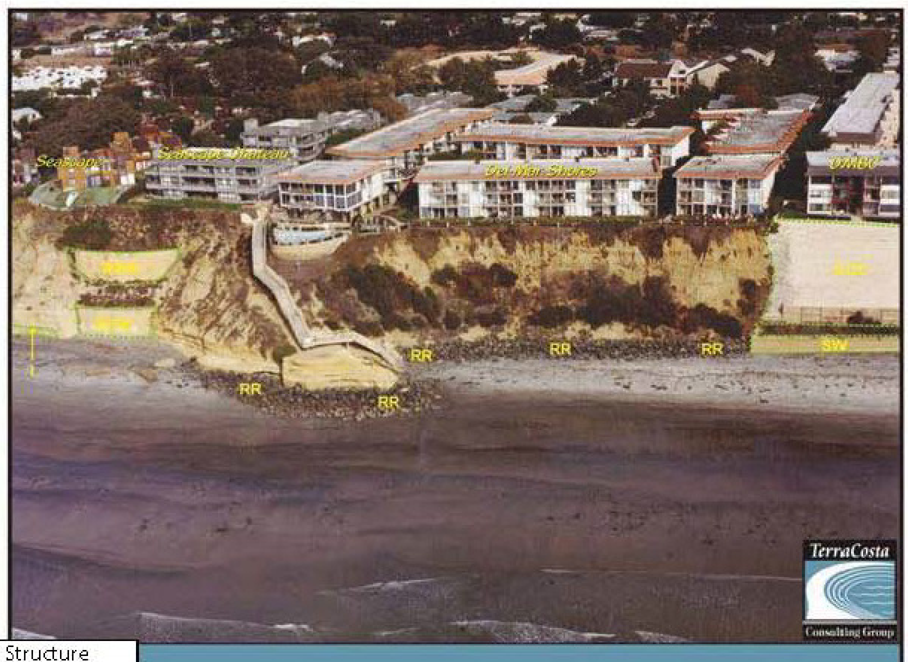
Historically, man-made structures have been constructed in localized areas by cities, residents, and business owners to protect coastal structures whose vulnerability has increased with increased beach erosion. A variety of bluff protection methods and materials have been used, including bluff notch (sea cave) filling, rock riprap revetments, seawalls, and concrete-based facing (shotcrete) of bluff sections. Over the last couple of decades, approximately half of the coastline in the study area has been armored to some degree in response to bluff failures, storm wave damage, and flooding (**Figure 3.4-10**).

<u>Major Assumptions Associated with the No Action Alternative</u>

Continuation of Permits/Localized Protection

Homeowners have built seawalls to protect their property when damage to the structure is imminent. The CCC must grant a permit when the primary structure is in “imminent danger” Under Section 30235 of the California Coastal Act, which is a more expedited process than a non emergency permit. Some permits are obtained on an emergency basis and others are not. Regardless of which permit path is pursued, a geotechnical finding must be made by the applicant indicating that the existing slope stability factor of safety is near 1.0 whereby failure is imminent. Although the regulatory environment is subject to change in the future, there is currently no firm indication of any impending change. Therefore, the No Action Alternative assumes continued piecemeal protection of the bluff by individual property owners under emergency and regular permits for construction of new seawalls and maintenance of existing structures.

The time period associated with the No Action Alternative is assumed to be 50 years beginning with 2015 and ending in 2065.



Existing Coastal Protection Structure	
CCC =	Concrete Covered Crib Wall
I =	Existing Seacave/Notch Infill
REW =	Reinforced Earth Wall
RR =	Riprap
SW =	Seawall

Figure 3.4-10 Existing Protection Device Example

Continued Lagoon Maintenance Dredging

Under the No Action Alternative, no significant beach replenishment activities would occur within the vicinity except for those associated with ongoing routinely authorized maintenance dredging projects (i.e., Oceanside sand bypass, Agua Hedionda Lagoon maintenance dredging, Batiquitos Lagoon maintenance dredging, San Elijo Lagoon entrance maintenance and San Dieguito Lagoon mouth dredging). These maintenance dredgings do not add any new sand to the littoral cell and therefore do not have a long-term effect on the shoreline in the study area (USACE-LAD 2003).

Restoration of the San Elijo Lagoon

A study is currently underway to evaluate various potential restoration alternatives for the San Elijo Lagoon. Under the original Congressional authorization for *this* project, the lagoon restoration project was an element of *this* project. Under one of the design alternatives a new lagoon entrance would be created and approximately 1 million cy of sand would be removed from the lagoon. While it is possible that this restoration project will be completed within the next 50 years, at the present time it is unknown when this project would actually be implemented and in what form and therefore it is somewhat speculative to include this possible future project in the No-Project Alternative baseline. Additional information on this lagoon project is however contained in Section 6 of this Report under the Cumulative Impacts analysis as it is considered a “reasonably foreseeable” future project.

Limited Sand on Beach

Under the No Action Alternative, beaches will experience seasonal and daily diurnal tide fluctuations as a small amount of sand moves onshore and offshore, but in general, denuded beach conditions will persist. This is consistent with conditions observed before the 2001 RBSP (SANDAG 2000a), and is supported by further data in Appendix B. Although there may be opportunities for beneficial re-use of sand excavated from inshore construction sites in the study area as allowed under the existing Sand Compatibility and Opportunistic Use Program (SCOUP) permits in Solana Beach and Encinitas, in accordance with Engineering Regulation (ER) 1105-2-100, opportunistic projects are not considered a substantive source of sand to beaches in the study area under the No Action Alternative. ER 1105-2-100 also states that in order for a project to be considered, it must be under construction or fully funded and permitted. Opportunistic sand made available would be a supplemental input to the federal project, requiring no additional federal funding or authorization.

In summary, opportunistic sand projects are not an effective or comprehensive long term solution to denuded beach conditions because of their uncertainty and the relatively small volumes associated with such projects (USACE 2003). Accordingly, it was assumed that the future without project shoreline, nearshore, and offshore areas would revert to pre-SANDAG 2001 RBSP I project conditions. RBSP II is currently scheduled to place one time sand nourishment on portions of Encinitas and Solana Beach beaches. The beach width would conservatively be expected to be similar to current widths by the time *this* action would be implemented given that approximately 3 years would have passed since RBSP II. In addition, it was assumed that there would be no significant net gain in sediment in any reach of the study area, and no significant long-term change in beach widths or nearshore bathymetry as a result of opportunistic beach fill projects.

Additional Future Seawall Construction

It was assumed that structures currently protected by seawalls over 8 ft in height (usually incorporating steel and/or timber, with tiebacks) would not suffer damages significant enough to affect any plan formulation or selection. The minimum design life of a seawall is 25 to 30 years, and even if damages occurred after that, these future damages, once discounted to present value, would be insignificant (USACE 2003). Projected sea walls are assumed to be no taller than 35 ft in height, noting that due to the presence of sand lens in Solana Beach, seawalls in Solana Beach could potentially be taller than in Encinitas. **Table 3.4-37** provides the existing and projected lengths of seawalls under the low and high sea level rise scenarios, for the No Action Alternative.

Table 3.4-37 Seawalls Summary, Existing and Projected Over Next 50 Years

	EN-3 Encinitas		**SB-3 Solana Beach**	
	Low SLR	High SLR	Low SLR	High SLR
Total Beach Length	8,044 ft	8,044 ft	7,793 ft	7,793 ft
Existing Seawalls	1,741 ft (approximately 30 walls)	1,741 ft (approximately 30 walls)	3,476 ft (approximately 46 walls)	3,476 ft (approximately 46 discrete walls)
Projected Additional Seawalls over next 50 years[1]	4,962 ft (approximately 80 walls)	5,395 ft (approximately 86 walls)	4,259 ft (approximately 34 walls)	4,259 ft (approximately 36 discrete walls)
Total Seawalls	**6,703 ft**	**7,136 ft**	**7,735 ft**	**7,735 ft**
Projected Remaining Beach	1,341 ft	908 ft	58 ft	58 ft

[1] Estimates established in the Economics Appendix E

3.5 Final Alternatives NED Analysis

The Federal objective of water and related land resources planning is to contribute to national economic development (NED) consistent with protecting the Nation's environment, in accordance with national environmental statutes, applicable executive orders, and other Federal planning requirements. The Planning and Guidance (P&G) use of the term objective should be distinguished from study planning objectives, which are more specific in terms of expected or desired outputs. The P&G's objective (Federal objective) may be considered more of a National goal. Water and related land resources project plans shall be formulated to alleviate problems and take advantage of opportunities in ways that contribute to study planning objectives and, consequently, to the Federal objective. Contributions to national economic development (NED outputs) are increases in the net value of the national output of goods and services, expressed in monetary units, and are the direct net benefits that accrue in the planning area and the rest of the Nation. Contributions to NED include increases in the net value of those goods and services that are marketed and also of those that may not be marketed. Protection of the Nation's environment is achieved when damage to the environment is eliminated or avoided and important cultural and natural aspects of our nation's heritage are preserved. Various environmental statutes and executive orders assist in ensuring that water resources planning is consistent with protection.

3.5.1 Coastal Storm Damage Reduction Benefits

Coastal storm damage reduction (CSDR) benefits were evaluated for the Beach Nourishment and Hybrid alternatives. The Beach Nourishment and Hybrid alternatives were evaluated to extend the mean-sea level (MSL) beach width 50 to 200 ft in Segment 1 and 50 to 400 ft in Segment 2 with nourishments occurring every 2 to 16 years.

Beach Nourishment: CSDR Benefits

Beach Fill alternatives generate average annual CSDR benefits as shown in **Table 3.5-1** and **Table 3.5-2**. These benefits range from approximately $600K to $2.4 million at Segment 1 and $200K to $2.3 million at Segment 2 under low SLR. Coastal storm damage reduction benefits are consistently higher when evaluating the high sea-level scenario.

Table 3.5-1 Beach Nourishment Average Annual CSDR Benefits (Segment 1)

Low SLR ($1,00s)	50 ft	100 ft	150 ft	200 ft
2 yr nourishment	$1,286	$1,999	$2,327	$2,429
3 yr nourishment	$1,229	$1,956	$2,284	$2,407
4 yr nourishment	$1,140	$1,914	$2,270	$2,398
5 yr nourishment	$1,052	$1,864	$2,247	$2,387
6 yr nourishment	$968	$1,800	$2,200	$2,359
7 yr nourishment	$895	$1,710	$2,139	$2,319
8 yr nourishment	$846	$1,608	$2,089	$2,287
9 yr nourishment	$802	$1,521	$2,035	$2,255
10 yr nourishment	$757	$1,431	$1,960	$2,214
11 yr nourishment	$732	$1,376	$1,912	$2,182
12 yr nourishment	$706	$1,302	$1,849	$2,141
13 yr nourishment	$672	$1,250	$1,792	$2,105
14 yr nourishment	$645	$1,219	$1,743	$2,070
15 yr nourishment	$617	$1,174	$1,679	$2,020
16 yr nourishment	$588	$1,124	$1,613	$1,958

Table 3.5-2 Beach Nourishment Average Annual CSDR Benefits (Segment 2)

Low SLR ($1,000s)	50 ft	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft
2 yr nourishment	$287	$850	$1,309	$1,647	$1,900	$2,090	$2,229	$2,325
3 yr nourishment	$283	$852	$1,305	$1,642	$1,885	$2,073	$2,210	$2,316
4 yr nourishment	$271	$855	$1,304	$1,632	$1,868	$2,045	$2,177	$2,280
5 yr nourishment	$268	$844	$1,303	$1,620	$1,855	$2,024	$2,154	$2,262
6 yr nourishment	$262	$828	$1,293	$1,614	$1,850	$2,024	$2,156	$2,265
7 yr nourishment	$257	$816	$1,275	$1,601	$1,839	$2,011	$2,145	$2,256
8 yr nourishment	$248	$803	$1,264	$1,596	$1,832	$2,003	$2,135	$2,247
9 yr nourishment	$242	$791	$1,247	$1,584	$1,820	$1,992	$2,123	$2,234
10 yr nourishment	$231	$775	$1,229	$1,571	$1,807	$1,979	$2,111	$2,224
11 yr nourishment	$220	$765	$1,217	$1,559	$1,798	$1,970	$2,103	$2,216
12 yr nourishment	$208	$749	$1,203	$1,548	$1,786	$1,957	$2,090	$2,203
13 yr nourishment	$199	$737	$1,190	$1,537	$1,776	$1,946	$2,080	$2,193
14 yr nourishment	$192	$726	$1,176	$1,525	$1,767	$1,940	$2,075	$2,190
15 yr nourishment	$184	$714	$1,162	$1,509	$1,754	$1,928	$2,064	$2,180
16 yr nourishment	$176	$696	$1,144	$1,494	$1,742	$1,918	$2,055	$2,171

Hybrid Alternatives: CSDR Benefits

Hybrid alternatives generate average annual CSDR benefits from approximately $700k to $2.4 million at Segment 1 and $400k to $2.3 million at Segment 2 under low SLR (**Table 3.5-3** and **Table 3.5-4**). Constructing the notch fills increases CSDR benefits more noticeably for smaller added beach widths and extended periods between nourishments compared to alternatives that only include sand placement. However, this difference diminishes when larger sand placements occur, since notch fill becomes redundant to some extent as the sand footprint increases.

Table 3.5-3 Hybrid Average Annual CSDR Benefits (Segment 1)

Low SLR ($1,000s)	50 ft	100 ft	150 ft	200 ft
2 yr nourishment	$1,334	$2,011	$2,330	$2,431
3 yr nourishment	$1,278	$1,970	$2,289	$2,410
4 yr nourishment	$1,198	$1,929	$2,275	$2,400
5 yr nourishment	$1,119	$1,881	$2,251	$2,389
6 yr nourishment	$1,044	$1,819	$2,207	$2,363
7 yr nourishment	$982	$1,733	$2,148	$2,325
8 yr nourishment	$938	$1,640	$2,100	$2,294
9 yr nourishment	$901	$1,560	$2,047	$2,262
10 yr nourishment	$862	$1,477	$1,976	$2,222
11 yr nourishment	$842	$1,428	$1,929	$2,191
12 yr nourishment	$820	$1,361	$1,870	$2,152
13 yr nourishment	$791	$1,314	$1,816	$2,117
14 yr nourishment	$770	$1,286	$1,771	$2,083
15 yr nourishment	$748	$1,247	$1,712	$2,035
16 yr nourishment	$725	$1,203	$1,652	$1,977

Table 3.5-4 Hybrid Average Annual CSDR Benefits (Segment 2)

Low SLR ($1,000s)	50 ft	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft
2 yr nourishment	$420	$917	$1,340	$1,664	$1,907	$2,089	$2,224	$2,321
3 yr nourishment	$417	$916	$1,335	$1,661	$1,894	$2,075	$2,206	$2,312
4 yr nourishment	$406	$918	$1,336	$1,653	$1,880	$2,051	$2,178	$2,279
5 yr nourishment	$404	$908	$1,336	$1,642	$1,869	$2,033	$2,157	$2,261
6 yr nourishment	$401	$895	$1,326	$1,636	$1,864	$2,031	$2,158	$2,264
7 yr nourishment	$398	$887	$1,312	$1,625	$1,854	$2,020	$2,148	$2,254
8 yr nourishment	$392	$876	$1,301	$1,620	$1,848	$2,012	$2,139	$2,246
9 yr nourishment	$387	$867	$1,287	$1,610	$1,838	$2,003	$2,128	$2,234
10 yr nourishment	$379	$853	$1,271	$1,597	$1,825	$1,991	$2,117	$2,225
11 yr nourishment	$372	$845	$1,260	$1,587	$1,817	$1,983	$2,110	$2,217
12 yr nourishment	$363	$831	$1,248	$1,576	$1,806	$1,971	$2,099	$2,206
13 yr nourishment	$357	$820	$1,236	$1,566	$1,797	$1,962	$2,090	$2,197
14 yr nourishment	$352	$812	$1,224	$1,555	$1,788	$1,955	$2,084	$2,193
15 yr nourishment	$346	$801	$1,212	$1,541	$1,776	$1,945	$2,075	$2,184
16 yr nourishment	$340	$786	$1,196	$1,527	$1,765	$1,935	$2,066	$2,176

3.5.2 Recreation Values & Benefits

The Beach Nourishment and Hybrid alternatives require beach fill that increases the quality and intensity of recreation. To estimate the value of recreation quality and intensity the unit day value method was employed for both with and without project conditions. For a description of how recreation values were derived, see section 5.3.2 in Appendix E.

With project benefits were generated for the Beach Nourishment and Hybrid alternatives to extend the mean-sea level (MSL) beach width 50 to 200 ft in Segment 1 and 50 to 400 ft in Segment 2 with nourishments occurring every 2 to 16 years. With-project recreation benefits, which equal with- minus without-project values, are given in **Table 3.5-5** and **Table 3.5-6**. As expected, recreation benefits increase with larger beach fills and shorter intervals between nourishments. Average annual recreation benefits range from approximately $400k to $2.4 million at Segment 1 and $800k to $2.1 million at Segment 2 under low SLR.

Table 3.5-5 Full Recreation Average Annual Benefits for Beach Nourishment & Hybrid Alternatives (Segment 1)[4]

Low SLR ($1000s)	50 ft	100 ft	150 ft	200 ft
2 yr nourishment	$1,380	$1,840	$2,130	$2,410
3 yr nourishment	$1,330	$1,840	$2,130	$2,410
4 yr nourishment	$1,270	$1,830	$2,130	$2,410
5 yr nourishment	$1,130	$1,820	$2,130	$2,410
6 yr nourishment	$1,010	$1,790	$2,130	$2,400
7 yr nourishment	$900	$1,740	$2,120	$2,400
8 yr nourishment	$810	$1,700	$2,100	$2,400
9 yr nourishment	$720	$1,590	$2,080	$2,400
10 yr nourishment	$630	$1,500	$2,060	$2,390
11 yr nourishment	$580	$1,430	$2,040	$2,380
12 yr nourishment	$520	$1,350	$2,010	$2,370
13 yr nourishment	$410	$1,240	$1,960	$2,350
14 yr nourishment	$430	$1,240	$1,930	$2,340
15 yr nourishment	$390	$1,160	$1,860	$2,310
16 yr nourishment	$340	$1,090	$1,800	$2,280

[4] Full recreation benefits shown. Actual recreation benefits used for plan selection are the lesser of recreation benefits shown or 50% of total benefits.

Table 3.5-6 Recreation Average Annual Benefits for Beach Nourishment & Hybrid Alternatives (Segment 2)

Low SLR ($1,000s)	50 ft	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft
2 yr nourishment	$1,070	$1,230	$1,400	$1,620	$1,840	$2,060	$2,060	$2,060
3 yr nourishment	$1,070	$1,230	$1,400	$1,620	$1,840	$2,060	$2,060	$2,060
4 yr nourishment	$1,070	$1,230	$1,400	$1,620	$1,840	$2,060	$2,060	$2,060
5 yr nourishment	$1,060	$1,230	$1,400	$1,620	$1,840	$2,060	$2,060	$2,060
6 yr nourishment	$1,060	$1,230	$1,400	$1,620	$1,840	$2,060	$2,060	$2,060
7 yr nourishment	$1,020	$1,230	$1,400	$1,620	$1,840	$2,060	$2,060	$2,060
8 yr nourishment	$990	$1,230	$1,400	$1,620	$1,840	$2,060	$2,060	$2,060
9 yr nourishment	$970	$1,230	$1,400	$1,620	$1,840	$2,060	$2,060	$2,060
10 yr nourishment	$940	$1,230	$1,400	$1,620	$1,840	$2,060	$2,060	$2,060
11 yr nourishment	$920	$1,230	$1,400	$1,620	$1,840	$2,060	$2,060	$2,060
12 yr nourishment	$900	$1,230	$1,400	$1,620	$1,840	$2,060	$2,060	$2,060
13 yr nourishment	$860	$1,230	$1,400	$1,620	$1,840	$2,060	$2,060	$2,060
14 yr nourishment	$870	$1,230	$1,400	$1,620	$1,840	$2,060	$2,060	$2,060
15 yr nourishment	$850	$1,230	$1,390	$1,620	$1,840	$2,060	$2,060	$2,060
16 yr nourishment	$830	$1,220	$1,390	$1,620	$1,840	$2,060	$2,060	$2,060

3.5.3 Total Project Benefits

Beach Nourishment Alternatives: Total Benefits

The Beach Nourishment alternatives generate total average annual benefits, inclusive of the 50% cap on recreation benefits, as shown in **Table 3.5-7** and **Table 3.5-8**. Total benefits range from approximately $1.0 to $4.6 million at Segment 1 and $400k to $4.3 million at Segment 2 under low SLR.

Table 3.5-7 Total Average Annual Benefits for Beach Nourishment Alternatives (Segment 1)

Low SLR ($1,000s)	50 ft	100 ft	150 ft	200 ft
2 yr nourishment	$2,402	$3,660	$4,301	$4,633
3 yr nourishment	$2,301	$3,601	$4,246	$4,604
4 yr nourishment	$2,148	$3,538	$4,224	$4,589
5 yr nourishment	$1,994	$3,461	$4,190	$4,574
6 yr nourishment	$1,815	$3,362	$4,126	$4,535
7 yr nourishment	$1,662	$3,220	$4,041	$4,478
8 yr nourishment	$1,546	$3,052	$3,964	$4,429
9 yr nourishment	$1,443	$2,904	$3,877	$4,378
10 yr nourishment	$1,341	$2,723	$3,758	$4,311
11 yr nourishment	$1,258	$2,602	$3,673	$4,257
12 yr nourishment	$1,201	$2,466	$3,568	$4,188
13 yr nourishment	$1,121	$2,351	$3,466	$4,123
14 yr nourishment	$1,012	$2,258	$3,375	$4,057
15 yr nourishment	$1,000	$2,193	$3,262	$3,972
16 yr nourishment	$940	$2,089	$3,135	$3,858

Table 3.5-8 Total Average Annual Benefits for Beach Nourishment Alternatives (Segment 2)

Low SLR ($1,000s)	50 ft	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft
2 yr nourishment	$573	$1,656	$2,430	$3,021	$3,501	$3,897	$4,139	$4,319
3 yr nourishment	$565	$1,658	$2,423	$3,014	$3,479	$3,875	$4,113	$4,306
4 yr nourishment	$540	$1,662	$2,421	$3,000	$3,457	$3,837	$4,071	$4,260
5 yr nourishment	$534	$1,642	$2,420	$2,984	$3,440	$3,808	$4,039	$4,235
6 yr nourishment	$523	$1,615	$2,405	$2,975	$3,432	$3,805	$4,040	$4,239
7 yr nourishment	$513	$1,595	$2,382	$2,958	$3,416	$3,788	$4,024	$4,225
8 yr nourishment	$496	$1,572	$2,365	$2,951	$3,407	$3,775	$4,010	$4,213
9 yr nourishment	$483	$1,552	$2,342	$2,935	$3,391	$3,760	$3,994	$4,195
10 yr nourishment	$460	$1,522	$2,315	$2,917	$3,372	$3,741	$3,977	$4,181
11 yr nourishment	$440	$1,505	$2,298	$2,901	$3,360	$3,728	$3,965	$4,169
12 yr nourishment	$415	$1,476	$2,276	$2,885	$3,343	$3,709	$3,947	$4,151
13 yr nourishment	$396	$1,452	$2,256	$2,869	$3,329	$3,693	$3,933	$4,138
14 yr nourishment	$384	$1,433	$2,236	$2,853	$3,316	$3,683	$3,924	$4,132
15 yr nourishment	$368	$1,410	$2,213	$2,830	$3,298	$3,666	$3,909	$4,118
16 yr nourishment	$350	$1,378	$2,186	$2,808	$3,280	$3,651	$3,896	$4,105

Hybrid Alternatives: Total Benefits

Hybrid alternatives generate total average annual benefits, inclusive of the 50% cap on recreation benefits, as shown in **Table 3.5-9** and **Table 3.5-10**. Total benefits range from approximately $1.1 to $4.6 million at Segment 1 and $700k to $4.3 million at Segment 2 under low SLR.

Table 3.5-9 Total Average Annual Benefits for Hybrid Alternatives at Segment 1

Low SLR ($1,000s)	50 ft	100 ft	150 ft	200 ft
2 yr nourishment	$2,471	$3,672	$4,301	$4,633
3 yr nourishment	$2,374	$3,616	$4,249	$4,604
4 yr nourishment	$2,235	$3,553	$4,226	$4,589
5 yr nourishment	$2,099	$3,481	$4,192	$4,574
6 yr nourishment	$1,934	$3,384	$4,131	$4,537
7 yr nourishment	$1,794	$3,250	$4,050	$4,482
8 yr nourishment	$1,684	$3,095	$3,975	$4,434
9 yr nourishment	$1,586	$2,959	$3,890	$4,385
10 yr nourishment	$1,490	$2,790	$3,776	$4,320
11 yr nourishment	$1,405	$2,676	$3,695	$4,268
12 yr nourishment	$1,350	$2,553	$3,595	$4,201
13 yr nourishment	$1,272	$2,445	$3,500	$4,138
14 yr nourishment	$1,160	$2,354	$3,415	$4,074
15 yr nourishment	$1,159	$2,298	$3,311	$3,992
16 yr nourishment	$1,104	$2,201	$3,192	$3,885

Table 3.5-10 Total Average Annual Benefits for Hybrid Alternatives at Segment 2

Low SLR ($1,000s)	50 ft	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft
2 yr nourishment	$841	$1,779	$2,483	$3,053	$3,517	$3,903	$4,139	$4,319
3 yr nourishment	$834	$1,775	$2,474	$3,048	$3,498	$3,883	$4,115	$4,306
4 yr nourishment	$812	$1,777	$2,475	$3,037	$3,481	$3,852	$4,078	$4,264
5 yr nourishment	$809	$1,760	$2,475	$3,022	$3,466	$3,827	$4,050	$4,240
6 yr nourishment	$802	$1,740	$2,461	$3,013	$3,458	$3,822	$4,049	$4,243
7 yr nourishment	$796	$1,727	$2,443	$2,998	$3,444	$3,807	$4,035	$4,229
8 yr nourishment	$783	$1,708	$2,427	$2,992	$3,436	$3,796	$4,023	$4,218
9 yr nourishment	$774	$1,693	$2,408	$2,978	$3,422	$3,783	$4,008	$4,202
10 yr nourishment	$759	$1,670	$2,385	$2,962	$3,405	$3,766	$3,992	$4,188
11 yr nourishment	$744	$1,657	$2,371	$2,948	$3,394	$3,754	$3,982	$4,177
12 yr nourishment	$726	$1,633	$2,352	$2,932	$3,379	$3,738	$3,966	$4,162
13 yr nourishment	$713	$1,613	$2,335	$2,918	$3,366	$3,723	$3,953	$4,149
14 yr nourishment	$704	$1,597	$2,318	$2,903	$3,353	$3,713	$3,945	$4,143
15 yr nourishment	$693	$1,578	$2,299	$2,884	$3,337	$3,698	$3,931	$4,131
16 yr nourishment	$681	$1,552	$2,276	$2,863	$3,321	$3,683	$3,919	$4,119

3.5.4 Project Costs

Beach Nourishment: Costs

Table 3.5-11 and **Table 3.5-12** list average annualized costs in thousands for all combinations of nourishment interval (2-16 years) and added beach widths (50-200/400 ft MSL) for the beach nourishment alternatives.

Table 3.5-11 Beach Nourishment Alternatives Average Annual Costs for Segment 1

Low SLR ($1,000s)	50 ft	100 ft	150 ft	200 ft
2 yr nourishment	$3,178	$3,620	$5,501	$7,599
3 yr nourishment	$2,484	$2,964	$4,786	$6,769
4 yr nourishment	$2,137	$2,576	$4,298	$6,163
5 yr nourishment	$1,821	$2,259	$3,962	$5,826
6 yr nourishment	$1,691	$2,222	$3,930	$5,740
7 yr nourishment	$1,602	$2,242	$3,997	$5,851
8 yr nourishment	$1,454	$2,102	$3,828	$5,653
9 yr nourishment	$1,331	$1,935	$3,679	$5,490
10 yr nourishment	$1,205	$1,803	$3,605	$5,289
11 yr nourishment	$1,160	$1,759	$3,566	$5,266
12 yr nourishment	$1,114	$1,726	$3,510	$5,197
13 yr nourishment	$1,023	$1,543	$3,315	$4,978
14 yr nourishment	$994	$1,503	$3,275	$5,172
15 yr nourishment	$968	$1,469	$3,244	$5,172
16 yr nourishment	$943	$1,426	$3,195	$5,121

Table 3.5-12 Sand Placement Alternatives Average Annual Costs for Segment 2

Low SLR ($1,000s)	50 ft	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft
2 yr nourishment	$2,864	$3,366	$4,266	$4,971	$5,832	$6,622	$7,224	$7,827
3 yr nourishment	$2,030	$2,424	$3,192	$3,804	$4,568	$5,212	$5,725	$6,258
4 yr nourishment	$1,627	$1,968	$2,658	$3,226	$3,935	$4,624	$5,154	$5,589
5 yr nourishment	$1,391	$1,711	$2,343	$2,826	$3,521	$4,117	$4,606	$5,129
6 yr nourishment	$1,274	$1,597	$2,196	$2,613	$3,194	$3,770	$4,204	$4,679
7 yr nourishment	$1,179	$1,492	$2,081	$2,484	$3,068	$3,586	$3,993	$4,450
8 yr nourishment	$1,084	$1,390	$1,973	$2,335	$2,885	$3,387	$3,785	$4,241
9 yr nourishment	$1,008	$1,313	$1,888	$2,256	$2,774	$3,247	$3,621	$4,053
10 yr nourishment	$935	$1,234	$1,804	$2,145	$2,647	$3,100	$3,444	$3,859
11 yr nourishment	$915	$1,217	$1,784	$2,117	$2,640	$3,118	$3,391	$3,805
12 yr nourishment	$890	$1,187	$1,753	$2,104	$2,611	$3,096	$3,372	$3,795
13 yr nourishment	$823	$1,123	$1,686	$2,014	$2,500	$2,965	$3,224	$3,627
14 yr nourishment	$798	$1,115	$1,680	$2,007	$2,485	$2,929	$3,171	$3,556
15 yr nourishment	$776	$1,108	$1,669	$1,996	$2,468	$2,914	$3,157	$3,535
16 yr nourishment	$756	$1,092	$1,651	$1,975	$2,441	$2,874	$3,239	$3,493

Hybrid Alternatives: Costs

Table 3.5-13 and **Table 3.5-14** list average annualized costs in thousands for all combinations of nourishment interval (2-16 years) and added beach widths (5-200/400 ft MSL) for the hybrid alternatives.

Table 3.5-13 Hybrid Alternatives Average Annual Costs for Segment 1

Low SLR ($1,000s)	50 ft	100 ft	150 ft	200 ft
2 yr nourishment	$3,276	$3,718	$5,599	$7,697
3 yr nourishment	$2,581	$3,062	$4,883	$6,867
4 yr nourishment	$2,234	$2,674	$4,395	$6,260
5 yr nourishment	$1,918	$2,357	$4,059	$5,923
6 yr nourishment	$1,789	$2,320	$4,028	$5,838
7 yr nourishment	$1,699	$2,340	$4,094	$5,949
8 yr nourishment	$1,551	$2,199	$3,926	$5,751
9 yr nourishment	$1,429	$2,033	$3,777	$5,588
10 yr nourishment	$1,303	$1,900	$3,703	$5,386
11 yr nourishment	$1,257	$1,856	$3,664	$5,364
12 yr nourishment	$1,212	$1,823	$3,608	$5,295
13 yr nourishment	$1,120	$1,640	$3,412	$5,075
14 yr nourishment	$1,092	$1,601	$3,373	$5,270
15 yr nourishment	$1,065	$1,567	$3,341	$5,269
16 yr nourishment	$1,040	$1,524	$3,293	$5,218

Table 3.5-14 Hybrid Alternatives Costs for Segment 2

Low SLR ($1,000s)	50 ft	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft
2 yr nourishment	$2,930	$3,432	$4,332	$5,037	$5,898	$6,688	$7,290	$7,893
3 yr nourishment	$2,096	$2,490	$3,259	$3,870	$4,634	$5,278	$5,791	$6,324
4 yr nourishment	$1,693	$2,034	$2,725	$3,292	$4,002	$4,690	$5,220	$5,655
5 yr nourishment	$1,457	$1,777	$2,410	$2,892	$3,587	$4,183	$4,672	$5,195
6 yr nourishment	$1,340	$1,663	$2,262	$2,680	$3,261	$3,837	$4,270	$4,745
7 yr nourishment	$1,245	$1,559	$2,147	$2,550	$3,134	$3,652	$4,060	$4,516
8 yr nourishment	$1,150	$1,456	$2,039	$2,401	$2,951	$3,453	$3,851	$4,307
9 yr nourishment	$1,075	$1,380	$1,954	$2,323	$2,840	$3,314	$3,688	$4,119
10 yr nourishment	$1,001	$1,301	$1,871	$2,211	$2,713	$3,166	$3,510	$3,926
11 yr nourishment	$981	$1,283	$1,850	$2,183	$2,706	$3,184	$3,458	$3,872
12 yr nourishment	$956	$1,254	$1,820	$2,171	$2,677	$3,162	$3,438	$3,861
13 yr nourishment	$889	$1,189	$1,752	$2,080	$2,566	$3,032	$3,290	$3,693
14 yr nourishment	$865	$1,182	$1,747	$2,073	$2,552	$2,995	$3,237	$3,622
15 yr nourishment	$842	$1,174	$1,735	$2,062	$2,534	$2,980	$3,223	$3,601
16 yr nourishment	$822	$1,158	$1,718	$2,041	$2,508	$2,940	$3,305	$3,559

3.5.5 Net Benefits

Beach Nourishment Alternatives: Net Benefits with Limited Recreation Benefits[5]

Based on the coastal storm damage reduction benefits and associated costs, no alternative was economically justified on coastal storm damage reduction benefits only. Recreation benefits are limited to 50% of the total benefits required for justification to ensure recreation is incidental to plan formulation.[6] Consequently, recreation benefits, not to exceed coastal storm damage reduction benefits, were included to determine the alternatives that are economically justified (net benefits greater than zero). All alternatives economically justified with limited recreation benefits are analyzed in a later step with full recreation benefits to determine the National Economic Development (NED) Plan.

Based on this threshold 50-ft, 100-ft, and 150-ft added beach width MSL alternatives were economically justified at Segment 1. See **Figure 3.5-1**.

Based on this threshold 100-ft through 400-ft added beach width MSL alternatives were economically justified at Segment 2. See **Figure 3.5-2**.

All alternatives that were economically justified (BCR greater than or equal to 1.0) were evaluated with full recreation benefits to select the NED Plans in the next section.

[5] Recreation benefits up to 50% of total benefits.
[6] ER 1105-2-100 section 3-4b.(4)(a)

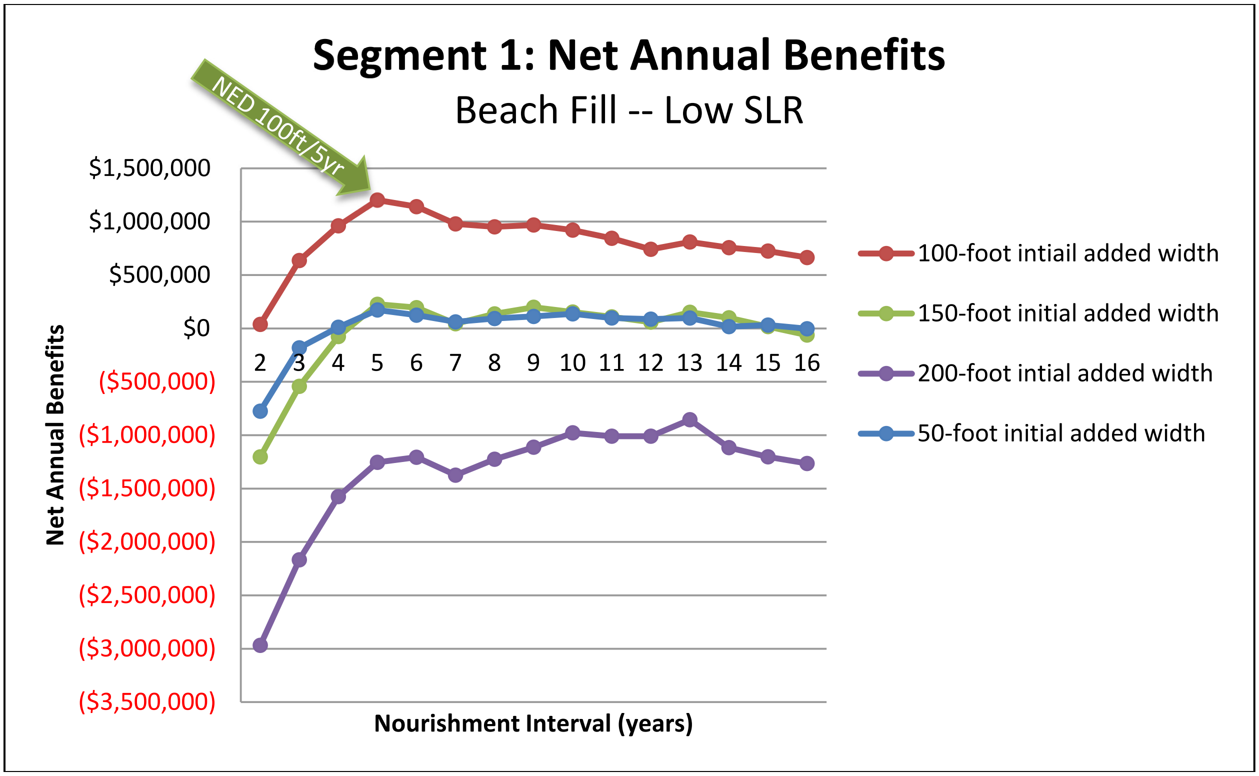


Figure 3.5-1 Net Annual Benefits for Segment 1 Beach Fill Alternatives with Limited Recreation Benefits (Low Sea-level Rise)

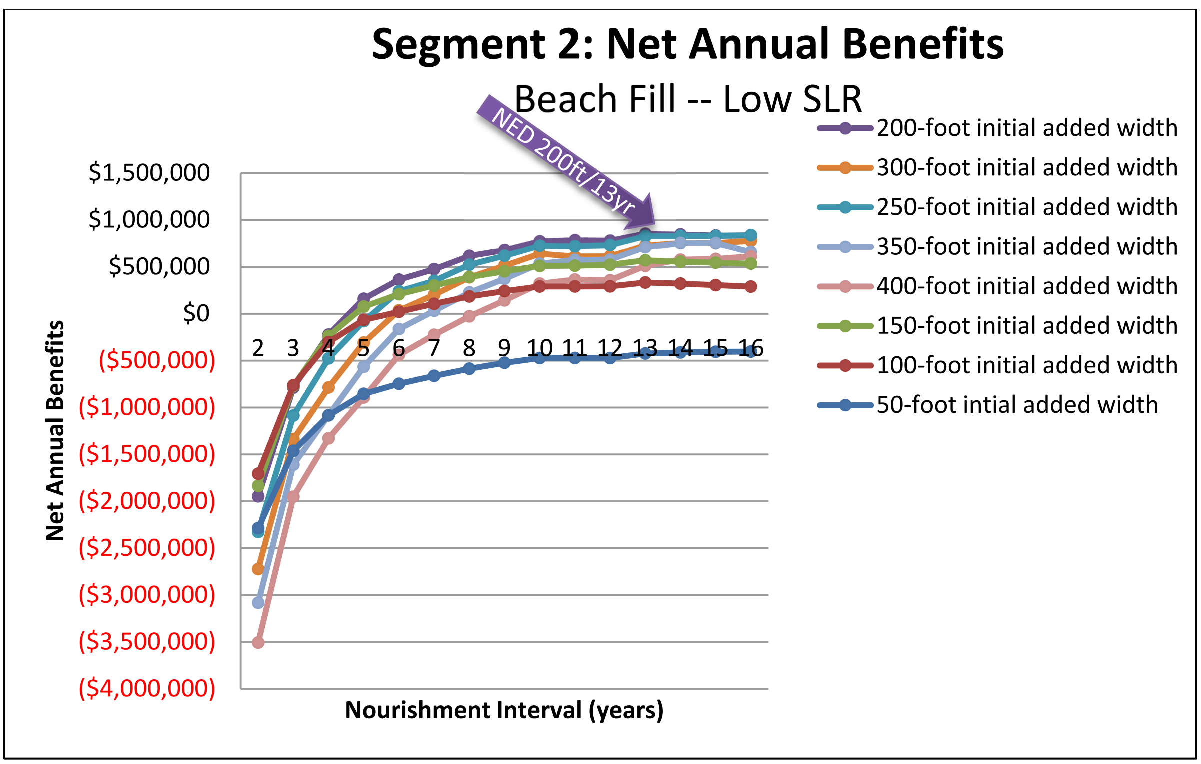


Figure 3.5-2 Net Annual Benefits for Segment 2 Beach Fill Alternatives with Limited Recreation Benefits (Low Sea-level Rise)

Hybrid Alternatives: Net Benefits with Limited Recreation Benefits[7]

The net annual benefits for the Hybrid Alternatives, which include toe notch fill & sand placement, were analyzed for 50 to 400 ft of added beach width (200 ft for Encinitas) and two to sixteen year nourishment intervals. Note the hybrid alternatives with the highest net benefits are moderately lower than comparable beach fill alternatives.

When evaluated with limited recreation benefits the 100-ft, 150-ft, and 200-ft added beach width MSL alternatives were economically justified at Segment 1. See **Figure 3.5-3**.

When evaluated with limited recreation benefits the 100-ft through 400-ft added beach width MSL alternatives were economically justified at Segment 2. See **Figure 3.5-4**.

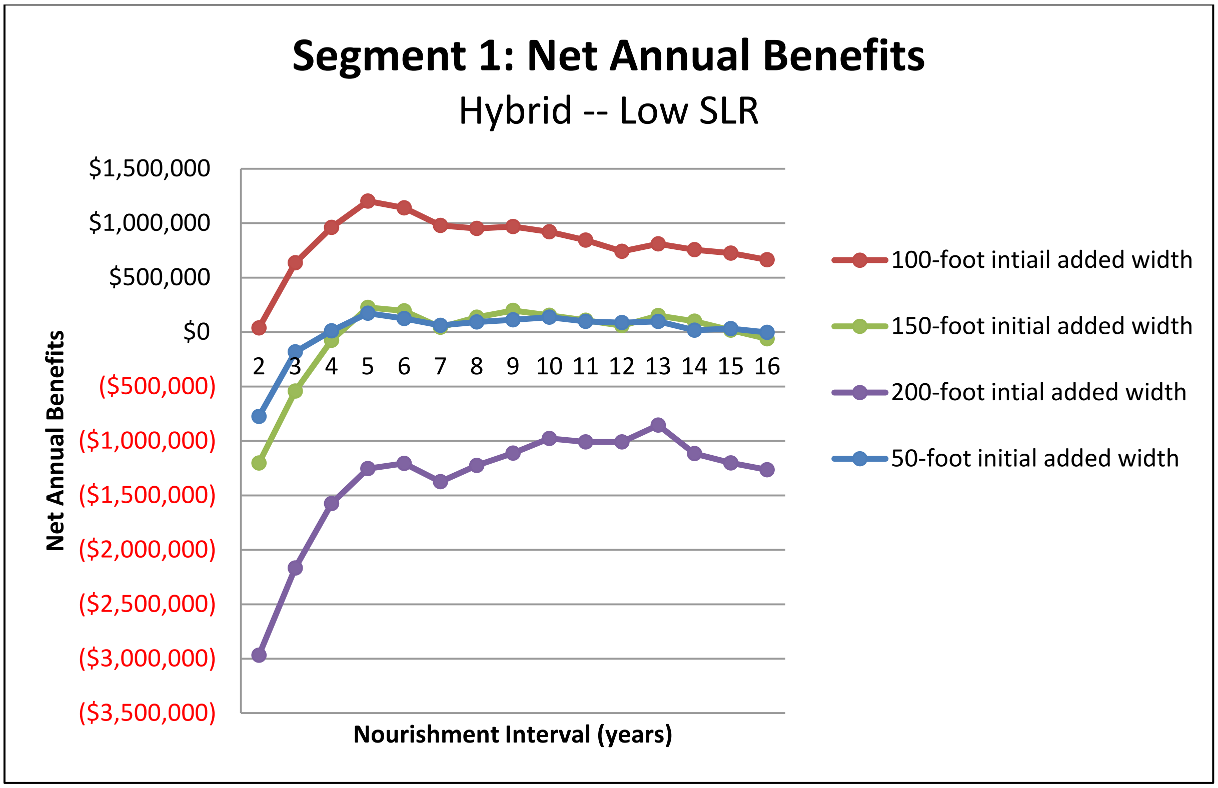


Figure 3.5-3 Net Annual Benefits for Hybrid Alternatives with Limited Recreation Benefits (Low Sea-Level Rise)

[7] Recreation benefits up to 50% of total benefits

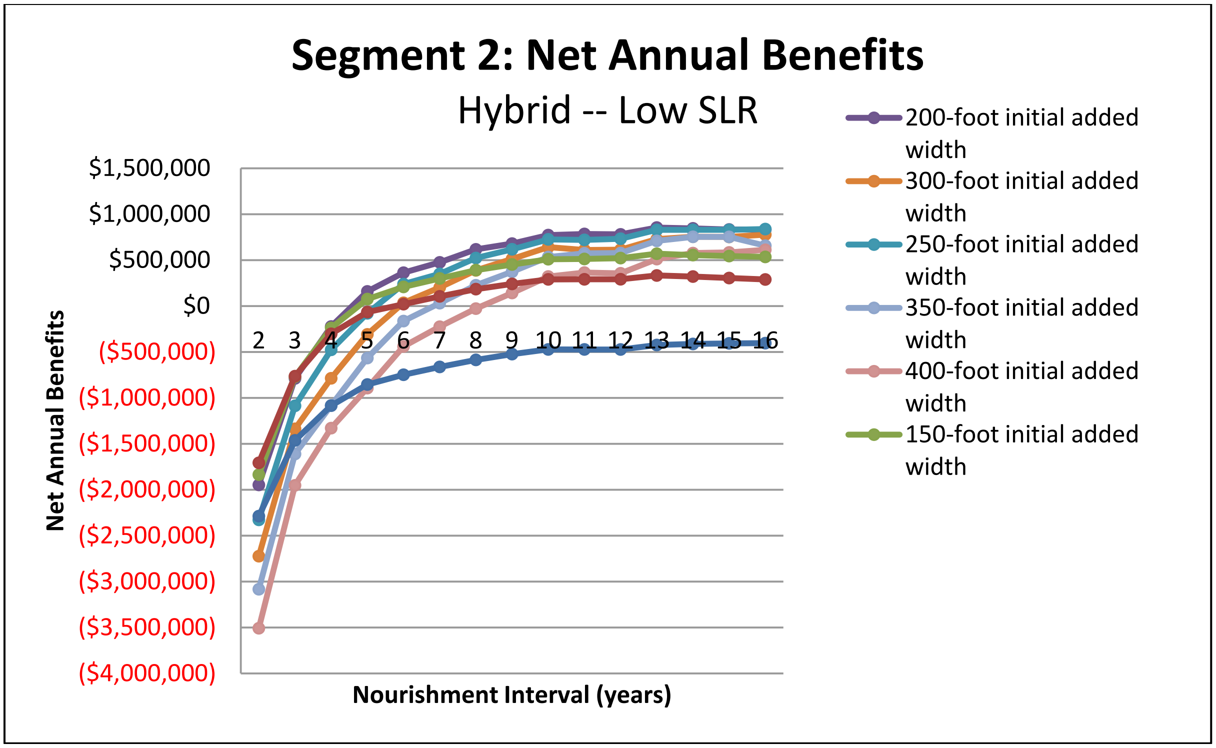


Figure 3.5-4 Net Annual Benefits for Hybrid Alternatives with Limited Recreation Benefits (Low Sea-Level Rise)

<u>Beach Nourishment Alternatives: Net Annual Benefits with Full Recreation Benefits</u>

The Beach Nourishment alternatives that are economically justified with limited recreation benefits (up to 50% of total benefits) were evaluated with full recreation benefits to determine the National Economic Development (NED) Plan. Results are shown **Table 3.5-15** and **Table 3.5-16**. Among the beach fill alternatives evaluated at Segment 1, extending the beach 100 ft MSL and nourishing every 5 years maximizes NED net annual benefits. This result is consistent under low and high sea-level rise scenarios.

Table 3.5-15 Segment 1: Beach Nourishment Alternatives Net Annual Benefits with Full Recreation Benefits

Low SLR ($1,000s)	50 ft	100 ft	150 ft	200 ft
2 yr nourishment	--	$225	--	--
3 yr nourishment	--	$836	--	--
4 yr nourishment	$332	$1,178	--	--
5 yr nourishment	$507	**$1,435**	$413	--
6 yr nourishment	$409	$1,393	$396	--
7 yr nourishment	$306	$1,257	$267	--
8 yr nourishment	$295	$1,250	$377	--
9 yr nourishment	$279	$1,283	$456	--
10 yr nourishment	$276	$1,220	$438	--
11 yr nourishment	$199	$1,114	$404	--
12 yr nourishment	$177	$1,010	$377	--
13 yr nourishment	$170	$1,054	$482	--
14 yr nourishment	$58	$960	$433	--
15 yr nourishment	$82	$940	$363	--
16 yr nourishment	--	$863	--	--

Among the beach nourishment alternatives evaluated with full recreation benefits at Segment 2, extending the beach 200 ft MSL and nourishing every 13 years maximizes NED net annual benefits. Under the high sea-level rise scenario the alternative that maximizes NED net annual benefits is 300-ft added beach width nourished every 14 years.

Table 3.5-16 Segment 2: Beach Fill Alternatives Net Annual Benefits with Full Recreation Benefits

Low SLR ($1,000s)	50 ft	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft
2 yr nourishment	--	--	--	--	--	--	--	--
3 yr nourishment	--	--	--	--	--	--	--	--
4 yr nourishment	--	--	--	--	--	--	--	--
5 yr nourishment	--	--	$362	$415	--	--	--	--
6 yr nourishment	--	$465	$498	$622	$496	$312	--	--
7 yr nourishment	--	$558	$596	$739	$611	$484	$279	--
8 yr nourishment	--	$646	$692	$883	$787	$674	$478	--
9 yr nourishment	--	$711	$760	$950	$887	$803	$629	$377
10 yr nourishment	--	$773	$825	$1,048	$1,000	$937	$795	$561
11 yr nourishment	--	$780	$833	$1,064	$998	$911	$839	$606
12 yr nourishment	--	$793	$849	$1,065	$1,016	$919	$846	$604
13 yr nourishment	--	$844	$903	**$1,144**	$1,116	$1,039	$984	$762
14 yr nourishment	--	$841	$894	$1,140	$1,122	$1,069	$1,031	$830
15 yr nourishment	--	$835	$891	$1,134	$1,126	$1,072	$1,035	$841
16 yr nourishment	--	$832	$890	$1,140	$1,140	$1,103	$944	$874
High SLR ($1000s)	**50 ft**	**100 ft**	**150 ft**	**200 ft**	**250 ft**	**300 ft**	**350 ft**	**400 ft**
2 yr nourishment	--	--	--	--	--	--	--	--
3 yr nourishment	--	--	--	--	--	--	--	--
4 yr nourishment	--	--	--	--	--	--	--	--
5 yr nourishment	--	--	$584	$622	--	--	--	--
6 yr nourishment	--	$589	$717	$840	$820	$688	--	--
7 yr nourishment	--	$675	$804	$937	$908	$767	$668	--
8 yr nourishment	--	$764	$887	$1,087	$1,088	$960	$864	--
9 yr nourishment	--	$822	$965	$1,171	$1,185	$1,085	$1,011	$763
10 yr nourishment	--	$874	$1,006	$1,217	$1,297	$1,214	$1,023	$939
11 yr nourishment	--	$876	$1,016	$1,238	$1,252	$1,255	$1,063	$982
12 yr nourishment	--	$879	$1,031	$1,255	$1,264	$1,258	$1,058	$973
13 yr nourishment	--	$923	$1,053	$1,331	$1,362	$1,373	$1,191	$1,126
14 yr nourishment	--	$912	$1,042	$1,325	$1,365	**$1,403**	$1,240	$1,191
15 yr nourishment	--	$895	$1,034	$1,241	$1,365	$1,253	$1,234	$1,197
16 yr nourishment	--	$879	$1,028	$1,243	$1,375	$1,279	$1,262	$1,222

Hybrid Alternatives: Net Annual Benefits with Full Recreation Benefits

The Hybrid alternatives that are economically justified with limited recreation benefits (up to 50% of total benefits) were evaluated with full recreation benefits in **Table 3.5-17** and **Table 3.5-18**. Among the Hybrid alternatives evaluated at Segment 1, extending the beach 100 ft MSL and nourishing every 5 years maximizes NED net annual benefits. This result is consistent under low and high sea-level rise scenarios.

Table 3.5-17 Segment 1: Hybrid Alternatives Net Annual Benefits with Full Recreation Benefits

Low SLR ($1,000s)	50 ft	100 ft	150 ft	200 ft
2 yr nourishment	--	--	--	--
3 yr nourishment	--	$750	--	--
4 yr nourishment	$290	$1,092	--	--
5 yr nourishment	$474	**$1,352**	$317	--
6 yr nourishment	$386	$1,311	$302	--
7 yr nourishment	$293	$1,181	--	--
8 yr nourishment	$288	$1,181	$287	--
9 yr nourishment	$278	$1,222	$368	--
10 yr nourishment	$282	$1,166	$353	--
11 yr nourishment	$209	$1,066	$321	--
12 yr nourishment	$191	$969	--	--
13 yr nourishment	$189	$1,018	$406	--
14 yr nourishment	$83	$927	$360	--
15 yr nourishment	$114	$914	--	--
16 yr nourishment	$78	$842	--	--

Among the Hybrid alternatives evaluated with full recreation benefits at Segment 2, extending the beach 200 ft MSL and nourishing every 13 years maximizes NED net annual benefits. Under the high sea-level rise scenario the alternative that maximizes NED net annual benefits is 300-ft added beach width nourished every 14 years.

Table 3.5-18 Segment 2: Hybrid Alternatives Net Annual Benefits with Full Recreation Benefits

Low SLR ($1,000s)	50 ft	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft
2 yr nourishment	--	--	--	--	--	--	--	--
3 yr nourishment	--	--	--	--	--	--	--	--
4 yr nourishment	--	--	--	--	--	--	--	--
5 yr nourishment	--	--	$332	$375	--	--	--	--
6 yr nourishment	--	$469	$469	$583	$449	--	--	--
7 yr nourishment	--	$565	$570	$701	$565	$431	--	--
8 yr nourishment	--	$655	$667	$845	$742	$623	$420	--
9 yr nourishment	--	$723	$737	$913	$842	$753	$572	$315
10 yr nourishment	--	$787	$804	$1,012	$957	$888	$739	$499
11 yr nourishment	--	$796	$813	$1,030	$956	$862	$784	$546
12 yr nourishment	--	$811	$831	$1,031	$974	$872	$793	$545
13 yr nourishment	--	$864	$886	**$1,111**	$1,075	$993	$932	$704
14 yr nourishment	--	$862	$879	$1,107	$1,081	$1,023	$979	$771
15 yr nourishment	--	$858	$878	$1,104	$1,087	$1,027	$984	$784
16 yr nourishment	--	$858	$879	$1,110	$1,102	$1,058	$893	$817
High SLR ($1000s)	**50 ft**	**100 ft**	**150 ft**	**200 ft**	**250 ft**	**300 ft**	**350 ft**	**400 ft**
2 yr nourishment	--	--	--	--	--	--	--	--
3 yr nourishment	--	--	--	--	--	--	--	--
4 yr nourishment	--	--	--	--	--	--	--	--
5 yr nourishment	--	--	$551	$580	--	--	--	--
6 yr nourishment	--	$586	$683	$797	$771	--	--	--
7 yr nourishment	--	$675	$773	$896	$860	$713	--	--
8 yr nourishment	--	$766	$857	$1,047	$1,041	$906	$806	--
9 yr nourishment	--	$826	$937	$1,131	$1,138	$1,033	$954	$701
10 yr nourishment	--	$880	$980	$1,179	$1,251	$1,163	$967	$878
11 yr nourishment	--	$883	$992	$1,200	$1,208	$1,205	$1,008	$921
12 yr nourishment	--	$889	$1,008	$1,217	$1,220	$1,208	$1,004	$913
13 yr nourishment	--	$934	$1,031	$1,295	$1,319	$1,325	$1,137	$1,067
14 yr nourishment	--	$925	$1,022	$1,289	$1,322	**$1,355**	$1,186	$1,132
15 yr nourishment	--	$909	$1,016	$1,206	$1,323	$1,205	$1,182	$1,138
16 yr nourishment	--	$896	$1,011	$1,210	$1,334	$1,232	$1,210	$1,164

3.6 NED Plan Selection

The NED Plans for Segments 1 and 2 were selected among all the alternatives considered to "reasonably maximize net national economic development benefits, consistent with the Federal objective…"[8] First, all alternatives were evaluated for economic justification (net benefits greater than zero) with Coastal Storm Damage Reduction (CSDR) benefits and recreation benefits not to exceed CSDR benefits when applicable. Among those alternatives economically justified, the benefits quantified to determine the NED Plan were Coastal Storm Damage Reduction (CSDR) and full recreation. The costs included construction and related activities, monitoring, environmental mitigation, if applicable, sand sedimentation & recreation loss fee, and lagoon sedimentation fees. All alternatives assume joint construction of Segments 1 and 2 with commensurate savings for the initial fill/construction but not joint construction during any subsequent beach nourishments.

Once the net annual benefits for the Beach Nourishment and Hybrid alternatives were compared, the Beach Nourishment alternatives, which have the highest net benefits, were selected as the NED Plan for Segment 1 and Segment 2 because among the alternatives analyzed, the *Beach Nourishment* alternatives maximize net benefits for both segments.

Table 3.6-1 NED Plan Selection: Net Annual Benefits[9]

	SEGMENT 1			SEGMENT 2			
Low SLR	**Benefits**	**Costs**	**Net Benefits**	**Alternative**	**Benefits**	**Costs**	**Net Benefits**
Hybrid (5yr/100ft)	$3,708,000	$2,357,000	$1,352,000	**Hybrid (13yr/200ft)**	$3,191,000	$2,080,000	$1,110,000
Beach Fill (5yr/100ft)	$3,694,000	$2,259,000	$1,435,000	**Beach Fill (13yr/200ft)**	$3,158,000	$2,014,000	$1,144,000
High SLR							
Hybrid (5yr/100ft)	$5,801,000	$2,669,000	$3,131,000	**Hybrid (14yr/300ft)**	$4,639,000	$3,283,000	$1,355,000
Beach Fill (5yr/100ft)	$5,789,000	$2,571,000	$3,217,000	**Beach Fill (14yr/300ft)**	$4,621,000	$3,219,000	$1,403,000

3.6.1 Results

Table 3.6-2 highlights key characteristics of the NED Plans for Segments 1 and 2.

- The NED Plan for Segment 1 is the Beach Fill Alternative with an initial dredged volume of 820,000 cy (890,000 cy under high SLR) that extends the base year beach width at mean-sea level approximately 100 ft. Nourishments would occur every 5 years and require dredging 340,000 cy of material (400-480,000 cy under high SLR). Net annual benefits are expected to be $1.44 million annually ($3.22 million under high SLR).

- The NED Plan for Segment 2 is the Beach Fill Alternative with an initial dredged volume of 1,117,000 cy (2,070,000 cy under high SLR) that extends the base year beach width at mean-sea level approximately 200 ft (300 ft under high SLR). Nourishments would occur every 13 years (14 years under high SLR) and require dredging 500,000 cy of

[8] *Economic and Environmental Principles for Water and Related Land Resources Implementation Studies*
[9] Totals may not add up due to rounding. Full recreation benefits included where applicable.

material (1-1.1 million cy under high SLR). Net annual benefits are expected to be $1.11 million annually ($1.67 million under high SLR).

Table 3.6-2 NED Plan Specifications

Low SLR	SEGMENT 1	SEGMENT 2
Type	Beach Fill	Beach Fill
Initial Added Width	100 ft	200 ft
Initial Volume Dredged	820,000 cyd	1,180,000 cyd
Nourishment Interval	5 yr	13 yr
Nourishment Volume Dredged	340,000 cyd	500,000 cyd
Net Annual Benefits		
Expected Value (full Recreation Benefits)	$1,435,000	$1,114,000
Expected Value (up to 50% Rec Benefits)	$1,201,000	$860,000
Expected Value (CSDR Benefits only)	-$234,000	-$345,000
BCR (incl full Recreation Benefits)	1.71	1.63
BCR (incl Rec Benefits up to 50% of CSDR Benefits)	1.53	1.43
BCR (CSDR Benefits only)	0.83	0.76
High SLR	**SEGMENT 1**	**SEGMENT 2**
Type	Beach Fill	Beach Fill
Initial Added Width	100 ft	300 ft
Initial Volume Dredged	880,000 cyd	1,970,000 cyd
Nourishment Interval	5 yr	14 yr
Nourishment Volume Dredged	400-480,000 cyd	900-1,020,000 cyd
Net Annual Benefits		
Expected Value (full Recreation Benefits)	$3,217,000	$1,665,000
Expected Value (up to 50% Rec Benefits)	$1,700,000	$1,196,000
Expected Value (CSDR Benefits only)	-$249,000	-$531,000
BCR (incl full Recreation Benefits)	2.32	1.52
BCR (incl Rec Benefits up to 50% of CSDR Benefits)	1.66	1.37
BCR (CSDR Benefits only)	0.83	0.75

3.6.2 Detailed Cost Estimate for the Tentatively Recommended Plan

Cost engineering performed a Project Csot and Schedule Risk Analysis in compliance with *Engineer Regulation (ER) 1110-2-1302 Civil Works Cost Engineering* for the tentatively recommended plans. The purpose is to identify and measure cost and schedule impact of project uncertainties. This analysis determined construction cost risk is the main source of uncertainty and specifically sand volumes, fuel prices, mitigation, and bidding climate. More information about the project risk and schedule analysis is available in *Appendix F – Cost Engineering*.

For the purposes of the Economic Analysis the formal risk analysis and Total Project Cost Summary, also performed by Cost Engineering, provide detailed project costs and contingency costs for the tentatively recommended plans. The overall contingency value is $38 million, or 29% of most likely project costs. Most likely project costs are $133 million. Project cost plus contingency totals approximately $171 million—$108 million at Segment 1 (Encinitas) and $63 million at Segment 2 (Solana Beach). Overall, these costs are slightly lower than preliminary estimates used in plan formulation due to lower contingency and mitigation cost estimates.

The economic project costs include Interest During Construction (IDC). The revised project cost estimate including IDC for initial fill is $14.2 million at Segment 1 and $23.2 million at Segment 2 and total initial nourishment cost of $37.5 million. Total cost for Segment 1 is $62.9 million and $107.8 million for Segment 2 shown below.

Table 3.6-3 Detailed Cost Estimate for the Tentatively Recommended Plans[10]

	Segment 1 (Encinitas)	Segment 2 (Solana Beach)	Total
Sand Replenishment	$36,052,000	$72,579,000	$108,631,000
Mitigation & Monitoring	$8,031,000	$4,021,000	$12,052,000
Lagoon Sedimentation	$7,612,000	$4,141,000	$11,753,000
Land Damages	$64,000	$154,000	$218,000
Pre-Engieering & Design	$8,164,000	$21,748,000	$29,912,000
Construction Management	$2,842,000	$5,179,000	$8,021,000
Interest During Construction	124,000	101,000	$225,000
Total	$62,889,000	$107,822,000	$170,711,000

These costs, which occur throughout the study period, were separated in to the year incurred, discounted at the current federal discount rate of 3.75%, and the Net Present Value (NPV) was calculated. Finally, the NPV was annualized (amortized) and presented in **Table 3.6-4.**

[10] FY 2013 price levels, undiscounted

Table 3.6-4 ER 1105-2-100 Appendix H - Economic Table[11]

Equivalent Annual Benefits and Costs Solana Beach-Encinitas Coastal Storm Damage Reduction Feasibility Study FY2013 Price Levels, 50-year Period of Analysis, 3.75% Discount Rate			
	Segment 1 (Encinitas)	Segment 2 (Solana Beach)	Total
Investment Costs			
Total Project Construction Costs	$107,821,000	$62,764,000	$170,585,000
Interest During Construction	$101,000	$124,000	$225,000
Total Investment Cost	$107,922,000	$62,888,000	$170,810,000
NPV of Investment Cost	$54,070,000	$37,290,000	$91,360,000
Average Annual Costs			
Interest and Amortization of Initial Investment	$2,410,000	$1,662,000	$4,072,000
OMRR&R	$0	$0	$0
Total Average Annual Costs	$2,410,000	$1,662,000	$4,072,000
Average Annual Benefits	$3,692,000	$3,167,000	$6,850,000
Net Annual Benefits	$1,282,000	$1,504,000	$2,777,000
Benefit-Cost Ratio	1.53	1.91	1.68
Benefit-Cost Ratio (computed at 7%)*	1.54	1.64	1.59
*per Executive Order 12893			

3.7 Risk and Uncertainty

The project alternatives were formulated to reduce erosion to the base/toe of the bluff exclusively. Preventable bluff erosion damages are the total without project damages excluding residual sloughing at the bluff top edge that would not be prevented by a Federal-interest project. *Prevented bluff erosion damages* are the NED Plan coastal storm damage reduction (CSDR) benefits. *Residual Preventable Damages* is the expected amount of damage that could occur with the NED Plan implemented. Again, residual damages are based on analysis of the spring shoreline profiles, which means expected residual damages may be biased upward due to lower sand density near the base of the bluff typical during this period. The *Residual Preventable Damage* as a share of the *Preventable Bluff Erosion Damages* is presented as the average across the study period and the minimum and maximum percentages attained within the nourishment interval as seen in **Table 3.7-1**.

[11] In addition to detailed, updated cost estimates for the NED Plans the benefits have been updated to FY 2013 price levels for this table.

Table 3.7-1 Summary of Residual Preventable Damages Alternatives EN-1A and SB-1A

	Encinitas		Solana Beach	
	Low SLR	High SLR	Low SLR	High SLR
Plan Characteristics Duration of Nourishment Interval Initial Added Beach Width	 5 yr 100 ft	 5 yr 100 ft	 13 yr 200 ft	 14 yr 300 ft
Preventable bluff erosion damages/max CSDR Benefits	$2,759,000	$3,166,000	$2,807,000	$3,513,000
Prevented bluff erosion damages/CSDR Benefits	$1,865,000	$2,141,000	$1,537,000	$2,424,000
Residual Preventable Damages, $ Expected Value	$895,000	$1,025,000	$1,270,000	$1,088,000
Residual Preventable Damages, % Expected Value, study period ("Level of Risk")	32%	32%	45%	31%

Major sources of economic uncertainty include variability in the cost of seawall construction, uncertainty about what share of parcels would be armored in time to prevent structure loss given the episodic nature of these bluff collapses, uncertainty about the financial resources private owners have to construct seawalls, variability in land and structure values, and uncertainty about how intensively study area beaches will be utilized in the future.

Risks from the tentatively recommended plan include life-safety risk from collapsing bluff tops given the uncertainty around processes that cause and can halt episodic bluff collapse—the TSP has been formulated to reduce life-safety risk but does not purport to eliminate this completely. Risk also stems from the variability in the authorization, appropriation, and ultimate construction schedule for the TSP. The consequences of delay constructing the TSP include unanticipated damages from structure loss/collapse as well as injury or death from falling debris.

The NED plan optimization considers variables that have high variability and can only be represented in probabilistic terms, and variables that are not precisely known and are predicted by methods with unquantifiable precision. Uncertainty in the primary factors of the cost and benefit estimates is examined in this Appendix B Section 13, where the measured statistics of critical parameters are displayed and a sensitivity test on Net Benefits is performed on key predictive values that cannot be forecast in advance. The factors considered include the wave climate, the cross-shore distribution of sand which forms the protective beach, the conversion rate of sand volume for a unit area of shoreline change (V/S ratio), the erosion rate of the beach fill, and the potential cost of mitigation. The uncertainty in future Sea Level Rise is examined in scenarios.

3.8 The Four Accounts

The Planning Principles and Guidelines (P&Gs) which replaced the 1972 "Principles and Standards," directs the studies of major water projects by Federal water resources development agencies. A stated purpose of the P&Gs is to ensure that the formulation and evaluation of water resource studies are done properly and consistently by federal agencies. The federal objective in project planning is to contribute to national economic development (NED) while protecting the environment. NED contributions are increases in the net values of national goods and services outputs, both marketed and non-marketed. A plan, consistent with federal objectives and which maximizes NED benefits, is the "NED plan."

In addition to NED, the P&Gs includes three other accounts: regional economic development (RED), environmental quality (EQ), and other social effects (OSE). Collectively, the four accounts are required to include all significant effects of a plan on the human environment. The RED account includes the regional incidence of NED effects, income transfers, and employment effects. The EQ account shows the non-quantifiable effects of a plan on ecological, cultural, and aesthetic attributes of significant natural and cultural resources. The OSE account displays the effects of a plan on urban and community settings and on life, health, and safety.

The P&Gs require only that the NED account be developed for the selection of a plan. However, information on the other three accounts, which may bear significantly on selection of a plan, should be included in the alternative assessment. To this end a comparable analysis of key components from each of the four accounts was performed when evaluating alternatives. These components included life-safety (OSE), residual risk (OSE), regional economic benefits (RED), mitigation acreage and costs (EQ), project cost and benefits (NED), and project net benefits (NED). These key components from all four accounts were evaluated separately and collectively for the array of alternatives under consideration.

Trade-offs among and within the four accounts were considered across these alternatives preceding identification of the Tentatively Recommended Plans. Trade-offs vary among alternatives considered but in general larger projects have higher project costs and greater benefit to the regional economy while decreasing life-safety risks. However, larger projects tend to increase environmental impacts and any associated mitigation costs. These relationships are typically retained with smaller projects, which mean that smaller projects have lower construction costs and less benefit to the regional economy while increasing life-safety risk compared to larger projects. National Economic Development goals were achieved in varying measure by the array of alternatives considered but alternatives scaled to moderate sizes tended produce more NED net benefits than projects of small or large scale. By analyzing these trade-offs to all four accounts, the key outputs/results of the alternatives were separately and collectively considered in the plan formulation process.

The Final Array plans were evaluated in accordance with the decision criteria for plan selection from ER 1105-2-100, specifically the plan recommending Federal action is to be the alternative plan with the greatest net economic benefit consistent with protecting the Nation's environment (the NED plan). The Economic Appendix (Appendix E) describes in detail the analysis conducted to identify the NED Plan for each segment, in full consideration of potential environmental impacts. See Appendix H for a detailed discussion of how environmental impacts were assessed and mitigation requirements and costs determined for the alternatives. Mitigation costs were included in the benefit/cost analysis for all of the Final Array alternatives presented in the NED analysis in the Economic Appendix and are detailed in Appendix M. While not a key consideration in plan selection, detailed Regional Economic Development and Other Social Effects analyses was also conducted on the NED Plans and are also presented in the Appendix E.

Table 3.8-1 and Table 3.8-2 present a summary of the four accounts for the Final Array alternatives for Encinitas and Solana Beach.

Table 3.8-1 Four Account Summary for City of Encinitas

Account	Criterion	EN-1A Beach Nourishment (100-ft ; 5 yr cycle)	EN-1B Beach Nourishment (50-ft; 5 yr cycle)	EN-2A Hybrid (100-ft; 10 yr cycle)	EN-2B Hybrid (50-ft; 5 yr cycle)	EN-3 No Action
NED	Net Benefits (annualized)	$1,435,000	$507,000	$1,352,000	$474,000	n/a
EQ	Environmental Impacts	n/a	n/a	n/a	n/a	n/a
RED	Regional Economic Development	Moderate	Low	Moderate	Low	n/a
OSE	Residual Risk/Life Safety	Low	Moderate	Low	Moderate	High

Table 3.8-2 Four Account Summary for City of Solana Beach

Account	Criterion	SB-1A Beach Nourishment (200-ft; 13 yr cycle)	SB-1B Beach Nourishment (150-ft; 10 yr cycle)	SB-1C Beach Nourishment (100-ft; 10 yr cycle)	SB-2A Hybrid (150-ft; 10 yr cycle)	SB-2B Hybrid (100-ft; 10 yr cycle)	SB-3 No Action
NED	Net Benefits (annualized)	$1,144,000	$825,000	$773,000	$1,006,000	$874,000	n/a
EQ	Environmental Impacts	Moderate	Moderate	Low	Moderate	Low	n/a
RED	Regional Economic Development	High	Moderate	Low	Moderate	Low	n/a
OSE	Residual Risk/Life Safety	Low	Moderate	High	Moderate	High	High

Notes:

1. Regional Economic Benefits (income, jobs) increase when nourishments happen more often, when more is spent on nourishments, and when beaches are wider to attract increased tourists/visitors
2. Life safety considers qualitatively the chance of bluff collapse and the injury/death that could occur as a result. Factors that impact this are the likelihood of bluff collapse and the "safe" beach area away from the bluff available to recreate
3. Environmental Impacts to 6-9 acres are labeledd moderate and impacts approximately 1.6 acr impacts above 9 acres are not in the final array.

3.8.1 Regional Economic Development (RED) Account

The RED account shows the effects of plan alternatives on the distribution of regional economic activity in the area where the plan will have significant income and employment effects. The effects on regional income are the sum of 1) the NED income benefits and 2) transfers from outside the region. Income transfers comprise income from implementation outlays, transfers of economic activities, and indirect and induced effects. Indirect effects are those that result from the changed outputs of goods and services in industries which help meet changes in final products and export demands. Induced effects result from changes in consumer expenditures stimulated by changes in personal income. The effects of a plan on regional employment parallel those on regional income. Typically, employment impacts of a plan are developed for individual industries at some level of aggregation in order to discern the distributional impacts on business sectors. A detailed analysis of the RED Account can be found in Section 10.1 of Appendix E.

Relation of the RED Account to Other Accounts

RED impacts include, principally, changes in income and employment. However, each of those categories may overlap with other accounts defined within the P&Gs. As indicated above, NED effects also contribute to RED if they occur within the region of interest. However, the NED account is to reflect all effects on the national economy and excludes indirect and induced effects because they represent inter-regional transfers of regional economic activity. Conversely, indirect and induced impacts are shown in the RED account, and differences between it and the NED accounts are therefore accounted for as transfers from or to the rest of the nation.

The RED account may also overlap with the OSE account. The OSE account for this study include, life-safety, social vulnerability & resiliency, emergency preparedness, displacement to population, and community cohesion & social connectedness were evaluated for impacts. After determining the extent of any impacts, life-safety, social vulnerability & resiliency, community cohesion were analyzed further due to the moderate to high probability the tentatively Recommended Plan and/or No Action Plan would cause moderate to significant impacts. All may have regional impacts as typically defined by the RED account, but many may not be quantifiable and thus be included in the OSE account. Others which are measurable may fit into the OSE account and concurrently be an RED impact. For example, people in flooded areas may be unable to live in their homes or commute to work. The inability to live in their homes is an OSE impact, while the inability to commute to work is also an OSE impact, but with RED implications. In the latter case, the outputs of industries will decline if employees are unable to reach their places of employment.

Study Area RED Analysis

The NED plans were evaluated in the Regional Economic Development (RED) and Other Social Effects (OSE) accounts. The No Action Plan was also evaluated in the OSE account. Results from the RED analysis show that the NED Plans constructed at both segments would produce moderate income growth and job development to the greater San Diego area. The benefits from increased economic activity related to recreation would be more substantial but still relatively moderate compared to the gross regional product within the greater San Diego, the smallest economic unit of measure for the RED analysis. The regional economic impact to the communities of Encinitas and Solana Beach would likely be more profound and substantial due to increased hotel occupancy and related spending on local goods & services.

Direct impacts (effects) to employment and income due to the demand for goods and services to nourish the beach include fuels sales, equipment manufacturing and repair, transportation, retail/wholesale sales, and labor. These contribute to additional output, additional demand for jobs, and increased value-added to goods and services within San Diego County, the state of California, and the nation as shown in **Table 3.8-3**.

Table 3.8-3 Overall Regional Economic Impacts from NED Plans Expenditure

Segment 1 (Encinitas)				
		Regional	**State**	**National**
Total Spending (Present Value)		$44,474,000	$44,474,000	$44,474,000
Direct Impact	**Output**	$4,907,000	$14,951,000	$41,071,000
	Jobs	94	116	955
	Labor Income	$2,151,000	$2,990,000	$21,016,000
	Value Added	$2,875,000	$4,175,000	$22,889,000
Total Impact	**Output**	$8,329,000	$25,835,000	$112,906,000
	Jobs	139	243	1,740
	Labor Income	$3,298,000	$6,254,000	$42,124,000
	Value Added	$4,926,000	$9,952,000	$59,306,000
Segment 2 (Solana Beach)				
		Regional	**State**	**National**
Total Spending (Present Value)		$42,264,000	$42,264,000	$42,264,000
Direct Impact	**Output**	$4,913,000	$15,664,000	$39,631,000
	Jobs	81	107	667
	Labor Income	$2,601,000	$3,825,000	$20,620,000
	Value Added	$3,379,000	$6,033,000	$23,889,000
Total Impact	**Output**	$8,392,000	$26,547,000	$101,610,000
	Jobs	117	204	1,216
	Labor Income	$3,779,000	$7,378,000	$40,596,000
	Value Added	$5,551,000	$12,321,000	$58,783,000

Based on these estimated impacts we expect about 175 full-time equivalent (FTE) jobs to be created from direct employment constructing the projects at both segments over the period of analysis. Roughly 81 additional FTE jobs should be created by indirect and induced effects that support or compliment that construction effort. More regional jobs are expected to be created per dollar spent on construction at Segment 2 because of mitigation measures that would require more localized expertise and labor. The regional capture rate, which is the region's direct output as a share of total spending, is around 12% and reflects the way hopper dredging is typically conducted—crews from outside the region travel with the hopper to the construction site. Since much of the labor and equipment comes from outside the region, we expect the capture rate to be lower as shown. However, from the perspective of the state of California the capture rate is over one-third suggesting that much more of the resources for construction would come from within the state as opposed to within San Diego County. Most of the remaining resources would come from other parts of the United States.

Overall, both projects should lead to $10.4 million in value-added goods and services to the region and nearly 256 additional job opportunities. Employment growth should be focused in those sectors specializing in maintenance and repair of construction equipment as well as food services, retail, and real estate/accommodations. The impact to the state would be of greater magnitude although less relative importance due to the large size of the California economy. Approximately $22 million in value-added goods and services and about 450 jobs would be created state-wide with similar business sectors impacted.

Based on the spending profiles outlined for Solana Beach and shown in **Table 3.8-2**, one thousand additional visits should create about $22,000 in personal income from direct effects and an additional $16,000 in personal income for indirect & induced effects, which is a $38,000 increase in total personal income. Value added to good and services is expected to increase $31,000 from direct spending and $59,000 overall per one thousand visitors. About one FTE is created by the additional spending from one thousand visitors meaning there would be increased demand for approximately 2080 hours of labor every year of the study period.

Table 3.8-4 Regional Economic Impacts of NED Plans from Increased Recreation

Encinitas (Segment 1)		Annual Impacts
Direct	Personal income	$2,340,000
	Value added	$3,250,000
	Jobs	63
Total	Personal income	$4,020,000
	Value added	$6,190,000
	Jobs	96
Solana Beach (Segment 2)		**Annual Impacts**
Direct	Personal income	$3,300,000
	Value added	$4,580,000
	Jobs	88
Total	Personal income	$5,630,000
	Value added	$8,680,000
	Jobs	138

3.8.2 Other Social Effects (OSE) Account

The evaluation under the OSE account revealed three dimensions that would be positively impacted by implementing the tentatively recommended plans—life-safety, social vulnerability & resiliency, and community cohesion & social connectedness. We found strong evidence that life-safety risks would be strongly to moderately reduced by implementing the tentatively recommended plans compared to the No Action Plan. Improvements to life safety should be greater when the tentatively recommended plan is implemented concurrently with continued public warnings about the dangers of bluff collapse. This should encourage those recreating in the study area to utilize the wider beaches to keep a safe distance from the bluffs. At the same time social vulnerability & resiliency as well as community cohesion & social connectedness would all benefit moderately compared to the No Action Plan. Details of the OSE analysis and results are described in detail in Section 11 of Appendix E.

3.8.3 Environmental Quality (EQ) Account

The Environmental Quality (EQ) Account is another means of evaluating the alternatives. The EQ Account is intended to display long-term effects that the alternatives may have on significant environmental resources. Significant environmental resources are defined by the Water Resources Council as those components of the ecological, cultural and aesthetic environments, which, if affected by an alternative, could have a material bearing on the decision-making process. The NED Plan for Encinitas, EN-1A is not expected to have impacts on the significant environmental resources. The NED Plan for Solana Beach, SB-1A, is expected to have nearshore impacts on the significant environmental resources in the study area. The nearshore impacts are presented and discussed further in Appendix H. However; both EN-1A and SB-1A are anticipated to also provide sandy beach habitat for species, such as Grunion, as discussed in Appendix M.

3.9 Value Engineering Activities

ER 11-1-321 Change 1 dated 1 January 2011, Appendix F, Section F.1, subsection 2(d) provides an example of the requirements needed for the capability of an in-house value engineering (VE) team based on an Annual VE Guidance Plan for USACE use. This section states that the "VE team must have an adequate amount of training and appropriate and sufficient experience" in the essential disciplines needed on projects, including "Architectural, Civil, Structural, Electrical, Mechanical Engineers, Cost Engineers, Environmental Scientists and other specialty consultants." The PDT members contributing on the Encinitas-Solana Beach Coastal Storm Damage Reduction Feasibility Study had an adequate amount of experience and training to cover this requirement.

During this Pre-Authorized (Feasibility Phase) a VE study was performed that was oriented toward planning level issues as part of the plan formulation process prior to the selection of final alternatives.

During the feasibility phase of the study, alternatives were developed by plan formulation, coastal engineering, economics, environmental studies, cost engineering, and geotechnical engineering team members whose combined experience resulted in a sufficient level of VE analysis. The alternatives developed during the plan formulation phase of the study should be considered the result of significant planning, engineering, environmental, and economic analysis yielding highly cost-effective options for reducing shoreline damages in Encinitas and Solana Beach, CA.

Specific examples of VE activities completed during the study include selection of borrow site, the screening of alternatives, study area refinement, and cost engineering estimation. As discussed in Appendix C, the borrow site offshore was chosen based on sediment compatibility with the receiving beach as well as quantity of material available. This borrow site was identified in Appendix C as suitable for use in this study based on the aforementioned criteria. Incorporation of this criteria in borrow site selection provided a means to meet sediment compatibility requirements for a dredge-nourishment operation, thus minimizing future study costs. It should also be noted that beach compatible sand is the only construction material that is reasonable and environmentally acceptable to use for beach nourishment, therefore, material selection was not a factor considered for VE activities.

During the screening of alternatives, several structural alternatives were eliminated due to costs that would not be in the federal interest. Among these alternatives were breakwaters and groins and managed retreat. These alternatives were both eliminated during initial screening of alternatives as they would demand extremely high costs relative to the project costs, potential environmental impacts and public opposition. Managed retreat would not meet the basic objectives of the project which is to reduce storm damages and shoreline erosion within the project study area. Initial screening of these alternatives ensured that only highly-cost effective and acceptable alternatives, specifically beach nourishment and notchfills were carried into the feasibility phase for further analysis. The cost estimation performed in the study provided the most accurate estimate of what the project would actually cost based on the methods of calculation.

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4 AFFECTED ENVIRONMENT/EXISTING ENVIRONMENTAL SETTING

4.1 Introduction

This section of the Integrated Report describes the environmental conditions in the project baseline year of 2015 within the project study area for the proposed action. The environmental conditions are described for each environmental resource topic and issue, principally establishing the physical conditions and the existing regulatory context. Additional details regarding the applicable laws and regulations are also provided in Section 2.0 of this Integrated Report. The area of influence for each environmental topic/issue varies. This affected environment section defines the area of influence relevant for each topic/issue and the conditions within that area that may thus be affected, directly or indirectly, as a consequence of project implementation. For example, aesthetics have a local area of influence confined to the project study area whereas air quality issues have a broader or more regional context. The affected environment provides the existing environmental conditions baseline (i.e., year 2015) against which the potential short term and long term effects of the proposed alternative actions are evaluated.

The study area extends along the shoreline with the northern boundary matching the northern boundary of the City of Encinitas and the southern boundary matching the southern boundary of the City of Solana Beach (see **Table 4.1-1**). For purposes of this analysis, the shoreline includes the first landward row of properties along the beach or bluff and includes the first public road, the bluffs, the beach and the nearshore area. The study area is the area of influence applicable to most of the environmental topics/issues. **Table 4.1-1** below summarizes the area of influence for each of the environmental topics/issues.

Table 4.1-1 Environmental Topics/Issues and Area of Influence

Environmental Topic/Issue	Area of Influence
4.1 Topography, Geology, and Geography	Study area plus offshore borrow sites*
4.2 Oceanographic Characteristics and Coastal Processes	Study area plus offshore borrow sites*
4.3 Water and Sediment Quality	Study area plus offshore borrow sites*
4.4 Biological Resources	Study area plus offshore borrow sites*
4.5 Air Quality	San Diego Air Basin
4.6 Greenhouse Gases	San Diego Air Basin
4.7 Aesthetics	Study area
4.8 Cultural Resources	Study area plus offshore borrow sites*
4.9 Noise	Study area
4.10 Socioeconomics [and Commercial Fishing]	San Diego County/North Coastal Region
4.11 Transportation	City streets west of Interstate 5
4.12 Land Use	City areas west of Interstate 5
4.13 Recreation	Study area
4.14 Public Safety	Study area
4.15 Public Utilities	Study area

A previous beach replenishment project the Regional Beach Sand Project I (RBSP I) was completed in San Diego County in 2001. The RBSP I placed approximately 2.1 million cy of sand on San Diego County beaches in 2001. This littoral cell retained the sand beyond the predicted 5 years for the beaches within the study area. A second regional beach sand replenishment project, (RBSP II), has been designed based on RBSP I and will utilize the same receiver sites as the 2001 project, with some slight variations. RBSP II is scheduled for implementation in August- November 2012 and will place approximately 2.3 million cy of sand on 10 beaches in San Diego County, including approximately 469,000 cy on the beaches within the study area (Leucadia, Moonlight Beach, Cardiff and Solana Beach).

The study area has been divided into two segments for characterizing environmental conditions (**Figure 1.8-2**) that generally align with city boundaries. The receiver site in Encinitas stretches from the 700 block of Neptune Avenue to the approximate end of West H Street, including Moonlight Beach. The receiver site in Solana Beach encompasses almost the entire shore of Solana Beach and stretches from Tide Park, south to the southern city limit of Solana Beach. The project study area represents the area where project activities, including sand placement or notch fills may occur.

4.2 Topography, Geology, and Geography

This section summarizes information provided in the Appendices B and C of this Integrated Report..

4.2.1 Geographic Setting

The study area is divided into two segments, based on differences in geology, shoreline morphology, and other physical differences along the shoreline. Receiver site in the city of Encinitas is approximately 1.5 miles in length. The Encinitas receiver site is shown on **Figure 3.1-1**.

Receiver site in the city of Solana Beach is approximately 1.4 miles in length. The southern boundary of Solana Beach receiver site is approximately 20 miles north of the city of San Diego. The Solana Beach receiver site is also shown on **Figure 3.1-2**.

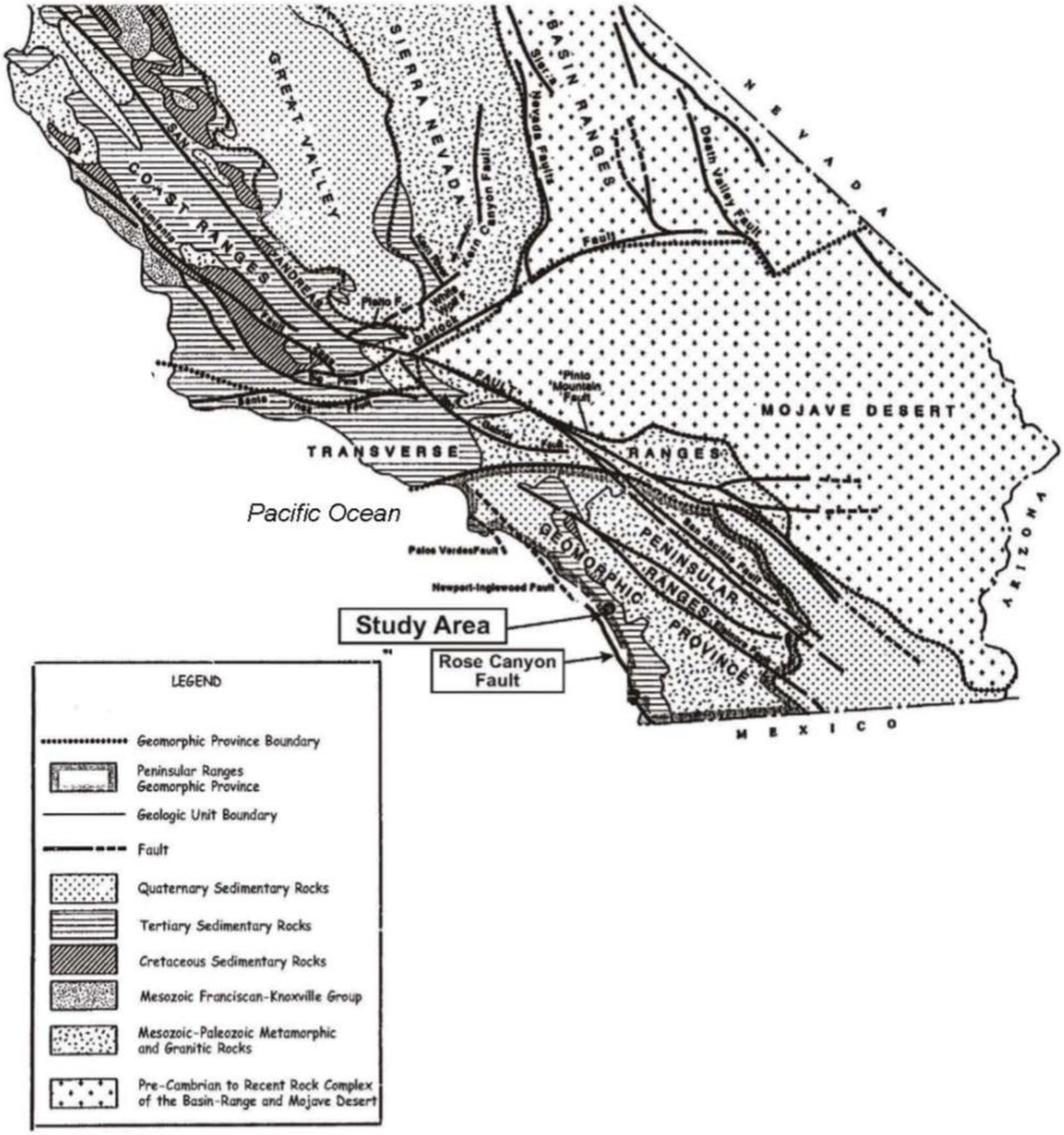
Broadly speaking, the shoreline in both segments can be described as having narrow to medium width sand and cobble beaches, backed by steep coastal bluffs. Bluff height tends to range between 30 and 80 ft, and the majority of bluff top in the study area is fully developed, primarily with residential, commercial and public land uses.

4.2.2 Topography and Bathometry

The study area is located within the coastal plain of the Peninsular Ranges Geomorphic Province (**Figure 4.2-1**). The coastal plain consists of marine and non-marine terraces dissected by a series of lagoons. Batiquitos Lagoon, which is located north of the study area boundary, San Elijo Lagoon, located between the two segments, and San Dieguito Lagoon immediately south of the study area boundary. Elevations range from sea level to approximately 80 ft at the tops of the coastal bluffs.

In general, the offshore bathymetric contours within the Encinitas and Solana Beach coastal region are gently curving and fairly uniform. The nearshore contours are relatively straight and parallel. On average, the shoreline can be characterized by an approximate beach face slope of 45:1 (horizontal ft to vertical ft) extending from the base of the coastal bluffs to about -10 ft MLLW. The nearshore slope extending seaward to approximately the -40 ft elevation contour is about 70:1. The beach face and nearshore slopes at Leucadia, within the City of Encinitas, are somewhat steeper than those to the south in the City of Solana Beach.

4.2.3



Source: AMEC 2002a

No Scale

Figure 4.2-1 Geographic setting of the study area

Geology and Soils

Seismicity

The seismic characteristics are previously described in subsection 1.5.4.

Onshore Geology

The onshore geologic characteristics are previously described in subsection 1.5.3.

Offshore Geology

Offshore from the bluffs, a shore platform extends 500 to 900 ft seaward at a slope of 1.25 degrees to a depth of -12 ft MLLW, followed by a steeper slope of 1.75 degrees to depths of over -60 ft MLLW. This surface is an active wave-cut abrasion platform subject to erosion in the present wave environment. The platform is underlain by the same Eocene-age claystone, shale, and sandstone bedrock formations exposed in the coastal bluffs. Gentle folding of the bedrock has imparted a northwestward inclination of a few degrees. As a result, the outcrops of individual bedrock formations in the shore platform are located southerly of their position in the coastal bluffs. Where the less erosion-resistant Torrey Sandstone underlies the platform, deeper water extends closer to the bluffs.

Further offshore, beyond the shore platform, substantial sand deposits or “borrow sites” have been identified and used by prior projects to supply sand. These sand deposits are thought to be ancient or relic beaches representing the shoreline position roughly 10,000 years ago when sea level was 400 ft lower. A number of available offshore sand sources were used during the SANDAG RBSP I Project and intended for use by the RBSP II project. Prior marine geology studies in the project area conducted by the USACE and other agencies have also identified potential offshore borrow sites within which the median sand grain size (d_{50}) is greater than 0.01 inch. The closest and most suitable for use on this Coastal Storm Damage Reduction Project segments are identified as borrow sites SO-6 and SO-5. **Figure 3.1-4** illustrates the locations of the offshore borrow sites in relation to the project study area.

Borrow Site SO-6

Borrow site SO-6 is located in the Swami’s State Marine Conservation Area (SMCA) approximately 4,500 ft offshore of San Elijo Lagoon, on the south side of the San Elijo wastewater outfall pipeline (see **Figure 4.2-2**). The borrow site covers approximately 44 acres of surface area and contains approximately 1,300,000 cy of sand available (assuming RBSP II removal). The results of a grain size analysis indicate that most, if not all, of the sediment within SO-6 is acceptable for beach replenishment purposes. The SO-6 borrow site consists of medium-grain sand with an average grain size of 0.014 inches. There is no silt overburden at this borrow site.

Figure 4.2-2 Swami's State Marine Conservation Area (SMCA)

Borrow Site SO-5

Site SO-5 is located approximately 4,500 ft offshore of San Dieguito Lagoon. The borrow site covers a surface area of approximately 124 acres and contains almost 7,800,000 cy of sand available (assuming RBSP II removal). The results of the grain size analysis indicate that most, if not all, of the sediment within SO-5 is acceptable for beach replenishment purposes. The SO-5 borrow site consists of sand with an average grain size of 0.02 inches. There is no silt overburden at this borrow site.

Borrow Site MB-1

Site MB-1 is located approximately 15 miles south of the study area and approximately 3,000 ft offshore from Mission Bay. The borrow site covers a surface area of approximately 107 acres and contains almost 5,800,000 cy of sand available (assuming RBSP II removal). The results of the grain size analysis indicate that most, if not all, of the sediment within MB-1 is acceptable for beach replenishment purposes. The MB-1 borrow site consists of medium to coarse sand with an average grain size of 0.02 inches. There is no silt overburden at this borrow site.

<u>Soils</u>

Soil and/or land types along the study area are mapped as coastal beaches, Marina loamy coarse sand (2 to 30 percent slope), terrace escarpments, and Chesterton fine sandy loam (2 to 9 percent slope). The coastal beaches land type includes gravelly and sandy beaches where the shore is washed by ocean waves. The Marina loamy coarse sand soil type consists of a brown and dark yellowish-brown, medium to slightly acid loamy coarse sand approximately 10 inches thick. The subsoil is approximately 47 inches thick and is a brown, neutral to mildly alkaline loamy coarse sand. Terrace escarpments occur on the fronts of coastal terraces and generally consist of 4 to 10 inches of loamy or gravelly soil over soft marine sandstone, shale, or gravelly sediments. Chesterton fine sandy loam typically has a 19-inch surface layer of brown and reddish-yellow, medium acid fine sandy loam and a 15 inch subsoil layer of brown, medium acid to strongly acid sandy clay (USDA 1973).

<u>Sediments</u>

With the exception of the Delmar Formation, all of the other materials exposed in the coastal bluffs are comprised predominantly of slightly- to moderately-cemented, medium- to coarse-grained sand suitable for use as beach fill. The marine-terrace deposits, which form the upper sloping portion of the coastal bluff, represents the largest source of sand-sized sediments. The medium-grain size ranges from 0.008 to 0.02 inches, and the fine fraction ranges from 5 percent to approximately 30 percent (USACE-LAD 1996, cited in USACE 2012a).

The sandy fraction of the Eocene-age Formations have a similar range in the medium grain size, with the Torrey Sandstone being the coarsest, and the sandy fraction of the Santiago being the finest. The Torrey Sandstone has a well-indurated, white-gray to light yellow-brown color, with the percent fines ranging from less than 5 percent, to upwards of 20 percent. The Santiago Formation, a well-indurated, light yellow-brown sandstone, is somewhat darker than the Torrey Sandstone with fines ranging from about 20 percent to 35 percent.

4.2.4 Description of Coastal Study Area

The physical characteristics of the receiver sites were described based on review of available data and reports, and field surveys conducted for this project.

<u>Encinitas Receiver Site – 700 Block, Neptune Avenue to West H Street, Encinitas</u>

Encinitas receiver site, which stretches between approximately the 700 block of Neptune Avenue and West H Street, is approximately 1.4 miles in length and is characterized as a narrow to medium beach (110 ft wide) backed by a high, steep sedimentary sandstone coastal bluffs that range from 30 to 100 ft in height. The bluff top is fully developed, primarily with private residential homes. The Self Realization Fellowship (SRF) property is located on the bluff top south of the receiver site end.

The upper bluff, composed of a poorly consolidated and weakly cemented siltstone to sandstone, is oversteepened along much of this receiver site. In the southern portion of the receiver site the bluff has a sloped face, as this formation is typically unstable at vertical angles. In addition, groundwater percolates through the porous upper, weakly-cemented sandstone, and then flows along the contact between the more resistant Delmar Formation. Evidence of groundwater seepage is prevalent along the low-lying rock face from approximately E Street south. Seawalls have been constructed intermittently along the bluff base in this receiver site, which contributes to slope stability in those areas.

In the northern and central portions of the receiver site, privately constructed seawalls and spotty notch fills have been instituted to help protect the bluffs from collapse. Some of the notch fills have been compromised as the bluff has since eroded out from behind them. A hybrid co-mixture of seawalls and upper bluff retention structures was constructed along the northern section of the receiver site. Some of these upper bluff stabilization techniques include shotcrete walls, and a terraced approach coupled with vegetation. Also within the northern section of the reach (south of 560 Neptune Avenue), there are several 15 ft high seawalls, which were constructed after 1996 when this portion of the reach experienced severe bluff toe erosion. In the area adjacent to Moonlight Beach, two patches of non-engineered rock revetment protect the bluff toe from erosion.

No recent bluff toe protective devices have been constructed within the southern portion of the receiver site. However, a long revetment structure is present below the SRF property, which is located outside of the receiver site end. The bluff at the SRF property has had a long history of slope stability issues, as the area is highly susceptible to landslides.

The beach conditions are narrow at the northern portion of the receiver site and gradually widen toward Moonlight Beach, which received sand nourishment in 2001 under SANDAG's RBSP I and will receive sand again in 2012 under RBSP II. The pocket beach that delineates Moonlight Beach is backed by a floodplain that gradually transitions into a cliff formation. The low-lying plain and the associated beach width within Moonlight Beach are highly subject to change, particularly in response to large storm events. During these events, the back beach is subject to flooding and structures (lifeguard and restroom buildings) are susceptible to damage. The city of Encinitas annually constructs a protective temporary sand berm during the winter months to prevent flooding and potential damage to the structures. The berm is constructed on the back beach and generally ranges from 10 to 12 ft high and approximately 600 ft long.

Coastal bluffs are composed of different formations. The northern and southern portions of the receiver site are composed of the slightly less-erosion-resistant Santiago or Delmar formations, while the central portion is backed by the more erodible Torrey Sandstone. There are several bluff collapse areas. In addition, a wave-cut notch (ranging from 2 to 6 ft deep) has developed along the entire receiver site at the base of the bluff in areas where seawalls are absent. In specific locations, particularly along the southern portion of the receiver site, the notches can be rather large, extending as deep as 8 or more ft and ranging from approximately 10 to 15 ft high. Due to the prevalent notch development, coupled with the already over-steepened upper bluff zone, the probability of future bluff collapses is increased in this area. An individual was killed in 2000 as the result of a bluff collapse along this stretch. Additional Encinitas receiver site public safety incidents include three construction workers being injured in an April 27, 1987 Neptune Avenue bluff collapse (one being completely buried) and a February 21, 2008 bluff collapse trapping a landscaper. In 2002, an unidentified man was killed in a seacave bluff collapse north of Encinitas receiver site within South Carlsbad State Beach.

Without corrective action, it is expected that this receiver site will continue to have episodic landslides and bluff failures. The beach provides minimal to no buffer zone between wave and tidal impacts to the bluff, the base of the bluff and bluff face bear the full brunt of this energy. The bluff toe is exposed during mid-tide levels. This repeated exposure has resulted in the continued erosion of the bluff face and the associated recession of the upper bluff. It is anticipated that without corrective action, the magnitude of the upper bluff recession would likely accelerate in this receiver site due to the ongoing erosion occurring at the base of the bluff.

<u>Solana Beach Receiver Site – Tide Park to Solana Beach Southern City Limit</u>

Receiver site in the city of Solana Beach stretches from Tide Park to the southern city limit. This receiver site includes Fletcher Cove. The bluff top is fully developed throughout the receiver site with residences and the City's Fletcher Cove Community Center, Solana Beach Marine Safety Center, and Fletcher Cove Park. The coastal bluffs are approximately 60 to 80 ft high, and are composed of Torrey Sandstone along the lower bluff and weakly consolidated sandstone throughout the upper portions of the bluff. These characteristics render the bluff vulnerable to wave erosion, sliding, and block failure. Shoreline protection features including seawalls have been constructed in many places along this receiver site, as shown in **Figure 3.4-10** and described below.

The shoreline consists of a narrow to non-existent sandy beach. In addition, small pockets of cobble exist in the back beach area at various locations. Fletcher Cove represents a small pocket beach with good public access. Prior to the 1997 to 1998 El Niño season, the moderate beach condition provided a buffer that helped prevent the bluff face from being directly exposed to storm waves and, as a result, only limited bluff erosion occurred. During the 1997 to 1998 winter months, sand was stripped away from the beach and the bluff face became directly exposed to wave abrasion. Subsequently, severe toe erosion developed and bluff failures have repeatedly occurred. Presently, notches on the order of 4 to 8 ft and large sea caves exist throughout the lower bluff region. Fractures that extend through the upper bluff are evident above, and adjacent to, the deeper notches in the southern area of the receiver site.

Numerous property owners have constructed bluff stabilization measures to protect against the direct impingement of waves and tides on the bluff face. These stabilization measures include concrete seawalls ranging in height from approximately 15 to 35 ft, as well as concrete notch infills and seacave plugs and infills are designed to fill in the voids created by the abrasive forces of waves, cobbles and tides. However, at several notch infill locations, erosion has flanked or occurred in the lee of the older infills resulting in the seepage of bluff sediment around the end of the infill. In places this has been measured to be as much as 3 to 4 ft. This is indicative of the fairly aggressive erosive nature of the base of the bluff in this shoreline receiver site of the study area. The existing notching at the base of the bluff, when combined with the already over-steepened upper bluff, increases the probability of future landslides and potentially catastrophic bluff collapses. Evidence of several landslides exists within the receiver site, and a large block failure occurred in the center of the receiver site in 2002. Sea caves are present in several areas near the southern portion of this receiver site, several of which extend as deep as 20 to 30 ft.

In 2001, a construction worker fell down the face of the bluff within Solana Beach receiver site when a bluff collapsed north of Fletcher Cove. In January of 1995, two tourists were killed when the bluff collapsed and a third individual was buried up to his chest with a compound leg fracture south of Solana Beach receiver site in Torrey Pines State Reserve. Without corrective action, it is expected that this receiver site will continue to have episodic landslides and bluff collapses. The beach provides minimal to no buffer zone between wave and tidal impacts to the bluff, and the base of the bluff and bluff face bear the full brunt of this energy. The bluff toe is exposed during mid-tide levels. This repeated exposure has resulted in the continued erosion of the bluff face and the associated recession of the upper bluff. It is anticipated that without corrective action, the magnitude of the upper bluff recession would likely accelerate in this receiver site due to the ongoing erosion occurring at the base of the bluff.

4.3 <u>Oceanographic Characteristics and Coastal Processes</u>

The oceanographic and coastal processes conditions are described in the previous subsections 1.8.7 through 1.8.8. Additional detailed description of oceanographic characteristics is available in the Appendix B - Coastal Engineering.

4.4 <u>Water and Sediment Quality</u>

Water and sediment resources within the project area were described based on recent surveys and relevant historical information.

4.4.1 Water Quality

Water quality is affected by a variety of factors including oceanographic processes, climatic conditions, atmospheric fallout, river runoff, municipal wastewater outfalls, minor industrial outfalls, non-point source runoff, and vessel discharges. Currents, waves, and seasonal variations, as well as episodic events such as El Niño conditions, are the main factors that affect fluctuations from surface to bottom waters.

Water quality within the project area reflects natural seasonal patterns. During late spring through fall, solar heating preferentially warms the ocean surface, resulting in depth-related gradients in water temperature (thermocline). Strong density gradients (pycnocline), related primarily to the water temperature changes with depth, restrict vertical mixing of the water column, which strongly affects the depth distribution of most water quality parameters (Jackson 1986). During winter and early spring, the strength of the vertical stratification decreases in response to weaker solar heating, mixing by winter storms, and upwelling.

Upwelling is initiated when northern winds displace surface waters offshore, resulting in replacement by colder, deeper waters with lower dissolved oxygen concentrations, and higher salinity and nutrient concentrations. Upwelling is generally present from late March though July in the San Diego County area. Downwelling occurs when southern winds push offshore waters toward the shore, thus pushing nearshore surface waters down and causing warmer waters and lower salinity than are typical for deeper waters (Mann and Lazier 1991). Seasonal upwelling and downwelling affect marine water quality along the San Diego coast (Hickey 1993).

El Niño-Southern Oscillation (ENSO) is a major source of interannual climate variability in the Southern California Bight (SCB), characterized by a warming of the tropical east Pacific and a rise in sea level that propagates northward into the SCB (Dailey et al. 1993). The ENSO cycle in the Pacific is not regular because of the complex feedback mechanisms between the tropical ocean and the atmosphere, but it occurs on average about every 4 years and can last a year or more.

Additionally, stormwater runoff from coastal rivers and streams adds freshwater that can cause large turbidity plumes and reductions in near-surface salinity up to several miles from shore. River and stream discharges also add suspended sediments, nutrients, bacteria and other pathogens, and chemical contaminants to nearshore waters.

Publicly-owned treatment works discharge treated sewage effluent to the ocean through subsurface wastewater outfalls, which introduces a low-salinity plume containing suspended solids and pollutants to the marine environment. There are five wastewater dischargers in the San Diego region. The largest is the Point Loma Treatment Plant, which discharges approximately 190 million gallons per day (mgd) of advanced primary treated effluent through an ocean outfall located about 4.5 miles offshore Point Loma at a discharge depth of 320 ft. Two wastewater outfalls are located in the project vicinity. The San Elijo Ocean Outfall is located offshore Cardiff at a discharge depth of -148 ft MLLW, and approximately 1.3 miles north of the study boundary is the Encina Ocean Outfall, which discharges at a depth of -180 ft MLLW.

Wastewater outfall monitoring is conducted in the surfzone and nearshore to assess bacteriological conditions in waters used for body-contact, as well as offshore monitoring for general physical and chemical parameters for compliance with the California Ocean Plan (SWRCB 2009). Bacteria concentrations in the surfzone also are monitored as part of the Coastal Storm Drain Outfall Monitoring Program, which was initiated in the San Diego region in November 2001. Existing conditions were described based on these sources of information and additional available information from monitoring conducted during beach replenishment programs. Several storm drains have coastal outlets within the study area. Three lagoons occur in the project vicinity that discharge flows to the sea.

Beneficial uses of nearshore and shoreline areas within the project area are defined in the Water Quality Control Plan for the San Diego Region (Basin Plan) and may vary in relevance to the proposed project depending on receiver site location. A number of shoreline segments within the general project area are on the current 303(d) list primarily as impacted by fecal indicator bacteria (*Enterococcus*, total or fecal coliforms). Several coastal wetlands in the project area also are on the 303(d) list for one or more of the following: eutrophication, bacteria, sediment/silt, invasive species and/or nutrients (Aqua Hedionda Lagoon, Buena Vista Lagoon, Loma Alta Slough, San Elijo Lagoon, Los Peñasquitos Lagoon). The San Luis Rey River is 303(d)-listed for bacteria, toxicity, chloride, nitrogen and phosphorus, and total dissolved solids. Tijuana Estuary is listed for a variety of pollutants and stressors, including bacteria, low dissolved oxygen, pesticides, organics, trace elements, trash, and turbidity.

<u>Physical and Chemical Characteristics</u>

Temperature

Offshore waters typically are stratified (development of thermocline/pycnocline) during the summer and fall, unstratified during the winter, and transitional (e.g., stratification weakening or increasing) in late fall and spring (**Table 4.4-1**). Thermoclines represent barriers to mixing between surface and bottom waters. Offshore temperatures in the study area range from 52 to 74 degrees Fahrenheit (ºF) near the surface, and from 49 to 61ºF near the bottom (KEA 1990, MEC 1997, 2000a). During the June 1999 survey of borrow sites SO-5, surface waters (approximately 66.2ºF) were 3.6 to 7.2ºF warmer than bottom waters (59 to 62.6ºF). Nearshore water temperatures are slightly warmer in the range of 57 to 75ºF, and tend to be more uniform throughout the water column due to turbulent mixing and shallower depths (Hickey 1993).

Table 4.4-1 Water Quality at Borrow Sites SO-5 (offshore Del Mar) and SO-7 (Offshore Batiquitos), June 1999

Station	Depth	Temperature		Water Quality			
			(ºF)	Salinity (ppt)	Dissolved Oxygen (mg/L)	pH	Transmissivity (%)
SO-5 (65 ft)	Surface		66	33.7	8.3	8.1	83.9
	Bottom		59	33.7	8.6	8.1	64.0
SO-7 (66 ft)	Surface		67	33.4	7.8	8.1	84.3
	Bottom		63	33.5	8.6	8.1	69.6

Salinity

Historical salinity levels are fairly uniform, ranging from 33 to 34 parts per thousand (ppt) within the nearshore portion of the study area (KEA 1990, MEC 1997, 2000a). Salinity levels are relatively homogenous throughout the water column, with differences typically less than 1 ppt from surface to bottom waters (**Table 4.4-1**). The exception is during winter storms when freshwater runoff reduces surface water salinity, especially at nearshore locations. Salinity levels in both surface and bottom waters may be slightly higher from April to August due to upwelling of denser bottom waters.

Dissolved Oxygen

Historical dissolved oxygen values range from 5.0 to 11.6 milligrams per liter (mg/L) throughout the study area (Hickey 1993). Natural deviations of dissolved oxygen result from a combination of factors, including intrusions of water masses, primary production (phytoplankton blooms), and upwelling/downwelling events. Surface water dissolved oxygen concentrations at borrow sites SO-5 was 8.3 mg/L, during June 1999 (**Table 4.4-1**). These concentrations are typical for surface waters with 100 percent oxygen saturation. The bottom water dissolved oxygen concentration at both sites was 8.6 mg/L. Nearshore waters generally have higher dissolved oxygen concentrations than offshore areas due to shallow water depths and continuous wave action that promotes mixing.

pH

Historical pH values range from 7.7 to 8.4 within the study area (MEC 1997, 2000a). Slightly higher pH values occur during May through September when water temperatures are warmer, and in surface waters as related to equilibrium with carbon dioxide in the atmosphere. Depth-related changes in pH typically are minimal. During June 1999, the pH value at borrow site SO-5 was 8.1 (**Table 4.4-1**).

Suspended Particulate Matter (Turbidity) and Light Transmission

Light penetration in seawater is the limiting factor associated with photosynthetic growth of phytoplankton, kelp, and other marine plants. Waters tend to be more turbid in the winter due to greater wave energy, surface runoff, and river discharges. Runoff related discharges and associated natural turbidity occur in pulses rather than as continual discharges (Continental Shelf Associates 1984). Other seasonal reductions in water clarity may occur in spring and summer due to plankton and suspended particles concentrating near the thermocline. Phytoplankton blooms (e.g., red tides) may reduce light transmittance (transmissivity) levels in summer months.

Water clarity is measured using a variety of methods, including percent light transmittance, suspended solids concentration, and the nephelometric method, which measures and compares light scattered by a water sample and light scattered by a reference solution. In general, light transmittance tends to increase and suspended solid concentrations decrease with distance from shore. Transmissivity levels typically range from 40 to 90 percent offshore (MEC 1997, 2000a) (**Table 4.4-1**).

Similar to transmissivity values, total suspended solids (TSS) or particulate concentrations are lower offshore than nearshore. TSS concentrations ranged from less than 1 to 47 mg/L offshore Carlsbad over a 13-year monitoring period, with highest concentrations recorded after storm events or occasionally in the summer (probably due to phytoplankton blooms) (MEC 1997).

Turbidity levels may be substantially higher near the mouths of coastal lagoons due to river discharges, storm runoff, and/or algal blooms. TSS concentrations of 100 mg/L were recorded just inside Batiquitos Lagoon at the same time that concentrations of 20 mg/L were recorded in the adjacent nearshore zone during a non-storm period (Sherman et al. 1998).

Nearshore measurements ranging from less than 1 to 11 Nephelometric Turbidity Units (NTU) represent typical background values; however, values of 50 to 187 NTU also have been reported at control locations during beach replenishment monitoring at Carlsbad and Oceanside (RWQCB files). These naturally occurring elevations in turbidity were related to high waves and/or storms.

Nutrients

Nutrient concentrations for nearshore waters typically are higher near the bottom than near the surface, except during upwelling periods. Nearshore nutrient concentrations may be elevated in areas of wastewater discharge and near the outlet of rivers, lagoons, bays, and harbors. Nitrate levels in nearshore surface waters may vary from 0.01 to greater than 8 mg/L, and phosphate levels may range from 0.05 to 0.8 mg/L, with higher values associated with upwelling or anthropogenic discharges (BLM 1978).

<u>Bacterial Characteristics</u>

Assembly Bill 411 (AB-411) was passed in 1997 that establishes bacteriological standards for water contact recreation at beaches. The standard is similar to the California Ocean Plan standard for total and fecal coliform bacteria (**Table 4.4-2**). In addition, AB-411 includes a standard for *Enterococcus* bacteria. Beach health risk postings are regulated according to AB-411 standards.

Table 4.4-2 Comparison of Ocean Plan and AB-411 Bacteriological Standards

	Ocean Plan (1997)		AB-411 (1997)	
	30-day (MPN/100 mL)	Single Sample (MPN/100 mL)	30-day (MPN/100 mL)	Single Sample (MPN/100 mL)
Total Coliform	1,000	10,000	1,000	10,000 or 1,000 if fecal > 10% of total coliform
Fecal Coliform	200	400	200	400
Enterococcus			35	104

MPN = most probable number of bacteria colonies per 100 milliliters (mL)
MPN standards also apply to measurements based on colony forming units (CFU)

Several storm drains have outlets onto beaches within the study area. The Cities of Encinitas and Solana Beach have been required to monitor bacterial levels at storm drain outlets and in the adjacent surfzone (associated receiving waters) since November 2001 as part of the Coastal Storm Drain Outfall Monitoring Program. Elevated bacteria concentrations have been measured at the outlets of the storm drains at varying frequencies depending upon the storm drain. However, with few exceptions bacteria concentrations measured in the surfzone of the storm drains have been within AB-411 standards for surfzone water-contact recreation.

The City of Encinitas monitors locations from Cottonwood Creek south to San Elijo State Beach. Elevated concentrations of total coliform (up to 11,000 CFU per 100 mL), fecal coliform (up to 3,000 CFU] 100 mL), and *Enterococcus* (up to 500 CFU per 100 mL) bacteria occurred at the Cottonwood Creek outlet, which is posted with public warning signs. However, waters within the surfzone at Moonlight Beach (located at terminus of Cottonwood Creek) had total coliform (3 to 89CFU per 100 mL), fecal coliform (4 to 75 CFU per 100 mL), and *Enterococcus* (1 to 62 CFU per 100 mL) concentrations that were within AB-411 standards.

Two storm drains flow to the ocean at Swami's Beach (Swami's pipe), and Swami's mid, which drains between Swami's and San Elijo State Beach. Another pipe flows at the north end of San Elijo State Beach State Beach (City of Encinitas 2002). All surfzone concentrations of total coliform (<1 to 5 CFU/100 mL), fecal coliform (<1 to 4 CFU/100 mL), and *Enterococcus* (<1 to 3 CFU/100 mL) bacteria within the surfzone associated with Swami's pipe were within AB-411 standards between October 2009 and September 2010. All sample collected in the surfzone associated with the storm drain pipe outlet at the north end of San Elijo State Beach had total coliform (<1 to 13 CFU per 100 mL), fecal coliform (4 to 30 CFU per 100 mL), and *Enterococcus* (<1 to 5 CFU per 100 mL) bacteria concentrations within AB-411 standards.

One coastal storm drain and the adjacent surfzone at Seascape Beach is routinely monitored by the City of Solana Beach. All samples collected at the surfzone of the storm drain pipe outlet at Seascape Beach had total and fecal coliforms and *Enterococcus* concentrations that were within AB-411 standards.

The San Elijo Joint Powers Authority monitors water quality for the San Elijo Ocean Outfall at seven offshore and seven nearshore stations. The nearshore stations range from approximately 4,000 ft) north to (8,000 ft) south of the outfall pipeline. Offshore stations located along the120-ft depth contour range from 2,000 ft north and (14,000 ft south of the outfall pipeline). Surfzone concentrations have not been included in the tables as the outfall is 8,000 ft offshore and surfzone could be affected contamination through runoff and storm drains.

During 2010, all samples taken nearshore and offshore at the San Elijo Water Reclamation Facility monitoring stations had bacteria concentrations within Ocean Plan and AB-411 standards (**Table 4.4-3**). The *Enterococcus* concentration was substantially higher 80 MPN/100 mL) in August 2010 at station N-6 for nearshore sampling. This surface water *Enterococcus* concentration is unlikely to be associated with the ocean outfall discharge. No high total or fecal coliform values were observed during this time at Station N-6 or at adjoining outfall monitoring stations. Shore stations also showed low indictor concentrations during this time, indicating that the high value at Station N6 was not due to shore contamination.

Encina Waste Water Authority monitors water quality for the Encina Water Pollution Control Facility and Ocean Outfall. Offshore and nearshore monitoring of bacteria concentrations for the Encina Ocean Outfall monitoring program, upcoast of the study area, showed no exceedances of AB-411 and Ocean Plan standards during 2010 (EWA 2010).

Table 4.4-3 Range of Monthly Values at Nearshore and Offshore San Elijo Water Reclamation Facility Monitoring Stations for the Period January – December 2010

Location	Total Coliform (MPN/100mL)	Fecal Coliform (MPN/100mL)	*Enterococcus* (MPN/100mL)
Nearshore			
N-1	<2 – 110	<2 – 17	<2 – 8
N-2	<2 – 27	<2 – 23	<2
N-3	<2 – 300	<2 – 50	<2 – 13
N-4	<2 – 50	<2 – 50	<2 – 9
N-5	<2 – 30	<2 – 23	<2 – 4
N-6	<2 – 20	<2 – 13	<2 – 80[1]
N-7	<2 – 8	<2 – 4	<2 – 2
Offshore (surface)			
A-14-S	<2 – 17	<2 – 17	<2 – 4
A-4-S	<2 – 16	<2 – 2	<2 – 2
A-2-S	<2 – 170	<2 – 130	<2 – 11
A-1-S	<2 – 70	<2 – 17	<2 – 4
A-0.5-S	<2 – 9	<2 – 7	<2 – 2
A-1-N	<2 – 8	<2 – 4	<2
A-2-N	<2 – 4	<2 – 4	<2 – 4

[1] This surface water *Enterococcus* concentration is unlikely to be associated with the ocean outfall discharge. No high total or fecal coliform values were observed during this time at Station N6 or at adjoining outfall monitoring stations. Shore stations also showed low indictor concentrations during this time, indicating that the high value at Station N6 was not due to shore contamination.
MPN = Most probable number of bacteria colonies per 100 mL
Range of values based on monthly averages reported by San Elijo Joint Powers Authority 2011

4.4.2 Sediment Quality

Sediment quality typically varies in relation to grain size and proximity to input sources. Trace metal and organic contaminants found in coastal waters typically adsorb onto suspended particulates and/or settle to the bottom where they adsorb onto sediment particles on the seafloor. Because of their high surface-to-volume ratio, finer sediments (silts and clays) generally have higher contaminant concentrations than coarser sediments (sands). Once incorporated into bottom sediments, contaminants may be remobilized by currents or storms, bioturbation, or mechanical disturbance such as dredging.

Within the project area, sediment texture varies from primarily sandy materials in shallow nearshore waters to finer-grained materials in deeper waters farther from shore. Relict sand deposits also occur offshore, particularly in locations of historical river outflows (URS 2009). Thus, grain size characteristics and sediment contaminant concentrations at the borrow sites are important to the evaluation of the potential for contaminant release and turbidity during dredging. They also are important considerations for determining compatibility with beach receiver sites.

No regulatory criteria exist for the protection of aquatic life from exposure to potentially contaminated sediments. Concentrations referred to as Effects Range-Low (ER-L) and Effects Range-Median (ER-M) generally are used as guidelines for evaluating the potential for constituents to cause adverse environmental effects (Bushman 2008). The ER-L concentrations are equivalent to the lower tenth percentile of available toxicity data screened by the NOAA, and indicate the low end of the range of concentrations at which adverse biological effects were observed or predicted in sensitive species and/or sensitive life stages. The ER-M concentrations, based on NOAA screened data, represent the concentrations at which effects were observed or predicted in 50 percent or the test organisms evaluated.

Sediment core samples (approximately 20 ft deep) were collected from proposed borrow sites using vibracore in November 2008 for RBSP II (Alpine Ocean Seismic Survey, Inc. 2008). A total of 6 to 12 vibracore samples were collected at each site and composite samples across each core length were analyzed for grain size characteristics using standard methods (URS 2009). Additional 2-ft cores were collected at the proposed borrow sites in November 2009 and composited for analysis of grain size, total organic carbon (TOC), moisture content, and chemical constituents in accordance with standard methods. Sediment information on beach sites in the study area is available from testing done for RBSP I and the U.S. Navy Homeporting Aircraft Carrier Project (U.S. Navy 1995). In addition, Moffatt & Nichol (2010) prepared a sampling and analysis results report for grain size and chemistry for sediment core samples and for beach sites within the study area from URS. **Table 4.4-3** summarizes results of available physical/chemical characteristics of sediments sampled on beaches within and near the study area, and **Table 4.4-4** summarize results of sediments from offshore borrow site depths ranging from 34 to 56 ft. Results for beach and offshore sediments are described in the following subsections.

<u>Beach Sediments</u>

The nearest beach sites to the project area with available recent physical data include Leucadia, south of Batiquitos Lagoon and a stretch of beach in Cardiff, south of the San Elijo Lagoon inlet. Beach sediment grain sizes measured in 2010 within the project vicinity are found in **Table 4.4-4**.

Table 4.4-4 Receiver Beach Sediment Grain Size, 2010

Receiver Beach	Transect	Size Fraction	Elevation (ft MLLW)							
			12	**6**	**0**	**-6**	**-12**	**-18**	**-24**	**-30**
Leucadia	SD-0690	Gravel (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5
		Sand (%)	99.6	98.8	98.3	95.5	93.1	94.3	88.0	86.9
		Fines (%)	0.4	1.2	1.7	4.5	6.9	5.7	12.0	4.6
Cardiff	SD-0630	Gravel (%)	12.3	0.0	0.0	0.1	0.0	0.3	0.0	0.0
		Sand (%)	87.1	99.4	98.8	97.9	95.4	92.6	92.8	86.8
		Fines (%)	0.6	0.6	1.2	2.0	4.6	7.1	7.2	13.2
	SD-0625	Gravel (%)	0.0	0.0	0.0	0.0	0.2	0.6	0.0	0.1
		Sand (%)	99.2	98.7	98.6	98.2	96.5	88.0	90.8	97.6
		Fines (%)	0.8	1.3	1.4	1.8	3.3	11.4	9.2	2.3

Source: SANDAG 2011

Offshore Sediments

Sediment quality descriptions for borrow sites SO-5 and SO-6 are provided based on results from analyses of samples collected in November 2008 and October-November 2009 for RBSP II. Offshore sediments from the 20-ft vibracore samples at borrow sites SO-5 and SO-6 ranged from fine- to medium-grained sand ranging between 0.43 and 0.71, and between 0.26 mm and 0.35 mm, respectively, with a fines content between 2 and 5 %. The weighted average grain size distribution for the borrow sites SO-5 and SO-6 were calculated as having a median grain size of about 0.59 and 0.35, respectively (URS 2009). Results from the 2-ft core composite sediment sample are described in **Table 4.4-5** below.

Table 4.4-5 Sediment Grain Size at Borrow Sites, October–November 2010 (2-ft sample)

Transect (Sample)	Core Depth (ft)	Description	Median Grain Size (mm)	Particle Size Distribution (%)				
				Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt/Clay
SO-6	~1.5	Medium Sand	0.429	0.00	0.00	55.51	38.55	5.94
SO-5	~1.5	Fine Sand	0.115	0.00	0.00	5.29	76.74	17.97

Source: SANDAG 2011

Contaminant concentrations of metals, pesticides, PCBs, PAHs, and phenols were non-detectable to low, and contaminant concentrations were below available ER-L and ER-M concentrations (**Table 4.4-6**).

Table 4.4-6 Comparison of physical/chemical sediment characteristics at offshore borrow sites within and near the Encinitas and Solana Beach study area

Analyte	Units	ERL (a)	ERM (b)	Offshore (SANDAG SO-6)	Offshore (SANDAG SO-5)
Medium grain sand	%			55.51	5.29
Fine grain sand	%			38.55	76.74
Silt/clay	%			5.94	17.97
Mean or Median Grain Size*	mm			0.35	0.59
Arsenic	mg/Kg	8.2	70	1.55	1.82
Chromium	mg/Kg	81	370	4.9	10.1
Copper	mg/Kg	34	270	1.56	9.04
Lead	mg/Kg	46.7	218	1.12	1.96
Nickel	mg/Kg	20.9	51.6	1.56	3.32
Selenium	mg/Kg	-	-	1.27	2.01
Zinc	mg/Kg	150	410	11.3	32.1
Di-n-Butyl Phthalate	µg/Kg	-	-	6.4	8.3
Diethyl Phthalate	µg/Kg	-	-	7.9	10
1,2,3,4,6,7,8-HpCDD	ng/Kg	-	-	0.275	0.533
Octachlorodibenzo-p-dioxin (OCDD)	ng/Kg	-	-	1.69	3.6
1,2,3,4,6,7,8-HpCDF	ng/Kg	-	-	0.0976	0.15
Octachlorodibenzofuran (OCDF)	ng/Kg	-	-	0.208	0.221
Total Hexa-Dioxins	ng/Kg	-	-	ND	0.173
Total Hepta-Dioxins	ng/Kg	-	-	0.838	1.37
Total Penta-Furans	ng/Kg	-	-	ND	0.632
Total Hexa-Furans	ng/Kg	-	-	ND	0.168
Total Hepta-Furans	ng/Kg	-	-	0.0976	0.15
Total TEQ	ng/Kg	-	-	0.0043	0.00798
Oil & Grease	mg/Kg	-	-	23	23
TRPH	mg/Kg	-	-	34	59
Total Volatile Solids	%	-	-	0.56	0.82
Total Sulfides	mg/Kg	-	-	0.36	1.1
Total Solids	%	-	-	83.5	70.8

Source: Moffatt & Nichol 2010
a – effects range low
b – effects range median

4.5 Biological Resources

The project area is in the eastern Pacific Ocean coastal region referred to as the Southern California Bight (SCB) which is an approximately 400 mile recessed section of coastline. Its boundaries span from Point Conception, California, to Punta Eugenia, Baja California, and is directly affected by two ocean currents. The colder, more northerly California Current and the southern, warm-water California Countercurrent (also known as the Davidson Current) influence the ocean within the SCB. These two currents “mix” in the Santa Barbara Channel. The water within the southern portion of the SCB is generally warmer and more saline than that within the northern area (Hickey 1993). These differing conditions, as well as upwelling of cooler, nutrient-rich waters, influence the unusually diverse marine biota within the SCB (Murray and Littler 1981). The distribution of species within the SCB is also affected by the complex hydrography and geology of the region. The mainland shelf, which extends from shore to approximately -650 ft MLLW, comprises 6 percent of the 40,000-square-mile SCB.

Marine ecosystems and habitats off San Diego County include sandy beach, rocky reefs, sandy or soft ocean bottoms, kelp forests, seagrass beds, and submarine canyons. The coastal study area for this project includes the shoreline and nearshore habitats to a depth of approximately 100 ft in the vicinity of the receiver and borrow sites. Deeper water habitats beyond the depth of closure would not be influenced by the project and are not discussed further in this Report.

Sandy beach habitat supports shorebirds, including the threatened western snowy plover (*Charadrius alexandrines nivosus*), and provides spawning habitat for the state-managed California grunion (*Leuresthes tenuis*). Pismo clam (*Tivela stultorum*) beds occur in sandy substrate in localized areas extending from intertidal to nearshore depths, but are not known to occur within the study area. Soft-bottom habitats also support diverse invertebrate populations that are preyed upon by demersal fish living on or near the bottom. Nearshore reefs and kelp beds harbor a variety of macroalgae, invertebrate, and fish populations. Marine mammals forage on invertebrates and fish throughout the water column over hard or soft bottoms and within kelp beds. Marine biological resources also support important commercial fisheries, are the target of recreational fishing and diving, and are the subject of educational research.

Marine habitats provide important linkages to adjacent coastal wetland and terrestrial ecosystems. Several ecologically valuable coastal wetlands occur within the region (Section 4.4.4). Migratory marine fish such as California halibut (*Paralichthys californicus*) use coastal wetlands as nursery habitats. Endangered California least tern (*Sternula antillarum browni*), which seasonally breed and nest at several coastal lagoons in the region, forage on small fish in the ocean as well as within coastal wetlands. Threatened snowy plover, which may be found wintering on southern California beaches, nest at Batiquitos Lagoon.

The project study area is characterized by a shoreline with an abrupt transition to coastal bluffs or urbanized landscapes where beaches are backed by revetment or seawalls, or are adjacent to roads and other development. Habitats and biological resources within the project area are described based on available recent surveys and relevant reports. Access routes to the receiver sites transition from urban roads directly to the beach or are at locations that are unvegetated. No dune, strand, marsh vegetation, or native plant communities occur within 200 ft of beach access locations.

4.5.1 Marine Shoreline and Offshore Habitats

The characterization of marine resources in the study area was based on review of relevant reports, Geographic Information System (GIS) data, and reconnaissance-level surveys, and examples include:

- 2009 and 2010 reef dives and intertidal surfgrass mapping within the study area were used to provide representative information on reef heights and habitat quality indicators (SANDAG 2011h).
- 2006 reef dives and intertidal surfgrass mapping within the study area were used to provide representative information on reef heights and habitat quality indicators (SAIC 2007a).
- 2005 Post-construction monitoring report for RBSP I (AMEC 2005)
- 2004 LiDAR data were used to provide bathymetric information for portions of the study area.
- 2003-2005 Coastal habitat study (SAIC 2006).

- 2002 California State Conservancy and SANDAG San Diego Nearshore Program GIS layers of bathymetry, hard substrate, and aquatic vegetation mapping served as the basis for reef and sensitive resource acreage calculations.
    - Substrate GIS data enabled calculation of reef dimensions and acreage.
    - Vegetation GIS data enabled calculation of acreage by dominant and/or sensitive resource categories (i.e., surfgrass, giant kelp, understory algae).
- 2000 reef dives and intertidal surfgrass mapping produced for the 2001 RBSP were used to provide additional representative information on reef heights and habitat quality indicators.

Information from above-described sources was considered for the description of baseline conditions for marine resources. The marine resource section is organized into the following subsections: habitats and associated organisms; an overview of essential fish habitat (EFH), plankton, birds, and mammals within the study area; and a summary of marine resources in the project area.

<u>Habitats</u>

The following Sections more fully describe the various habitats and biological communities found in the study area, as identified in **Figure 4.5-1** and **Figure 4.5-2**.

Soft Bottom Communities

Soft-bottom habitats include sandy beaches and nearshore sandy or silty-sand bottoms. These are the predominant habitats in the region with sandy beaches covering approximately 80 percent of the shoreline in the SCB (CCC 1987). Sandy beaches are unstable habitats due to daily sand movement associated with waves and currents and larger-scale seasonal cycles of sand movement. Biological resource development on sandy beaches varies seasonally, generally being greater in spring to summer and less in fall to winter associated with seasonal sand erosion and accretion as well as reproduction and recruitment. Most sandy beach invertebrates are mobile and move up and down the beach with changes in tide level and some, such as the sand crab (*Emerita analoga*) migrate to the shallow nearshore during high tides and seasonal periods of beach erosion.

<u>Sandy Beach</u>

Common invertebrates observed on San Diego County sandy beaches include sand crabs, beach hoppers (*Megalorchestia* spp, Orchestodea spp.), amphipods (e.g., Eohaustorius spp.), isopods (e.g., *Excirolana* spp.), and other crustaceans; bean clam (e.g., *Donax gouldii*), and olive snail (*Olivella biplicata*); bloodworm (*Euzonus mucronata*) and other polychaetes worms (e.g., *Hemipodus borealis*., *Lumbrineris* spp., *Nephtys californiensis*, *Scololepis* spp.); and nemertean ribbon worms (Straughan 1981; SAIC 2006, 2007b). In her 12-year study of sandy beaches from Estero Bay to Coronado, Straughan (1981) found that higher abundance and species diversity were found on long, gently sloping, relatively fine grain beaches with no periodically-exposed beach rock. Beaches that were short and steep, coarse-grained, and/or experienced more erosion had fewer organisms, and, in some cases, only sand crabs. Beaches within the study area prior to the 2001 RBSP were characterized as narrow and with various cobble coverage and, in some cases, had seasonally exposed bedrock. These beaches varied between having limited marine resources (sand crabs, worms), or slightly more developed marine resources (sand crabs, worms, and bean clams or amphipod crustaceans) (MEC 2000b). Terrestrial insects are an important ecological component of the sandy beach and help break down washed ashore kelp and seagrass wrack. The wrack may harbor a variety of insects and invertebrates that are important prey items for gulls and shorebirds.

The California grunion (*Leuresthes tenuis*), which is a nearshore species that feeds on plankton, comes to shore to spawn on sandy beaches. Their spawning generally extends from March through August although start and end dates may vary earlier or later between years. The peak of spawning occurs April through June (Martin 2006). Grunion spawn at night on any or all of the 3 to 4 nights after the highest tide associated with each full or new moon and then only for a 1- to 3-hour period. Eggs incubate in the sand for approximately 10 days until the next tide series is high enough to reach them, when exposure to wave action triggers their hatching and the baby grunion are washed back into the sea. Grunion are managed as a game species by the CDFG, who post annually updated predicted spawning runs on the internet (www.dfg.ca.gov/marine/grunionschedule.asp). Beaches in the study area either had unsuitable substrate or were potentially only seasonally suitable for grunion spawning prior to the 2001 RBSP. After beach nourishment, potential grunion spawning habitat was created, and in some areas habitat suitability extended 2005 (SAIC 2006).

<u>*Sandy Subtidal*</u>

Soft-bottom nearshore communities have similar characteristics for a given water depth, sediment type, and wave energy. Thus, sandy nearshore communities off Oceanside would generally be similar to those found at similar depths and bottom type off Imperial Beach. The subtidal zone is classified into general regions, including the shallow subtidal to a depth of about -30 ft MLLW (generally corresponds to littoral zone), an inner shelf zone from about -30 to -80 ft MLLW, middle shelf from about -80 to -300 ft MLLW, and outer shelf zone from about -300 to -600 ft MLLW. Thus, the study region encompasses the shallow, inner shelf, and a small portion of the middle shelf zones.

Bottom-dwelling invertebrate species in the shallow subtidal zone are well adapted to shifting sediments and turbidity, with suspension feeders being the dominant group. Many of the sandy beach invertebrates move between the intertidal and shallow subtidal depths and additional species live on and within sediments within increasing distance offshore as wave energy diminishes toward the seaward limit of the littoral zone. Common species in the shallow subtidal of the study region include burrowing anemones, sea pansy, sea pen, purple globe crab (*Randallia 208runca*), clams, snails, sand dollar, sea star, and tube worms (**Table 4.5-1**; U.S. Navy 1995, SAIC 2009).

Fish commonly found over sandy subtidal habitat off San Diego County beaches include barred surfperch (*Amphistichus argenteus*), California corbina (*Menticirrhus runcates*), California halibut (*Paralichthys californicus*), queenfish (*Seriphus politus*), round stingray (*Urobatis halleri*), shovelnose guitarfish (*Rhinobatos productus*), spotfin croaker (*Roncador stearnsii*), and white croaker (USACE 1994, U.S. Navy 1997a). Speckled sanddabs (*Citharicthys stigmaeus*) and bat rays (*Myliobatis californica*) also have been observed in these waters at depths of -10 to -30 ft MLLW. Schooling water column fish, abundant just beyond the surfzone, include northern anchovy, jack mackerel (*Trachurus symmetricus*), Pacific bonito (*Sarda chiliensis*), and topsmelt (*Atherinops affinis*) (Cross and Allen 1993, Garfield 1994).

The two proposed borrow sites fall within the inner shelf zone, which is influenced by oceanic swell. The number of species and abundances of bottom-dwelling macroinvertebrates is lower in the inner shelf compared to the middle and outer shelf depth zones. Polychaete worms and/or small, mobile crustaceans dominate the inner to middle shelf infaunal community. The most abundant species collected in sediment core samples at depths of -49 to -134 ft MLLW on the

San Diego shelf include brittle stars, polychaete worms (e.g., *Aricidea* spp., *Diopatra* spp., *Mediomastus* spp., *Monticellina* spp., *Spiophanes* spp., *Sternaspis fossor*, and *Streblosoma crassibranchia*), and small crustaceans (*Heterophoxus oculatus*, *Photis* spp., and *Rhepoxynius* spp.) (SCCWRP 1994, 1998, 2003). Macroinvertebrate species living on or above the bottom comprising 80% or more of the abundance in trawls collected during the 2003 Regional Bight program included blackspotted shrimp (*Crangon nigromaculata*), California sand star (*Astropecten verrilli*), sea pens, and white sea urchin (*Lytechinus pictus*) (SCCWRP 2003). Fish species comprising 80 percent or more of the abundance in trawls on the inner shelf during the 2003 Regional Bight program included English sole (*Parophrys vetulus*), Pacific sanddab (*Citharichthys sordidus*), pink seaperch (*Zalembius rosaceus*), speckled sanddab, yellochin sculpin (*Icelinus quadriseriatus*), and white croaker (*Genyonemus lineatus*) (SCCWRP 2003). The most abundant species of the middle shelf include Dover sole (*Microstomus pacificus*), longspine combfish (*Zaniolepis latipinnis*), Pacific sanddab, speckled sanddab, and rockfish (*Sebastes* spp.). Twenty species of fish were observed by divers and collected by otter trawl at borrow sites SO-5 and SO-7 (MEC 2000b). The most abundant fish included barred sand bass (*Paralabrax nebulifer*), California halibut, California lizardfish (*Synodus lucioceps*), English sole, horneyhead turbot (*Pleuronichthys verticalis*), queenfish, speckled sanddab, and white croaker.

Table 4.5-1 Common Organisms Observed from Soft Bottom Habitat in San Diego County

Organism	Common Name	Scientific Name	Water Depth MLLW (ft)		
			-10	-20	-30
Macroalgae			none found		
Invertebrate	Tube-dwelling Polychaete	*Diopatra ornata*		X	X
	Tube-dwelling Polychaete	*Diopatra splendissima*		X	X
	Tube-dwelling Polychaete	*Pista pacifica*		X	X
	Tube-dwelling Polychaete	*Loimia medusa*			X
	Tube-dwelling Polychaete	*Chaetopterus* spp.		X	
	Crab	*Pagurus* spp.		X	X
	Crab	*Pagurites* spp.		X	X
	Porcelain Crab	*Randallia ornata*		X	X
	Swimming Crab	*Portunus xantusii*		X	
	Elbow Crab	*Heterocrypta occidentalis*	X		
	Snail	*Olivella biplicata*	X	X	X
	Snail	*Polinices* spp.	X	X	X
	Snail	*Nassarius fossatus*		X	
	Razor Clam	*Ensis* spp.		X	
	Sea Star	*Astropecten armatus*		X	X
	Brittle Star	Ophiurodea		X	X
	Sand Dollar	*Dendraster excentricus*		X	
	Burrowing Anenome	*Harenactis attenuata*		X	X
	Burrowing Anenome	*Zaolutus actius*		X	X
	Sea Pansy	*Renilla kollikeri*		X	X
	Sea Pen	*Stylatula elongata*		X	X
Fish	Halibut	*Paralichthys californicus*	X	X	X
	Speckled Sanddab	*Citharichthys stigmaeus*	X	X	X
	Bat Ray	*Myliobatus californica*	X	X	X
	Shovelnose Guitarfish	*Rhinobatos productus*	X		X

Source: U.S. Navy 1995

Fish commonly found over sandy subtidal habitat off San Diego County beaches include barred surfperch (*Amphistichus argenteus*), California corbina (*Menticirrhusundulatus*), California halibut (*Paralichthys californicus*), queenfish (*Seriphus politus*), round stingray (*Urobatis halleri*), shovelnose guitarfish (*Rhinobatos productus*), spotfin croaker (*Roncador stearnsii*), and white croaker (USACE 1994, U.S. Navy 1997a). Speckled sanddabs (*Citharicthys stigmaeus*) and bat rays (*Myliobatis californica*) also have been observed in these waters at depths of -10 to -30 ft MLLW. Schooling water column fish, abundant just beyond the surfzone, include northern anchovy (*Engraulis mordax*), jack mackerel (*Trachurus symmetricus*), Pacific bonito (*Sarda chiliensis*), and topsmelt (*Atherinops affinis*) (Cross and Allen 1993, Garfield 1994).

The two proposed borrow sites fall within the inner shelf zone, which is influenced by oceanic swell. The number of species and abundances of bottom-dwelling macroinvertebrates is lower in the inner shelf compared to the middle and outer shelf depth zones. Polychaete worms and/or small, mobile crustaceans dominate the inner to middle shelf infaunal community. The most abundant species collected in sediment core samples at depths of -49 to -134 ft MLLW on the San Diego shelf include brittle stars, polychaete worms (e.g., *Aricidea* spp., *Diopatra* spp., *Mediomastus* spp., *Monticellina* spp., *Spiophanes* spp., *Sternaspis fossor*, and *Streblosoma crassibranchia*), and small crustaceans (*Heterophoxus oculatus*, *Photis* spp., and *Rhepoxynius* spp.) (SCCWRP 1994, 1998, 2003). Macroinvertebrate species living on or above the bottom comprising 80% or more of the abundance in trawls collected during the 2003 Regional Bight program included blackspotted shrimp (*Crangon nigromaculata*), California sand star (*Astropecten verrilli*), sea pens, and white sea urchin (*Lytechinus pictus*) (SCCWRP 2003). Fish species comprising 80 percent or more of the abundance in trawls on the inner shelf during the 2003 Regional Bight program included English sole (*Parophrys vetulus*), Pacific sanddab (*Citharichthys sordidus*), pink surfperch (*Zalembius rosaceus*), speckled sanddab, yellochin sculpin (*Icelinus quadriseriatus*), and white croaker (*Genyonemus lineatus*) (SCCWRP 2003). The most abundant species of the middle shelf include Dover sole (*Microstomus pacificus*), longspine combfish (*Zaniolepis latipinnis*), Pacific sanddab, speckled sanddab, and rockfish (*Sebastes* spp.). Twenty species of fish were observed by divers and collected by otter trawl at borrow sites SO-5 and SO-7 (MEC 2000b). The most abundant fish included barred sand bass (*Paralabrax nebulifer*), California halibut, California lizardfish (*Synodus lucioceps*), English sole, horneyhead turbot (*Pleuronichthys verticalis*), queenfish, speckled sanddab, and white croaker.

Hard-Bottom and Vegetated Habitats

Hard-bottom habitats are productive ecosystems that support a variety of plants and animals. They include rocky intertidal shores and nearshore reefs, and support vegetated habitats such as seagrass beds and kelp forests. Less than 15 percent of the coastline in San Diego County is estimated to be rocky. The species that associate with hard-bottoms differ greatly with depth, type of substratum (e.g., cobble, boulders, rocky outcrop, sandstone reef), and substrate relief height and complexity.

Rock or sandstone reefs provide hard substratum to which kelp and other algae can attach in the nearshore zone (<100 ft depth). In addition, many invertebrates such as sea anemones, sea fans, scallops, and sponges require hard substratum for attachment. The structural complexity of hard-bottom habitats shelter and provide foraging habitat for mobile invertebrates (e.g., lobster) and fish.

The proportion of hard substrate habitat at any given time relates to rock relief height and time of year, with lower relief substrate subject to exposure or burial by sand associated with seasonal on and offshore sand movement or large waves associated with substantial storm events (e.g., El Niño).

Several physical factors influence the types and diversity of marine life associated with rocky habitats. Important substrate qualities include relief height (low, high), texture (smooth, pitted, cracked), size, and composition (sandstone, mudstone, basalt, granite). Substrates that are of higher relief, greater texture, and larger size generally have the richest assemblages of marine species.

In contrast, low-lying rocks or reefs subject to sand scour from seasonal burial and uncovering typically are unvegetated or colonized by opportunistic species with annual life cycles or sand tolerant species. Cobbles on beaches, which get tumbled about by waves during the rise and fall of the tides, do not support plants or attached animals. However, cobbles in subtidal waters may support understory algae and kelp beds, although they are generally subject to greater annual variability due to their greater instability under storm surge and large wave conditions.

Estimated acreages of hard-bottom and vegetated habitats in the study region are given in **Table 4.5-2**. The acreage is based on the 2002 Nearshore Program Habitat Inventory GIS, which provides the most comprehensive dataset of the spatial extent of hard-bottom and vegetated habitats off San Diego County. In addition, recent kelp cover acreages are provided. The acreage estimates are summarized by city and were computed by extending the jurisdictional boundaries offshore.

Table 4.5-2 Estimated Hard-Bottom and Vegetated Habitat Acreage in the Vicinity of the Study Area

Jurisdiction	Bedrock 2002	Cobble 2002	Surfgrass 2002	Understory Kelp 2002	Kelp		
					2002	2005	2008
Encinitas	751.0	0.9	81.9	469.2	225.5	10.4	355.2
Solana Beach	267.0	0	3.5	115.2	30.7	15.9	153.7
Del Mar	141.0	0	9.1	150.7	8.3	0	16.3
Total	1,674.9	2,564.4	128.6	1,486.2	360.1	114.9	1,142.1

Note: Vegetated habitats occur on hard-bottom and should not be added to hard-bottom acreage.

The data shown in **Table 4.5-2** are valuable for identifying the general distribution and relative percentages of type of hard-bottom (rock, cobble) and different types of vegetated hard-bottom habitats (kelp, surfgrass, understory algae) within the local region (see **Figure 4.5-1** and **Figure 4.5-2**). However, acreage calculations should be viewed as estimates relative to current conditions. This limitation applies to both the hard-bottom and vegetated habitat. Because hard-bottom varies from cobble to high-relief reefs (greater than 3 ft in height), there is potential for variability in the amount of hard-bottom at any given time due to natural sand movement patterns in the littoral zone. This applies to low-relief rock and cobble subject to burial and uncovering by sand. The term “ephemeral reefs” has been used to describe hard-bottom areas that experience this type of disturbance.

Vegetated habitats also experience variability in cover between years due to a number of factors. Surfgrass is a sand-tolerant, perennial species that may be subject to less interannual variability. Studies suggest it may be more vulnerable to variability along its inshore distribution limit in the lower intertidal, where wave action and sand movement are greater. Kelp beds naturally die back and regrow each year, the extent of which is influenced by oceanographic and climate conditions. Key factors include water temperature, nutrient levels (tied to upwelling and current patterns), and storm-generated waves and sedimentation. Annual canopy cover of kelp beds off San Diego exhibited a general pattern of increase during colder water and decrease during warmer water oceanographic conditions. Kelp canopy was low after the 1998

El Nino, increased with the cooler La Nina conditions of 1999 to 2000, decreased again during a period of warmer than average temperatures and low nutrients, and rebounded in 2007. In addition, the San Diego Region experienced changes in kelp harvesting patterns. Observed canopies in 2008 were one of the best seen in the last 50 years (MBC 2009). **Table 4.5-3** summarizes kelp canopy coverage in San Diego County from 1998 to 2008 relative to cold and warm water events. Kelp (particularly juvenile plants) also may be affected by predation by sea urchins. The understory algae category mapped in 2002 includes perennial species, as well as, opportunistic species that may exhibit annual variability associated with rock exposure or burial.

Biological resources associated with distinct hard-bottom habitats are summarized below, and include intertidal and nearshore reefs, surfgrass beds, and kelp beds of the study area.

<u>Rocky Intertidal Zone</u>

The intertidal zone, also known as the littoral zone, in marine aquatic environments is the area of the foreshore and seabed that is exposed to the air at low tide and submerged at high tide (i.e., the area between tide marks). Biological resource development on hard substrates in the intertidal zone varies with tide exposure, relief height and complexity, and oceanographic conditions, and on persistent, high-relief reefs exhibit a distinct zonation with tidal level (Connor 1993, Reish 1972). The upper intertidal or splash zone is characterized by simple green algae (*Chaetomorpha* spp., *Enteromorpha* spp., *Ulva* spp.), acorn barnacles (*Cthamalus* spp.), limpets (*Collisella* spp., *Lottia* spp.), and periwinkles (*Littorina* spp.). California mussel (*Mytilus californianus*), gooseneck barnacle, aggregating sea anemones, chitons, hermit crabs, and a variety of marine snails (e.g., *Acanthina* spp., *Lithopoma undulosa*, *Kelletia kelletia*, *Ocenebra* spp., *Tegula* spp.) are commonly observed in the middle intertidal zone of rocky shores (Stewart 1982, MEC 2000a). The low to minus intertidal zone of persistent reefs are characterized by a greater diversity of animals, including aggregating and green sea anemones (*Anthopleura elegantissima*), purple sea urchin (*Strongylocentrotus purpuratus*), California sea hare (*Aplysia californica*), crabs, marine snails, brittlestars (e.g., *Ophithrix* spp.), and starfish (*Asterina miniata*, *Pisaster* spp.). Wooly sculpin (*Clinocottus analis*) is one of the more commonly encountered fish in tidepools. Feather boa kelp (*Egregia menziesii*) may opportunistically recruit to exposed rock but rarely lives more than a year in the intertidal, although it is perennial in subtidal waters (Black 1974).

Hard-bottom benches occur under the sand at several of the beaches in north San Diego County. Several of the RBSP I receiver sites had sand scoured rocks or extensive cobbles that became exposed during winter prior to the RBSP I. The rocks had few resources (e.g., turf algae) or were bare. Seasonal rockiness substantially decreased after the RBSP I (e.g., SAIC 2006). High wave conditions removed several ft of sand from local beaches in January-February 2010, leaving many with a similar appearance of rockiness as before the RBSP I. Because these rock benches are low relief, they are naturally subject to sand influence and support few if any biological resources (SANDAG 2011h).

Marsh birds, including great blue heron (*Ardeaherodias*) and snowy egret (*Egretta thula*), gulls, and shorebirds forage on invertebrates and fish on exposed reefs and in tidepools.

Table 4.5-3 Kelp Canopy coverage (acres) of project study area kelp beds from 1998 to 2008

Kelp Bed	Canopy Area (acres)										
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Leucadia	-	3.71	22.24	51.64	82.53	45.71	11.86	0.25	3.95	57.57	104.03
Encinitas	-	7.17	9.88	32.37	37.81	12.36	3.95	-	0.49	50.66	85.50
Cardiff	3.95	15.57	37.07	76.35	100.08	49.91	11.12 -	-	0.99	70.67	119.60
Solana Beach	2.22	22.49	49.42	100.57	120.58	60.54	5.44	22.98	0.07	112.92	203.36
Del Mar	0.99	-	1.48	3.71	8.65	7.41	-	-	-	9.14	14.08
Water Temperature Period	Warm	Cold	Cold	Cold	Neutral	Warm	Warm	Warm	Neutral	Cold	Cold

Notes: "-" indicate no canopy was present during kelp overflights at given location

Values represent approximately the maximum coverages for each year. Areal estimates derived from charts based on infrared aerial photographs.

Source: MBC 2009

Nearshore Reefs

Subtidal reefs in the shallow nearshore also exhibit considerable variation in resource development associated with the seasonal onshore and offshore migration of sand. Similar to intertidal reefs, substrate factors such as relief height, texture, composition, and size largely determine resource development (Ambrose et al. 1989). Historical average differences in sand depth between winter and summer generally range from 1 to 3 ft in the low intertidal and shallow nearshore depths (to -20 ft MLLW) of the study area (MEC 2000b). Thus, reefs less than 3 ft in height are subject to varying degrees of sedimentation, which may range from complete to partial burial on a seasonal basis depending upon reef height and the amount of sand moving onshore and offshore. Resource development on the low-relief reefs can vary substantially on a seasonal basis associated with cycles of exposure and partial or complete sedimentation (MEC 2000b). Because low-relief reef may be buried below the sand surface, sometimes it may only be distinguished by the presence of surfgrass and/or feather boa kelp, which because of their long blades or fronds may extend above the sand surface. **Figure 4.5-1** and **Figure 4.5-2** depict nearshore resources in the vicinity of the project area.

Hard substrate less than 2 ft in height tends to be poorly vegetated with annual or tolerant species (e.g., coralline algae, feather boa kelp, *Ulva*) that can develop rapidly when the surface becomes exposed from sand (Stewart 1991; MEC 2000b). Invertebrates may or may not be associated with these lower relief reefs. While reefs above 3 ft in height, which generally extend above the height of seasonal sand movement, typically support more persistent marine resources.

Understory algae are common on nearshore reefs. Feather boa kelp is conspicuous growing up to 12 ft in length (Black 1974). The sea palm may co-occur with feather boa kelp at subtidal depths. Sea palms (*Eisenia arborea*) may live more than 10 years and grow to about 1 to 1.5 ft in height in areas of high surge, but they may reach up to 3 ft in height in deeper water. Their shorter height and occurrence on higher relief reefs suggests they may be less tolerant of sand sedimentation than surfgrass and feather boa kelp (AMEC 2005). A variety of smaller red algae (*Corallina* spp., *Erythroglossum californicum*, *Gigartina* spp., *Gracilaria* spp., *Jania* spp., *Lithothrix* spp. *Rhodoymenia* spp.) and brown algae (juvenile giant kelp, *Cystoseira osmundacea*, *Sargassum* spp., *Zonaria farlowi*) may co-occur with feather boa kelp and/or sea palms on nearshore reefs. Persistent reefs support hundreds of species of invertebrates (e.g., crabs, nudibranchs, sea urchins, scallops, sea stars, snails, sponges, tunicates, worms) and attract a variety of fish such as garibaldi (*Hypsypops rubicundus*), blacksmith (*Chromis punctipinnis*), and black perch (*Embiotoca jacksoni*).

Fish abundance on reefs is dependent on vegetative cover, substrate complexity, and relief; however, increases in relief height on reefs greater than 3 ft have minimal effects (Cross and Allen 1993). Fish associated with nearshore reef habitats within the study area include kelp bass (*Paralabrax clathratus*) and barred sand bass; black, shiner, walleye, and dwarf surfperches (Embiotocidae); señorita (*Oxyjulis californica*); California sheephead (*Pimelometropon pulchrun*); garibaldi; opaleye (*Girella nigricans*); white seabass (*Cynoscion nobilis*); sargo (*Anisotremus davidsonii*); salema (*Xenistius californiensis*); giant kelpfish (*Heterostichus rostratus*); painted greenlings (*Oxylebius pictus*); and halfmoon (*Medialuna californiensis*).. **Table 4.5-4** summarizes common organisms observed from nearshore reefs in San Diego County.

Table 4.5-4 Common organisms observed from hard bottom reefs in San Diego County

Organism	Common Name	Scientific Name	Water Depth MLLW (ft)		
			-10	-20	-30
Algae	Brown	*Macrocystis pyrifera*			X
	Brown	*Cystoseira osmundacea*	X	X	X
	Brown	*Egregia menziesii*	X	X	X
	Brown	*Zonaria farlowi*	X		
	Red	*Gigartina* spp.	X	X	X
	Red	*Gracillaria sjoestedtii*	X	X	X
	Red	*Rhodymenia* spp.	X	X	X
	Red	*Lithothrix aspergillium*	X	X	X
	Red	*Jania* spp.	X	X	X
	Red	*Corallina* spp.	X	X	X
Surfgrass	Surfgrass	*Phyllospadix torreyi*	X		
Invertebrate	Nudibranch	*Phidiana crassicornis*	X	X	X
	California Spiny Lobster	*Paniluris interruptus*	X	X	X
	Kellet's Whelk	*Kelletia kelletii*	X	X	X
	Snail	*Armina californica*		X	X
	Cone Snail	*Conus californica*		X	X
	Olive Snail	*Olivella baetica*		X	X
	Snail	*Neverita draconis*		X	
	Leather Star	*Dermisterias imbrcata*		X	X
	Sea Star	*Pisaster giganteus*		X	X
	Sea Fan	*Muricea* spp.	X	X	X
Fish	Black Surfperch	*Embiotoca jacksoni*	X	X	X
	Shiner Surfperch	*Cymatogaster aggregata*	X	X	X
	Dwarf Surfperch	*Micrometrus minimus*	X	X	X
	White Sea Bass	*Cynoscion nobilis*	X	X	X
	Sargo	*Anisotremus davidsonii*	X	X	X
	Salema	*Xenistius californiensis*	X	X	X
	Giant Kelpfish	*Heterostichus rostratus*	X	X	X
	Painted Greenling	*Oxylebius pictus*	X	X	X
	Halfmoon	*Medialuna californiensis*	X	X	X
	Señorita	*Oxyjulis californica*	X	X	X
	Opaleye	*Girella nigricans*	X	X	X
	California Sheephead	*Pimelometropon pulchrun*	X	X	X
	Garibaldi	*Hypsopops rubicundus*	X	X	X
	Northern Anchovy	*Engraulis mordax*	X	X	X
	Pacific Mackerel	*Scomber japonicus*	X	X	X

Source: U.S. Navy 1995

Surfgrass Beds

Surfgrass (*Phyllospadix* spp.) generally grows on hard-substrate from approximately 0 to -20 ft MLLW, and may form conspicuous beds in the low intertidal to shallow subtidal zones of rocky beaches in San Diego County (Stewart 1991, MEC 2000b). Surfgrass provides important habitat for a variety of algae, invertebrates, and fish, and up to 34 species of algae and 27 species of invertebrates may be associated with surfgrass on San Diego beaches (Stewart and Myers 1980). It also serves as a nursery habitat for California spiny lobster, *Panuliris interruptus* (Williams 1995). **Figure 4.5-1** and **Figure 4.5-2** depict surfgrass resources in the vicinity of the project area.

The distribution of surfgrass is within the active portion of the beach profile characterized by seasonal onshore and offshore movement of sand. Surfgrass is considered a stress tolerant strategist that is morphologically adapted to withstand shifting sand movement (O'Brien and Littler 1977, Taylor and Littler 1982, Littler et al. 1983). Surfgrass has long shoots (3 to 5 ft) that can extend above a variety of sand depths. The shoots are protected from sand abrasion by fibrous sheaths, dense rhizomatous roots bind and enmesh with sand to form an effective anchor, and growth and colonization is by vegetative propagation of rhizomes and/or seasonal seed production (Stewart and Meyers 1980, Taylor and Littler 1982, Cooper and McRoy 1988, Stewart 1989, Williams 1995). Surfgrass may recover relatively quickly from disturbance via re-growth if the rhizome mat remains intact (Engle 1999). However, recovery can take several years if the rhizome mat is removed (Stewart 1989, Turner 1985).

Although surfgrass is adapted to sand accretion, the amount of sand affects its health and growth. The timing of sand cover also appears important. Pelchner (1996) found that the amount of carbohydrates stored in summer months from photosynthesis was important to the survival of plants over winter and early spring. Experimental manipulations showed that surfgrass was less healthy without any sand cover (more shoots, but less leaf biomass), whereas sand depths up to 2 inches optimized growth (more leaf biomass and productivity). However, sand depths of 5 inches resulted in less carbohydrate storage, which if it occurred during summer reduced plant biomass and potential survival over winter. Based on surveys conducted in 2010, surfgrass normally experience sand depths ranging from 1 to 10 inches at in the vicinity of the study site (SANDAG 2011a). Critical thresholds of sand cover are not well understood and may vary depending on site-specific conditions related to factors such as exposure (e.g., tides, wave energy).

Fish commonly found in surfgrass habitats off San Diego include barred sand bass, black perch, blacksmith, garibaldi, opaleye, señorita (*Oxyjulis californica*), and topsmelt (DeMartini 1981, MEC 1995).

<u>*Kelp Forests/Beds*</u>

Southern California kelp forests are dominated by giant kelp (*Macrocystis pyrifera*), which grows at depths between -20 and -120 ft MLLW (Aleem 1973, Leet et al. 1992). Kelp attaches to hard substrate by means of a holdfast, and fronds may grow to heights that exceed the water depth, forming leafy canopies at the water surface. Giant kelp, and its associated hard bottom habitat, supports a diverse community of algae, invertebrates, and fish. Invertebrates found in kelp beds include lobster, sea stars, sea urchins, and tunicates. Surfperch, rockfish (*Sebastes* spp.), cabezon (*Scorpaenichthys marmoratus*), lingcod (*Ophiodonelongatus*), and wrasses (senorita, rock wrasse, and sheephead) are common.

In addition, kelp beds provide food for marine birds and mammals. Gulls commonly scavenge on the surface canopy, and cormorants, pelicans, and terns feed on schooling fish near the edge of the canopy (Foster and Schiel 1985). Seals, sea lions, and whales forage within kelp beds, and kelp is commercially harvested for food products, fertilizers, adhesives, paints, pharmaceuticals, rubbers, and textiles (Foster and Schiel 1985, Bakus 1989).

Aerial photography has been used to map and quantify the surface area of kelp canopies offshore southern California for a number of years. The density and distribution of the kelp canopy exhibits seasonal and interannual variability related to a variety of physical and chemical factors (e.g., nutrient concentrations, sedimentation, temperature, turbidity). Kelp beds in Southern California commonly deteriorate to some degree during summer and fall when temperatures are higher and nutrient concentrations are lower (Foster and Schiel 1985, Tegner and Dayton 1987). Kelp beds also may show dramatic die-back during El Niño and recovery during La Niña conditions.

Giant kelp is adversely affected by sedimentation and turbidity. Large amounts of shifting sediment can bury small plants and prevent settling of microscopic spores, both of which can reduce kelp beds (Dayton et al. 1984). El Niño conditions, which result in high waves, higher-than-average temperatures, and low nutrients, have been linked to periodic and widespread reductions in kelp canopy. Kelp canopy has substantially regrown in the region since the 1997-1998 El Niño (**Table 4.5-3**).

Figure 4.5-1 and **Figure 4.5-2** depict kelp bed resources in the vicinity of the project area, and **Table 4.5-3** summarizes the surface area of kelp canopies off San Diego County from 1998 to 2008 Kelp beds identified on **Table 4.5-3** as Leucadia, Encinitas, Cardiff, and Solana Beach occur within the study area.

<u>Essential Fish Habitat</u>

EFH is managed under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). This act protects waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity (Magnuson-Stevens Act, 16 U.S.C. 1801 et seq.). The entire coastal area ranging from the mean high tide level to offshore depths represents EFH within the study area. EFH encompasses nearshore areas adjacent to the receiver sites, as well as the borrow sites. Nearshore areas characterized by reef, seagrass, estuaries, or kelp canopy are more specifically defined as Habitat Areas of Particular Concern (HAPCs). The Pacific Groundfish and Coastal Pelagic fishery management plans (FMPs) apply to EFH in the study region. The habitat designations associated with those plans are defined below.

EFH for species in the Pacific Groundfish FMP, which applies to 89 fish species (e.g., flatfish, rockfish, and sharks), is identified as all waters and substrate within the following areas:

- Depths less than or equal to 11,480 ft to mean higher high water level (MHHW) or the upriver extent of saltwater intrusion, defined as upstream and landward to where ocean-derived salts measure less than 0.5 ppt during the period of average annual low flow;
- Seamounts in depths greater than 11,482 ft as mapped in the EFH assessment GIS; and
- Areas designated as HAPCs (e.g., seagrass, kelp canopy, estuaries, rocky reef).

EFH for species in the Pacific Groundfish FMP also is relevant to species designated in the Nearshore Fishery Management Plan (NFMP), which are generally managed by the state (CDFG 2002). For instance, 16 of the 19 species designated in the NFMP are officially designated in the Pacific Groundfish FMP, including 13 species of rockfishes (black, black-and-yellow, blue, brown, calico, China, copper, gopher, grass, kelp, olive, quillback, and treefish – *Sebastes* spp.), spotted scorpionfish (*Scorpaena gutatta*), Cabezon (*Scorpaenichthys marmoratus*), and kelp greenling (*Hexagrammos decagrammus*). Three species designated in the NFMP are not specifically designated in the Pacific Groundfish FMP (rock greenling – *Hexagrammous lagocephalus*, California sheephead –*Pimelometropon pulchrun*, and monkeyfaceeel– *Cebidichthys violaceus*) and are actively managed by the state; however, designated groundfish EFH (including HAPC) generally is relevant because these three species are associated with rocky reef, kelp bed, or surfgrass habitats (CDFG 2002).

EFH for species in the Coastal Pelagic FMP, which applies to four fish and one invertebrate species (e.g., anchovy, sardine, Pacific mackerel, jack mackerel, and market squid) is identified as all waters and substrate within the following areas:

- All marine and estuarine waters from the shoreline to the limits of the Exclusive Economic Zone (EEZ), which extends approximately 200 nautical miles offshore; and
- Water surface boundary, which is the water column between the thermoclines where temperatures range from 10 to 26 degrees Centigrade.

Plankton

Plankton includes a diverse group of microscopic plants (phytoplankton), larval fish and eggs (ichthyoplankton), and other animals (zooplankton). The most abundant component of the plankton community is the phytoplankton, which aggregate near the surface where primary production occurs. They are grazed upon by zooplankton and ichthyoplankton and small fishes such as anchovies, which are in turn fed upon by larger fishes, birds, mammals, and man. Thus, phytoplanktons are the primary producers in the marine food web.

There are over 280 species of phytoplankton recorded from California coastal waters (Riznyk 1977); however, species composition of the community at any particular location at any given time exhibits considerable variability as the plankton drift with the currents (Goodman et al. 1984). The most common types of phytoplankton that may be expected within the study area include centric diatoms, pinnate diatoms, dinoflagellates, and coccolithophores. Under certain oceanographic conditions, blooms of dinoflagellates (e.g., *Gonyaulax polyedra*) may cause red tide conditions. Decreased water clarity typically is associated with red tides.

Zooplankton that would be expected within the study area include microscopic animals (e.g., radiolarians, ciliates, foraminifera), larval forms of macroinvertebrates (e.g., crabs, lobster, shrimps), and animals that live within the plankton community (e.g., arrow worms, copepods, cladocerans, ctenophores, salps). Larger zooplankton (greater than 35 mm) serve as a major food source for fish.

Ichthyoplankton includes larvae and eggs of resident fish that spawn nearshore, migratory species, and subarctic and temperate/tropical species whose spawning ranges extend into the area (Loeb et al. 1983). Vertical and cross-shelf variations in species composition vary with season. A study off San Diego County documented that larvae with persistently higher concentrations within 1 mile of shore include cheekspot goby (*Ilypnus gilberti*), giant kelpfish (*Heterostichus rostratus*), bay goby (*Lepidogobiuslepidus*), and unidentified larvae of blennies, clinids, and silversides (Barnett et al. 1984). The larvae of northern anchovy (*Engraulis mordax*), queenfish (*Seriphus politus*), and white croaker (*Genyonemus lineatus*) tended to concentrate nearshore between 1 and 2.5 miles offshore, although queenfish and white croaker had a more inshore distribution during spring and summer.

Marine-Associated Birds

Seabirds and shorebirds are commonly observed along southern California beaches. Seabirds such as cormorants, pelicans, and terns forage for fish offshore. Gulls may feed on fish and invertebrates, and are notable scavengers. Shorebirds probe for marine invertebrates in the damp sands of the intertidal zone and may feed on small fish and crustaceans in tide pools. However, in areas of beach erosion, foraging opportunities for shorebirds decrease. Shallow sand depths and exposed cobble and/or bedrock support few invertebrate prey. Approximately 50 species of marine-associated birds have been reported to occur along the shoreline and adjacent nearshore ocean between Carlsbad and Del Mar (MEC 2000b). A total of 12 species of birds was observed along the shoreline during the September 2002 reconnaissance survey (**Table 4.5-5**).

Table 4.5-5 Birds observed along the shoreline within the Encinitas and Solana Receiver Sites, September 2002

Scientific Name	Common Name	Encinitas Receiver Site	Solana Beach Receiver Site
Pelecanus occidentalis	brown pelican		
Phalacrocorax auritus	double-crested cormorant CSC		
Charadrius vociferus	killdeer		
Actitis macularia	spotted sandpiper	O, V	O
Arenaria melanocephala	black turnstone	O	O
Calidris alba	sanderling		O
Catoptrophorus semipalmatus	willet	O	O
Limosa fedoa	marbled godwit	O	O
Numenius phaeopus	whimbrel		O
Larus delawarensis	ring-billed gull		O
Larus heermanni	Heermann's gull	O	O
Larus occidentalis	western gull	O	O

O=observation; V=vocalization
CSC = California Species of Special Concern

The most commonly observed seabirds within the study area during the September 2002 survey included Heerman's gull (*Larus heermanni*), ringed-billed gull (*Larus delawarensis*), and western gull (*Larus occidentalis*). Other commonly observed seabird species in the ocean waters offshore of northern San Diego County include the brown pelican *(Pelecanus occidentalis*); surf scoter (*Melinita perspicillata*); western grebe (*Aecmophorus occidentalis*); double-crested cormorant (*Phalacrocorax auritus*); Brandt's cormorant (*Phalacrocorax pencillatus*); and pelagic cormorant (*Phalacrocorax pelagicus*). Terns, including the state and Federal endangered California least tern (*Sternula antillarum browni*), elegant tern (*Sternula elegans*), Caspian tern (*Sternula caspia*), and Forster's tern (*Sternula forsteri*), may forage in nearshore waters of the project area.

The most commonly observed shorebirds during the September 2002 survey were black turnstone (*Arenaria melanocephala*), marbled godwit (*Limosa fedoa*), sanderling (*Calidris alba*), whimbrel (*Numenius phaeopus*), and willet (*Caloptrophorus semipalmatus*). Marsh birds, including great blue heron, great egret, and black-crowned night heron (*Nycticorax nycticorax*), were observed foraging on exposed reefs south of Swami's during the May 2002 surfgrass mapping survey. Other commonly observed and/or expected shorebirds in the project area include killdeer (*Charadrius vociferus*), black-bellied plover (*Pluvialis squatarola),* wandering tattler (*Heteroscelus incanus*), and spotted sandpiper (*Actitis macularia*).

The most commonly observed birds at RBSP II receiver sites in November 2008, July 2009, and January 2010 included Heerman's gull (*Larus heermanni*), western gull (*Larus occidentalis*), black-bellied plover (*Pluvialis squatorola*), marbled godwit (*Limosa fedoa*), western sandpiper (*Calidris mauri*), whimbrel (*Numenius phaeopus*), and willet (*Tringa semipalmata*). The western snowy plover was observed on the wider beach adjacent to the Batiquitos receiver site and at the Cardiff receiver site. The endangered California least tern (*Sternula antillarum browni*) and the elegant tern (*Sternula elegans*) were observed in flight near the jetties of Batiquitos Lagoon during beach surveys of the nearby Batiquitos receiver site.

<u>Marine Mammals</u>

Common dolphins (*Delphinus delphis*) and Pacific bottlenose dolphins (*Tursiops runcates*) occur in the surf zone and in offshore waters. Pacific white-sided dolphins (*Lagenorhynchus obliquidens*) and Risso's dolphins (*Grampus griseus*) also are known to occur seasonally in southern waters of the SCB.

Gray whales (*Eschrichtius robustus*) migrate through the study area. The southbound migration through the SCB begins in December and lasts through February; the northbound migration is February through May. Gray whales migrate up to 125 miles offshore along three pathways through the SCB. The project area lies within the nearshore migration path, which extends from the shoreline to approximately 12 miles offshore.

Harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*) haul out on sandy beaches, but haul-outs are infrequent on beaches in the region. An established harbor seal haul-out area occurs at La Jolla, which is several miles from any of the beaches in the study area. No established sea lion haul-out locations occur in the local region. Other marine mammals occur in nearshore waters (see Sandy Subtidal discussion below).

All marine mammals are protected by the MMPA, which prohibits harassment and harm to these animals. Under the 1994 amendments, harassment includes disturbance that would cause injury or disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

<u>Marine Resource Summary in Study Area</u>

The 2002 SANDAG seafloor mapping provides the best available comprehensive data of nearshore habitat in the study area (**Figure 4.5-1, Figure 4.5-2, and Figure 4.5-3**). Similarly, the 2002 SANDAG vegetation map provides the best available quantitative estimates of the vegetative indicator species (**Figure 4.5-1** and **Figure 4.5-2**). Those data include acreage estimates for various habitat types: surfgrass, giant kelp (kelp canopy), and understory algae. The understory category includes several species, including feather boa kelp and sea palm indicators. Indicator species were selected in coordination with resource agencies to be consistent with previous reef characterization surveys and monitoring conducted in the study area (US Navy 1997a, b; MEC 2000b, AMEC 2005). The indicators represent dominant species that are sensitive to varying degrees of sand scour and sedimentation, as follows:

- Persistent indicator species considered relatively sensitive to sand scour and sedimentation (sea fans, giant kelp).
- Persistent indicator species considered relatively tolerant of some sand influence (surfgrass, sea palm).

- Opportunistic indicator species considered relatively sand tolerant (feather boa kelp).

The USACE model area, which extends from the shoreline to approximately 1,600 ft offshore, includes approximately 480 acres of reef offshore Encinitas and Solana Beach. The combined total acreage of the vegetative categories is similar to that of bedrock on the substrate map (**Table 4.5-6**). While the amount of exposed reef may vary depending on time of year and environmental conditions, the 2002 substrate and vegetation acreage estimates are considered representative for the impact analysis, and is further supported by subsequent sampling and monitoring from 2003 to 2010.

Table 4.5-6 Summary of nearshore resources within each Segment (in acres)

Reach Name	Segment	Total bedrock substrate	Bedrock with surfgrass	Bedrock w/other indicators
Stone Steps	1 (Encinitas)	31.5	3.6	26.4
North of Moonlight	1 (Encinitas)	28.0	1.8	25.0
South of Moonlight to Swami's	1 (Encinitas)	65.7	13.0	50.5
North of Fletcher Cove	2 (Solana Beach)	31.9	3.7	26.2
Fletcher Cove to San Dieguito Lagoon	2 (Solana Beach)	30.2	0.7	27.0
TOTAL		**187.3**	**22.8**	**155.1**

Source: SANDAG 2002

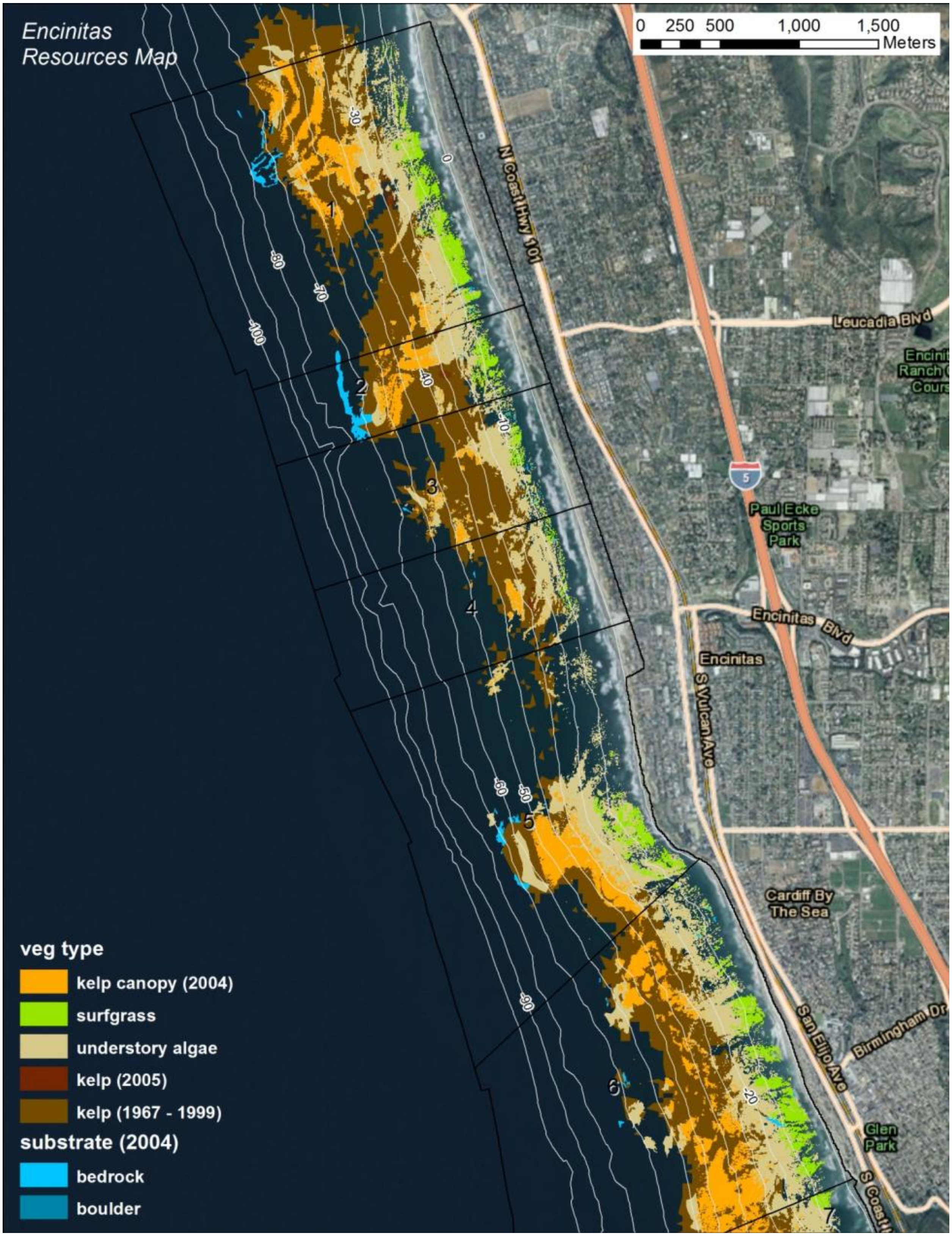


Figure 4.5-1 Nearshore hard-bottom resources mapped offshore the Encinitas study area

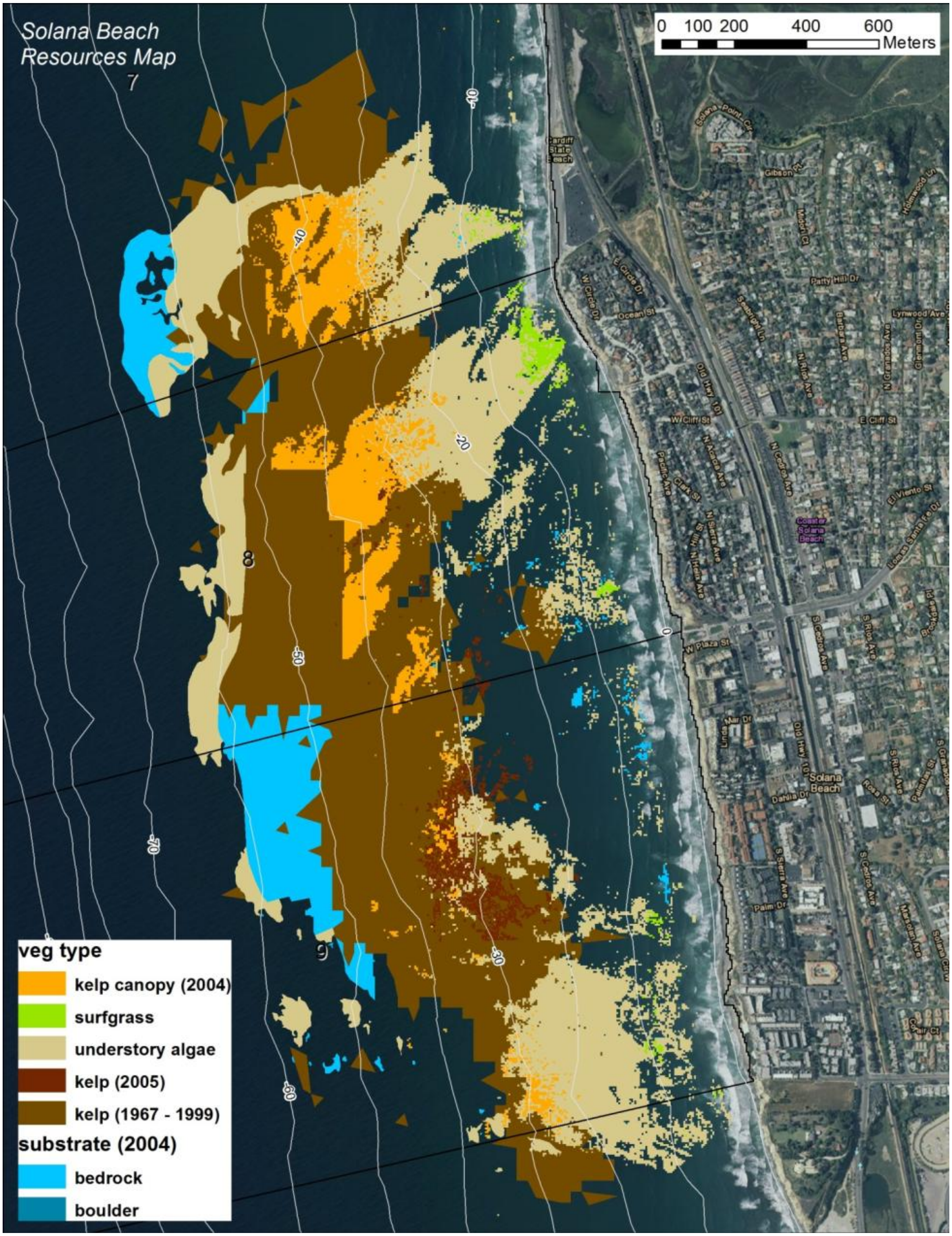


Figure 4.5-2 Nearshore hard-bottom resources mapped offshore the Solana Beach study area

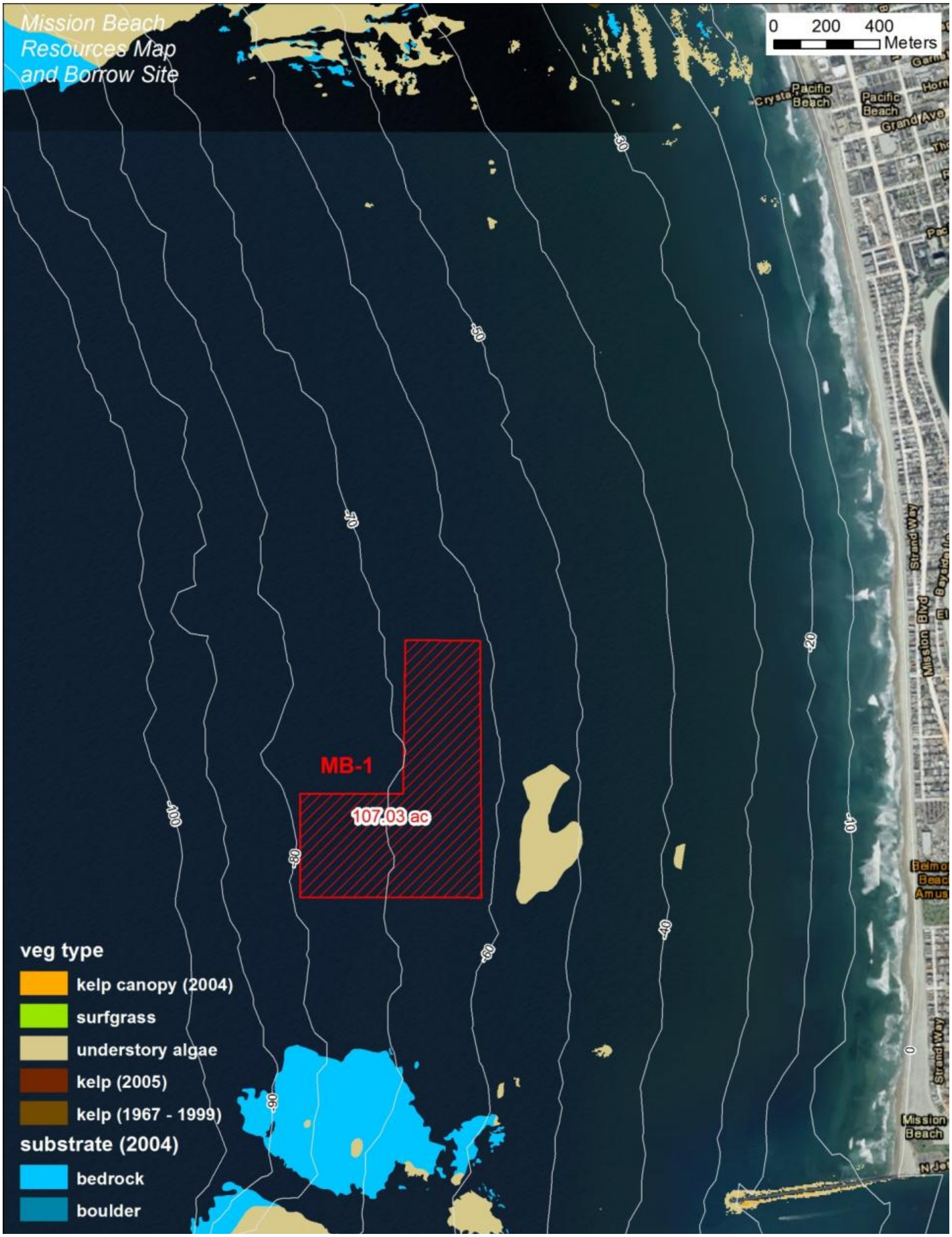
1 

Figure 4.5-3 Nearshore hard-bottom resources mapped offshore Mission Beach and Borrow Site MB-1

Reef quality or the ability to support indicator species is directly correlated with reef elevation (i.e., height of the reef), as higher-relief reefs are more resistant to sedimentation and scour, and therefore, allows perennial species to persist. Reef heights in relatively higher quality areas include a greater percentage of heights >1 foot compared to relatively lower quality areas. Substrate heights along 70 percent of the transects surveyed in 2006 were predominantly <1 foot in relatively lower quality reef areas (SAIC 2007a). In some cases, low-relief reefs may also support perennial indicator species, if other factors contribute to minimize the effects of sedimentation and scour. An example includes the presence of sand channels which allow sand to migrate on and off shore between low-relief reefs. A summary of reef elevation within the project area is provided in **Table 4.5-7**, with a further breakdown by surfgrass (**Table 4.5-8**) and other indicator species (**Table 4.5-9**).

Table 4.5-7 Summary of bedrock by reef elevation within each Segment (in acres)

Bedrock		**Reef Elevation (ft)**			
Reach Name	**Segment**	**(0 – 1)**	**(1 – 2)**	**(2 – 3)**	**(> 3)**
Stone Steps	1 (Encinitas)	20.0	4.9	2.9	3.7
North of Moonlight	1 (Encinitas)	16.8	3.4	3.6	4.3
South of Moonlight to Swami’s	1 (Encinitas)	25.1	6.2	4.7	29.8
North of Fletcher Cove	2 (Solana Beach)	12.2	2.6	1.5	15.6
Fletcher Cove to San Dieguito Lagoon	2 (Solana Beach)	13.5	3.0	3.3	10.3
TOTAL					

Source: SANDAG 2002

Table 4.5-8 Summary of bedrock with surfgrass by reef elevation within each receiver site (in acres)

Bedrock with Surfgrass		**Reef Elevation (ft)**			
Reach Name	**Receiver Site**	**(0 – 1)**	**(1 – 2)**	**(2 – 3)**	**(> 3)**
Stone Steps	Encinitas	2.1	0.8	0.3	0.4
North of Moonlight	Encinitas	1.4	0.2	0.2	0.0
South of Moonlight to Swami’s	Encinitas	3.8	2.1	1.6	5.5
North of Fletcher Cove	Solana Beach	0.0	0.0	0.0	3.7
Fletcher Cove to San Dieguito Lagoon	Solana Beach	0.0	0.0	0.0	07
TOTAL					

Source: SANDAG 2002

Table 4.5-9 Summary of bedrock with other indicator species by reef elevation within each receiver site (in acres)

Bedrock w/Other Indicators		Reef Elevation (ft)			
Reach Name	Receiver Site	(0 – 1)	(1 – 2)	(2 – 3)	(> 3)
Stone Steps	Encinitas	16.6	4.0	2.6	3.3
North of Moonlight	Encinitas	14.3	3.1	3.3	4.3
South of Moonlight to Swami's	Encinitas	19.9	3.9	2.9	23.8
North of Fletcher Cove	Solana Beach	10.7	2.4	1.4	11.7
Fletcher Cove to San Dieguito Lagoon	Solana Beach	11.5	2.9	3.2	9.4
TOTAL					

Source: SANDAG 2002

Results from 2006 dive surveys also indicated that surfgrass extended farther offshore (i.e., to a water depth of approximately 23 ft and that giant kelp extended farther inshore (i.e., to a water depth of approximately 15 ft than depicted in the 2002 vegetation map (SAIC 2007a), suggesting that acreage may be underestimated with the 2002 map data. It is possible that understory algae may have obscured detection of those species at mid-depths. The vegetation categories include two of the indicator species (surfgrass, giant kelp) and a combined understory algae category. Because the understory algae category does not distinguish among species, it may also represent a conservative overestimate of habitat associated with feather boa kelp and sea palm indicator species. However, those limitations should have a relatively minor influence on acreage associated with the 2002 vegetation map given the relatively small are affected.

The SAIC 2007 study also noted relationships between indicator species occurrence and reef heights and suggest that it appeared to be influenced by depth distribution. Several examples include:

- Surfgrass, which primarily occurred at water depths ≤15 ft, was uncommon on reef heights <1 ft and had denser cover on substrate heights ≥2 ft than on 1 ft heights.
- Giant kelp primarily occurred at water depths >15 ft on reef heights ≥1 ft. Giant kelp had sparse occurrence on nearshore reefs. Primary kelp canopies occur further offshore the beach depth of closure (MEC 2000).
- Sea palm and feather boa understory algae mainly occurred at water depths <26 ft, with a similar or greater number of records between 15 and 26 ft. Both species had greater cover on reef heights >1 ft.
- Sea fan occurrence increased with depth, with most records at depths >26 ft. Although sea fans mainly occurred on ≥1 ft substrate, there were more records on reefs <1 ft in height than observed for other indicator species, most likely related to less sand influence with increasing depth.
- Hard substrate with opportunistic turf algae, sparse occurrence of opportunistic feather boa kelp, and/or lacking vegetation has been used to distinguish substantially sand influenced (scoured) reef (MEC 2000b, SAIC 2007a).

4.5.2 Sensitive Species

Sensitive wildlife and plant species potentially occurring within the study area were identified based on review of appropriate databases and lists, and comparison of species specific habitat requirements with site specific habitat characteristics, including disturbance, vegetation, and soils. The most recent records of the California Natural Diversity Database (CNDDB) (CDFG 2012c) and the CNPS's Electronic Inventory of Rare and Endangered Plants of California (CNPS 2012a) were reviewed for the quadrangles containing and surrounding the project area (i.e., Del Mar, Encinitas, Rancho Santa Fe, and San Luis Rey USGS 7.5 minute quadrangles). These databases contain records of reported occurrences of Federal- and/or State- listed endangered or threatened species, proposed endangered or threatened species, former Federal Species of Concern, California Species of Special Concern (CSC), or otherwise sensitive species or habitat. Lists from the USFWS and the CDFG were also reviewed. These lists included the USFWS list of Federal threatened and endangered species for the region, CDFG list of State threatened and endangered species, and the CDFG Special Animals list (CDFG 2011a, 2012b, and USFWS 2012).

A sensitive species was considered as a potential inhabitant of the study area if its known geographical distribution encompassed part of the study area, or if its distribution was near the area and general habitat requirements of the species were present (such as the presence of roosting, nesting, or foraging habitat, or a permanent water source). Furthermore, the potential for each species to occur within the study area was categorized as absent, low, moderate, high or observed based on the following criteria:

<u>Vegetation</u>

For each of the sensitive plant species identified through the CNDDB and CNPS databases as occurring within the vicinity of the study area, the habitat was assessed and the following guidelines were used to assess each sensitive species' potential to occur:

- Absent – Species habitat requirements do not occur within the study area.
- Low – No recent or historical records exist of the species occurring within the study area or its immediate vicinity (approximately 5 miles), and/or habitats needed to support the species within the study area are of poor quality.
- Moderate – Either a historical record exists of the species within the immediate vicinity of the study area (approximately 5 miles) or the habitat requirements associated with the species occur within the study area.
- High – Both a historical record exists of the species within the study area or its immediate vicinity (approximately 5 miles), and the habitat requirements associated with the species occur within the study area.
- Observed – Species was observed within the study area at the time of the survey.

<u>Wildlife</u>

- Absent – Species habitat requirements do not occur within the study area.
- Low potential for occurrence – There are no recent or historical records/observations of the species occurring within the study area or its immediate vicinity (within approximately 5 miles), and the diagnostic habitat requirements strongly associated with the species do not occur within the study area or its immediate vicinity.

- Moderate potential for occurrence – There is a recent or historical record/observation of the species within the study area or its immediate vicinity (within approximately 5 miles), and a limited amount of suitable habitat associated with the species occurs within the study area or its immediate vicinity.
- High potential for occurrence – There is both a recent or historical record/observation of the species in or in the immediate vicinity of the study area (within approximately 5 miles), and the diagnostic habitat requirements strongly associated with the species occur in or in the immediate vicinity of the study area.
- Species present – The species was observed in the study area at the time of the survey.

4.5.3 Threatened and Endangered Plants

The literature review resulted in a list of several sensitive plant species that have historically occurred in north San Diego County (Del Mar, Encinitas, Rancho Santa Fe or San Luis Rey quadrangles). No sensitive plant species occur in the project study area.

4.5.4 Threatened and Endangered Wildlife

Two species that are Federal- or State-listed as endangered or threatened either occur or have the potential to occur within the project area based on literature review and an assessment of the habitat types within the study area (**Table 4.5-10**). These species and the rationale for the determination of their potential occurrence within the study area are discussed below.

California least tern (**Strernula **antillarum browni) nesting colony

The California least tern is Federal- and State-listed as endangered. This species is a seasonal migrant to San Diego and nests in colonies at constructed nest sites in coastal wetlands and on sandy beaches with sparse vegetation. The least tern nesting season extends from April 15 to September 15. California least terns nest in loose colonies in areas relatively free of human disturbance; they will abandon nesting areas if disturbed by predators. Nests occur on the ground on sparsely vegetated sandy or gravelly substrate. CNDDB occurrences for locations of nesting tern colonies include Batiquitos and San Elijo Lagoons. No nesting has occurred at San Elijo Lagoon since 2005 when a single nest was observed. Least terns are visual predators on small fish, and they usually forage within a 2-mile radius of their nesting site, although they may forage as far as 5 miles away. This species can be expected to forage in nearshore waters adjacent to Batiquitos Lagoon. Recent breeding status of the species at nesting locations in the vicinity of the project area are shown in Table 4.5-11. Nesting locations in the vicinity of project area are shown in Figures 4.5-4 and 4.5-5.

Western snowy plover (Charadrius alexandrinus nivosus) nesting colony

The western snowy plover is Federal-listed as threatened and is considered a California Species of Special Concern. This small shorebird is a resident in San Diego and nests at constructed nest sites in coastal wetlands, alkali flats at river mouths, salt evaporators, and on sandy beaches with sparse vegetation. Critical habitat for snowy plover in the project vicinity includes portions of Batiquitos Lagoon, with recent nesting observed. Results of summer surveys are shown in Table 4.5-12, and recent nesting and potential overwintering locations are shown on Figures 4.5-4 and 4.5-5. Newly constructed sites are at San Dieguito Lagoon. CNDDB occurrences for locations of nesting plover colonies include Batiquitos and San Elijo Lagoons. In 2002, western snowy plovers also bred at San Dieguito Lagoon (Patton 2002). Additionally, this species can be expected to forage along the shoreline. Western snowy plover were not observed within the receiver sites but have been observed on the beach south of Batiquitos Lagoon, on Cardiff State Beach south of San Elijo Lagoon (usually about midway between the restaurants and the south parking lot), and in the lagoon inlet of San Dieguito Lagoon in 2002.

Table 4.5-10 Threatened or endangered wildlife species occurring or potentially occurring within the Encinitas and Solana Beach study area

Scientific Name	Common Name	Status	PFO	Habitat	Comments
CLASS AVES	**BIRDS**				
CHARADRIIDAE	PLOVERS & RELATIVES				
Charadrius alexandrinus nivosus	western snowy plover (coastal populations)	FT, CSC	H	Inhabits sandy beaches, salt pond levees and shores of large alkali lakes. Requires sandy or friable soils for nesting.	CNDDB occurrences within the project vicinity include Batiquitos and San Elijo Lagoons.
LARIDAE	GULLS AND TERNS				
Sternula antillarum browni	California least tern	FE, SE	H	Nests on sparsely vegetated, flat substrates, sandy beaches, or alkali flats.	CNDDB occurrences within the project vicinity include Batiquitos and San Elijo Lagoons.

Status Codes

Federal
FE = Federal-listed; Endangered
FT = Federal-listed, Threatened
FPE = Federal-Proposed for Listing as Endangered
FC = Federal Candidate

State
ST = State-listed; Threatened
SE = State-listed; Endangered

CSC = California Species of Special Concern

* Taxa that are biologically rare, very restricted in distribution, declining throughout their range, or at a critical stage in their life cycle when residing in California

Source:
CDFG (2012a)

PFO (Potential for Occurrence) Probability:
<u>A</u> - Absent from Site – Species is concluded to be absent from the project area based on failure to detect the species during focused surveys
<u>L</u> - Low Potential for Occurrence – There are no recent or historical records/observations of the species occurring within the project site or its immediate vicinity (within approximately 5 mi) and the diagnostic habitat requirements strongly associated with the species do not occur within the project site or its immediate vicinity
<u>M</u> - Moderate Potential for Occurrence – There is a recent or historical record/observation of the species within the project site or its immediate vicinity (within approximately 5 mi) and a limited amount of suitable habitat associated with the species occurs within the project site or its immediate vicinity
<u>H</u> - High Potential for Occurrence – There is both a recent or historical record/observation of the species in or in the immediate vicinity of the project area, (within approximately 5 mi) and the diagnostic habitat requirements strongly associated with the species occur in or in the immediate vicinity of the project area
<u>P</u> - Species Present – The species was observed in the project site at the time of the survey

Table 4.5-11 Status of Least Tern Breeding in the Vicinity of the Project Area, 2005-2009

Site	2005		2006		2007		2008		2009	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Batiquitos Lagoon	571	571	601	601	575	578	596	596	576	620
San Elijo Lagoon	1	1	0	0	0	0	0	0	0	0

Table 4.5-12 Results of Summer Window Surveys for Snowy Plovers in the Vicinity of the Project Area, 2005-2010

Site	2005	2006	2007	2008	2009	2010
Batiquitos Lagoon	12	14	8	5	3	3
San Elijo Lagoon	0	0	0	0	0	0
Cardiff SB	0	0	0	0	0	0
San Dieguito Lagoon	0	0	0	0	0	0

Source: USFWS 2010a and 2010b

Turtles

Federal-listed marine turtles occasionally are sighted in warm-water areas of estuaries and bays in the region, but do not come to shore on beaches in the study area.

Abalone

Two species of abalone are listed as federal endangered species, the black abalone (*Haliotis cracherodii*) and the white abalone (*Haliotis sorenseni*). Both species are associated with reef habitats. The black abalone occurs in shallow subtidal and intertidal rocky habitats throughout southern California. The population of this species has been severely reduced by a wasting disease caused by a bacteria-like organism (Federal Register Vol. 74, No. 9). Abalone are broadcast spawners, but adults must be at a close distance (e.g., within a few ft) for reproduction to be successful. This life history characteristic in combination with depleted stocks limit the ability of these species to naturally recover. Reefs in the project area are not potential habitat for this species. The white abalone generally occurs in water depths between 66 and 200 ft (NMFS 2008), which is outside the littoral zone subject to sand transport effects. Natural hard bottom generally is located 500 ft or more away from the borrow sites; therefore, white abalone would not be expected to be affected by the project.

Swami's State Marine Conservation Area (SMCA)

Swami's SCMA was designated under the MLPA (**Figure 4.5-4** and **Figure 4.5-5**). Take of all living marine resources is prohibited with the exception of: 1) recreational take by hook-and-line from shore; 2) the recreational take of pelagic finfish, including Pacific bonito, and white seabass by spearfishing; and 3) take pursuant to beach nourishment and other sediment management activities and operation and maintenance of artificial structures inside the conservation area per any required federal, state and local permits, or as otherwise authorized by the department.

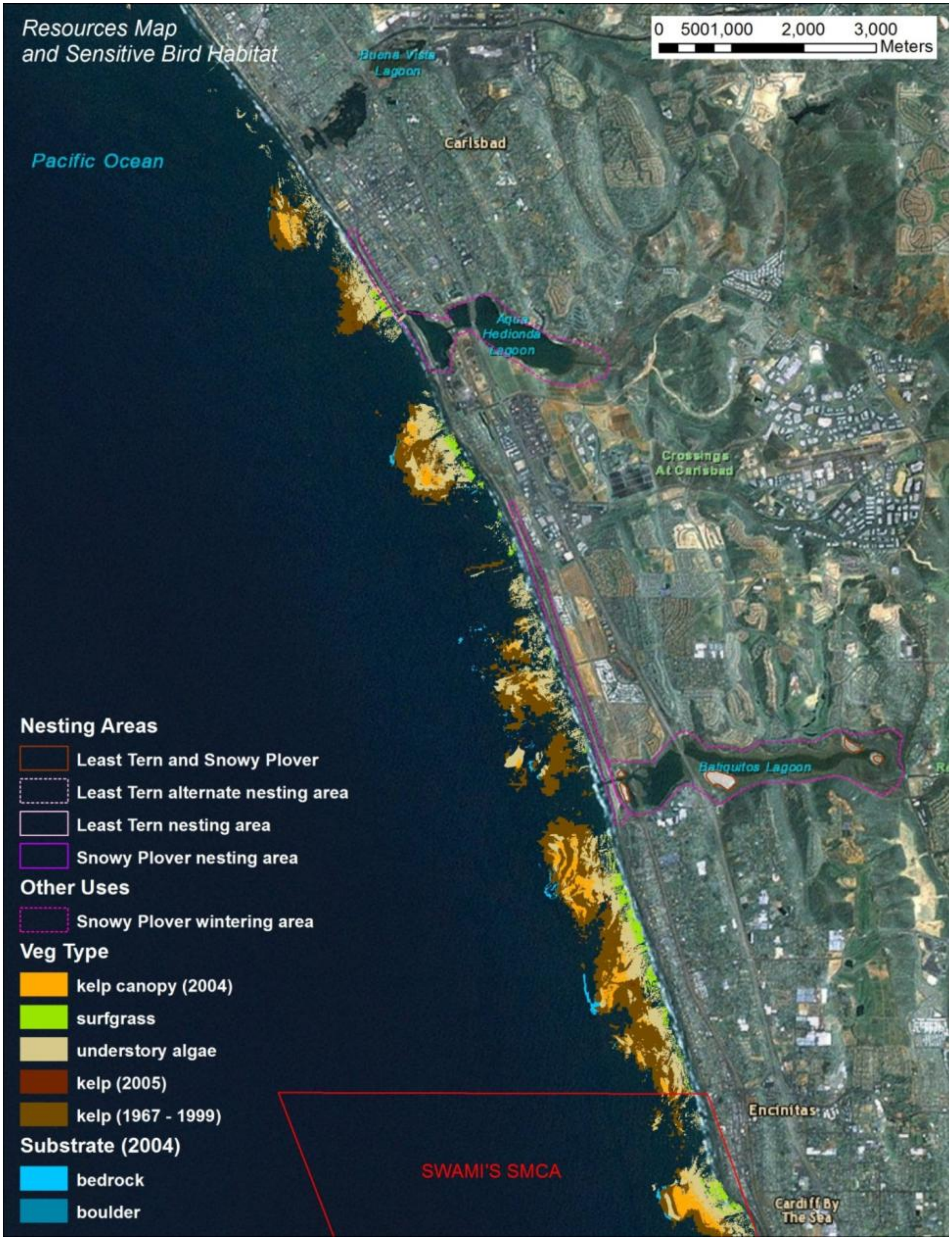


Figure 4.5-4 Sensitive Habitats in the Vicinity of Encinitas

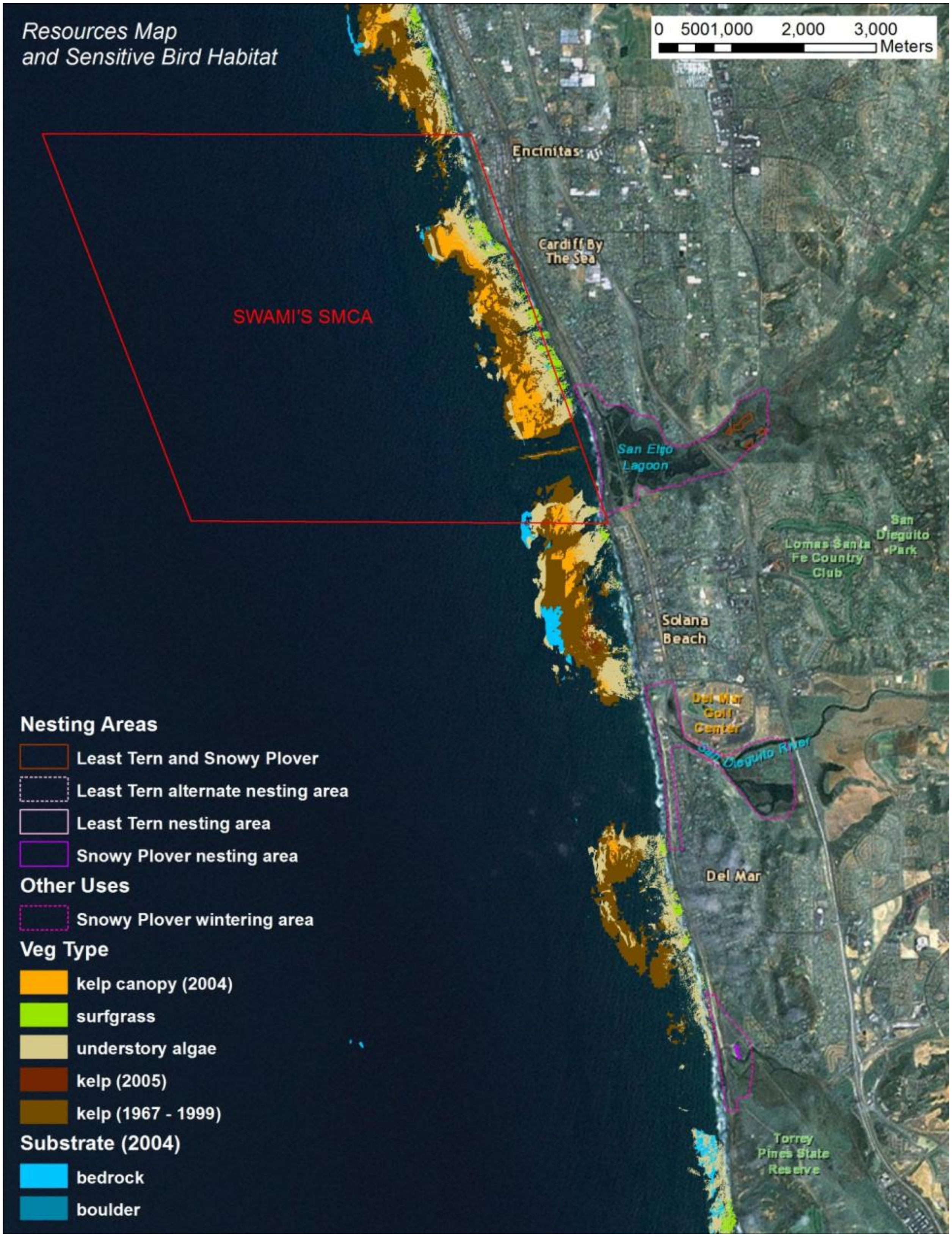


Figure 4.5-5 Sensitive Habitats in the Vicinity of Solana Beach

4.6 Air Quality

This section describes existing air quality conditions in the project study area within the San Diego Air Basin and a summary of applicable regulations. This section also summarizes technical information presented in Appendix I.

4.6.1 Climate and Meteorology

Air quality is defined by the concentration of pollutants related to human health. Ambient concentrations of air pollutants are determined by the rate and location of pollutant emissions released by pollution sources, and the atmosphere's ability to transport and dilute such emissions. Natural factors that affect transport and dilution include terrain, wind, atmospheric stability, and sunlight. Therefore, ambient air quality conditions within the local air basin are influenced by such natural factors as topography, meteorology, and climate, in addition to the amount of air pollutant emissions released by existing air pollutant sources.

The Encinitas and Solana Beach coastal region has a semi-arid Mediterranean type climate that is maintained through relatively mild sea breezes over the cool waters of the California current. Winters are usually mild with rainfall totals around the coast averaging approximately 11 inches per year (WRCC 2011).

Typically, the wind climate in the offshore area within 50 to 100 miles of Encinitas and Solana Beach is characterized by northwesterly winds averaging between 10 to 30 miles per hour. The predominant winds within the coastal region during October through February are from the east-northeasterly direction while the winds during March through September are from the west-northwesterly direction. Average wind velocities during the summer and winter months along the coast are approximately 5 and 7 miles per hour, respectively. During occasional winter storms wind speed and direction may vary. Additionally, during Santa Ana conditions wind speeds are usually strong out of the northeast.

The proposed project is located in the San Diego Air Basin (SDAB), which is an area equivalent to that of the County. The climate of the County is characterized by warm, dry summers and mild, wet winters. One of the main determinants of the climatology is a semi permanent high-pressure cell (the Pacific high-pressure cell) in the eastern Pacific Ocean. In the summer, this high-pressure cell is located well to the north, causing storm tracks to be directed north of California. The high-pressure cell maintains clear skies for much of the year. However, when the high-pressure cell moves southward during the winter, this pattern changes, and low-pressure storms are brought into the region, causing widespread precipitation.

A common atmospheric condition known as a temperature inversion affects air quality in the County. During an inversion, air temperatures get warmer rather than cooler with increasing height. Subsidence inversions occur during the warmer months (May through October) as warm descending air associated with the Pacific high-pressure cell comes into contact with cool marine air. The boundary between the layers of air represents a temperature inversion that traps pollutants below it. The inversion layer is approximately 2,000 ft above mean sea level (AMSL) during the months of May through October. During the winter months (November through April), the temperature inversion is approximately 3,000 ft AMSL. Inversion layers are important elements of local air quality because they inhibit the dispersion of pollutants, thus resulting in a temporary degradation of air quality.

4.6.2 Ambient Air Quality

The California Air Resources Board (ARB) and the U.S. Environmental Protection Agency (EPA) focus on the following air pollutants as indicators of ambient air quality: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), respirable particulate matter with an aerodynamic resistance diameter of 10 micrometers or less (PM_{10}), fine particulate matter with an aerodynamic resistance diameter of 2.5 micrometers or less ($PM_{2.5}$), and lead (Pb). Because these are the most prevalent air pollutants known to be deleterious to human health and extensive health-effects criteria documentation is available for these pollutants, they are commonly referred to as "criteria air pollutants."

Health-based air quality standards have been established for these pollutants by ARB at the state level and by EPA at the national level. These standards were established to protect the public with a margin of safety from adverse health impacts due to exposure to air pollution. California has also established standards for sulfates, visibility-reducing particles, hydrogen sulfide, and vinyl chloride. A brief description of each criteria air pollutant including source types and impacts to health is provided in Appendix I along with the most current monitoring station data and attainment designations for the project study areas. In addition, Appendix I includes the California Ambient Air Quality Standards (CAAQS) and the National Ambient Air Quality Standards (NAAQS).

Odor

Odor is considered an air quality issue, either at the local level (e.g., odor from wastewater treatment) or at the regional level (e.g., smoke from wildfires). An air pollutant means any fume, smoke, PM, vapor, gas, odorous substance, or any combination thereof. Odors are generally regarded as an annoyance rather than a health hazard. However, manifestations of a person's reaction to foul odors can range from psychological (e.g., irritation, anger, or anxiety) to physiological (e.g., circulatory and respiratory effects, nausea, vomiting, and headache).

4.6.3 Regulatory Setting

Federal Regulations

At the federal level, EPA is charged with implementing national air quality programs. EPA's air quality mandates are drawn primarily from the federal Clean Air Act (CAA), which was enacted in 1970. The most recent major amendments made by Congress occurred in 1990.

The CAA required EPA to establish primary and secondary NAAQS. The CAA also required each state to prepare an air quality control plan referred to as a State Implementation Plan (SIP). The federal Clean Air Act Amendments of 1990 (CAAA) added requirements for states with nonattainment areas to revise their SIPs to incorporate additional control measures to reduce air pollution. EPA is responsible for reviewing all state SIPs to determine conformation to the mandates of the CAAA and to determine whether implementation will achieve air quality goals. If EPA determines an SIP is inadequate, a Federal Implementation Plan (FIP) that imposes additional control measures may be prepared for the nonattainment area.

State Regulations

ARB is the agency responsible for coordination and oversight of state and local air pollution control programs in California and for implementing the California Clean Air Act (CCAA). The CCAA was adopted in 1988 and required ARB to establish the CAAQS. ARB has established CAAQS for sulfates, hydrogen sulfide, vinyl chloride, visibility-reducing particulate matter, and criteria air pollutants. In most cases, the CAAQS are more stringent than the NAAQS and incorporate a margin of safety to protect sensitive individuals.

ARB and local air pollution control districts are currently developing plans for meeting new national air quality standards for ozone and $PM_{2.5}$. California's adopted 2007 State Strategy was submitted to EPA as a revision to the SIP in November 2007 (ARB 2008).

Local Plans and Policies

In the SDAB, the San Diego Air Pollution Control District (SDAPCD) is the agency responsible for protecting the public health and welfare through the administration of federal and State air quality laws and policies. Included in the SDAPCD's tasks are the monitoring of air pollution, the preparation of the County's portion of the State Implementation Plan (SIP), and the promulgation of Rules and Regulations. The SIP includes strategies and tactics to be used to attain and maintain acceptable air quality in the County; this list of strategies is called the San Diego Regional Air Quality Strategy (RAQS). The rules and regulations include procedures and requirements to control the emission of pollutants and prevent significant adverse impacts.

Included in the SDAPCD's tasks are monitoring of air pollution, preparation of the SIP for the SDAB, and promulgation of Rules and Regulations. In response to the federal nonattainment designation for the 8-hour O_3 standard, the SDAPCD prepared and ARB approved and submitted the *Eight-Hour Ozone Attainment Plan for San Diego County* (May 2007) to the EPA. The Plan identifies control measures and associated emission reductions necessary to demonstrate attainment of the 8-hour O_3 NAAQS. The SIP provides plans for attaining and maintaining the 8-hour NAAQS for O_3 and demonstrates how the SDAB would continue to maintain compliance with federal CO standards. The SDAB achieved the NAAQS for CO in 1993 and the EPA approved a 10-year maintenance plan in 1998. The current version of the maintenance plan is the *2004 Revision to the California State Implementation Plan for Carbon Monoxide Updated Maintenance Plan for Ten Federal Planning Areas*.

The APCD does not have quantitative emissions limits for construction activities, nor for long-term emissions that may result from increased vehicle use. The Rules and Regulations include procedures and requirements to control the emission of pollutants and to prevent adverse impacts.

General Conformity

General conformity requirements were adopted by Congress as part of the CAAA and were implemented by EPA regulations in 1993. The purpose of the general conformity program is to ensure that actions taken by the Federal government do not undermine state or local efforts to achieve and maintain NAAQS.

The General Conformity Rule (40 Code of Federal Regulations [CFR] Sections 51.850–51.860 and 93.150–93.160), requires any Federal agency that is responsible for an action in a Federal nonattainment or attainment/maintenance area to demonstrate conformity to the applicable SIP. To do so, the Federal agency must determine that the action is either exempt from General Conformity Rule requirements or subject to a formal conformity determination. All reasonably foreseeable emissions predicted to result from the action—both direct and indirect—must be considered, and the location and quantity of emissions must be identified.

A Federal action is exempt and considered to conform to the SIP if an applicability analysis shows that total direct and indirect emissions of pollutants from construction and operation of the action would be less than specified emission-rate thresholds, known as *de minimis* levels. The *de minimis* levels are based on the attainment/maintenance and nonattainment designations and classifications for the project area. If the action is not determined to be exempt and the emissions would exceed the *de minimis* levels, a formal air quality conformity analysis is required. The action cannot proceed unless mitigation measures are identified that would bring the project into conformance. Only Federal nonattainment and maintenance pollutant emissions are considered under a general conformity analysis.

4.6.4 Existing Air Quality

The SDAB currently meets the NAAQS for all criteria air pollutants except O_3 and meets the CAAQS for all criteria air pollutants except O_3, PM_{10}, and $PM_{2.5}$. For the 8-hour O_3 standard, the SDAB was previously classified as “basic” nonattainment, which is the designation the U.S. Environmental Protection Agency (USEPA) assigned to regions that where in attainment of the previous 1-hour standard, but would become nonattainment when subject to the new 8-hour standard. The SDAPCD submitted an air quality plan (*8-Hour Ozone Attainment Plan*) to the USEPA in 2007 based on the “basic” nonattainment designation; the plan demonstrated how the 8-hour O_3 standard will be attained by 2009. However, USEPA was challenged on their justification for “basic” designations and in January 2009, published proposed reclassifications for all “basic” nonattainment areas for which the SDAB would be considered “moderate” nonattainment. Therefore, the previous 2007 *8-Hour Ozone Attainment Plan* is not expected to be approved by USEPA. The SDAB currently falls under a federal “maintenance plan” for CO, following a 1998 redesignation as a CO attainment area. The SDAB is currently classified as a state “serious” O_3 nonattainment area and a state nonattainment area for PM_{10} and $PM_{2.5}$.

Ambient air pollutant concentrations in the SDAB are measured at 10 air quality monitoring stations operated by the SDAPCD. The closest and most representative SDAPCD air quality monitoring station to the project site is the Del Mar monitoring station, located at 215 9th St in Del Mar, CA, approximately 2 miles south of the southern end of Solana Beach receiver site. However, that monitoring station only collects data on concentrations of O_3. The closest monitoring station with complete data is the Escondido monitoring station, located at 600 East Valley Parkway in Escondido, California, approximately 12 to 15 miles to the northeast. The Escondido station is in an urbanized area located inland, and therefore, may not completely represent the existing conditions at the project site, especially for CO, PM_{10}, and $PM_{2.5}$, which are pollutants attributable to local emission sources. **Table 4.6-1** presents the most recent data over the past four years from the Del Mar and Escondido monitoring stations as summaries of the exceedances of standards and the highest pollutant levels recorded for years 2008 through 2010.

As shown in **Table 4.6-1**, ambient air concentrations of CO and NO_2 at the Escondido monitoring station have not exceeded the NAAQS/CAAQS in the past 3 years. The PM_{10} concentrations have not exceeded the federal standards for the past 3 years, but did exceed the state standards in 2008 and 2009. The $PM_{2.5}$ concentrations have exceeded the federal standards in each of the past 3 years. Concentrations of 8-hour ozone registered at the monitoring station exceeded the CAAQS and NAAQS in 2008 and 2009, as well as the CAAQS in 2010.

Table 4.6-1 presents the most recent data over the past four years from the Del Mar and Escondido monitoring stations as summaries of the exceedances of standards and the highest pollutant levels recorded for years 2008 through 2010.

Table 4.6-1 Ambient Air Quality Summary – Del Mar and Escondido Monitoring Stations

Pollutant Standards		2008	2009	2010
Carbon Monoxide (CO)				
National maximum 8-hour concentration (ppm)		2.81	3.24	2.46
State maximum 8-hour concentration (ppm)		2.81	3.54	2.46
State maximum 1-hour concentration (ppm)		5.7	5.2	4.6
<u>Number of Days Standard Exceeded</u>				
NAAQS 8-hour (>9.0 ppm)		0	0	0
CAAQS 8-hour (>9.0 ppm)		0	0	0
CAAQS 1-hour (>20.0 ppm)		0	0	0
Nitrogen Dioxide (NO_2)				
State maximum 1-hour concentration (ppm)		0.081	0.073	0.064
Annual Average (ppm)		0.018	0.016	0.014
<u>Number of Days Standard Exceeded</u>				
CAAQS 1-hour		0	0	0
Ozone				
State max 1-hour concentration (ppm)		0.117	0.097	0.085
National maximum 8-hour concentration (ppm)		0.078	0.084	0.072
<u>Number of Days Standard Exceeded</u>				
CAAQS 1-hour (>0.09 ppm)		2	1	0
CAAQS 8- hour (>0.070 ppm)/ NAAQS 8-hour (>0.075 ppm)		11/3	3/1	2/0
Particulate Matter (PM_{10}) [a]				
National maximum 24-hour concentration (μg/m^3)		82.0	73.0	42.0
State maximum 24-hour concentration (μg/m^3)		84.0	74.0	43.0
State annual average concentration (μg/m^3)		*	24.6	21.0
<u>Estimated Number of Days Standard Exceeded</u>				
NAAQS 24-hour (>150 μg/m^3)		0	0	0
CAAQS 24-hour (>50 μg/m^3)		1	1	0
Particulate Matter ($PM_{2.5}$) [a]				
National maximum 24-hour concentration (μg/m^3)		44.0	78.3	48.4
State maximum 24-hour concentration (μg/m^3)		44.0	78.4	52.2
National annual average concentration (μg/m^3)		*	13.4	12.2
State annual average concentration (μg/m^3)		12.4	*	*
<u>Estimated Number of Days Standard Exceeded</u>				
NAAQS 24-hour (>65 μg/m^3)		3	2	2

Notes:

* Data unavailable

[a] State and national statistics may differ for the following reasons: State statistics are based on California-approved samplers, whereas national statistics are based on samplers using federal reference or equivalent methods. State and national statistics may therefore be based on different samplers. State statistics are based on *local* conditions; national statistics are based on *standard* conditions. State criteria for ensuring that data are sufficiently complete for calculating valid annual averages are more stringent than the national criteria.

ppm = parts per million; μg/m^3 = micrograms per cubic meter

Source: ARB 2011

4.6.5 Toxic Air Contaminants

In addition to criteria pollutants, air quality regulations also focus on localized hazardous air pollutants, which are also called toxic air contaminants (TACs). For those TACs that may cause cancer there is, in general, no minimum concentration that does not present some risk. This contrasts with the criteria air pollutants, for which acceptable levels of exposure can be determined and ambient standards have been established (i.e., NAAQS).

EPA and ARB have ongoing programs to identify and regulate TACs. Among the many substances identified as TACs are diesel exhaust particulates, asbestos, and lead. The regulation of TACs is generally through statutes and rules that require the use of the maximum or best available control technology (MACT or BACT) to limit TAC emissions.

Particulate exhaust emissions from diesel-fueled engines (diesel PM) were identified as a TAC by ARB (1998). The control of diesel PM emissions is a very active current concern of regulatory agencies at all levels. The majority of the estimated local health risk from TACs is from diesel PM. The composition of diesel PM emissions from diesel-fueled engines varies depending on engine type, operating conditions, fuel composition, lubricating oil, and whether an emission control system is present. Federal and state efforts to reduce diesel PM emissions have focused on the use of improved fuels, adding particulate filters to engines, and requiring the production of new-technology engines that emit fewer exhaust particulates.

4.6.6 Greenhouse Gases

This section describes the project study area within the San Diego Air Basin. It provides a description of global climate change, greenhouse gas (GHG) emissions, the existing regulatory framework surrounding GHG emissions. This section also summarizes technical information presented in Appendix I.

<u>Existing Conditions</u>

Climate Change Predictions

Certain gases in Earth's atmosphere, classified as GHGs, play a critical role in determining Earth's surface temperature. Solar radiation enters Earth's atmosphere from space. A portion of the radiation is absorbed by Earth's surface and a smaller portion of this radiation is reflected back toward space. The absorbed radiation is emitted from Earth as low-frequency infrared radiation; however, the infrared radiation is absorbed by GHGs in the atmosphere. As a result, the radiation that otherwise would have escaped back into space is instead "trapped" in the atmosphere, resulting in a warming of the atmosphere. This phenomenon, known as the greenhouse effect, is responsible for maintaining a habitable climate on Earth. Without the greenhouse effect, Earth would not be able to support life as we know it.

Key GHGs contributing to the greenhouse effect are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Individual projects may emit GHGs during the construction and operational phases of development. The primary GHGs associated with development projects are CO_2, CH_4, and N_2O. HFCs, PFCs and SF_6 are considered high global warming potential (high-GWP) GHGs and are generally emitted from certain commercial and industrial processes and equipment. GWP is a concept developed to compare the ability of each GHG to trap heat in the atmosphere relative to another gas; the global warming potential is based on several factors, including the relative effectiveness of a gas to absorb infrared radiation and length of time that the gas remains in the atmosphere ("atmospheric lifetime"). GHGs have long atmospheric lifetimes (one year to several thousand years) and persist in the atmosphere for a long enough time to be dispersed around the globe. The GWP of each gas is measured relative to CO_2, the most abundant GHG. GHGs with lower emission rates than CO_2 may still contribute to climate change because they are more effective at absorbing outgoing infrared radiation than CO_2. The concept of CO_2-equivalency (CO_2e) is used to account for the different GWPs of GHGs to absorb infrared radiation.

Climate change is a global issue. GHGs are global pollutants, unlike criteria air pollutants and TACs, which are pollutants of regional and local concern. Whereas pollutants with localized air quality effects have relatively short atmospheric lifetimes (about 1 day), GHGs have much longer atmospheric lifetimes of 1 year to several thousand years, which allow GHGs to be dispersed around Earth.

Although the exact lifetime of any particular GHG molecule is dependent on multiple variables and cannot be pinpointed, it is understood by scientists who study atmospheric chemistry that more CO_2 is emitted into the atmosphere than is sequestered by ocean uptake, vegetation, and other forms of sequestration. Of the total annual human-caused CO_2 emissions, approximately 54 percent is sequestered within 1 year through ocean uptake, by northern hemisphere forest regrowth, and other terrestrial sinks; the remaining 46 percent of human-caused CO_2 emissions remains stored in the atmosphere (Seinfeld and Pandis 1998).

Greenhouse Gas Emission Sources

Emissions of GHGs are attributable to human activities associated with the transportation, industrial/manufacturing, electric utility, residential, commercial, and agricultural sectors. Emissions of CO_2 are byproducts of fossil fuel combustion while CH_4, a highly potent GHG, is the primary component in natural gas and also is associated with agricultural practices and landfills. N_2O is also largely attributable to agricultural practices and soil management.

California GHG Emissions

The California Air Resources Board (ARB) performs an annual GHG inventory for emissions and sinks of the major GHGs discussed earlier. In 2008, California produced 484 million gross metric tons (MT) of CO_2e (ARB 2011). The inventory is divided into seven broad sectors and categories in the inventory: Agriculture, Commercial, Electricity Generation, Forestry, Industrial, Residential, and Transportation. Transportation was the sector with the largest percentage of GHG emissions, 37 percent, followed by electricity generation (25 percent), and industrial sources (20 percent). The remaining sectors each accounted for less than 10 percent of overall emissions. Domestic water-borne ships accounted for approximately 2 million MT, or 0.4 percent, of the total emissions. In addition to the State of California GHG Inventory, more specific regional GHG inventories have been prepared for on-road mobile sources and land use emissions.

San Diego County GHG Emissions

The University of San Diego School of Law Energy Policy Initiative Center prepared a GHG inventory for San Diego County (Anders et al. 2008, this reference is ancient in GHG world.).

The inventory included estimates of GHG emissions for 1990, 2006, and 2020. Total GHG emissions in San Diego County for the year 2006 are estimated at 34 MMT of CO_2e. Transportation is the largest emissions sector, accounting for 16 MMT of CO_2e, or 46percent of total emissions. Energy consumption, including electricity and natural gas use, is the next largest source of emissions at 34percent of the total. In 2006, off-road equipment and vehicles generated approximately 1.3 MMT CO_2, or approximately 4 percent to the total regional GHG emissions. In 2006, emissions from water-borne navigation accounted for approximately 0.4percent of the total greenhouse gas emissions in San Diego County.

City of Encinitas GHG Emissions

The City of Encinitas baseline inventory established that 2005 city-wide emissions totaled 548,993 metric tons of CO_2e (City of Encinitas 2011). Population growth and development planned for the City of Encinitas by 2020 are expected to increase city-wide emissions to 646,947 metric tons of CO_2e, an overall increase of almost 18 percent (City of Encinitas 2011).

City of Solana Beach GHG Emissions

In 2005, the Solana Beach community emitted approximately 149,772 metric tons of CO_2e. The transportation sector was the largest source of GHG emissions, generating approximately 109,388 metric tons of CO_2e, or 74 percent of total emissions (City of Solana Beach 2009). Electricity and natural gas consumption within the residential sector was the second greatest source of 2005 emissions, generating 21,642 metric tons CO_2e, or 14 percent of the total. Electricity and natural gas use in Solana Beach's commercial sector produced 14,141 metric tons CO_2e, or 9 percent of total community emissions. The remaining 3 percent are the estimated emissions associated with decomposition of waste and wastewater emissions that were generated by the Solana Beach community during 2005. Under a business-as-usual scenario, Solana Beach's emissions will increase from 149,772 to 181,351 metric tons CO_2e, or approximately 21 percent, by the year 2020 (City of Solana Beach 2009). However, in 2012 the City will initiate preparation of a climate action plan to reduce GHG emissions in the City.

<u>Regulatory Settings</u>

Federal Plans, Policies, Regulations, and Laws

The USEPA is the federal agency responsible for implementing the federal CAA. The Supreme Court of the United States ruled on April 2, 2007, that CO_2 is an air pollutant as defined under the CAA, and that USEPA has the authority to regulate emissions of GHGs.

<u>Proposed Endangerment and Cause or Contribute Findings for GHG under the CAA</u>

On December 7, 2009, USEPA signed two distinct findings regarding greenhouse gases under section 202(a) of the Clean Air Act:

- **Endangerment Finding:** The Administrator finds that the current and projected concentrations of the six key well-mixed greenhouse gases—CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6—in the atmosphere threaten the public health and welfare of current and future generations.
- **Cause or Contribute Finding:** The Administrator finds that the combined emissions of these well-mixed greenhouse gases from new motor vehicles and new motor vehicle

engines contribute to the greenhouse gas pollution which threatens public health and welfare.

These findings do not themselves impose any requirements on industry or other entities. However, this action is a prerequisite to finalizing USEPA's proposed GHG emission standards for light-duty vehicles, which USEPA proposed in a joint proposal including the Department of Transportation's (DOT) proposed Corporate Average Fuel Economy (CAFE) standards on September 15, 2009. In April 2010, the DOT and USEPA established greenhouse gas emission and fuel economy standards for model year 2012-2016 light-duty cars and trucks. On November 16, 2011, the DOT and USEPA proposed stringent federal greenhouse gas and fuel economy standards for model year 2017-2025 passenger cars and light-duty trucks. In addition to the standards for light-duty vehicles, the DOT and USEPA announced standards to reduce GHG emissions and improve the fuel efficiency of heavy-duty trucks and buses on August 9, 2011.

Mandatory Greenhouse Gas Reporting Rule

On September 22, 2009, USEPA published the Final Mandatory Greenhouse Gas Reporting Rule (Reporting Rule) in the Federal Register. The Reporting Rule requires reporting of GHG data and other relevant information from fossil fuel and industrial GHG suppliers, vehicle and engine manufacturers, and all facilities that would emit 25,000 MT or more of CO_2e per year. Facility owners are required to submit an annual report with detailed calculations of facility GHG emissions due on March 31 for emissions in the previous calendar year. The Reporting Rule would also mandate recordkeeping and administrative requirements to enable USEPA to verify the annual GHG emissions reports. Owners of existing facilities that commenced operation prior to January 1, 2011, are required to submit an annual report for calendar year 2011.

Council on Environmental Quality Guidance

On February 18, 2010, the CEQ Chair issued a memorandum titled *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions* (U.S. Council on Environmental Quality). The draft guidance recognizes that many federal actions would result in the emission of GHGs, and that, where a proposed federal action may emit GHG emissions "in quantities that the agency finds may be meaningful," CEQ proposes that an agency's NEPA analysis focus on aspects of the environment that are affected by the proposed action and the significance of climate change for those aspects of the affected environment. In particular, the guidance proposes a reference point of 25,000 metric tons per year of direct GHG emissions as a "useful indicator" of when agencies should evaluate climate change impacts in their NEPA documents. CEQ notes that this indicator is not an absolute standard or threshold to trigger the discussion of climate change impacts.

When a proposed federal action meets an applicable threshold for quantification and reporting of GHG emissions, the draft guidance proposes the agency should consider measures and reasonable alternatives to reduce emissions. CEQ also recognizes the limitations and variability of climate change models to reliably project potential impacts. Thus, agencies should disclose these limitations when explaining the extent to which they rely on particular studies or projections.

State Plans, Policies, Regulations, and Laws

ARB is the agency responsible for coordination and oversight of state and local air pollution control programs in California and for implementing the California Clean Air Act (CCAA).

Assembly Bill (AB) 1493

AB 1493, signed in 2002, required that ARB develop and adopt by January 1, 2005, regulations that achieve "the maximum feasible reduction of greenhouse gases emitted by passenger vehicles and light-duty trucks and other vehicles determined by ARB to be vehicles whose primary use is noncommercial personal transportation in the state."

In 2004, ARB adopted standards requiring automobile manufacturers to meet fleet-average GHG emissions limits for all passenger cars, light-duty trucks within various weight criteria, and medium-duty passenger vehicle weight classes (i.e., any medium-duty vehicle with a gross vehicle weight rating less than 10,000 pounds that is designed primarily for the transportation of persons), and beginning with the 2009 model year. For passenger cars and light-duty trucks, the GHG emission limits for the 2016 model year are approximately 37 percent lower than the limits for the first year of the regulations, the 2009 model year. Before the regulations could go into effect, US EPA had to grant California a waiver under the CAA, allowing California to regulate GHG emissions from motor vehicles within the state. USEPA granted the waiver in 2009.

In the fall of 2010, California accepted compliance with the federal GHG standards as meeting similar state standards as adopted in 2004, resulting in the first coordinated national program.

State of California: Executive Order S-3-05

Executive Order S-3-05, signed in June 2005, proclaimed that the State of California is vulnerable to the impacts of climate change. Executive Order S-3-05 declared that increased temperatures could reduce the Sierra Nevada's snowpack, further exacerbate California's air quality problems, and potentially cause a rise in sea levels. To combat those concerns, the Executive Order established total GHG emission targets. Specifically, emissions are to be reduced to the 2000 level by 2010, the 1990 level by 2020, and to 80 percent below the 1990 level by 2050.

Executive Order S-3-05 directed the Secretary of Cal/EPA to coordinate a multi-agency effort to reduce GHG emissions to the target levels and to submit biannual reports to the Governor and the State Legislature describing progress made toward reaching the emission targets, impacts of global warming on California's resources, and mitigation and adaptation plans to combat these impacts. The Secretary of Cal/EPA created the California Climate Action Team (CCAT), made up of members from various state agencies and commissions, which responsible for implementing global warming emissions reduction programs. CCAT is also responsible for reporting on the progress made toward meeting the statewide GHG targets.

California State Coastal Conservancy: Policy Statement on Climate Change

The Climate Change Policy, adopted June 4, 2009, describes the concerns about the effects of global warming on coastal, marine, and near-coast resources within the Conservancy's jurisdiction. The policy of primary importance to the proposed project includes that, prior to the completion of the National Academies of Science report on sea level rise, consistent with Executive Order S-13-08, the Conservancy will consider the following sea level rise scenarios in assessing project vulnerability and, to the extent feasible, reducing expected risks and increasing resiliency to sea level rise of 16 inches by 2050, and 55 inches by 2100 (4.6 ft).

AB 32 Climate Change Proposed Scoping Plan

In December 2008, ARB adopted its *Climate Change Scoping Plan* (Scoping Plan), which contains the main strategies California will implement to achieve reduction of approximately 169 million metric tons (MMT) of CO_2e, or 28 percent from California's projected 2020 emission level of 507 MMT of CO_2e under a business-as-usual scenario.. The Scoping Plan was revised by the ARB in 2011 to reflect updated information collected since 2008. The Scoping Plan also includes ARB-recommended GHG reductions for each emissions sector of California's GHG inventory. The Scoping Plan calls for the largest reductions in GHG emissions to be achieved by implementing the following measures and standards:

- Improved emissions standards for light-duty vehicles (26.1 MMT CO_2e);
- The Low-Carbon Fuel Standard (15.8 MMT CO_2e);
- Energy efficiency measures in buildings and appliances, and the widespread development of combined heat and power systems (11.9 MMT CO_2e); and
- A renewable portfolio standard for electricity production (12.0 MMT CO_2e).

ARB has not yet determined what amount of GHG reductions it recommends from local government operations; however, the updated Scoping Plan does state that land use planning and urban growth decisions will play an important role in the state's GHG reductions because local governments have primary authority to plan, zone, approve, and permit how land is developed to accommodate population growth and the changing needs of their jurisdictions.

State of California: Executive Order S-1-07

Executive Order S-1-07, signed in 2007, establishes a goal that the carbon intensity of transportation fuels sold in California should be reduced by a minimum of 10 percent by 2020. ARB identified this Low Carbon Fuel Standard (LCFS) as a discrete early action item under AB 32, and the final ARB resolution (No. 09-31) was issued on April 23, 2009.

SB 97

Signed in August 2007, SB 97 acknowledges that climate change is a prominent environmental issue that requires analysis under CEQA. This bill directed the California Office of Planning and Research (OPR) to prepare, develop, and transmit to the California Natural Resources Agency, guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions under CEQA. On February 16, 2010, the Office of Administrative Law approved the CEQA amendments and filed them with the Secretary of State for inclusion in the California Code of Regulations. The CEQA amendments became effective on March 18, 2010. The amended guidelines establish two new guidance questions in the Environmental Checklist of the CEQA Guidelines Appendix G. The amendments do not establish a GHG emission threshold, and allow a lead agency to develop, adopt, and apply its own threshold of significance or those developed by other agencies or experts.

State of California: Executive Order S-13-08

On November 14, 2008, Governor Arnold Schwarzenegger issued Executive Order S-13-08 (Office of the Governor, 2008) to enhance the State's management of potential climate effects from sea level rise, increased temperatures, shifting precipitation and extreme weather events.

There are directives for four key actions in the Executive Order including:

a) initiate California's first statewide climate change adaptation strategy that will assess the state's expected climate change impacts, identify where California is most vulnerable and recommend climate adaptation policies by early 2009;
b) request the National Academy of Science (NAS) establish an expert panel to report on sea level rise impacts in California to inform state planning and development efforts;
c) issue interim guidance to state agencies for how to plan for sea level rise in designated coastal and floodplain areas for new projects; and
d) initiate a report on critical existing and planned infrastructure projects vulnerable to sea level rise.

Local Plans, Policies, and Laws

Both the City of Encinitas and the City of Solana Beach have prepared GHG inventories. Encinitas has a draft CAP and Solana Beach is expected to initiate the preparation of a CAP in 2012. ARB's Scoping Plan (ARB 2011) states that local governments are “essential partners” in the effort to reduce GHG emissions. The Scoping Plan also acknowledges that local governments have “broad influence and, in some cases, exclusive jurisdiction” over activities that contribute to significant direct and indirect GHG emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations. Many of the proposed measures to reduce GHG emissions rely on local government actions. The Scoping Plan encourages local governments to reduce GHG emissions by approximately 15 percent from current levels by 2020 (ARB 2008). Neither the City of Encinitas nor the City of Solana Beach has adopted any official policy or guidance relative to sea level rise projections.

4.7 Aesthetics

The visual qualities of the environment include natural and man-made features that together contribute an observer's overall impression of an area. Landform, vegetation, access, and manufactured features contribute to the aesthetics of an area. The coastlines of both Encinitas and Solana Beach have substantial visual amenities and are valued by residents and visitors alike. The Cities have adopted policies for the development and maintenance of vista points and preservation of scenic visual resources consistent with the California Coastal Act, which was adopted in 1976 to generally protect the natural and scenic resources of the California coastal zone. These policies are described in Subsection 4.7.1.

To evaluate change to the landscape character of a project site, it is necessary to understand the existing visual qualities. Visual reconnaissance were undertaken in late 2011 and early 2012. During the reconnaissance's representative photographs were taken. Each receiver site is described below and representative photographs are provided. Because the borrow sites are underwater and the actual site character is not visible, they are not discussed separately in this section. The open water surface of the borrow sites is indistinguishable for the adjacent open water visible along the entire San Diego regional coast line. The visual resources are summarized in Subsection 4.7.2.

4.7.1 Regulatory Settings

A portion of the City of Encinitas and all of the City of Solana Beach are within the Coastal Zone, and as such have developed Local Coastal Programs (LCP). An LCP consists of a coastal Land Use Plan (LUP) and implementing ordinances. The LCP issues and policies are included in the General Plans of the City of Encinitas (1995a and 1995b). Solana Beach has a standalone LUP which was approved by the CCC in March 2012. Policies relative to visual resources are described for both cities in the subsections below.

City of Encinitas

The City of Encinitas LCP is integrated into the General Plan, which specifies the following goal relative to protection of aesthetic resources:

Goal 9: Preserve the existence of present natural open spaces, slopes, bluffs, lagoon areas, and maintain the sense of spaciousness and semirural living within the I-5 View Corridor and within other view corridors, scenic highways and vista/view sheds as identified in the Resource Management Element (Coastal Act/30240/30251).

The Resource Management Element of the General Plan lists the following goals and policies relative to protection of visual access and vista points:

Goal 4: The City, with the assistance of the State, Federal and Regional Agencies, shall provide the maximum visual access to coastal and inland views through the acquisition and development of a system of coastal and inland vista points (Coastal Act/30251).

Policies 4.1, 4.2, and 4.3 specify development and/or maintenance of the following vista points within the study area:

- San Elijo and Kilkenny (overlooking lagoon and coast),
- West end of “D” Street,
- West end of “F” Street,
- West end of “J” Street,
- West end of “I” Street,
- Leucadia Beach State Park, and
- Moonlight State Beach

Goal 8: The City will undertake programs to ensure that the Coastal Areas are maintained and remain safe and scenic for both residents and wildlife (Coastal Act/30240).

Policy 8.5 encourages the retention of the coastal bluffs in their natural state to minimize geologic hazard and scenic resources.

City of Solana Beach

The City of Solana Beach General Plan specifies the following goal relative to protection of aesthetic resources (City of Solana Beach 2001):

Goal 3.2: Protect and enhance sensitive open space areas and viewsheds.

The Open Space and Conservation Element of the General Plan lists the following objectives and policies relative to protection of visual access and vista points:

Objective 1.0: Preserve existing open spaces at appropriate locations throughout the city.

Policy 1a. The city shall restrict development along the bluffs overlooking Solana Beach and other areas … to those uses which retain the open space character of these areas …in accordance with the open space plan.

Policy 1b: The city shall ensure the preservation of existing public beaches, parks, trails, open space areas, and golf courses pursuant to the adopted land use element of this general plan.

Policy 1c: The city shall implement the objectives and policies established in the community design element of the general plan, which promote the preservation and enhancement of open space features.

Objective 2.0: Preserve the city's hillside areas and natural landforms in their present state to the greatest extent possible.

Policy 2.1 enacts a hillside development ordinance that encourages development standards to: (1) maintain the natural visual character of the hillsides to the maximum feasible extent, … (3) preserve significant visual and environmental elements, … (8) encourage the use of innovative structural designs which adapt to natural topography, … and (10) require the blending of colors and materials with the hillside environment.

Objective 3.0: Maintain the quality of scenic views in the city as well as the overall visual quality of the city's landscape.

Policy 3.a. The city shall require new developments to be subject to visual impact analyses where potential impacts upon sensitive locations are identified.

Policy 3.b. The city shall require that new structures and improvements be integrated with the surrounding environment to the greatest extent possible.

The Solana Beach Municipal Code includes specific regulations designed to protect visual resources. Chapter 17.63 requires assessment of the impact of proposed development on existing view and viewsheds by the City prior to approval of proposed development or redevelopment.

The City of Solana Beach LUP was approved by the CCC on March 7, 2012 (CCC 2012). The LUP recognizes the importance of aesthetic resources and includes a number of policies that specifically address scenic views of the coastline and Pacific Ocean, some of which are identified below.

Policy 6.1: To protect the scenic and visual qualities of Solana Beach, including the unique character of the Highway 101 Corridor, the Cedros Design district, and the coastal bluffs.

Policy 6.2: Public views to and along the shoreline and the lagoon as well as to all designated open space areas and scenic resources from public vantage points, as identified in Exhibit 6-1 should be protected to the extent feasible. Development that may affect an existing or potential public view should be designed and sited in a manner so as to preserve, enhance, restore, or mitigate designated view opportunities, where feasible. Street trees and vegetation should be chosen and located so as not to block views upon maturity.

4.7.2 Visual Resources Description by Coastal Receiver Site

Key viewpoints, identified as protected in the General Plans for the City of Encinitas and City of Solana Beach, are shown in **Figure 4.7-1**. Representative photographs taken in 2011 and 2012, illustrating the visual character of the shoreline along both study receiver sites are presented in **Figure 4.7-2** through **Figure 4.7-14**. Visual characteristics of both receiver sites are summarized below based on results of the field reconnaissance. A review of city-designated significant viewpoints, was also undertaken though due to the narrowness of the beaches along the majority of the receiver sites, unless otherwise noted, views form scenic viewpoints include only limited views of beach looking north or south of the main view and during significant low tide events.

<u>Encinitas Receiver Site – 700 Block, Neptune Avenue to West H Street, Encinitas</u>

Encinitas receiver site extends approximately 1.5 miles and stretches from the beginning of the 700 block of Neptune Avenue southwards to end of West H Street. This receiver site contains a variety of visual features, dominated by uninterrupted views of the Pacific Ocean to the north and south as well as west to the horizon. The landward components of the view include partially vegetated coastal bluffs, up to 110 ft in height, the broad beach opening at Moonlight Beach, and the rock/reef point at Swami's at the southern end located just north of Santa Fe Drive. Residences, including substantial single-family houses as well as multi-story apartment/condominium structures, exist along the top of the bluffs. This residential development is visible from the beach along almost all of Encinitas receiver site. There are seawalls and/or notch filled areas intermittently through the receiver site with generally a grey or light tan appearance and of heights ranging from just a few ft to more than 50 ft. There are also a small number of steps to the beach from bluff tops. The beach itself is comprised of mixed yellow and dark brown sand that has a general grey appearance when wet.

The northern end of Encinitas receiver site includes a substantial seawall of 50 + ft in height that dominates the visual landscape of the landside of the beach, with large concrete and wooden components in grey and brown extending vertically with some relief provided by vegetated slope sections (**Figure 4.7-2**). The majority of the northern portion of Encinitas receiver site, as well as the mid section north of Moonlight Beach, consists of taller bluffs. The bottom approximately 30 to 40 ft is typically vertical and light tan in color. The remaining upper approximately 50 ft (+/-) of the bluffs tends to be steeply sloped with areas of exposed light tan rock interspersed with green vegetative coverings. Some private residences are visible atop the bluffs in this northern portion of Encinitas receiver site, most notably at the northern end and towards Moonlight Beach (**Figure 4.7-3**).

Moonlight Beach, located at the end of B Street, has a different visual character (**Figure 4.7-4**). The beach widens at Moonlight State Beach due to the Cottonwood Creek. There are no tall bluffs; instead there is a substantial back beach with generally more yellow sands. The back beach includes some paved areas and amenities including lifeguard towers and access ramp, restrooms, seating, and picnic tables. The beach is backed by green landscaped/vegetated slopes, a public park, parking lots, and viewing areas, which continues and comprises the view of the south end of Moonlight Beach. The northern end of Moonlight Beach is dominated by grey and brown structures associated with residences up the side of the slope and some landscaping, and rip-rap protection at the toe of the slope.

The long stretch of Encinitas receiver site that extends south from Moonlight Beach is dominated by the bluffs (**Figure 4.7-5**). The bluffs have 20-30 ft vertical section starting at the beach, which is light-dark tan coloring. Above the vertical section a 50-ft section of the bluffs slopes away from the beach and is covered with dense green vegetation, particularly along the portions immediately south of Moonlight Beach. Above the dense vegetation an uneven slope character is visible with a mix of tan (exposed rock) and green (vegetation) coloring, as well as less steep sloping areas covered with dense green vegetation. Multi-story condominium/apartment structures occur on top of the bluffs at the southern end of Encinitas receiver site, which are clearly visible from the beach (**Figure 4.7-6**).

The City maintains vista points at the western termini of D, F, J, and I Streets and Sea Cliff Park (**Figure 4.7-7**). These points primarily afford uninterrupted views of the Pacific Ocean to the north and south as well as west to the horizon.

<u>Solana Beach Receiver Site – Tide Park to Solana Beach Southern City Limit</u>

Solana Beach receiver site extends 1.4 miles and stretches from Tide Park, south to the southern city limit of Solana Beach, which is located at Via de la Valle. This receiver site has a similar visual character to Encinitas receiver site and is also dominated by uninterrupted views of the Pacific Ocean to the north and south as well as west on the horizon. As with Encinitas receiver site, Solana Beach receiver site includes landward views dominated by 80-ft high coastal bluffs though of a generally more vertical aspect and with typically more man-made features, such as seawalls and notch-filled bluffs. A mixture of single family residences and multi-story condominiums on top of the bluffs are visible from the beach. Sands are typical of this coastline and consist of predominantly yellow sands with black and/or grey sands inter-dispersed.

The northern end of Solana Beach receiver site is contiguous to the City's Tide Park (**Figure 4.7-8**). The beach at Table Tops, which is located north of the receiver site, is backed by an existing seawall which is 15-20 ft in height. Above the seawall, the bluffs extend an additional 60 ft in height. The beach from Table Tops to Tide Park is characterized by a mix of yellow and grey/black sands with rock reef outcroppings at the northern limit (**Figure 4.7-9**). The bluffs are generally vertical for the first 20-30 ft from beach level consisting of exposed tan colored rock or artificial rock-fill (notch-fill). Above the vertical portion of the bluffs are less steep sections that host some sporadic green vegetative cover amongst a tan to grey exposed rock surface before reaching the final 20 ft of the bluffs that are a more dark tan exposed rock that is once again vertical. On top of the bluffs landscaping, vegetation, and residential structures are visible. An earthen-colored wooden public viewing platform at the western terminus of Ocean Street on the west side of Pacific Avenue, while not visual from the beach below, provides views of the Pacific Ocean.

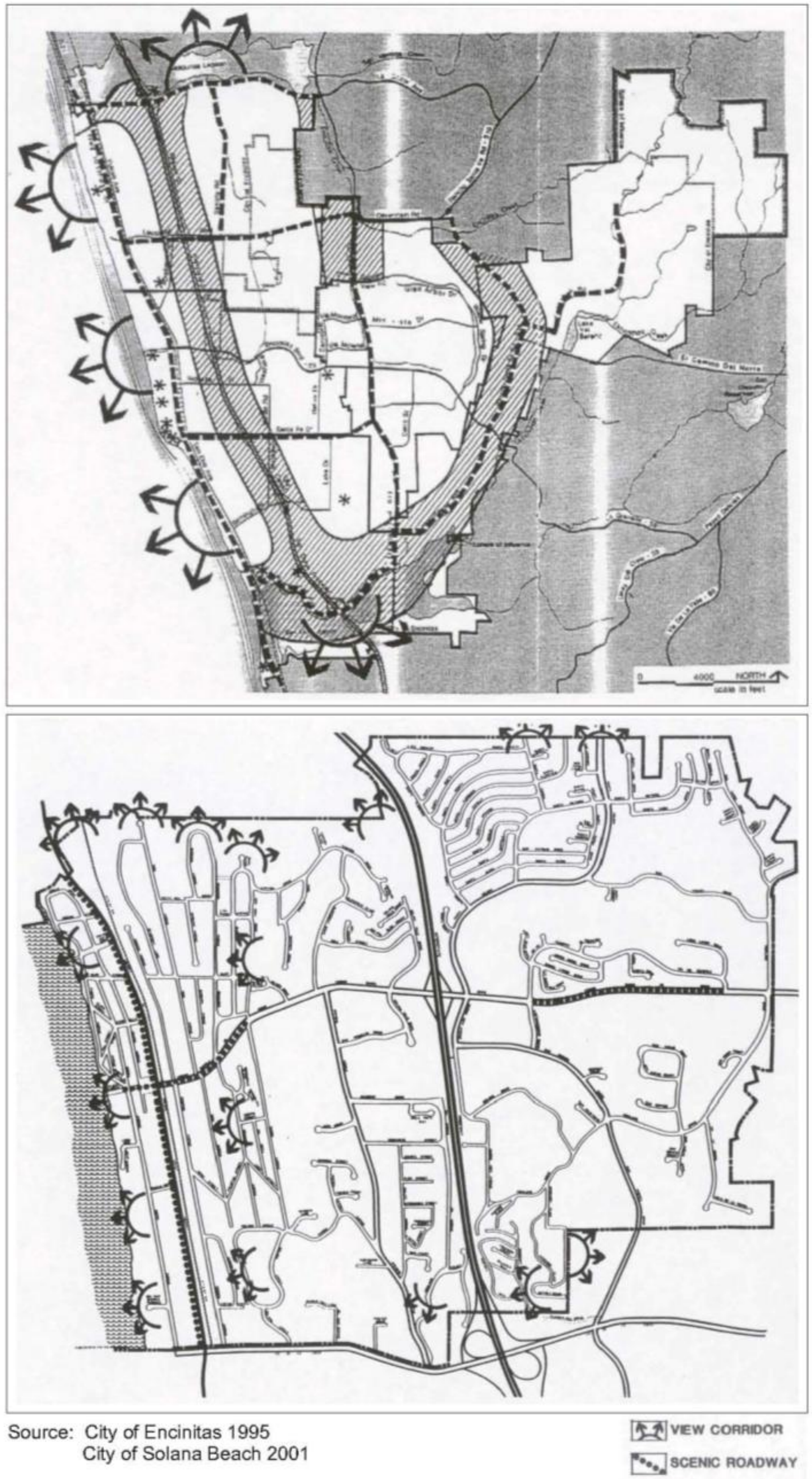
At Tide Park the beach coloring remains consistent but the beach widens and is backed by a substantial sloped seawall that is grey in color. The sandbag wall at Tide Park extends approximately 150 ft in length and 20 ft in height and mimics the slope angle of the bluffs above which is more gently sloping and more green and vegetated than the flanking bluffs to the north and the south. The sand bag wall itself is a curved structure hugging the recessed cove at Tide Park and was constructed in 1970 using hundreds of individual burlap bags filled with cement and then stacked one on top of the other. In some areas, the burlap has disintegrated leaving intermittent fabric impressions and/or a rougher cement texture which becomes visible upon a closer inspection of the seawall. Adjacent to the sand bag wall is a public beach staircase of concrete and wooden construction provides access to the beach from the public street above.

From south of Tide Park looking south to Fletcher Cove, the beach narrows again and the bluffs take on a relatively uniform appearance with seawalls and notch-fills in excess of 30 ft in height from the beach level. The newer seawalls have a more natural appearance required by the City to match the natural bluff coloring and contouring (**Figure 4.7-10**). Above the vertical sections are less steep slope portions greened with vegetation in some areas and grey or tan coloring in other areas where either natural rock is exposed or additional slope stabilization efforts are underway, such as installation of geotextile fabric and revegetation.

At Fletcher Cove Beach Park, a concrete ramp leads from a parking lot at Plaza Street to the public beach below (**Figure 4.7-11**). Landscaping and vegetation provides abundant greenery around the park and slopes adjacent to the back of the beach at Fletcher Cove, with the most extensive vegetation surrounding the access ramp. The ramp is the dominant landside feature visible at Fletcher Cove and is grey concrete with tan colored concrete wall portions adjacent to the vehicle ramp providing pedestrian access and vantages as well as storm water drain outlets. Amenities above the ramp such as the public parking lot, restrooms, play area, and seating are generally not visible from the beach. A wider beach is associated with the cove, but is narrow both north and south. Sand coloring remains yellow with grey/black components and the cove is flanked by the light tan bluffs predominant in Solana Beach receiver site.

The narrow beaches dominated by the steep, grey and tan coastal bluffs reaching up to 80 ft (+/-) high, once again comprise the landside views that extend from the south side of Fletcher Cove to the southern city limits of Solana Beach (**Figure 4.7-12**). The bluffs continue to include a high proportion of artificial strengthening and protection at the base and some stabilization of upper slopes with the tan and grey rock colorings dominating the scene with the higher green vegetated areas becoming sporadic. The residential structures on the top of the bluffs south of Fletcher Cove become increasingly visible as the scale changes from the northern single family structures to the southern multi-story condominium complexes at Fletcher Cove (**Figure 4.7-13**). A break in the visual uniformity is the structural armoring and the Del Mar Shores beach stair access that occurs in front of the western most condominium structure towards the southern limits of the city (**Figure 4.7-14**). At this location the tan and grey concrete armoring extends westerly further onto the beach than at any other location with limited small outcroppings of grey rock rip rap on the beach exposed during low tides.

Views from atop the coastal bluffs and from viewpoints designated by the city such as at the Ocean Street viewing platform, Tide Park, Fletcher Cove, Seascape Surf (Cherry Hill) and Del Mar Shores offer limited views of the beach and coastline and are valued for their uninterrupted views of the Pacific Ocean out to the horizon.



Source: City of Encinitas 1995
City of Solana Beach 2001

Figure 4.7-1 Scenic viewpoints within the Cities of Encinitas and Solana Beach

Figure 4.7-2 Encinitas Receiver Site: seawall at north end, looking northeast

Figure 4.7-3 Encinitas Receiver Site: Bluffs and homes along northern portion, looking southeast

Figure 4.7-4 Encinitas Receiver Site: Moonlight Beach looking northwest

Figure 4.7-5 Encinitas Receiver Site: Bluffs south of Moonlight Beach, looking north

Figure 4.7-6 Encinitas Receiver Site: Looking north towards south end

Figure 4.7-7 Encinitas Receiver Site: Representative views from scenic viewpoints (D Street)

Figure 4.7-8 Solana Beach Receiver Site: Table Tops and existing seawall, looking south

Figure 4.7-9 Solana Beach Receiver Site: Tide Park to Fletcher Cove looking southeast

Figure 4.7-10 Solana Beach Receiver Site: Fletcher Cove to Tide Park, looking north

Figure 4.7-11 Solana Beach Receiver Site: Fletcher Cove, looking east

Figure 4.7-12 Solana Beach Receiver Site: Looking south from Fletcher Cove

Figure 4.7-13 Solana Beach Receiver Site: Southern end, looking south

Figure 4.7-14 Solana Beach Receiver Site: from south end looking north

4.8 Cultural Resources

4.8.1 Regulatory Setting

The federal government has developed laws and regulations designed to protect cultural resources that may be affected by actions undertaken, regulated, or funded by federal agencies. The National Historic Preservation Act (NHPA) of 1966 established the Advisory Council on Historic Preservation (ACHP) and State Historic Preservation Officers (SHPO) to assist federal and state officials regarding matters related to historic preservation. Section 106 of the Act requires federal agencies to consider the effects of an action on cultural resources in or eligible for listing in the National Register of Historic Places (NRHP). The administering agency, the ACHP, has authored regulations implementing Section 106 located in 36 Code of Federal Regulations (CFR) Part 800, Protection of Historic Properties (recently revised, effective January 11, 2001).

Under Section 106 of the NHPA, initial SHPO coordination was undertaken on July 15, 2005 and initial Tribal coordination was undertaken on September 11, 2003. The USACE coordinates with the SHPO regarding defining the APE for the project, and consults with SHPO, the ACHP, and other interested parties, including Native American Tribes to determine ways to reduce impacts from the project, as warranted. Renewed coordination with SHPO and Tribal coordination was been initiated in April 2012.

According to NHPA (36 CFR Part 800), three steps are required for compliance:

a) identification of significant resources that may be affected by an undertaking;
b) assessment of project impacts on those resources; and

c) development and implementation of mitigation measures to offset or eliminate adverse impacts. All three steps require consultation with interested Native American Indian tribes, local governments, and other interested parties.

Identification and National Register of Historic Places Evaluation

36 CFR Part 800.3 discusses the consultation process. Section 800.4 sets out the steps the Agency must follow to identify historic properties. 36 CFR Part 800.4(c)(1) sets out the process for National Register of Historic Places (NRHP) eligibility determinations.

The Historic Sites, Buildings and Antiquities Act of 1935 required the survey, documentation, and maintenance of historic and archaeological sites in an effort to determine which resources commemorate and illustrate the historic and prehistory of the United States. The NHPA expanded on the NRHP and assigned the responsibility for carrying out this policy to the U.S. Department of the Interior, National Park Service (NPS). Per NPS regulations 36 CFR Part 60.4 and guidance published by the NPS, “National Register Bulletin, Number 15, How to Apply the National Register Criteria for Evaluation,” different types of values embodied in districts, sites, buildings, structures, and objects are recognized. These values fall into the following categories:

- Associate Value (Criteria a and b): Properties significant for their association or linkage to events (Criterion a) or persons (Criterion b) important in the past.
- Design or Construction Value (Criterion c): Properties significant as representatives of the manmade expression of culture or technology.
- Information Value (Criterion d): Properties significant for their ability to yield important information about prehistory or history.

Cultural resources that are determined eligible for listing in the NRHP, along with State Historic Preservation Officer concurrence, are termed “historic properties” under Section 106, and are afforded the same protection as sites listed in the NRHP.

Identification of Historic Properties

Results of literature searches, field surveys and tribal consultation are coordinated with the SHPO staff. Regulation 36 CFR Part 800.4(d) stipulates that when an agency finds that either there are no historic properties present or there are historic properties present but the undertaking will have no effect upon them, then the agency will make a “no historic properties affected” determination. If the agency finds that there are historic properties which may be affected by the undertaking, the agency will make a “historic properties affected” determination.

Assessment and Resolution of Adverse Effects

In accordance with 36 CFR Part 800.5 of the ACHP’s implementing regulations, criteria of adverse effect, impacts on cultural resources are considered significant if one or more of the following conditions would result from implementation of the proposed action:

a) An undertaking has an effect on a historic property when the undertaking may alter characteristics of the property that may qualify the property for inclusion in the NRHP. For the purpose of determining the type of effect, alteration to features of a property’s location, setting, or use may be relevant depending on a property’s significant characteristics and should be considered.

b) An undertaking is considered to have an adverse effect when the effect on a historic property may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on historic properties include, but are not limited to:

1. Physical destruction, damage, or alteration of all or part of the property.
2. Isolation of the property from or alteration of the character of the property's setting when that character contributes to the property's qualification for the NRHP.
3. Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting.
4. Neglect of a property resulting in its deterioration or destruction.
5. Transfer, lease, or sale of the property.

Regulation 36 CFR Part 800.6 details provisions relating to Memoranda of Agreement. The negotiation of such a document evidences an agency's compliance with Section 106 of the NHPA and is obligated to follow its terms. An agreement document is prepared in consultation with the SHPO. The ACHP is notified regarding the project and may participate. Interested Native American tribes, local governments, and other parties are provided the draft materials and are invited to be concurring or consulting parties to the agreement document. Mitigation measures defined in an agreement document may include data recovery excavations involving prehistoric sites, or photographic documentation and archival research for historic resources (standing buildings and structures).

4.8.2 Cultural Setting

<u>Near Surface Geology</u>

Sea level changes and other geologic processes govern the development and preservation of sediments on the continental shelf. About 20,000 years ago global sea level was as much as 400 ft lower than today (Curray 1965), exposing several miles of the coastal shelf offshore in the San Diego region. Streams incised deep valleys into the coastal plain and deposited deep fluvial sediments in the drainage bottoms. Beginning 18,000 years ago, the climate began to warm rapidly, glaciers began to melt, and sea level began rising at a rate of between 6 and 12 ft per century (Masters and Aiello 2007). This rapidly flooded the coastal shelf, converting the stream valleys into bays, and the streams then deposited their sediment load into these bays. Sea level rise was particularly rapid between about 16,000 and 7,000 years before present (B.P.), and for most of this interval the rate of sedimentation within the bays did not match the rate of sea level rise. However, this period of rapid transgression was interrupted by at least two periods with static sea level. The most significant of these events is known as the Younger Dryas (YD) episode, which occurred between 13,000 and 11,500 years ago, while the second is the 8.2 Kilo-Year (8.2KY) cooling event, which lasted between 8,400 and 8,200 years ago. These events allowed the development of wavecut terraces with stable beach profiles and the accumulation of sediment deposits within the coastal bays. On the Southern California coast, the YD episode formed a terrace that is now located at about 190 ft water depth and the 8.2KY event formed a terrace at 78 ft water depth (Nardin et al. 1981). During these periods, the continuing accumulation of sediment in the coastal bays allowed the formation of sediment bars that blocked the bay mouths to form tidal lagoons. A more gradual rate of sea level rise between 7,000 and 3,000 years ago produced many such lagoons and estuaries and allowed the development of wetland habitats containing many resources useful to prehistoric humans.

Present-day sea level was attained by about 3,000 years ago, allowing sedimentation to almost completely fill the existing coastal bays and lagoons (Inman and Jenkins 1983).

Regional Cultural History

A variety of different regional chronologies, often with overlapping terminology, has been used in coastal southern California and they vary from region to region. Today, the prehistory of San Diego County is generally divided into three major temporal periods: Paleoindian, Archaic, and Late Prehistoric. These time periods are characterized by patterns in material culture that are thought to represent distinct regional trends in the economic and social organization of prehistoric groups. In addition, particular scholars referring to specific areas utilize a number of cultural terms synonymously with these temporal labels: San Dieguito for Paleoindian, La Jolla for Archaic, and San Luis Rey for Late Prehistoric (Meighan 1959; Moriarty 1966; Moratto 1984; Rogers 1939, 1945; True 1966, 1970; Wallace 1978; Warren 1964).

Paleoindian Period

The antiquity of human occupation in the New World has been the subject of considerable debate over the last few decades. The currently accepted model is that humans first entered the western hemisphere between 12,000 and 15,000 years B.P. There is currently no firm evidence of human occupation in coastal southern California prior to 12,000 B.P. The Paleoindian period in San Diego County is considered to date to the terminal Pleistocene and the early Holocene, from at least 10,000 B.P. to 8500/7500 B.P. (Moratto 1984; Warren et al. 1998). Although no Clovis sites are documented in the region, occasional isolated fluted points have been recovered. A variety of terms has been proposed for Paleoindian assemblages in the southern California region, and Rogers (1939, 1945) coined the term San Dieguito, still widely used today, to refer to the earliest artifact assemblages in San Diego County.

San Dieguito assemblages are composed almost entirely of flaked stone tools, including scrapers, choppers, and large projectile points (Warren 1987; Warren et al. 1998). Until recently, the near absence of milling tools in San Dieguito sites was viewed as the major difference between Paleoindian economies and the lifeways which characterized the later Archaic period. The range of possible San Dieguito economic adaptations and the interpretation of the San Dieguito complex as a big game hunting tradition is based primarily on materials from the Harris Site (Ezell 1983, 1987; Warren 1966, 1967). Subsequently, it was hypothesized that differences between San Dieguito and the subsequent La Jollan artifact assemblages may reflect functional differences rather than temporal or cultural variability (Bull 1987; Gallegos 1987; Wade 1986; Warren et al. 1998).

Archaic Period

The Archaic period (similar to the Encinitas tradition and the Millingstone horizon) begins between 9,000 and 8,500 years ago and ends between 1,300 and 800 years ago (Gallegos 1992; Moratto 1984; Rogers 1966; Warren et al. 1998). A distinction is often made between coastal shell midden sites (La Jolla complex) and inland non-shell midden sites (Pauma complex). Shell middens are generally characterized by flaked cobble tools, basin metates, manos, discoids, and flexed burials. Three temporal phases have been distinguished within the Archaic period (Moriarty 1966; Warren et al. 1998).

Initial Archaic exploitation of the San Diego area littoral zone is generally considered to have entailed sizable semisedentary populations focused around resource-rich bays and estuaries (Crabtree et al. 1963; Gallegos 1992; Moriarty et al. 1959; Shumway et al. 1961; Warren 1964, 1968; Warren and Pavesic 1963; Warren et al. 1961). Shellfish were interpreted as a dietary staple; plant resources (both nuts and grasses) were also an important dietary component, while hunting and fishing were less important.

Major changes in human adaptations are considered to have occurred after 4,000 years ago when estuarine silting was considered to have become so extensive as to cause a decline in associated shellfish populations. (Masters and Gallegos 1997; Warren 1964, 1968). There are numerous exceptions to this scenario including San Diego Bay, Mission Bay, Penasquitos Lagoon/Sorrento Valley area, and the Camp Pendleton area (see discussion in Byrd 1998). Most interpretations about the timing of estuarine silting, decreased productivity at specific localities, and related effects on human settlement were based on inferences derived from excavated shell midden sites (Masters and Gallegos 1997; Miller 1966; Warren et al. 1961), and not from independent paleoenvironmental data.

A potentially important element of Archaic adaptations along the San Diego County coast may be represented by the several hundred submerged artifacts that have been reported at numerous locales. Consisting mainly of cobble mortars, these artifacts have been found off Del Mar, Solana Beach, Torrey Pines, and Point Loma, but principally in the area around La Jolla Cove and La Jolla Shores (Masters 1983; Masters and Gallegos 1997). At La Jolla Shores, many artifacts are associated with a submerged cobble bar thought to have been exposed around 4,000 B.P. (Masters and Gallegos 1997).

Late Prehistoric Period

The Late Prehistoric period is generally considered to have begun between 1,300 and 800 years ago (Moratto 1984; Rogers 1945; Warren et al. 1998). Local regional cultural complexes have been distinguished including the Yuman complex around San Elijo Lagoon and southward. In general, this period was characterized by the appearance of small pressure flaked arrow points (Cottonwood Triangular and Desert Side-notched points) indicative of bow and arrow technology, the appearance of ceramics, the replacement of flexed inhumations with cremations, the possible appearance of the mortar and pestle, and an emphasis on inland plant food collecting and processing, especially of acorns (Christenson 1990; McDonald and Eighmey 1998; Meighan 1954; Rogers 1945; True 1966; Warren 1964, 1968). The precise timing of the introduction of these items is still debated due to the poor chronological resolution and bioturbation at multicomponent sites (Griset 1996; McDonald and Eighmey 1998).

Explanations for the origin of the Late Prehistoric period vary. Kroeber (1925:578) speculated that Shoshonean-language speakers migrated from the deserts to the southern coast of California at least 1,000-1,500 years ago. Some archaeologists have embraced this hypothesis and correlated it with the origins of the Late Prehistoric period (Meighan 1954; Warren 1968). Subsequently, scholars have emphasized several cultural processes to explain Late Prehistoric cultural developments including: a chronological gap (Wallace 1955), cultural continuity and the addition of new traits (True 1966, 1970; Warren 1964, 1968), a population replacement (Bull 1987), or that several factors were at play (Moriarty 1966). In addition, the Late Prehistoric period has been paradigmatically linked with the subsequent ethnohistoric record, and direct historical analogies assume considerable adaptive stability for populations, linguistic groups, and their territorial extent as documented by Europeans.

Post-Contact Native American Ethnohistory

The Post-Contact period began in A.D. 1769 with the Spanish establishment of the Mission San Diego de Alcalá. Yet, Spanish explorers first encountered Native Americans in the San Diego area in A.D. 1542 when Cabrillo landed at Point Loma along San Diego Bay, and local inhabitants may have been negatively affected by protohistoric transmission of diseases via sea visits and through contact with Native Americans in the Baja region. Portolá's A.D. 1769 expedition from San Diego to Monterey documented a series of Native American coastal villages in the San Diego area, typically situated along the region's major drainages (Carrico 1977). The subsequent establishment of the San Juan Capistrano Mission in 1776 and the San Luis Rey de Franciscan Mission in 1798 further impacted traditional coastal settlement systems. Aculturization, assimilation, and the introduction of Old World diseases greatly disrupted and reduced Native American populations, and by the early 1800s traditional coastal villages were largely abandoned (Carrico 1998). As a result, we know very little about traditional coastal life, except what can be gleaned from mission records. Nineteenth and twentieth century ethnohistoric reconstructions provide only minimal insight into coastal adaptations.

San Elijo Lagoon falls within the territory of the Yuman-speaking Kumeyaay (also termed Diegueño and Ipai-Tipai) who occupied a large and diverse environment including marine, foothill, mountain, and desert zones (Luomala 1978; Shipek 1982; Spier 1923). Considerable variability in social organization and settlement is noted, and the Kumeyaay claimed prescribed territories but rarely owned resources (Luomala 1976; Spier 1923). Some of the lineages occupied procurement ranges that required considerable residential mobility (Hicks 1963). Acorns are considered to have been a primary staple, and Shipek (1982, 1989) argued that proto-agriculture of small-seed grasses, notably fire management activities, occurred prior to contact.

Euro-American History

The historic period in coastal San Diego County was ushered in by Juan Rodriguez Cabrillo, leader of the first expedition to what would become Alta California in September of 1542. Cabrillo was followed in 1602 by Sebastian Viscaino, but 160 more years would pass before the Spanish developed a permanent presence in San Diego through the establishment of the San Diego Presidio and mission (1769) and Mission San Luis Rey (1799). The Mexican period of California history (1821 to 1848) saw the secularization of the missions, the award of numerous large land grants by the Mexican government, and the establishment of an extensive of hide trading industry. Because San Diego Bay was utilized as a hide processing station, the waters off San Diego County were heavily traveled by trading ships.

The discovery of gold in 1849 and the signing of the treaty of Guadalupe Hidalgo acted to dramatically increase both land and maritime traffic along the San Diego coast. Additionally, the completion of the California Southern and the Santa Fe railroad tracks along the coast during the 1880s, combined with increased development of port facilities in San Diego, encouraged maritime commerce regional commerce and spurred a boom in development during the late 19th and early 20th centuries. By 1900, the Navy began to realize the strategic importance of San Diego and the Great White Fleet arrived in 1908. The rapid development of the San Diego fishing industry in the first half of the 20th century also greatly increased the maritime use of the coast. During the 1930s prohibition smugglers used the north county beaches. Illegal shipments of bootleg liquor were landed along the remote stretch of beaches and hidden in brush to await transportation by truck. The outbreak of World War II greatly spurred development in San Diego

County and brought increased Naval activities throughout San Diego waters and adjacent shore.

4.8.3 Receiver Sites

A records and literature search was conducted at the South Coastal Information Center at San Diego State University. This facility is part of the California Historical Resources Information System (CHRIS), which is a statewide system for managing information on prehistoric and historical resources identified in California. It is authorized and directed by the state Office of Historic Preservation (OHP). The information available at these centers consists of current and historic maps, historic register lists, site records, and survey reports. Historic registers include the National Register of Historic Places (2000), the California State Historic Resources Inventory (2000), the California Points of Historical Interests (1992) and the California Historical Landmarks (1996).

There are no previously recorded historic properties within the areas of potential effect s (APE). A 0.5-mile radius of the APE indicates that sacred sites have been identified and recorded on the bluffs above the shoreline. With erosion, some of these artifacts have ended up underwater for divers to find. The APE was surveyed by a USACE Staff Archaeologist in June 2004 and again in June 2012. No cultural material was located.

4.8.4 Offshore Borrow Sites

Cultural resources within the proposed borrow sites may include either historic or prehistoric resources. Historic resources may include shipwrecks, discarded debris, or materials intentionally placed to provide artificial reefs. Prehistoric resources may include submerged artifacts such as cobble mortars, pestles, net weights, metates, flaked stone tools, or other items (Masters 1983; Masters and Gallegos 1997), or preserved deposits of prehistoric habitation debris on the continental shelf that were inundated during marine transgression during the Holocene.

Substantial information on the potential for significant cultural resources within borrow sites SO-6, SO-7, and MB-1 is provided by investigations conducted in support of the RBSP I (Pettus and Hildebrand 2000) and the more recent RBSP II (Hildebrand and York 2010) undertakings. The following discussion is based primarily on the RBSP I and RBSP II findings.

<u>Data Sources</u>

Prehistoric Resources

The potential for prehistoric resources within the borrow sites was assessed mainly through the development and application of a predictive model to address the likelihood for the occurrence and preservation of archaeological deposits within each borrow area (Pettus and Hildebrand 2000; Hildebrand and York 2010). Based on analysis of geophysical data, sediment cores, and marine invertebrate fossils, this model considers access to prehistoric resources, topography, depth of erosion, sediment supply, and rate of sea level rise in assessing the archaeological sensitivity within each borrow area. A fundamental component of the model is that certain geologic settings are conducive to the burial and preservation of cultural materials, placing them beneath the impact of shoreline erosion during marine transgression. River valley settings are particularly appropriate, since sites within these valleys may become covered by fluvial and estuary sediments and protected from erosion. Additionally, records on file in the South Coast Information Center of the California Historical Resources Information System (CHRIS) were consulted to identify the locations of any known submerged artifacts within the borrow sites.

Historic Resources

Assessment of the potential for historic-period cultural resources within the borrow areas is based mainly on data compiled for the RBSP I project (Pettus and Hildebrand 2000). This assessment presents the results of archival research and review of side-scan sonar data obtained for the RBSP I borrow areas. Archival sources and interviews included the following:

- *Museums and Historical Societies*: Archival research was conducted at the San Diego Historical Society, the San Diego Maritime Museum, the National Maritime Museum, the San Diego Museum of Man, and Scripps Institute of Oceanography.
- *Shipwreck Databases*: Shipwreck databases consulted included government shipwreck data on file at the Minerals Management Service (Outer Continental Shelf Office) in Camarillo, California, and the California Shipwreck Database maintained by the CSLC, as well as two private shipwreck databases (the Smith Collection and the Schwemmer Collection).
- *Cultural Resource Registers*: The National Register of Historical Resources, the California State List of Historic Landmarks, and the California Historical Information System were consulted.
- *Charts*: Historic hydrographic charts, topographic maps, and existing locations data on shipwrecks in local and regional newspaper files were examined.
- *Cultural Resource Reports*: A wide variety of cultural resources reports and papers were consulted. In addition to the previous RBSP I study (Pettus and Hildebrand 2000), reports most pertinent to the present borrow areas are Stright (1986, 1990), Stickel (1977), Gagliano (1977), and Piersen et al. (1987).

The RBSP I investigations at SO-6 and MB-1 also included side-scan sonar imaging compiled by Sea Surveyor, Inc. (Pettus and Hildebrand 2000). The compiled images allow the detection of seafloor bedforms or objects such as sunken ships or structures. These covered the areas currently proposed for the MB-1 borrow sites, and an area adjacent to the SO-6 borrow site.

<u>Borrow Site SO-6</u>

Geoarchaeology

The potential for intact prehistoric archaeological deposits was assessed through the analysis of seismic reflection data and sediment recovered in selected vibracores taken from the proposed borrow site (Hildebrand and York 2010). The interpretation of the vibracore and seismic reflection data suggests a shallow (3–5 ft below seafloor) bedrock interface, with overlying offshore sediments in the northern and southern portions of the site. The offshore river valley is filled with a sequence of sedimentary facies that contains 5 to 15 ft of estuary/lagoonal sediments, and a 1- to 2-ft intertidal sand layer, underlain by fluvial sediments. A paleochannel is located along the southern portion of the river valley, flanked by terraces at depths 5 to 10 ft shallower.

Based on the RBSP II study, the potential for occurrence of archaeological sites at SO-6 varies with location. Uneroded regions of the survey area located along the margins of the river valley are designated as having a high potential for archaeological site presence. These areas are extensions of the eroded zones where artifact materials are exposed and have been recovered by divers. The probability of site occurrence diminishes with distance from the river valley to the north and south, both due to lower desirability for prehistoric site location and because these regions tend to have experienced greater erosion with offshore sediments resting directly on bedrock. The terraces within the river valley (both north and south of the paleochannel) have a moderate probability for site occurrence since these are regions where an intertidal-to-fluvial (pre-transgression to transgression) contact is present. The river paleochannel has a low probability for prehistoric site occurrence. The designated dredge area at SO-6 falls mostly within the paleochannel and therefore has low potential for prehistoric site occurrence.

Historic Resources

Side-scan sonar and magnetometer data was collected during the RBSP I effort revealed a single isolated target is located just seaward of the proposed dredge zone (Pettus and Hildebrand 2000). Although this feature remains unidentified, analysis of sonar imagery suggests that it has sufficient apparent size, height above sea floor and reflectivity to represent a cultural feature such as a sunken vessel.

According to Pettus and Hildebrand (2000), two historic ships have been reported to exist in this vicinity. Precise locations of shipwrecks are often notoriously inaccurate but historic vessel wreckage washed ashore at Cardiff State Beach in 1991. The wreckage is currently curated with California State Parks in Old Town San Diego. Another probable wrecksite was reported in the August 1955 San Diego Union. A cultural resource management study performed in 1990 (Pettus) at the San Elijo outfall, seen at the southern edge of the survey grid, revealed no submerged cultural resources.

No shipwrecks or other historic cultural resources are verified within the area of SO-6.

<u>Borrow Site SO-5</u>

Geoarchaeology

The seismic reflection profiles reported at SO-5 during the RBSP II study (Hildebrand and York 2010) reveal a well-defined bedrock layer beneath sedimentary sequences that thicken seaward. In the beach parallel profiles, the outline of a broad paleochannel is preserved, with some suggestion that the channel may be divided into at least two separate branches. Based on the survey and core data, a geological cross-section was developed for SO-5 in support of RBSP II. The interpretation shows the river valley filled with a succession of sediment facies. The lowest strata is pre-transgression fluvial sediments, represented by cores SO-5-209 and SDG-79. Above this is a substantial strata of intertidal sands, measuring 2 to 8 ft thick, which is suggestive of a tidal bar at this location. At mid-depths in this core, poorly sorted sand deposits represent lagoonal environments. The uppermost layer is an offshore sediment facies with uniformly silty-sand materials.

The potential for occurrence of archaeological sites at SO-5 varies with location within the borrow site (Hildebrand and York 2010). Uneroded regions of the site located along the margins of the river valley are designated as having a high potential for archaeological site presence. These are extensions of the eroded zones; on the southern margin, artifact materials are exposed and have been recovered by divers. The probability of site occurrence diminishes with distance from the river valley margin to the north and south, both due to lower desirability for prehistoric site location, and because in these areas the offshore sediments rest directly on bedrock. The terraces within the river valley on both the north and south have a moderate probability for site occurrence. Although the northern terrace is poorly defined by the existing data, the southern terrace appears to be at a shallower depth, so it may have a somewhat higher potential for site occurrence. The river paleochannel has a low probability for prehistoric site occurrence. The potential for occurrence and preservation of archaeological sites within the SO-5 borrow site is low to moderate.

Historic Resources

No shipwrecks or other historic cultural resources are recorded within the area of SO-5.

Borrow Site MB-1

Geoarchaeology

Seismic reflection profiles at MB-1 reveal a stair-stepped series of formations, stepping downward in the beach perpendicular direction (e.g., Sea Surveyor 1999, line 1). These are suggestive of a series of stable sea level stands at this location. These stable sea level stands may also represent the YD or 8.2KY events. The beach parallel subbottom profiles at MB-1 suggest a well-defined paleochannel, present in the southern portion of the river valley.

During the RBSP II investigations (Hildebrand and York 2010) a geological cross-section for MB-1 was developed based on the seismic reflection and core data. The cross-section shows that the proposed dredge area for MB-1 is entirely within the submerged river valley. The river valley is filled with a sequence of sediment facies on the north side as follows (from top to bottom): estuary/lagoon, intertidal, marsh, and fluvial. On the south side of the valley the paleochannel is filled with at least 15 ft of intertidal sands. The channel fluvial layer and basement rocks were not reached by any of the cores (up to 15 ft below the seafloor).

In the northern portion of the survey grid the sediment sequence suggests a low energy transition from fluvial to marsh sediments, conductive to prehistoric site preservation. In the central and southern portions of the grid, core data suggest that the sediments were deposited in a high-energy intertidal environment. Pebble and cobble layers are present throughout these cores, which are dominated by poorly sorted sands. An intertidal environment is also suggested by the presence of bean clam (Donax gouldii) throughout the depth range of these cores (e.g., SDG-95; MB1-205).

The potential for occurrence of archaeological sites at MB-1 varies with location within the survey area. Uneroded regions of the survey area on both the north and south margins of the river valley appear to have a high potential for archaeological site presence, owing to their desirability for prehistoric occupation and potential for preservation. These areas, however, are adjacent to but outside of the proposed dredging area. In the northern portion of the river valley there is a low energy transition between fluvial and marsh sediments that would help to preserve prehistoric materials contained in the fluvial sediments. Although this transition was identified at approximately 10 ft below the seafloor in core MB-203, it may occur at somewhat higher elevations elsewhere in the borrow area. Therefore, the northern portion of MB-1 is considered to have moderate potential for archaeological site occurrence and preservation at depths less than 8 ft below the seafloor and high potential at lower than 8 ft. The potential for site presence and preservation is reduced in the southern portion of the river valley within the paleochannel, given that these sediments are intertidal, perhaps representing a tidal sandbar. The southern portion of the MB-1 borrow area has a low probability for prehistoric site occurrence.

Historic Resources

The RBSP II study identified several historic cultural features within the overall MB-1 study area. Three intentionally sunken vessels are located in this area including the Yukon, Ruby E, and El Rey. At least three other types of subsea cultural features exist within or in the immediate vicinity of MB-1. Artificial reef materials are found in several locations proximate to MB-1. The NOSC Tower, a navy research platform collapsed onto the seafloor in 1986, lies on the seafloor at the eastern edge of the proposed borrow area. These resources are outside the areas defined for the MB-1 dredging and would not be affected.

4.8.5 Native American Concerns

Section 106 of the National Historic Preservation Act, the American Indian Religious Freedom Act of 1978, the Native American Graves Protection and Repatriation Act of 1990, and Executive Order 13084 of May 14, 1999: Consultation and Coordination with Indian Tribal Governments all require that government agencies consult with Native Americans to determine their interests in federal projects. A search at the California Native American Heritage Commission (CNAHC) determined that no sacred sites are recorded within the project area. Project description, maps, and a letter inviting comment on the project were mailed (May xx, 2012) to those on the list provided by the CNAHC (Appendix A (Scoping Report)).

4.9 Noise

This section describes the existing noise setting within the project study area. Sound intensity and noise levels described in this EIS/EIR are measured in decibels (dBA) that are A-weighted to correct for the relative frequency response of the human ear. Unlike linear units (e.g., inches or pounds), dBA are measured on a logarithmic scale, representing points on a sharply rising curve (Caltrans 2009).

The decibel scale increases as the square of the change, representing the sound pressure energy. While 10 dBA are 10 times more intense than 1 decibel, 20 dBA is 100 times more intense and 30 dBA is 1,000 times more intense. A 10- dBA increase in sound level is perceived by the human ear as only doubling of the loudness of the sound. Ambient sounds generally range from 30 dBA (very quiet) to 100 dBA (very loud) (Caltrans 2009).

Sound levels are generated from a source and their dBA level decreases as the distance from that source increases. For a single point source, such as construction operations, sound level decays approximately 6 dBA for each doubling of distance from the source (Caltrans 2009).

Several rating scales (or noise "metrics") exist to analyze adverse effects of environmental noise on a community. These scales include the average equivalent noise level (L_{eq}), the community noise equivalent level (CNEL) and the day/night noise average level (L_{dn}). L_{eq} is a measurement of the sound energy level averaged over a specified time period, usually 1 hour (Caltrans 2009).

Unlike the L_{eq} metric, the CNEL and L_{dn} noise metrics are based on 24 hours of measurement. CNEL also differs from L_{eq} in that it applies a time-weighted factor designed to emphasize noise events that occur during the evening and nighttime hours (when quiet time and sleep disturbance is of particular concern). Noise occurring during the daytime period (7:00 a.m. to 7:00 p.m.) receives no penalty. Noise produced during the evening time period (7:00 p.m. to 10:00 p.m.) is penalized by 5 dBA, while nighttime (10:00 p.m. to 7:00 a.m.) noise is penalized by 10 dBA. The Ldn noise metric is similar to the CNEL metric except that the period from 7:00 p.m. to 10:00 p.m. receives no penalty. Both the CNEL and Ldn metrics yield approximately the same 24-hour value with the CNEL being the more restrictive (i.e., higher) of the two by approximately 0.3 dBA (Caltrans 2009).

4.9.1 Regulatory Settings

Applicable noise standards include Federal regulations, State regulations (Health and Safety Code Section 46000 et seq.), and municipal ordinances with specific noise criteria established by the Cities of Encinitas and Solana Beach.

Federal Government

The Federal Government regulates occupational noise exposure common in the workplace through the Occupational Safety and Health Administration (OSHA) under the USEPA. Noise exposure of this type is dependent on work conditions, is addressed through a facility's or contractor's Health and Safety Plan, and is therefore not applicable to this project and is not addressed further in this document.

State of California Standards

The California Office of Noise Control has set acceptable noise limits for sensitive uses. Sensitive-type land uses, such as schools and homes, are "normally acceptable" in exterior noise environments up to 65 dBA CNEL and "conditionally acceptable" in areas up to 70 dBA CNEL. A "conditionally acceptable" designation implies that new construction or development should be undertaken only after a detailed analysis of the noise reduction requirements for each land use type is made and needed noise insulation features are incorporated in the design. By comparison, a "normally acceptable" designation indicates that standard construction can occur with no special noise reduction requirements.

City of Encinitas

Encinitas receiver site is located within the City of Encinitas. **Figure 4.9-1**, reprinted from the City of Encinitas General Plan Noise Element, illustrates the acceptable noise levels for the various types of land uses within the city. This figure is based on the state guidelines relative to noise levels.

The majority of the area surrounding the lagoon is an ecological reserve and low density residential. These residential uses are normally acceptable in areas with noise levels up to 60 dBA L_{dn} and conditionally acceptable up to 70 dBA L_{dn}. Additionally, the west portion of the project area near Highway 101 / Pacific Coast Highway commercial uses. These uses are normally acceptable in areas with noise levels up to 67.5 dBA. Water recreation is normally acceptable up to 70 dBA L_{dn}. Note that in all cases, these standards are to be used in citing new land uses. The City also sets an interior standard of 45 dBA for residential land uses. Shoreline bluff area in the City of Encinitas consists primarily of residential development with some commercial development and public park areas.

The goals and policies included in the Noise Element are administered through the Municipal Code. Chapter 9.32, "Noise Abatement and Control." Section 9.32.410 provides for noise generated from the use of construction equipment. The section notes that:

"Except for emergency work, it shall be unlawful for any person, including the City, to operate construction equipment at any construction site, excepts as outlined in Subsections A and B below:

- It shall be unlawful for any person, including the City, to operate construction equipment at any construction site on Sundays, and days appointed by the President, Governor or the City Council for public fast, Thanksgiving, or holiday. In addition, it shall be unlawful for any person to operate construction equipment at any construction site on Mondays through Saturdays except between the hours of 7 a.m. and 7 p.m.
- No such equipment, or combination of equipment regardless of age or date of acquisition, shall be operated so as to cause noise at a level in excess of 75 dBA for more than 8 hours during any 24-hour period when measured at or within the property lines of any property which is developed and used either in part of in whole for residential purposes."

Section 9.32.417 provides for exemptions to the regulations. Subsection D notes that "The provisions of this chapter shall not apply to an activity to the extent regulation thereof has been preempted by State or Federal law."

<u>City of Solana Beach</u>

Project Solana Beach receiver site is located within the City of Solana Beach. **Figure 4.9-2**, reprinted from the City of Solana Beach General Plan Noise Element, illustrates the acceptable noise levels for the various types of land uses within the city. Again, the majority of the land uses in this receiver site consist of low and medium density residential uses. Residential uses are clearly compatible in areas with noise levels up to 60 dBA CNEL and normally compatible up to 70 dBA CNEL. **Figure 4.9-3** presents the City's interior and exterior standards. This figure shows residential land uses to be acceptable to an exterior level of 65 dBA CNEL. The interior standard is 45 dBA CNEL with windows shut. If windows are to be used for ventilation (i.e., no mechanical ventilation is to be provided for new development, the exterior standard is reduced to 55 dBA CNEL.

The goals and policies included in the Noise Element are administered through the Solana Beach Municipal Code (SBMC). SBMC Section 7.34.100, "Construction hours and noise levels limited" provides for noise generated from the use of construction equipment. The section notes that:

"The erection, demolition, alteration or repair of any building structure or the grading or excavation of land in such a manner as to create disturbing, excessive or offensive noise during the following hours, except hereinafter provided, is a violation of this code:

Before 7:00 a.m. or after 7:00 p.m., Monday through Friday, and before 8:00 a.m. or after 7:00 p.m. on Saturday;

All day on Sunday, New Year's Day, Martin Luther King Day, President's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day.

SBMC 7.34.100 also states:

> *"C. Construction noise levels shall not exceed 75 decibels for more than eight hours [L_{eq}(8)] during any 24-hour period when measured at or within (sic) property lines of any property which is developed and used either in part of in whole for residential purposes."*

SBMC Section 7.34.170 provides for exemptions. Subsection C notes that "The provisions of this chapter shall not apply to an activity to the extent regulation thereof has been preempted by State or Federal law. In the past, the City has granted an exemption from this section of the SBMC to allow beach nourishment activities associated with the RBSP I and RBSP II to allow expedited and efficient placement of materials on a 24/7 basis.

4.9.2 Baseline Noise Conditions

A field survey was performed on January 12, 2012 to augment known existing noise measurement levels from previous environmental documents in the same area. The study revealed that noise within the project area is generally characterized by noise from waves breaking in the surf zone and people talking in addition to vehicles traveling on nearby roadways including Highway 101. Intermittent railroad noise is also notable in the project area. While several trains were noted during the field study (the Coaster, Amtrak and freight trains), no trains actually passed during a noise measurement. Aircraft overflights also contribute to the ambient noise and numerous helicopter overflights were observed.

The field survey included two noise readings. The locations of these readings were chosen to best represent the beach area and the adjacent homes. In all cases, the L_{eq}, L_{min}, L_{max}, L_{50}, and L_{90} values were recorded. As discussed above, the L_{eq} value is representative of the equivalent noise level or logarithmic average noise level obtained over the measurement period. The L_{min} and L_{max} represent the minimum and maximum root-mean-square noise levels obtained over a period of one second. The L_{50} and L_{90} represent the values that are exceeded 50 and 90 minutes per hour if the readings were extrapolated out to an hour's duration. The monitoring locations are illustrated in **Figure 4.9-4**, and noise readings are presented in **Table 4.9-1**.

Table 4.9-1 Noise Measurements (2012)

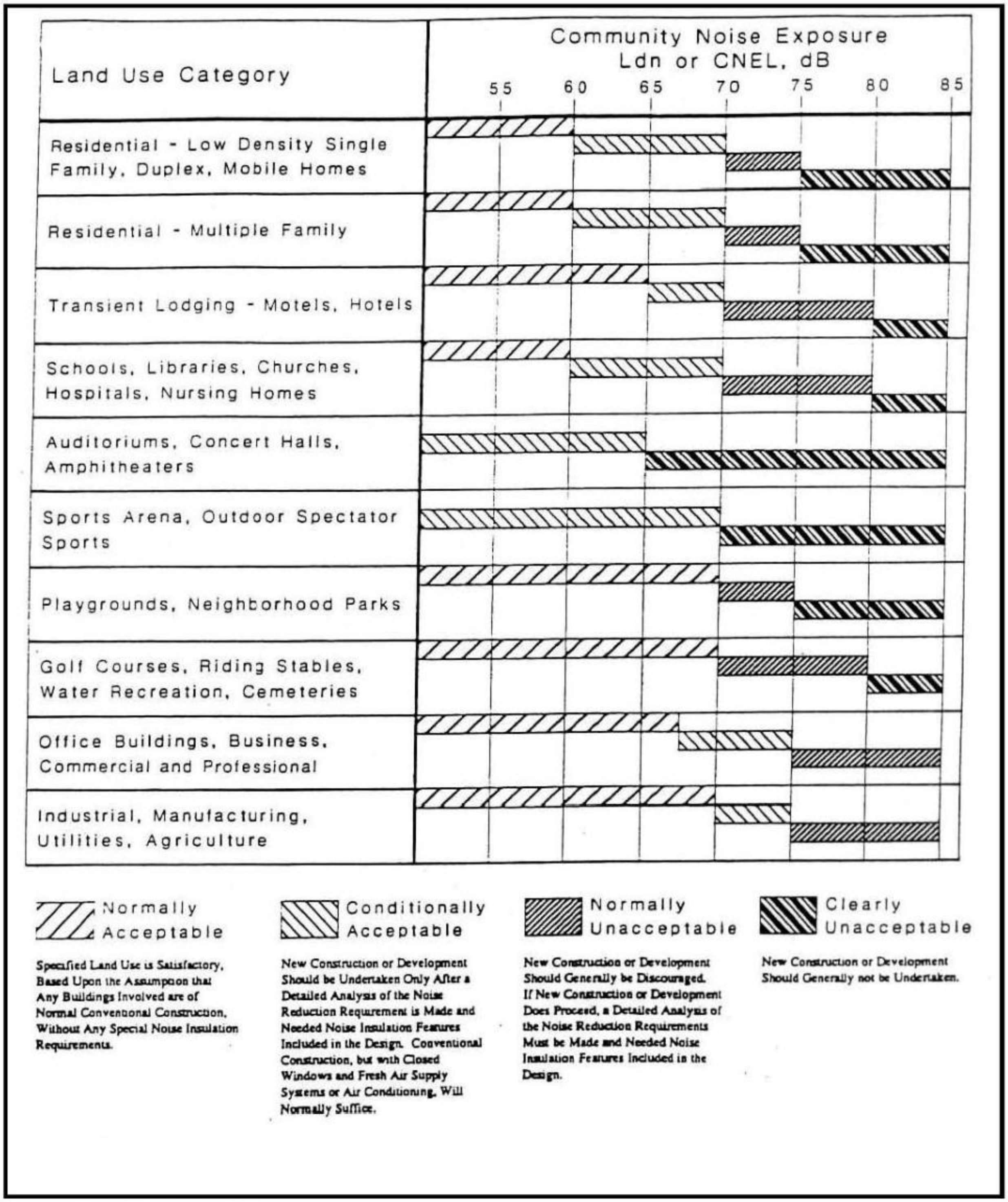
Monitoring Location	L_{eq} (dBA)	L_{50} (dBA)	L_{90} (dBA)	L_{min} (dBA)	L_{max} (dBA)
NM-1	66.3	65.9	64.7	62.6	71.4
NM-2	66.0	66.2	65.0	63.9	75.0

Noise measurements were also made in the project area at various coastal locations as part of the environmental compliance documents prepared for the RBSP I (2001) and RBSP II (2012) projects. Those noise measurements were made between July 26 and September 27, 1999, using a Larson-Davis Laboratories Model 712 Type 2 sound level meter and on April 20 and 27, 2010 using a Larson-Davis Laboratories Model 820 Type 1 sound level meter. The results of those measurements are shown below in **Table 4.9-2** which indicates that ambient noise levels have increased approximately 3 to 6 dBA's in both receiver sites in the approximately eleven years between the two sound measurements.

Table 4.9-2 Noise Measurements (1999 and 2010)

Monitoring Location	L_{eq} in 1999 (dBA)	L_{eq} in 2010 (dBA)
700 Block, Neptune Avenue to end of West H Street, Encinitas	63 to- 66	69
Tide Park to Solana Beach Southern City Limit	63 to- 66	69

The Noise environment offshore in the vicinity of the offshore borrow sites generally consists of boating activities associated with commercial and recreational boaters traversing within the project study area. As a consequence of the distance of 2,000 to 3,000 ft, and as sound levels dramatically decrease with distance, such boating activities are generally not audible along the beaches or by sensitive residential receptors adjacent to the beaches.



Source: City of Encinitas 1995

Figure 4.9-1 State of California Noise and Land Use Compatibility Guidelines

LAND USE CATEGORIES		COMMUNITY NOISE EQUIVALENT LEVEL CNEL						
CATEGORIES	USES	≤55	60	65	70	75	80≥	
RESIDENTIAL	Single Family, Duplex, Multiple Family	A	A	B	B	C	D	D
RESIDENTIAL	Mobile Home	A	A	B	C	C	D	D
COMMERCIAL Regional, District	Hotel, Motel, Transient Lodging	A	A	B	B	C	C	D
COMMERCIAL Regional, Village District, Special	Commercial Retail, Bank Restaurant, Movie Theatre	A	A	A	A	B	B	C
COMMERCIAL INDUSTRIAL INSTITUTIONAL	Office Building, Research and Development, Professional Offices, City Office Building	A	A	A	B	B	C	D
COMMERCIAL Recreation INSTITUTIONAL Civic Center	Amphitheatre, Concert Hall Auditorium, Meeting Hall	B	B	C	C	D	D	D
COMMERCIAL Recreation	Childrens Amusement Park, Miniature Golf Course, Go-cart Track, Equestrian Center, Sports Club	A	A	A	B	B	D	D
COMMERCIAL General, Special INDUSTRIAL, INSTITUTIONAL	Automobile Service Station, Auto Dealership, Manufacturing, Warehousing, Wholesale, Utilities	A	A	A	A	B	B	B
INSTITUTIONAL General	Hospital, Church, Library Schools' Classroom	A	A	B	C	C	D	D
OPEN SPACE	Parks	A	A	A	B	C	D	D
OPEN SPACE	Golf Course, Cemeteries, Nature CentersWildlife Reserves, Wildlife Habitat	A	A	A	A	B	C	C
AGRICULTURE	Agriculture	A	A	A	A	A	A	A

INTERPRETATION

ZONE A
CLEARLY COMPATIBLE — Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction without any special noise insulation requirements.

ZONE B
NORMALLY COMPATIBLE — New construction or development should be undertaken only after detailed analysis of the noise reduction requirements are made and needed noise insulation features in the design are determined. Conventional construction, with closed windows and fresh air supply systems or air conditioning, will normally suffice.

ZONE C
NORMALLY INCOMPATIBLE — New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of noise reduction requirements must be made and needed noise insulation features included in the design.

ZONE D
CLEARLY INCOMPATIBLE — New construction or development should generally not be undertaken.

Source: City of Solana Beach 2001

Figure 4.9-2 City of Solana Beach Land Use Compatibility Guidelines

LAND USE CATEGORIES		ENERGY AVERAGE CNEL	
CATEGORIES	USES	INTERIOR[1]	EXTERIOR[2]
RESIDENTIAL	Single Family, Duplex, Multiple Family	45[3] 55[4]	65
	Mobile Home	-----	65[5]
COMMERCIAL INDUSTRIAL INSTITUTIONAL	Hotel, Motel, Transient Lodging	45	65[6]
	Commercial Retail, Bank Restaurant	55	-----
	Office Building, Research and Development, Professional Offices, City Office Building	50	-----
	Amphitheatre, Concert Hall Auditorium, Meeting Hall	45	-----
	Gymnasium (Multipurpose)	50	-----
	Sports Club	55	-----
	Manufacturing, Warehousing, Wholesale, Utilities	65	-----
	Movie Theatres	45	-----
INSTITUTIONAL	Hospital, Schools' classroom	45	65
	Church, Library	45	-----
OPEN SPACE	Parks	------	65

INTERPRETATION

1. Indoor environment excluding: Bathrooms, toilets, closets, corridors.
2. Outdoor environment limited to: Private yard of single family
   Multi-family private patio or balcony which is served by a means of exit from inside.
   Mobile home Park
   Hospital patio
   Park's picnic area
   School's playground
   Hotel and motel recreation area
3. Noise level requirement with closed windows. Mechanical ventilating system or other means of natural ventilation shall be provided as of Chapter 12, Section 1205 of UBC.
4. Noise level requirement with open windows, if they are used to meet natural ventilation requirement.
5. Exterior noise level should be such that interior noise level will not exceed 45 CNEL.
6. Except those areas affected by aircraft noise.

Source: City of Solana Beach 2001

Figure 4.9-3 City of Solana Beach Interior and Exterior Noise Standards

Figure 4.9-4 Noise Measurement Locations

4.10 Socioeconomics and Environmental Justice

Under NEPA, "economic" and "social" effects are environmental consequences to be examined (40 C.F.R. § 1502.16 and 40 C.F.R. § 1508.8). Under CEQA, the focus of an EIR is primarily on potential changes to the "physical conditions" which include land, air, water, flora, fauna, population, housing, noise, and objects of historic or aesthetic significance (Cal. Pub. Res. Code § 21060.5; Cal. Code Regs. Title 14 § 15358(b) and § 15382).

In addition to examining potential social and economic impacts to local and regional populations as a whole, any NEPA document must consider the potential for disproportionate environmental impacts to minority or low-income populations, as well as potential disproportionate environmental health and safety risks to children, in order to comply with relevant federal Executive Orders.

This section presents local and regional demographic and income information as well as information on commercial fisheries, the local social and economic sector most likely to be adversely impacted by the proposed project. Recreational fishing and diving is described as part of Section 4.10.5 in terms of economic value based on the estimated number of participants. Other information on tourism (based on number of beach visitors) and recreation services that are within the vicinity of the study area (on-shore, surfing and off-shore borrow sites) are described in Section 4.13 (Recreation).

The data presented in this section for local jurisdictions and the region as a whole are from the U.S. Census (2010a-d) and SANDAG's most recent population and housing estimates data available from their website (2012).

4.10.1 Population

Approximately 60 percent of Californian residents live in southern California, a distribution that has not changed significantly in the past four decades. Almost 75 percent of Californians live in the coastal regions, with the inland-dwelling proportion increasing steadily over the past three decades (Johnson 2002).

San Diego County, like the rest of coastal southern California, experienced a slowed recorded population growth in the 2000s due to the recession in the early part of the decade. However, overall, growth still occurred. International migration was especially strong in the South Coast and San Diego (San Diego and Imperial Counties) regions.

The population of San Diego County in 2010 comprised 8 percent of the population of California, as the County population was 3,095,313 and the State population was 37,253,956. As shown in **Table 4.10-1**, the County experienced a net population increase of 10.0 percent between 2000 and 2010, similar to California as a whole during this same period (10.0 percent). Both the County and California as a whole are expected to experience a large amount of growth through the year 2050. San Diego County is expected to experience a population growth of approximately 41.7 percent by 2050, which is lower than the State's expected growth of 59.7 percent.

Table 4.10-1 Comparison of Population Growth, 2000 to 2050

Place	2000	2010	2050	% Change (2000-2010)	% Change (2010-2050)
City of Encinitas	58,014	59,518	76,659	2.6%	28.7%
City Solana Beach	12,979	12,867	15,942	-0.9%	23.9%
San Diego County	2,813,833	3,095,313	4,384,867	10.0%	41.7%
California	33,871,648	37,253,956	59,507,876	10.0%	59.7%

Source: U.S. Census Bureau 2000, 2010a; SANDAG 2012.

The City of Encinitas has experienced a growth of approximately 2.6 percent between 2000 and 2010 and is projected to continue growing with a 28.7 percent increase in population by 2050. The City of Solana Beach did not experience any growth between 2000 and 2010 but is expected to grow by 23.9 percent from 2010 to 2050 according to the SANDAG 2050 Regional Growth Forecast (RGF). Although the Cities of Encinitas and Solana Beach are expected to increase in population by 2050, they are growing at a slower rate than San Diego County and California as whole. Both cities are nearly physically built out and further growth is inferred to result from infill development.

Another contributing factor to the lower population growth in both cities is the higher median age of the population. Solana Beach has a median age of 45.1 years and the median age in Encinitas is 41.7 years, which for both cities is much older than San Diego County's median age of 35 years and the median age for California (34.7 years). A large portion of the population of Solana Beach is above the age of 65 (19 percent), compared to Encinitas (12 percent), and the State of California and San Diego County (both 11 percent). Solana Beach also has a lower percentage below age 18 (16 percent), compared to Encinitas (19 percent), and San Diego County (24 percent).

4.10.2 Housing

In 2010, the region's homeownership rate (owner-occupied housing units) was 54.4 percent, as shown in **Table 4.10-2**. The homeownership rate for the Cities of Encinitas and Solana Beach was slightly higher than the region at 63.1 percent and 60.2 percent, respectively.

Table 4.10-2 Comparison of Baseline Housing Data, 2010

Place	Housing Units (Total)	Owner-Occupied Housing Units
City of Encinitas	25,740	63.1%
City of Solana Beach	6,540	60.2%
San Diego County	1,164,786	54.4%
California	13,680,081	55.9%

Source: U.S. Census Bureau 2010a

Encinitas has 23,664 households and the average household size is 2.69 persons. Solana Beach has 5,773 households and the average household size is 2.34 persons. According to the 2010 US Census data on housing tenure, 46 percent of San Diego County households are renters compared to 37 percent in Encinitas and 40 percent in Solana Beach. Among occupied units, 11 percent are owned free and clear of any mortgage or loan in San Diego County, while that figure is 11 percent in Encinitas and 13 percent in Solana Beach. Among the two largest populations in Encinitas and Solana Beach, White and Latino/Hispanic, housing tenure within the white population is predominantly owner-occupied (65-69 percent), while tenure within the

Latino/Hispanic population is predominantly renter-occupied (56-75 percent). Neither population has a significant share of owner-occupied units held free-and-clear of any mortgage (7-13 percent). A smaller share of households have children in the study area when compared with county and state averages, which appears consistent with age demographics presented earlier in this section. The share of households with children is lowest in Solana Beach (22 percent), and higher in Encinitas (27 percent) but still below county (31 percent) and state (33 percent) levels.

4.10.3 Employment

Table 4.10-3 indicates the predominant sectors of employment for residents of the study area, according to the SANDAG current economic estimates. As shown in the table, the service industry is important in all regions associated with the study area. The service industry includes: information, professional, scientific, management, administrative, and waste management services; educational, health and social services; arts, entertainment, recreation, accommodation and food services; and other services. The distribution of employment across all industry sectors is fairly consistent between the State of California, San Diego County, and the city of Encinitas. Solana Beach is the exception—over 75 percent of employment is concentrated in services (including public administration). These services are primarily professional, scientific, educational, and health care. Nearly all the service sector employment in Encinitas is concentrated in these same four segments.

Table 4.10-3 Comparison of Baseline Employment by Industry, 2010

Industry	City of Encinitas	City of Solana Beach	San Diego County	California
Farming & Mining	133	35	10,200	356,312
Construction	2,024	359	99,014	1,157,120
Manufacturing	2,781	365	127,357	1,622,500
Wholesale & Retail Trade	3,865	650	188,396	2,349,238
Transportation & Warehousing, and Utilities	890	111	52,688	753,237
Information	873	327	35,159	455,625
Finance, Insurance & Real Estate	3,146	644	102,868	1,044,890
Services	16,338	3,759	690,188	7,859,562
Public Administration	775	236	75,037	813,061
Employed Civilian Population (Total)	30,825	6,486	1,380,907	16,243,172

Source: U.S. Census 2010d

In San Diego County, the unemployment rate for June 2010 was 9.6 percent, while the cities of Solana Beach and Encinitas had lower unemployment rates of 6.6 percent and 6.9 percent, respectively. These rates of unemployment are all more favorable than the statewide rate of 11.7-percent (U.S. Census 2010d).

Approximately 76.2 percent of County workers were listed as private wage and salary workers. Government workers comprise another 15.4 percent while another 8.2 percent were self-employed in non-incorporated businesses. Less than 1 percent (0.2 percent) was classified as unpaid family workers. An estimated 12.3 percent of the County population was living below the poverty level in 2010. The per capita income and median household income in the City of Encinitas ($86,845) and the City of Solana Beach ($86,908) are substantially higher than figures for the County ($63,069) and State ($60,883).

4.10.4 Environmental Justice

Environmental justice refers to the concept of the fair and equitable treatment of individuals regardless of ethnicity or income level in the development and implementation of environmental management policies and actions. Federal Executive Order 12898 requires each federal agency to incorporate environmental justice into its actions under NEPA.

CEQA does not have an Environmental Justice analytical requirement. However, Environmental Justice is a defined term in California statute. Specifically, California Government Code Section 65040.12 defines Environmental Justice as “the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations and policies”.

The fundamental goal of an Environmental Justice analysis is to answer the question: Would this Proposed Project, if implemented, result in a disproportionate effect on minority populations, low income populations or Native Americans. Key to this analysis is a review of existing environmental conditions and impacts relative to these populations and analyze how project impacts could affect these populations, focusing on the fundamental question of possible disproportionate effects and potential exacerbation of existing conditions utilizing selected socio-demographic data.

The population data that are key to the analysis of environmental justice include race, income, and age characteristics to address the following:

- Percent of minority population;
- Percent of population below the poverty level; and
- Percent of population below 18 years of age.

Poverty status, race, age distribution for the cities of Encinitas and Solana Beach are presented in **Table** 4.10-4. Comparative data for San Diego County and the State of California are also presented.

Table 4.10-4 Comparison of Baseline Ethnic Characteristics as a Percent of Total Population, 2010

Place	Race						% of Individuals Below Poverty Level	Under 18
	White	African American	American Indian	Asian	Native Hawaiian or Pacific Islander	Hispanic or Latino Origin		
City of Encinitas	85.8	0.6%	0.5%	3.9%	0.2%	13.7%	9.4%	20.6%
City of Solana Beach	85.8	0.5%	0.5%	4%	0.1%	15.9%	7.6%	18.5%
San Diego County	64.0	5.1%	0.9%	10.9%	0.5%	32.0%	14.8%	23.4%
California	57.6	6.2%	1.0%	13.0 %	0.4%	37.6%	15.8%	25.0%

The total may be more than 100 percent because individuals may report more than one race. Additionally, Hispanic or Latino is considered to be an origin by the U.S. Census Bureau. Therefore, those who are counted as Hispanic are also counted under one or more race categories.
Source: U.S. Census Bureau 2010a

A comparison of the data in **Table** 4.10-4 shows that both Encinitas and Solana Beach have lower percentages of minority race and Hispanic or Latino origin populations, and a lower percentage below the poverty level than San Diego County or the State.

4.10.5 Commercial and Sport Fisheries

San Diego County supports a substantial commercial fishing industry as well as being a center for sport and recreational fishing and diving activities. This section describes the commercial fishing activity specific to the project area, which is the local social and economic sector most likely to be adversely impacted by the proposed project. The information presented in this section has been gathered from CDFG catch statistics, recent work conducted by CDFG for the MLPA, NMFS, and the San Diego Unified Port District (SDUPD).

<u>Commercial Catch Records</u>

Commercial fishery landings in annual pounds and dollars are monitored by the CDFG, who provide data by port of landing and by geographical areas or fish blocks. Fish Block 821 is located within the Encinitas and Solana Beach study area (**Figure 4.10-1**). Other nearshore fish blocks within San Diego County include 801 and 822 (Oceanside), 842 (Del Mar to Torrey Pines), 860 (La Jolla to Point Loma), and 877 (Imperial Beach). Fish block data were combined across all fishing gear types, and catch values for the Encinitas/Solana Beach Fish Block 821 were compared with other San Diego fish blocks and were compared for Fish Block 821 over time. It is generally understood that fish block data are not fully accurate due to reporting inaccuracies in fishermen catch records. Nevertheless, fish block data provide valuable trend information on the most heavily fished and most valuable catch species.

San Diego area port landings for the period 1999 through 2008 had an average total dollar value over $27 million and nearly 28 million pounds (**Table 4.10-5**). This dollar amount was an ex-vessel value (e.g., whole fish, wholesale price), whereas the final economic contribution may be estimated to have been three to four times higher. On average, invertebrates comprised the greatest proportion (57 percent) of the commercial catch by weight and the greatest proportion

(88 percent) of the landed value of the commercial catch for the 1999 to 2008 period. California spiny lobster and red urchin ranked first ($1,534,453) and second ($577,199) in value, respectively, and together accounted for 76 percent of the annual mean landed catch value. Other top ranked species in terms of annual mean catch value included squid ($145,043), crab ($94,881), California sheephead ($84,031), and swordfish ($43,510), which each ranged from 1.6 to 5.2 percent of the total mean catch value.

Over 73 percent ($20,405,747) of the annual average commercial catch value was taken from nearshore waters extending from La Jolla to Point Loma (Fish Block 860) (**Table 4.10-5**). Approximately 9 percent ($2,418,883) of the annual average commercial catch value was taken from nearshore waters of the Encinitas and Solana Beach study area (Fish Block 821).

Table 4.10-5 San Diego County Landings by Fish Block for 1999–2008 Averaged Volume (Pounds) and Values (Dollars)

Species	Area Name and Fish Block Number					Totals
	Oceanside Block 801/822	Encinitas/ Solana Beach Block 821	Del Mar/ Torrey Pines Block 842	La Jolla/ Point Loma Block 860	Imperial Beach Block 877	
Fish						
Anchovy	17,097	--	5,453	886	--	23,436
	$4,023	--	$181	$14	--	$4,217
Barracuda	430	--	424	3,978	--	4,832
	$225	--	$306	$3,185	--	$3,717
Bonito	2	--	6	2,947	--	2,955
	$2	--	$5	$1,345	--	$1,351
Croaker	40	--	--	56	--	96
	$2	--	--	$106	--	$108
Hagfishes	14,495	--	--	7,863	--	22,358
	$14,969	--	--	$7,950	--	$22,919
Halibut	1,141	7	98	10,623	19	11,889
	$4,622	$9	$144	$33,951	$64	$38,791
Mackerel	291,678	--	235,947	56,801	43	584,469
	$18,586		$15,832	$4,576	$13	$39,007
Rockfish	1,219	54	537	5,521	3	7,335
	$2,903	$112	$1,216	$10,078	$7	$14,316
Sardine	221,573	--	116,870	1,396	--	339,839
	$22,211	--	$4,489	$228	--	$26,928
Seabass	422	--	118	882	20	1,442
	$625	--	$295	$22,040	$88	$23,048
Shark	1,782	34	431	8,406	113	10,765
	$2,892	$61	$617	$11,199	$116	$14,885
Sheephead	533	1,547	3,183	14,907	75	20,245
	$2,013	$6,113	$14,754	$60,881	$270	$84,031
Swordfish	673	--	331	10,888	346	12,238
	$3,415	--	$1,583	$37,242	$1,270	$43,510

Species	Area Name and Fish Block Number					Totals
	Oceanside Block 801/822	Encinitas/ Solana Beach Block 821	Del Mar/ Torrey Pines Block 842	La Jolla/ Point Loma Block 860	Imperial Beach Block 877	
Tuna	718	48	1,448	13,872	534	16,618
	$1,083	$40	$691	$14,612	$983	$17,409
Yellowtail	347	3	146	4,297	--	4,793
	$500	$2	$243	$5,985		$6,731
Invertebrates						
Crab	9,627	3,368	9,145	65,377	2,221	89,739
	$9,893	$3,912	$9,133	$68,831	$3,112	$94,881
Lobster	9,255	29,880	17,147	142,080	1,367	199,728
	$70,164	$226,639	$125,563	$1,101,597	$10,490	$1,534,453
Prawn / Shrimp	1,196	168	4,651	2,253	--	8,268
	$11,514	$1,521	$48,714	$25,672	--	$87,422
Urchin	12,202	4,625	2,029	714,625	1,156	734,636
	$10,243	$3,470	$1,411	$561,293	$781	$577,199
Squid	31,301	--	103,001	233,986	6,147	374,434
	$40,156	--	$28,530	$69,585	$6,771	$145,043
Averages Total	615,731	39,733	500,964	1,301,645	12,042	2,470,115
	$220,039	$241,880	$253,707	$2,040,372	$23,967	$2,779,964
Total for all species	**8,980,704**	**403,362**	**5,048,477**	**13,437,294**	**122,117**	**27,991,954**
	$2,200,401	**$2,418,883**	**$2,537,430**	**$20,405,747**	**$239,674**	**$27,802,135**

Source: SANDAG 2011

A similar trend in catch value was noted for Encinitas-Solana Beach Fish Block 821 as compared to all San Diego nearshore fish blocks over the period from 1999 to 2008 with one exception (**Figure 4.10-2**). The highest values over the period for the Encinitas/Solana Beach Block from 1999 to 2008 were the California spiny lobster ($226,639) and California sheephead ($6,113), followed by crab ($3,912) and red sea urchin ($3,470). The catch value for all San Diego nearshore fish blocks over the same period had a similar ranking of values with California spiny lobster at the highest ($1,534,453), followed by red sea urchin ($577,199), squid ($145,043), prawn/shrimp ($87,422), and Sheephead ($84,031).

The average landings value from Encinitas-Solana Beach Fish Block 821 from 1999-2008 was $2,415,883 (**Table 4.10-5**). The Encinitas-Solana Beach Fish Block 821 accounted for 8.7 percent of the total catch value for this 9-year period. Lobster, rock crab, red urchin and California sheephead were the top ranked species both in terms of catch value and weight from this fish block. The average landed value for lobster across all fish blocks was $7.60 per pound (for 1999-2008). Rock crab and red urchin, on average, landed at $1.10 and $0.80 per pound, respectively; and average landings of California sheephead were valued at approximately $4.00 per pound.

In the last three decades, the California fishing industry was generally harvesting less catch, required fewer fisherman, and utilized a smaller fleet in both boat length and numbers to bring the catch to port. Locally, the number of fisherman and boats has declined significantly, but the value of the landings declined only slightly from the 1980s to 1990s (SDUPD 1998). Following this trend, the volume of landings in the region decreased slightly from 2000 to 2008, but the total value of landings increased by 9 percent (CDFG 2010).

Although throughout southern California including San Diego County the commercial fishing industry has seen a steady decline in recent decades, the industry is predicted to undergo a substantial revitalization. The decline of the commercial fishing industry has been attributed to competition from other areas and a variety of regulatory, economic, and environmental factors. In terms of participants, the commercial fishing industry was reduced by more than 70 percent from the late 1970s to 1998 (SDUPD 1998). During that period, the number of fishing vessels in the San Diego region declined by about 67 percent. However, there may be an opportunity for future growth. Although the number of fishing vessels and fishermen in the San Diego region declined from 1999 to 2006, there was a slight increase from 2006 to 2007 (MLPA 2009). One reason for that potential upswing is that the global appetite for seafood has more than doubled over the past 30 years, and a demand for local, sustainable seafood is growing (SDUPD 2010). The number of people employed in the fishing industry in San Diego County is projected to increase from 130 to 170 jobs by 2016, surpassing projected employment in the industry for areas such as Los Angeles County and Monterey County (CEDD 2010). The four San Diego landings earned nearly $200 million in the period from 1985 to 2008 (in 2009 dollars). In 2008 alone, commercial fishing brought the region nearly $7 million in ex-vessel value, the price paid to fishermen (SDUPD 2010).

Kelp Harvesting

Kelp harvesting has occurred in California since 1911 and involves the use of cutter barges, which harvest the upper kelp canopy down to a depth of about 4 ft below the water surface. During the 1980s and 1990s, Kelco operated a kelp harvesting barge in the project area including off the coast of both Encinitas receiver site in the vicinity of the northern reaches near Leucadia and Solana Beach receiver site in the general vicinity of Fletcher Cove.

The harvesting of kelp in the state is regulated by the CDFG. The State of California has imposed a number of restrictions on harvesting activities, both commercial and recreational. In recent years, the alginate industry has considerably reduced its demand for California kelp, and commercial kelp harvest (in weight) decreased by 96 percent from 2002 to 2007. The dramatic decrease in kelp harvesting after 2005 resulted from the departure of a large kelp harvesting company, which moved its operations overseas (MLPA 2009).

Two kelp beds, one located from the California/Mexico International Boundary to southern tip of San Diego Bay, and one located from the southern tip of San Diego Bay to the southern tip of Point Loma, are considered open, which means they may be harvested by anyone with a kelp harvesting license. Kelp beds at Point Loma, Mission Bay, Scripps Pier, and the San Dieguito River to middle of Loma Alta Lagoon at south Oceanside are considered leaseable and provide the exclusive privilege of harvesting to the lessee (MPLA 2009). Kelp harvesting within the Encinitas City Marine Life Refuge (California Fish and Game Code SS 10913) is prohibited, except under a permit.

Recreational Fishing and Diving

A wide range of marine recreational fishing and diving opportunities exist along the San Diego coast. These include surf and shoreline fishing, pier fishing, party boat fishing, private boat fishing, snorkeling, and SCUBA diving. The specific diving opportunities associated with possible borrow sites are described in Section 4.13 (Recreation).

According to the NMFS (2010), the direct economic impact of recreational fisheries in California totaled more than $1.7 billion in 2008, with nearly $1 billion more in value-added impacts. Of the $1.7 billion, durable equipment accounted for $1.3 billion, shore activities such as pier and beach fishing accounted for $226 million, charter boats accounted for $174 million, and private boats accounted for $107 million. Recreational fisheries employ nearly 12,000 people in the state.

The most common target species for beach fishing were barred surfperch, yellowfin croaker, opaleye, and jacksmelt. Fishing from man-made structures target Pacific mackerel, Pacific sardine, northern anchovy, queenfish, and jacksmelt. Rented and chartered boat fishing targets offshore and pelagic species, especially mackerel, croaker, bass, and rockfish (MPLA 2009). There is a small contingent of operators that specialize in half-day and 1-day charters that typically fish the nearshore areas and kelp beds. These operators target sand and kelp bass and California halibut. Oceanside harbor has a few boats that specialize in this fishery while Mission Bay and San Diego Bay have a large charter fleet. Fishing occurs year-round in the study region, although effort markedly increases in the summer months, peaking in July. According to estimates produced by the CDFG's California Recreational Fisheries Survey, over 40 percent of fishing trips occur in the months of June, July, and August (MPLA 2009).

Sport diving and spearfishing activities mostly occur in the nearshore waters, and the number of diving trips in San Diego in the early 1990s was about 30,000 per year. It is assumed that this rate has increased as the rate of Professional Association of Diving Instructors (PADI) certification has increased substantially since 1990 (NMFS 1991; PADI 2010). Most diving occurs in habitats rich in marine life, especially kelp beds and rocky reefs. Much of the diving in San Diego involves trips to locations not accessible other than by boat, including offshore kelp beds, the vessels intentionally sunk as artificial reefs in "Wreck Alley" off of Mission Beach, and even offshore islands and banks. Shoreline diving is also popular.

Appendix E provides additional information about important top ranked commercial nearshore species taken from the Encinitas and Solana Beach coastal area.

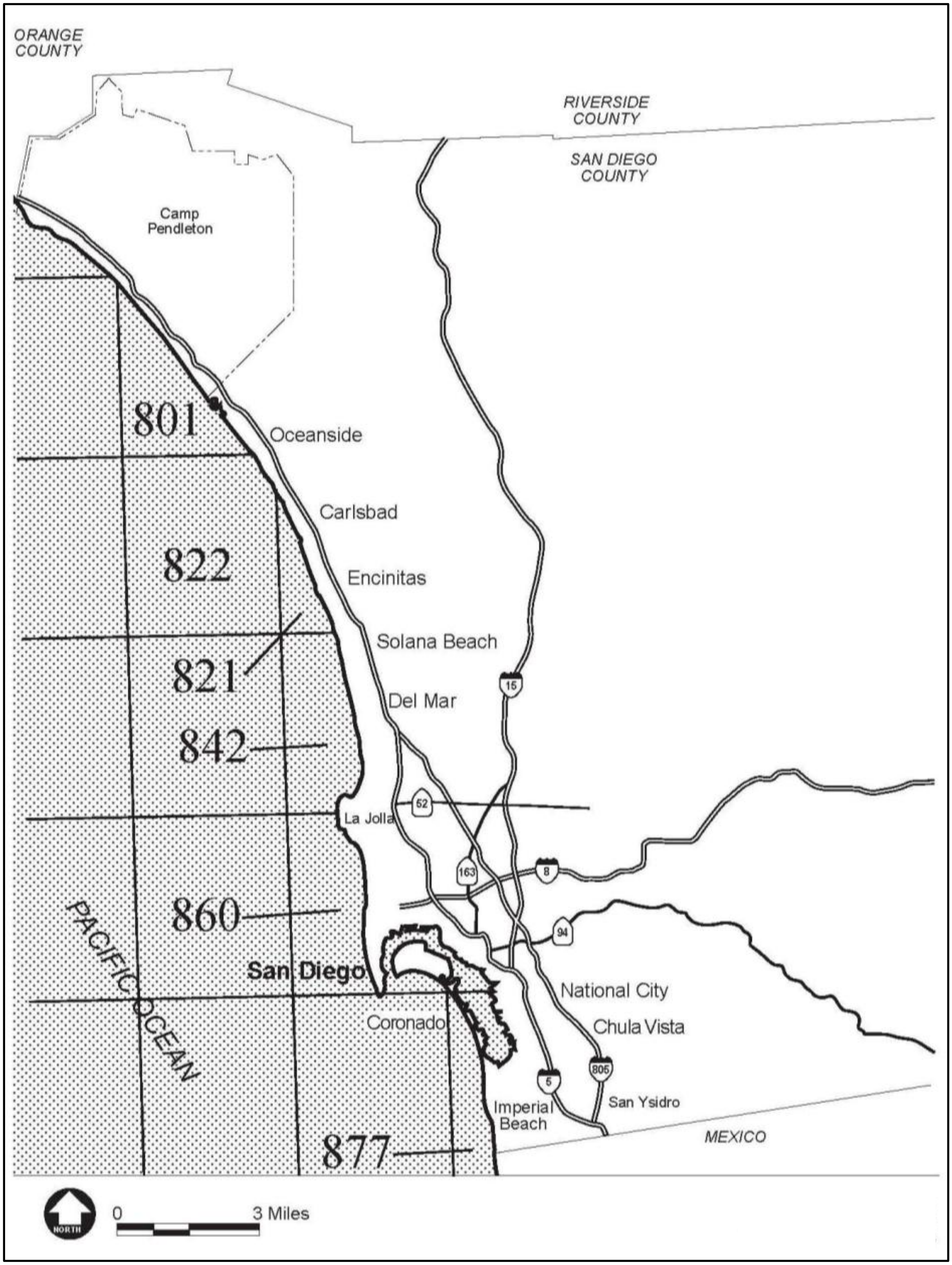


Figure 4.10-1 California Department of Fish and Game nearshore fish blocks within areas of San Diego County

Oceanside Area **San Diego Area** **Oceanside Area** **San Diego Area**

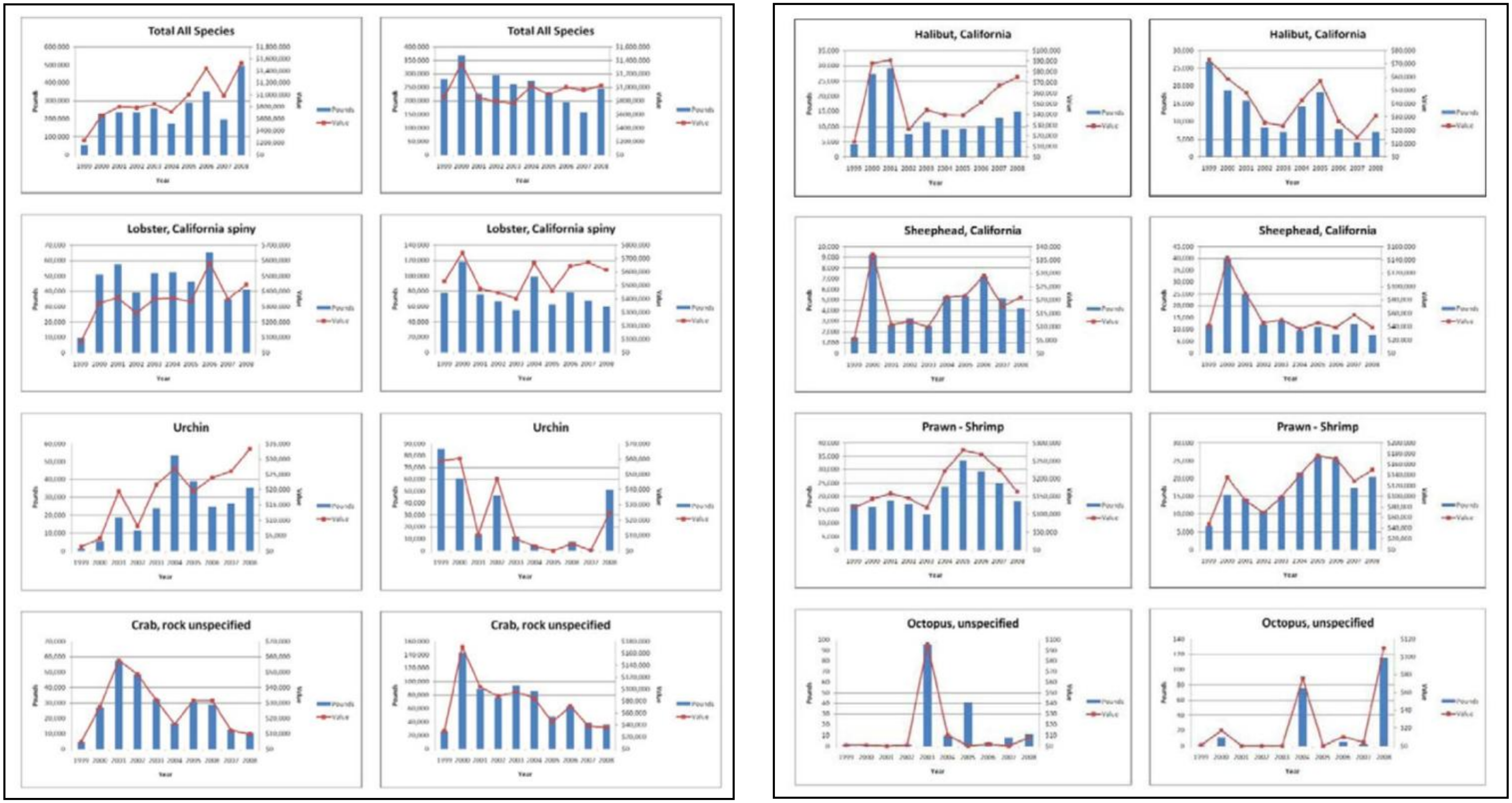
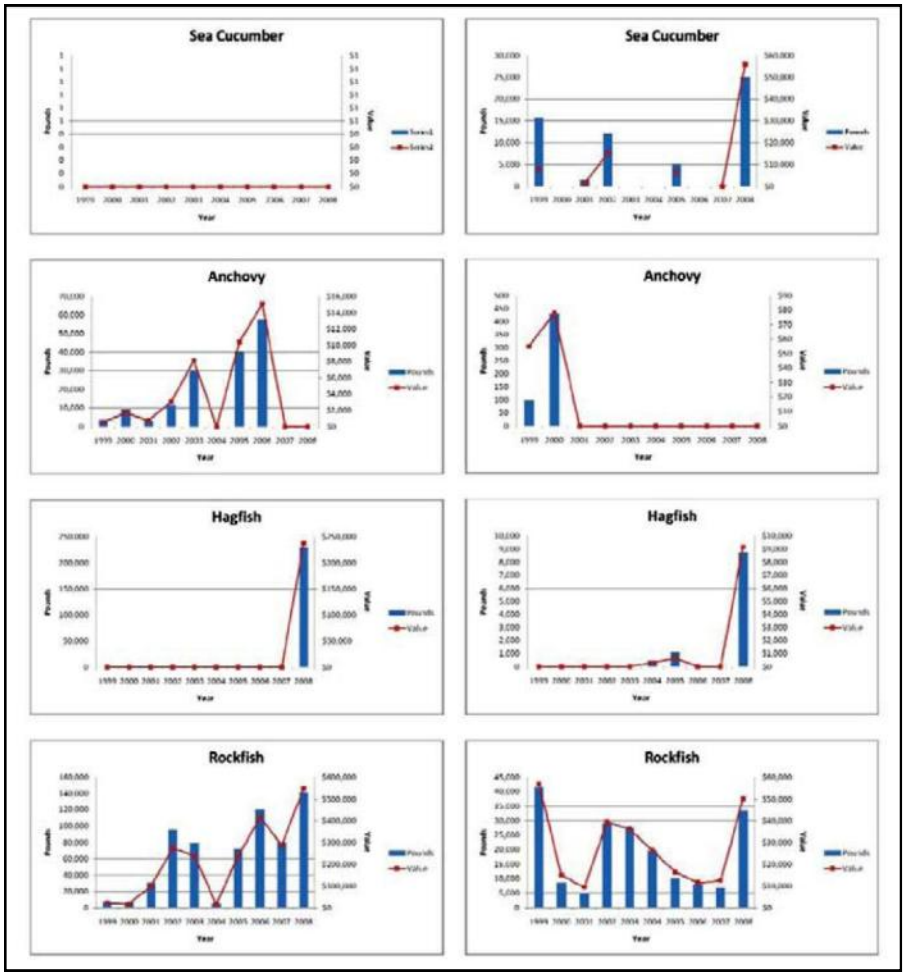
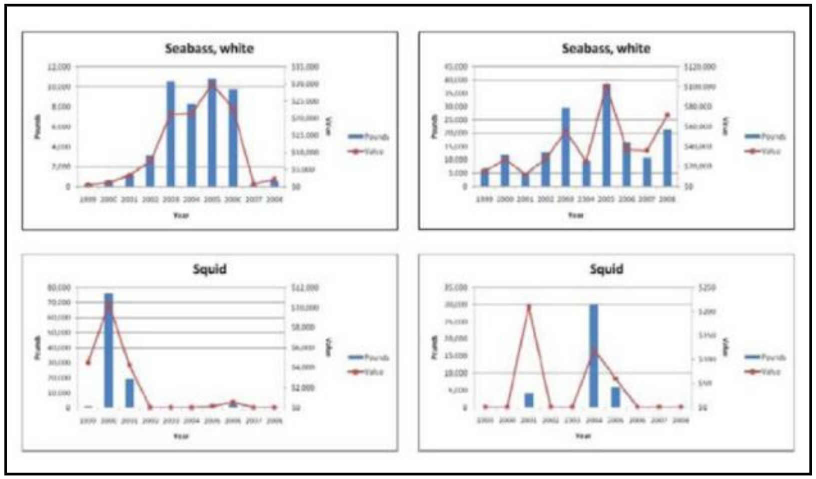


Figure 4.10-2 Commercial landings (pounds and value) for all nearshore and selected commercially important species from Encinitas and Solana Beach fish block 821 as compared to the total of all nearshore San Diego County fish blocks (1999 to 2008)

Oceanside Area **San Diego Area**



Oceanside Area **San Diego Area**



4.11 Transportation

Several transportation corridors traverse the Cities of Encinitas and Solana Beach providing access to these cities and the San Elijo Lagoon Ecological Reserve (hereafter referred to as the San Elijo Lagoon). The focus of this discussion is on the primary transportation corridors including State Highways and major local streets with interconnections to the highways. In addition to the several major roadway corridors, rail service is provided in both the Cities of Encinitas and Solana Beach through the North County Transit District (NCTD) "Coaster" and AMTRAK (2012) rail-passenger service "Pacific Surfliner." Freight trains also traverse along the NCTD railroad through the Cities of Encinitas and Solana Beach. On a daily basis, more than 50 trains travel on this segment of railroad through the two cities.

4.11.1 Major Highways

Interstate 5 Freeway

The Cities of Encinitas and Solana Beach are bisected by Interstate 5 (I-5), which is a primary transportation link between Los Angeles, Orange and San Diego Counties. Within the project area, I-5 runs in a north-south direction parallel to the coastline ranging approximately 0.5 to 1.25 mi inland from the coast. I-5 passes over the San Elijo Lagoon via a berm and bridge. I-5 is designated a freeway through these cities and consists of a minimum of 8 travel lanes, with additional express travel lanes presently planned by Caltrans and SANDAG. Vehicle Trips on I-5 within these stretches of the cities are shown below in **Table 4.11-1**.

Table 4.11-1 Summary of Baseline Traffic Volumes for Interstate 5

Count Location	Back of Count Location			Ahead of Count Location		
	Peak Hour[1]	Peak Month[2]	Annual Average Daily Trips[3]	Peak Hour[1]	Peak Month[2]	Annual Average Daily Trips[3]
at Leucadia, La Costa Ave	14,900	215,000	200,000	14,600	211,000	197,000
at Santa Fe Drive, Encinitas	14,500	221,000	206,000	15,300	216,000	206,000
at Birmingham Drive, Encinitas	14,400	220,000	207,000	14,500	221,000	206,000
at Manchester Avenue, Encinitas	15,900	244,000	231,000	14,400	220,000	207,000
at Lomas Santa Fe Drive, Solana Beach	18,100	248,000	229,000	15,900	244,000	231,000
at Via De La Valle	15,900	243,000	244,000	18,100	248,000	229,000

Volumes are combined northbound and southbound traffic
[1] Normally occurs every weekday
[2] Average daily traffic for the month of heaviest traffic flow
[3] Total volume for the year divided by 365. The traffic count year is October 1 through September 30, 2010.
Source: California Department of Transportation 2010

Highway 101 (S21)

Highway 101 (Pacific Coast Highway) also traverses the Cities of Encinitas and Solana Beach and runs parallel to the Pacific Ocean coastline in a north-south orientation ranging from shoreline-adjacent to 0.3 mi) from the coast. Highway 101 is a four-lane roadway designated a

Major Arterial in the City of Encinitas and Solana Beach General Plan Circulation Elements. This roadway connects both cities and provides the only north/south travel corridor west of I-5. Highway 101 also provides primary access to numerous beaches and parks along the coast. Highway 101 is also a designated emergency evacuation route for tsunamis and other conditions warranting a coastal evacuation.

It is located immediately adjacent to and west of the railroad tracks running the entire length of both cities. In Encinitas receiver site, it crosses the mouth of the San Elijo Lagoon via a bridge. At this location, the highway is on the peninsula that makes up the Cardiff State Beach and a small portion of the City of Encinitas between the lagoon and the Pacific Ocean. Summary traffic volumes for Highway 101 within the Cities of Encinitas and Solana Beach are shown below in **Table 4.11-2**.

Table 4.11-2 Summary of Baseline Traffic Volumes for Highway 101

Segment	Daily Volume	Peak Hour		Peak Hour Volume	
		AM	PM	AM	PM
S/O La Costa Avenue [1]	16,753	7:00 to 8:00	4:00 to 5:00	1,704	1,431
S/O Marcheta Street[1]	18,342	7:00 to 8:00	4:00 to 5:00	1,546	1,513
N/O Chesterfield Drive[1]	16,607	8:00 to 9:00	4:00 to 5:00	1,642	1,411
S/O Chesterfield Drive[1]	23,163	8:00 to 9:00	5:00 to 6:00	2,471	1,681
Within the City of Solana Beach[2]	19,400	NA	NA	NA	NA

NA = Information not available

Sources: [1] City of Encinitas 2007 (Citywide Intersection Turning Movement & 24-Hour Machine Counts)
[2] City of Solana Beach 2009. Number is a daily average

4.11.2 Local Streets/Coastal Access

The following is a brief discussion of the local streets within the Cities of Encinitas and Solana Beach and County of San Diego that provide the primary access to the cities and from the I-5 to Highway 101, whereby the coastline can be accessed. These roadways provide regional access via interchanges with the I-5.

<u>Encinitas Receiver Site</u>

Encinitas Boulevard (City of Encinitas) is a Major Arterial four lane divided roadway between I-5 and Highway 101. It trends in an east-west direction (City of Encinitas 1995). East of the I-5 it becomes a six-lane Prime Arterial. A Major Arterial has a typical roadway width of 85 to 120 ft and a curb to curb pavement width of approximately 80 ft.

Access to most of the coast within the study area is limited by residential development and the coastal bluffs. Travel parallel to the bluffs is via Neptune Avenue, a one-way street allowing travel from south to north.

Encinitas Boulevard provides coastal access and it becomes B Street after it crosses Highway 101. The Moonlight State Beach parking lot is at the foot of B Street.

Fourth Street, which is not continuous, is the closest street to the edge of the bluffs. C through K Streets are perpendicular to the coastline.

Solana Beach Receiver Site

Lomas Santa Fe Drive (City of Solana Beach) runs in an east-west direction. It is a four-lane divided roadway providing coastal access. It is designated a Major Arterial in the Solana Beach General Plan. Major Arterials are expected to carry the majority of traffic through the city. It is expected to have a maximum capacity of 38,000 vehicles per day (City of Solana Beach 2001).

Via De La Valle (City of Del Mar and Solana Beach) is a four-lane divided roadway, designated a Major Arterial in the Solana Beach General Plan. Only a small portion of the roadway is in the city (i.e. between Highway 101 and the west city boundary). It provides coastal and inland access. Similarly to Lomas Santa Fe Drive, Via De La Valle has a maximum capacity of 38,000 vehicles per day (City of Solana Beach 2001).

Access to most of the coast within the study area is limited by residential development and the coastal bluffs. Lomas Santa Fe Drive provides the major access to the coast within Solana Beach receiver site. Lomas Santa Fe Drive becomes Plaza Street when it crosses Highway 101. Plaza Street ends at the Fletcher Cove Beach Park parking area. Pacific Avenue runs parallel to the bluffs north of Plaza Street.

Via De La Valle at the southern end of Solana Beach receiver site is the major thoroughfare providing access to the coast within this reach. Sierra Avenue is the north-south road closest to the edge of the bluffs.

4.11.3 Traffic Volumes and Local Streets

A summary of the traffic volumes for the local streets within or immediately adjacent to the Cities of Encinitas and Solana Beach is provided in **Table 4.11-3**.

Table 4.11-3 Summary of Baseline Traffic Volumes on Local Streets within or immediately adjacent to the Cities of Encinitas and Solana Beach

Street Segment	Date of Count	Daily Volume
La Costa Ave. between Coast Hwy 101 and Vulcan Ave	2010	8,200
La Costa Ave. between Vulcan Ave. and I-5 SB Ramps	2010	11,400
Leucadia Blvd between Coast Hwy 101 and Vulcan Ave.	2010	13,200
Leucadia Blvd between Vulcan Ave and Orpheus Ave	2010	15,600
Leucadia Blvd between Orpheus Ave and I-5	2010	24,400
Encinitas Blvd. between Coast Hwy 101 and Vulcan Ave	2010	18,800
Encinitas Blvd. between Vulcan Ave and I-5	2010	25,800
Santa Fe Dr. between Vulcan Ave and Rubenstein Ave	2010	8,100
Santa Fe Dr. between Rubenstein Ave and I-5	2010	12,200
Birmingham Dr. between Mackinnon Ave. and I-5 SB Ramps	2010	15,800
Manchester Ave. between San Elijo Ave. and I-5	2010	8,800
San Elijo Ave. between Birmingham Dr. and Chesterfield Dr.	2010	11,300
Lomas Santa Fe Dr. between Solana Hills Dr. and I-5 SB Ramps	2010	35,600
Via De La Valle west of I-5	2010	54,400

4.11.4 Railroads

<u>AMTRAK Pacific Surfliner</u>

AMTRAK provides rail service to the area via the Pacific Surfliner. A Pacific Surfliner station is located on Cedros Avenue near the intersection of Lomas Santa Fe Drive and Highway 101 in the City of Solana Beach. There are no Pacific Surfliner stations in the City of Encinitas. This rail service has round trips between Los Angeles and San Diego daily. There are 10 to 12 Pacific Surfliner trains available in each direction, varying a little depending on the day of the week, with stops at the Solana Beach station.

<u>North County Transit District Coaster</u>

The NCTD Coaster is a public transportation rail system that traverses the Cities of Encinitas and Solana Beach and passes through the San Elijo Lagoon near the coast. It is operated by the North County Transit District. The rail service has eight stations south of the City of Oceanside, and offers an alternative to driving and link between the north county and the City of San Diego.

Coaster stations are located in the Cities of Encinitas and Solana Beach. The 2012 schedule for the north- and southbound Coaster indicates there are 11 trains in either direction with stops at stations in Encinitas and Solana Beach.

4.12 <u>Land Use</u>

This section focuses on the study area that includes the coastline of the Cities of Encinitas and Solana Beach. State and local land use policies regarding shoreline protection are discussed in Subsection 4.12.1. Following this background section are descriptions of land uses for the cities (Subsection 4.12.2). Land uses are then summarized according to coastline receiver sites (Subsection 4.12.3).

Each California City is responsible for maintaining a quality environment for its citizens and users through adoption of long-range planning documents usually called General Plans. These General Plans contain goals, policies, implementation procedures, and regulatory controls, including permitting requirements, to guide and enforce conformance with local land use laws and regulations. State and federal agencies rely on executive orders, various laws, codes, mandates, management plans, and master plans to govern land use decisions under their jurisdiction. The most common guide used by local jurisdictions to define land use patterns is the General Plan, which is implemented by local municipal codes. Land Use Elements of General Plans typically contain those policies and maps governing land use compatibility within the jurisdiction. Local Coastal Plan (LCPs) are also key planning documents guiding land use within the coastal zone, as defined by the California Coastal Act (Cal. Code Regs. Title 14 § 30000).

4.12.1 Coastal Plans and Local Policies

Under the federal Coastal Zone Management Act of 1972 (16 C.F.R § 1451 [1997]), long-range planning and management of California's coastal zone was conferred to the state with implementation of the California Coastal Act in 1977. The California Coastal Act (Cal. Code Regs. Title 14 § 30000) created the California Coastal Commission (CCC) who assist local governments in implementing local coastal planning and regulatory powers. Under that Act, local governments are encouraged to adopt LCPs. The LCP consists of a Land Use Plan (LUP) with goals and regulatory policies as well as a set of Implementing Ordinances.

Section 30235 of the California Coastal Act focuses on shoreline construction. All of these sections contain an element pertaining to the protection of existing structures and the protection of public beaches in danger of erosion. Under these sections, construction is allowed through revetments, breakwaters, groins, or other means that alter natural shoreline process; dredging of open coastal waters, lakes, wetlands, and other areas will be permitted only where less feasible environmentally damaging alternatives are not available. Section 30233 states that dredge spoils suitable for beach replenishment should be transported to appropriate beaches or into suitable longshore current systems.

California State Lands Commission

The California State Lands Commission (CSLC) has exclusive jurisdiction over all of California's tide and submerged lands and the beds of naturally navigable rivers and lakes, which lands are sovereign lands, and swamp and overflow lands and State School Lands, which are proprietary lands.

Authority of the CSLC originates and is exercised from the state's position as a landowner. The CSLC has statutory authority (Division 6 of the California Resources Code) to approve appropriate uses of state lands under its jurisdiction and is the administrator of the Public Trust Doctrine over sovereign lands. The Public Trust is a sovereign public property right held by the State or its delegated trustee for the benefit of the people. This right limits the use of these lands to waterborne commerce, navigation, fisheries, open space, recreation, or other recognized Public Trust purposes. Sovereign lands may only be used for purposes consistent with this public trust; uses include commerce, navigation, fisheries, open space, wetlands and other related trust uses. The CSLC has an oversight responsibility for tide and submerged lands legislatively granted in trust to local jurisdictions (Public Resources Code [PRC] § 6301).

Management responsibilities of the CSLC extend to activities within submerged lands (from mean high tide line) and those within 3 nautical miles offshore. These activities include oil and gas developments; harbor development and management oversight; construction and operation of any offshore pipelines or other facilities; dredging; reclamation; use of filled sovereign lands; topographical and geological studies; and other activities that occur on these lands. The CSLC also surveys and maintains title records of all state sovereign lands as well as settling issues of title and jurisdiction.

Marine Life Protection Act Initiative

In 1999, the California state legislature approved and the governor signed the Marine Life Protection Act Initiative (MLPA) (codified at Section 2850 through 2863 of the Fish and Game Code). The purpose of MLPA is to ensure that the existing collection of Marine Preserve Areas (MPAs) are designed and managed according to clear, conservation-based goals and guidelines that take full advantage of the multiple benefits that can be derived from the establishment of marine life reserves by modifying the existing MPAs (URS 2010).

On December 15, 2010, the final MPA regulations were adopted for the South Coast Study Region, which extends from Point Conception to the California border with Mexico; and went into effect January 1, 2012 (California Department of Fish and Game 2012a). The regulations restrict specific activities within designated preserves but identify exceptions within specific MPA boundaries, including dredging and sand replenishment. The proposed receiver site in Encinitas and the SO-6 borrow sites are located within the Swami's State Marine Conservation Area (SMCA) boundary under the California MLPA. The MPA regulations for Swami's SMCA include a specific provision allowing sand replenishment and sediment management activities within its boundaries (California Department of Fish and Game 2012b):

Permitted/Prohibited Uses: Take of all living marine resources is prohibited except:

3. Take pursuant to beach nourishment and other sediment management activities and operation and maintenance of artificial structures inside the conservation area is allowed per any required federal, state and local permits, or as otherwise authorized by the department.

<u>City of Encinitas</u>

The Encinitas General Plan identified issues and opportunities relative to planning decisions within the City. Regarding beaches, the plan states, "the beach areas are losing sand depth each year and sand replenishment programs are needed to provide for their restoration." Additionally, the Resource Management Element (as amended 2005) of the General Plan identifies the following policies relevant to the proposed action:

8.6 *The City will encourage measures which would replenish sandy beaches in order to protect coastal bluffs from wave action and maintain beach recreational resources. The City shall consider the needs of surf-related recreational activities prior to implementation of such measures.*

10.3 *The City shall explore the prevention of beach sand erosion. Beaches shall be artificially nourished with excavated sand whenever suitable material becomes available through excavation or dredging, in conjunction with the development of a consistent and approved project. The City shall obtain necessary permits to be able to utilize available beach replenishment sands (as necessary, permits from the Army Corps of Engineers, California Coastal Commission, Department of Fish and Game, USEPA, etc.).*

In compliance with the California Coastal Act of 1976, the City of Encinitas has integrated its LCP LUP in its General Plan. The LUP identifies policies and provisions that implement the Coastal Act in the City.

<u>City of Solana Beach</u>

The City of Solana Beach identifies goals and policies regarding shoreline protection in Chapter 17.62 of the Solana Beach Municipal Code (SBMC). Excerpts from the SBMC are presented below.

10B *Preservation and enhancement of the beach is an important city goal. The city will also support regional efforts to manage beach sand.*

Permits for the construction of seawalls, revetments, bluff retaining walls, gunite coverings, metal or wood armoring and other similar structures will

> *be issued only when necessary to accomplish one of the following purposes:*
>
> *1. To protect existing legally built structures, 2. To preserve economically viable use of property, and 3. To abate a public nuisance.*

The City of Solana Beach draft LUP was approved by the CCC on March 7, 2012. The LUP for the Solana Beach LCP recognizes the importance of a sandy beach, and includes a number of policies that specifically encourage beach sand replenishment and sand retention strategies to establish a wide sandy beach in the city. The LUP has an overarching land use policy that addresses beach replenishment and sand retention. The specific policies below addresses sand replenishment and are relevant to the proposed project:

LUP Policy 4.65: Establish a wide, safe, sand beach to: (a) maintain, and when feasible, provide increased public access and recreational opportunities; (b) minimize impacts on sensitive marine resources; (c) protect water quality; (d) mitigate adverse impacts of bluff retention devices.

LUP Policy 4.66: Continue to coordinate with SANDAG, the USACE, the State Lands Commission, California Department of Boating and Waterways, and others to establish and fund programs for periodic sand nourishment of beaches which are vulnerable to wave damage and erosion. Beach nourishment programs should include measures to minimize potential adverse biological resource impacts from deposition of material, including measures such as timing or seasonal restrictions and identification of environmentally preferred locations for deposits. Any program for beach sand nourishment shall not be effective until certified as an amendment to the LCP by the CCC or permitted as an independent project subject to a CDP.

LUP Policy 4.71: Develop a long-term beach replenishment program based on data and analysis from the Regional Beach Sand Project (RBSP) and SCOUP programs. Longer-term projects will be implemented at regular intervals in the future as determined by sand loss rates or as needed after severe storm seasons. Planning and budgeting will be established to carry out the program to a pre-determined date. The City should take into account climate change research and projections of future sea level rise using the most relevant, valid, and peer-reviewed data sets relative to long term planning assumptions to ensure regional planning consistency. The most relevant research into design and maintenance plans for the long-term beach sand replenishment and retention program should also be considered. The effectiveness of any such program will be reassessed after a specified period, but at least every five years, to identify any needed modifications.

LUP Policy 4.72: Participate in and encourage other long-term beach sand replenishment and retention programs at the federal, state, and regional level.

4.12.2 City of Encinitas

The City of Encinitas was incorporated on October 1, 1986 and encompasses an area of approximately 12,514 acres (SANDAG 2011a). Existing (2008) land uses are dominated by residential, recreational, and agricultural land uses, and commercial/services (**Table 4.12-1**, **Figure 4.12-1**).

Table 4.12-1 Existing Land Use Within the City of Encinitas, 2008

Land Use	Acres	Percent[1]
Developed Acres	11,651	93%
Low Density Single Family	1,435	11.5%
Single Family	3,871	30.9%
Multiple Family	172	1.4%
Mobile Homes	64	0.5%
Other Residential	36	0.3%
Mixed Use	0	0%
Industrial	73	0.6%
Commercial/Services	737	5.9%
Office	67	0.5%
Schools	208	1.7%
Roads and Freeways	1,786	14.3%
Agricultural Extractive[2]	431	3.4%
Parks and Military Use	2,771	22.1%
Vacant Developable Acres	871	7.0%
Low Density Single Family	337	2.7%
Single Family	339	2.7%
Multiple Family	13	0.1%
Mixed Use	8	<0.1%
Industrial	0	0%
Commercial/Services	82	0.7%
Office	9	<0.1%
Schools	25	0.2%
Parks and Other	51	0.4%
Future Roads and Freeways	7	<0.1%
Constrained Acres	6	<0.1%

[1] Percentage based upon SANDAG total acres of 12,529 – percentages may not total 100% due to rounding.
[2] This is not a forecast of agricultural land, because the 2050 Regional Growth Forecast does not account for land that may become agricultural in the future; also, some types of development that occurs on agricultural land, such as low density single family residential, may allow for the continuation of existing agricultural use.
Source: SANDAG 2011b

The City of Encinitas is comprised of five distinct communities: Cardiff-by-the-Sea, Olivenhain, Old Encinitas, New Encinitas, and Leucadia. Encinitas receiver site is located within the community of Old Encinitas. Located north of the community of Cardiff-by-the-Sea, the community of Old Encinitas covers approximately 1,656 acres. The coastal areas of this community (west of the I-5) include predominately residential and commercial development. Much of the land designated for commercial land uses in the community is located along Highway 101 and Encinitas Boulevard. Residential densities in Old Encinitas are greater in neighborhoods located adjacent to the beach. A large area of intensive agricultural uses including greenhouse flower production is located west of the I-5 and south of Santa Fe Drive. Coastline areas within this community include Encinitas County Park, Seaside Gardens Park, Moonlight State Beach, and several city parks.

4.12.3 City of Solana Beach

The City of Solana Beach incorporated on July 1, 1986 and is comprised of approximately 2,190 acres (SANDAG 2011c) with approximately 1.7 miles along the Pacific Ocean coastline (City of Solana Beach 1999). The City of Encinitas, including San Elijo Lagoon, borders Solana Beach to the north. The unincorporated County of San Diego, including San Dieguito Regional Park and the inland communities of Rancho Santa Fe and Fairbanks Ranch, are inland to the east. To the south, the City of Solana Beach is bounded by the Cities of Del Mar and San Diego.

Solana Beach has been extensively developed (99 percent built out) and has little vacant developable land remaining. Existing land uses with the City of Solana Beach are shown in **Table 4.12-2** and **Figure 4.12-2**. Land uses are governed by the City's General Plan initially adopted in 1988 as amended. The predominant land uses within Solana Beach receiver site are residential, public facilities, institutional, commercial/services, and parks and open space. Coastline areas include Fletcher Cove and North Seascape Surf Beach Parks.

Table 4.12-2 Existing Land Use within the City of Solana Beach, 2012

Land Use	Acres	Percent[1]
Developed Acres	2,146	98.3%
Low Density Single Family	0	0%
Single Family	1,023	46.9%
Multiple Family	140	6.4%
Mobile Homes	1	<0.1%
Other Residential	0	0%
Mixed Use	0	0%
Industrial	42	1.9%
Commercial/Services	289	13.2%
Office	40	1.8%
Schools	66	3.0%
Roads and Freeways	429	19.7%
Agricultural Extractive	0	0%
Parks	116	5.3%
Vacant Developable Acres	37	1.7%
Low Density Single Family	0	0%
Single Family	25	1.1%
Multiple Family	2	<0.1%
Mixed Use	1	<0.1%
Industrial	0	0%
Commercial/Services	4	0.2%
Office	5	0.2%
Schools	0	0%
Parks and Other	0	0%
Future Roads and Freeways	0	0%
Constrained Acres	0	0%

[1] Percentage based upon SANDAG total acres of 2,183 – percentages may not total 100% due to rounding. Source: SANDAG 2011d

4.12.4 Land Use Description by Receiver Site

The proposed project includes two receiver sites. Encinitas receiver site stretches approximately 1.4 miles from the 700 block of Neptune Avenue to end of West H Street, encompassing Moonlight Beach. Solana Beach receiver site extends 1.5 miles stretches from Tide Park to the southern city limit of Solana Beach, encompassing Fletcher Cove.

Encinitas Receiver Site – 700 Block, Neptune Avenue to West H Street

Encinitas receiver site is approximately 7,392 ft in length. This receiver site possesses a narrow to medium (approximately 50 to 150 ft wide) beach width south to Stone Steps then it gradually widens toward Moonlight Beach. Continuing south from Moonlight Beach to approximate end of West H Street, the beach condition is narrow to nonexistent. The bluff top is developed with residential homes and high density residential structures. Land uses in this receiver site also include Encinitas Beach Park, Seaside Gardens Park and a parking area at the northern end of Moonlight State Beach. Two parks on the bluffs, H Street and I Street Viewpoint Parks, provide public access and viewing areas on the bluffs. Recreational facilities such as a lifeguard building and restrooms are located within the floodplain. Five storm drains occur at Moonlight Beach, three convey flows from Cottonwood Creek, and two are from residential neighborhoods. Throughout the receiver site, adjacent land uses are primarily residential.

Encinitas receiver site is located within the coastal zone as designated in the City of Encinitas General Plan (1995). It is also within the Coastal Bluff Overlay zone. Public beaches in the City of Encinitas are designated as Ecological Resource/Open Space/Parks in the City's General Plan (1995).

The CSLC has jurisdiction over sovereign land in Encinitas. Authorization from the CSLC would be required for implementation of the proposed action.

Moonlight State Beach is a unit of the state park system but is operated by the City of Encinitas. The state beach is subject to the San Diego Coastal State Park System General Plan (California Department of Parks and Recreation 1983). This plan identifies proposed improvements to Moonlight State Beach facilities and policies intended to protect natural resources in the vicinity of the State Beach. The following policy is relevant to the proposed action:

> *Littoral sand loss is recognized as a major threat to existing facilities and recreational resources. The department shall work with other agencies, including the San Diego Association of Governments, California Department of Boating and Waterways, and the U.S. Army Corps of Engineers, to develop regional solutions to the sand loss problem. Any major program of sand replenishment or retention must consider the regional nature of the problem and the regional impact of actions taken along a segment of the shoreline.*

Solana Beach Receiver Site – Tide Park to Solana Beach Southern City Limit

Solana Beach receiver site is approximately 7,920 ft in length. The bluff top is fully developed throughout the receiver site with large multi-story residences and residential houses, as well as multiple family town homes and condominiums. The bluffs and beach are severely eroded, and as previously described, numerous efforts to slow erosion, such as riprap, the filling in of sea caves, engineered in-fills, sea walls, and other revetments occur along the bluffs and beach. Fletcher Cove represents a small pocket beach with good public access. This receiver site includes Tide Beach Park, Fletcher Cove Beach Park (including parking area), Seascape Surf Beach Park and Del Mar Shores.

Solana Beach receiver site is within the CCC's jurisdiction. Any decision regarding activities on the beach would be subject to CCC review and approval under a federal Consistency Determination that he project complies with the Federal Coastal Zone Management Act.

Borrow Sites

Both borrow sites are located in ungranted sovereign lands under the jurisdiction of the CSLC. A lease is required from the CSLC for any portion of a project extending into State-owned lands that are under its exclusive jurisdiction.

SO-5 borrow area is located offshore of the San Dieguito River. The SO-5 borrow site is within approximately 2 miles of a portion of the San Diego–La Jolla Underwater Park, a recreational area for divers. There are no artificial reefs or recorded shipwrecks within the area of SO-5.

SO-6 is located in the Swami's SMCA west of San Elijo Lagoon and south of both the RBSP I SO-6 borrow area and the San Elijo wastewater outfall pipeline. SO-6 is located seaward of a lease to the California Department of Parks and Recreation from the CSLC (PRC 7365) for an underwater recreational park. This lease area extends along the shore from Swami's Point in Encinitas south to Tabletops reef in Solana Beach and it extends seaward approximately 3,500 ft. SO-6's closest boundary is approximately 250 ft away (seaward) from the lease area. The closest artificial reef within the underwater park is located approximately 2,250 ft from SO-6. There are no recorded shipwrecks within the area of SO-6.

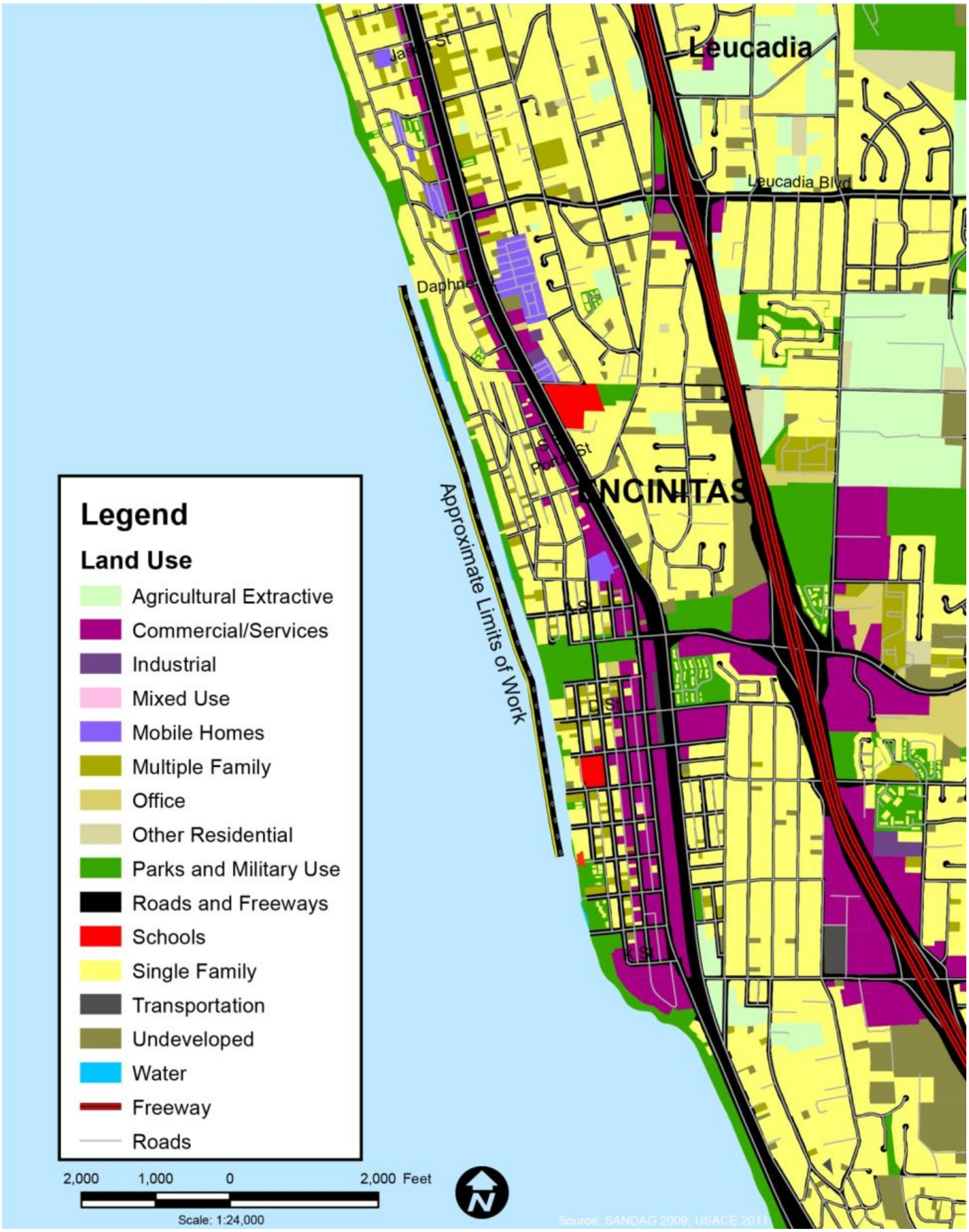


Figure 4.12-1 Land Use Within the Encinitas Receiver Site

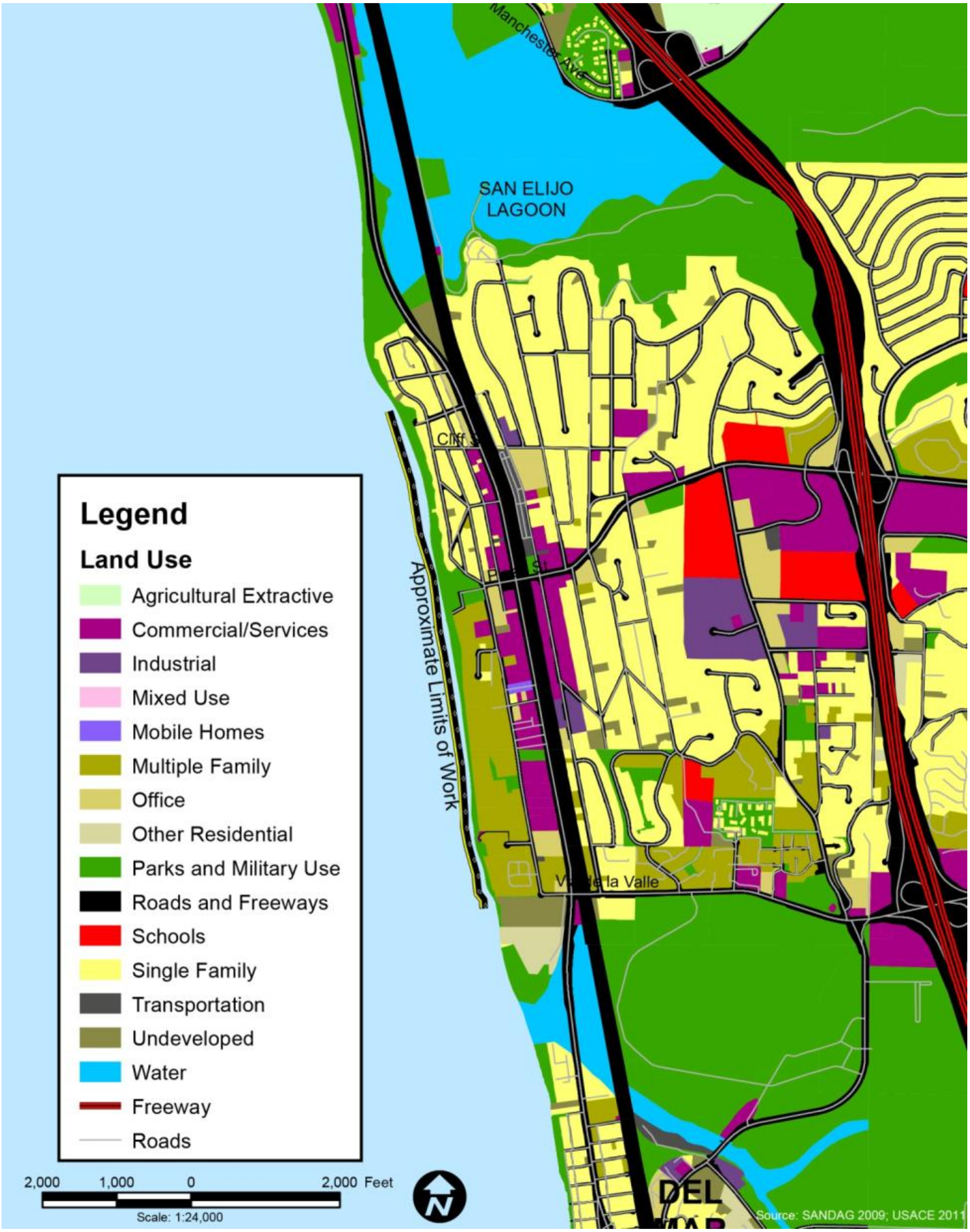


Figure 4.12-2 Land Use Within the Solana Beach Receiver Site

4.13 Recreation

The project area provides a variety of coastal-oriented recreational activities including beach going, surfing, fishing, skin and SCUBA diving, and nature study. Recreational opportunities are facilitated by a series of local, county and state parks in the project area that provide access to the beach. Numerous private staircases also provide access for bluff top residents. Parks and popular surfing spots are shown on **Figure 4.13-1**.

Recreational use of the shoreline is affected by the narrow beaches under baseline conditions. Wave run-up limits access along the shore during high tides. Cobble and exposed sandstone in some reaches limit the amount of sandy beach on which beach users can sunbathe and picnic.

Recreational safety is provided by lifeguard services. The California Department of Parks and Recreation provide lifeguards at the state beaches, and the Cities of Encinitas and Solana Beach provide lifeguards at beaches within their jurisdiction. Bluff erosion remains a public safety concern. As previously discussed, several fatalities and injuries due to bluff collapse have occurred within and adjacent to the study area. A bluff collapse destroyed part of the public access trail at Leucadia State Beach, and both public and private stairways have been intermittently closed over the years due to bluff erosion. Several private beach access points in both Solana Beach and Encinitas have never reopened.

Water pollution stemming from storm drain outlets and from the outlets of coastal lagoons has resulted in posting and/or occasional closing of beaches to protect public recreational safety. Bacteria indicators are monitored at the storm drain outlets and adjacent surfzone and in the surfzone offshore coastal lagoons. With few exceptions, bacteria concentrations measured in the surfzone up- and downcurrent of the storm drain outlets have been within state standards for water-contact recreation.

4.13.1 California State Parks

Four California State Parks are located along the coastline of the City of Encinitas. At the north end of the city is Leucadia State Beach (also known as Beacon's). Leucadia State Beach is currently operated by the City of Encinitas on behalf of California Department of Parks and Recreation (California Department of Parks and Recreation, 2012a). Swimming, surfing, fishing and picnicking are popular at this beach (California Department of Parks and Recreation 2012a). Access to the beach is via an improved trail at the foot of Leucadia Boulevard. Parking is located along Leucadia Boulevard.

Moonlight State Beach is located at the end of Encinitas Boulevard. This beach offers swimming, surfing and fishing. Facilities include two lifeguard tower, volleyball and tennis courts, picnic facilities, recreational equipment rentals, and a snack bar. During the summer, this is the central point for activities such as Junior Lifeguard programs, surf schools, and YMCA camps. Parking is located on C Street. As with Leucadia State Beach, Moonlight State Beach is operated by the City of Encinitas on behalf of the California Department of Parks and Recreation (California DPR 2012a).

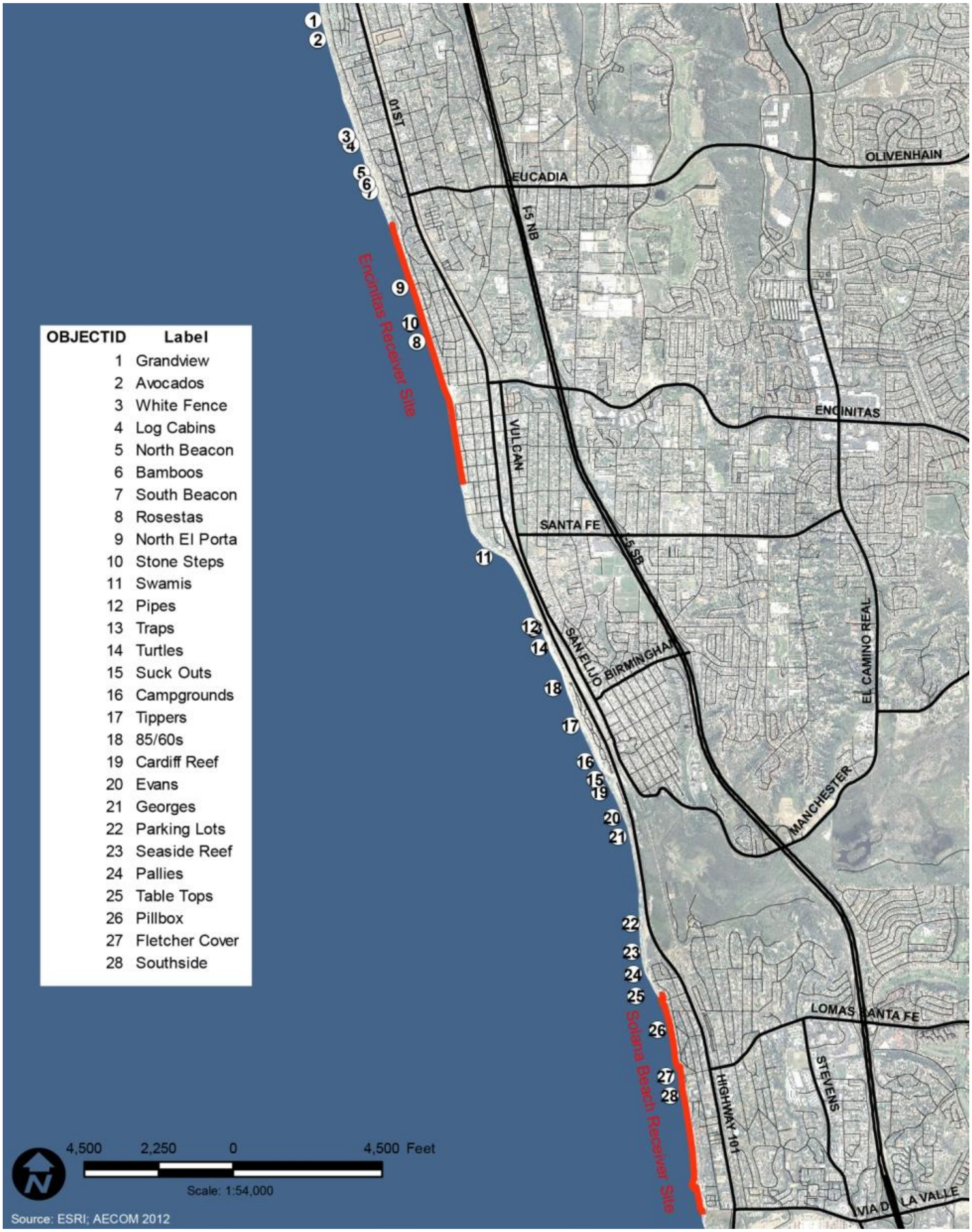


Figure 4.13-1 Popular Surfing Spots

San Elijo State Beach is located north of the San Elijo Lagoon entrance channel, near the community of Cardiff-by-the-Sea. San Elijo State Beach is a popular camping spot and offers swimming, surfing, showers and picnicking. A camp store and snack bar located near the campground entrance operates March through October and provides amenities including some RV supplies, boogie boards, and firewood (California Department of Parks and Recreation 2012a). Located near the campground entrance is an overnight surf camp, which provides summer surf camps, private surf parties, surf rentals, and day surf lessons year round. The narrow, bluff-backed stretch of sand has a nearby reef popular with snorkelers and divers. San Elijo State beach had approximately 960,683 visitors in fiscal year 2008-2009 (DPR 2010).

Cardiff State Beach is located south of the San Elijo Lagoon inlet channel. Cardiff State Beach includes parking lots next to the beach and restrooms. There is also a large pay parking lot at the south end of Cardiff Beach, just off the highway. This section of beach is called Seaside Beach, named after Seaside Reef (San Diego Coast Life 2012a) (also called Table Tops). Recreational opportunities include swimming, surfing and beachcombing (California Department of Parks and Recreation 2012). Visitors at Cardiff State Beach were estimated at over 2,264,500 during the 2008-2009 fiscal years at both the south and central sections of Cardiff State Beach (DPR 2010).

There are no State Parks or beaches located within the City of Solana Beach.

4.13.2 County Parks

One county park is located within the study area. The San Elijo Lagoon County Park and Ecological Reserve encompass approximately 915 acres of diverse habitat in and surrounding the lagoon. There are over 5 miles of hiking trails in the reserve open to the public. A Nature Center is located on the northwest side of the lagoon south of Manchester Avenue. Facilities include a parking lot, restrooms, drinking water, and a 1 mile loop trail.

4.13.3 Local Beaches and Parks

Several city-managed beaches/parks are located along the coastline of the Cities of Encinitas and Solana Beach. Stone Steps, in the City of Encinitas has a steep public staircase that leads down to a rocky beach. Stone Steps is a good surfing spot (San Diego Coast Life 2012b). A lifeguard is on duty from 10am to 6pm during the summer (late June to Labor Day). There is limited street parking near the beach. Encinitas Beach Park is located north of Stone Steps Beach in the City of Encinitas. Free parking is available on the street. The beach is open from 5 a.m. to 2 a.m. and is popular for surfing. Further south is Swami's Beach, located north of San Elijo State Beach. Swami's Beach is located at the base of bluffs, where a wooden stairway makes its way down. Large waves make this beach renowned by surfers. Swamis beach is also good for diving and swimming. The beach offers a picnic area with restrooms and free parking and Seacliff Roadside Park at the top of the cliff overlooking the beach. Rocky reef tide pools are exposed under low tides. Lifeguard Towers are opened during the summer season (late June to Labor Day) (San Diego Coast Life 2012c).

Additional local parks are located within the City of Solana Beach. Tide Beach Park is located at the northern end of the City of Solana Beach at the western terminus of Ocean Street. The park includes a pocket beach and offshore rocky reef tide pools and extends north to the more extensive Table Tops reef. Tide Beach Park provides opportunities for surfing, surf-fishing, snorkeling, SCUBA diving, swimming, body-boarding, jogging, and walking. Parking is available along local residential streets. Lifeguards are on duty during the summer months only (City of Solana Beach, 2012).

Fletcher Cove Beach Park, also known as Pillbox, is located at the western terminus of Plaza Street and offers recreational access for activities such as surfing, surf-fishing, swimming, body-boarding, jogging, and walking and sunbathing. Park facilities include restrooms, showers, picnic tables, playground and a basketball court located on top of the bluffs next to the Marina Safety Department Headquarters. Lifeguards are on duty year round (City of Solana Beach 2012a).

Within the southern portion of Solana Beach, Seascape Surf Beach Park (also known as Cherry Hill) is located approximately ½ mile south of Fletcher Cove. There is parking along South Sierra Avenue and on nearby side streets. Seascape Surf Beach Park offers recreational access for opportunities such as surfing, surf-fishing, swimming, body-boarding, snorkeling, other water related activities, walking, jogging, and Frisbee throwing. Lifeguards are on duty only during the summer months (City of Solana Beach 2012a). At the far southern end of Solana Beach is the Del Mar Shores beach access which also has a summer use lifeguard tower where activities similar to Seascape Surf occur.

In the City of Solana Beach there are eight vertical access points that provide access to the beach below. No additional access points are planned. Four of these vertical access points are public and four are private. Public access points exist at Tide Park, Fletcher Cove, SeaScape Sur, and adjacent to Del Mar Shores Terrace. These public access points are located from 1,000 to 2,000 ft of one another and other public access points, such as Cardiff State Beach in Encinitas. Private access points exist at Solana Palisades, Seascape Shores, Seascape I, and at the Del Mar Beach Club. In addition, there is a public view overlook at the border of the Cities of Solana Beach and Del Mar.

Each of the eight coastal access-ways consists of stairs or a ramp. Various public and private access stairs have been undermined at times by wave attack and storm damage. The City repairs and maintains the public access points as part of an ongoing operations and maintenance program. No unauthorized or uncontrolled access-ways exist within the City.

In Solana Beach, due to the narrow beaches, lateral beach access is limited during high tides, Pedestrian access on the California Coastal Trail is replaced by the Coastal Rail Trail along Pacific Coast Highway/Highway 101 during high tides.

Nearby lateral beach access is also available immediately north of the City at Cardiff State Beach in Encinitas and from the south within the City of Del Mar near the mouth of the San Dieguito Lagoon. Due to the narrow beaches in the City, lateral beach access is often discontinuous even at low tide along the shoreline. Lateral access along the top of the bluff is not available due to the presence of private property, fragile bluffs and steep bluff faces. Public access to the top of the bluff, providing views of the ocean, are provided in three locations in the City including the overlook at Ocean Street/Pacific Avenue and at the Surfsong and Las Brisas residential developments located south of Fletcher Cove. In addition, a new public view corridor and seating area was created in 2009 at the western terminus of Ocean Street adjacent to the intersection of West Circle Drive/Pacific Avenue and Ocean Street.

4.13.4 Beach Attendance Estimates

Table 4.13-1 provides beach attendance estimates compiled for Cardiff State Beach, San Elijo State Beach, and by the Cities of Encinitas and Solana Beach for local beaches. There are four state beaches within the City of Encinitas. Cardiff State Beach and San Elijo State Beach are managed by the California Department of Parks and Recreation. The other two state beaches, Leucadia and Moonlight State Beaches are managed by the City of Encinitas. Beach attendance counts are normally people recreating in the water or on the sand, and at adjacent picnic areas, parking lots, recreation concessions and bike paths. They do not include people that merely transit on bikes or in cars. This is an estimate by lifeguards on duty (USLA 2012).

Table 4.13-1 Beach Attendance by Jurisdiction, 2001-2011

Fiscal Year	San Elijo State Beach	Cardiff State Beach	Year	City of Encinitas	City of Solana Beach
2001/02	766,100	1,189,445	2001	3,414,129	850,000
2002/03	801,096	1,315,308	2002	0	0
2003/04	857,860	1,274,876	2003	0	0
2004/05	858,859	1,225,631	2004	-	-
2005/06	996,646	1,715,856	2005	2,502,345	-
2006/07	840,932	1,330,007	2006	-	-
2007/08	1,016,013	2,221,668	2007	2,891,026	0
2008/09	960,683	2,264,552	2008	2,992,331	101,075
2009/10	860,706	1,538,338	2009	3,027,050	202,275
2010/11	973,238	1,392,097	2010	3,440,422	207,300
-	-	-	2011	0	210,500

Source: USACE 2003, USLA 2012 (United States Lifesaving Association) Available at http://www.usla.org/?page=STATISTICS, California Department of Parks and Recreation 2012b

The borrow sites land ownership and underwater recreational opportunities are described in Section 4.12.4. There are no recorded shipwrecks near either borrow site. There is an artificial reef located approximately 0.4 mile from the SO-6 borrow site, but no artificial reefs near the SO-5 site.

4.13.5 Recreation Description by Receiver Site

Recreational opportunities within Encinitas receiver site include Stone Steps, which is a popular spot for surfing and fishing. It can be accessed from a public stairway. It also includes Seaside Gardens County Park and Moonlight State Beach. This part of receiver site can be accessed from the north at the stairway at Stone Steps and from the south by the Moonlight State Beach parking area at C Street. Access along the beach is dependent upon tidal stage (SANDAG 2011a).

Tide Beach Park and Fletcher Cove Park are located within Solana Beach receiver site. Tide Beach Park can be accessed by a public stairway down the bluffs. Reefs occur at the north end of the receiver site at Table Tops and to a lesser extent at Tide Beach Park. Table Tops is a popular tidepool, fishing, skin and SCUBA diving, and surfing spot. Access to these reefs and Tide Beach Park also is available from the parking area at the south end of Cardiff State Beach. They also can be accessed from the south starting at Fletcher Cove. Stairways to the beach are located at North Seascape Surf Beach Park, near the middle of the receiver site, and Del Mar Shores near the south end of the receiver site. Access along the beach is dependent upon tidal stage. **Table 4.13-2** presents a list of the beaches in the project study area.

Table 4.13-2 Local Beaches with public access in shoreline study area

Beach Location	General Facilities	Other Public Amenities
Encinitas Receiver Site		
Stone Steps Beach 350 South El Portal[1]	Public access via stairway	On street parking
Moonlight Beach 400 B Street[1]	Public stair access Handicap access Polyetylene walkway Picnic facilities Restrooms Showers Concession stand in summer Fire Rings Benches Phone Lifeguard towers	Tennis Volleyball Play Equipment Parking lot
D Street Beach 450 D Street[1]	Public stair access Shower	On street parking Viewing areas Blufftop trail
Solana Beach Receiver Site		
Fletcher Cove Beach 111 S. Sierra[2]	Public ramp access at Plaza Street Restrooms Showers Picnic Facilities Lifeguard tower	Parking lot Basketball Court Shuffleboard Volleyball Playground
Tide Beach Park 302 Solana Vista Drive[2]	Public stair access at Solana Vista Drive	-
Seascape Surf[2]	Public stair access at Dahlia Drive	-
Del Mar Shores - 180 Del Mar Shores Terrace[2]	Public stair access at Del Mar Shores Lifeguard tower	-

Source:
[1] City of Encinitas, Parks and Recreation, Beaches in Encinitas, 2011 http://www.cityofencinitas.org/Government/CityD/ParksAndRecreation/Parks+and+Beaches/Beach+Information.htm
[2] City of Solana Beach Local Coastal Program Land Use Plan, Chapter 2 – Public Access and Recreation, April 2011

4.13.6 Surfing

Surfing is the recreational act of riding breaking waves and is an important part of the local culture. Within the project area, the surf site known as Swamis was made popular by The Beach Boys in their 1963 musical hit, “Surfin USA”. Waves can be ridden using various equipment such as surfboards (e.g., longboards and shortboards), stand up paddle boards, body boards, boogie boards, wave skis, kayaks, sailboards, and kiteboards. In the project study area, surfing is most often defined as riding waves on longboards and shortboards (USACE 2012a). **Table 4.13-3** lists the surf sites within Encinitas and Solana Beach.

Table 4.13-3 Surf Sites in the Study Area

Name	Location
Ponto, Batiquitos	North of Encinitas Receiver Site
Grandview	North of Encinitas Receiver Site
Avocados	North of Encinitas Receiver Site
White Fence	North of Encinitas Receiver Site
Log Cabins	North of Encinitas Receiver Site
North Beacons	North of Encinitas Receiver Site
Bamboos	North of Encinitas Receiver Site
South Beacons	North of Encinitas Receiver Site
North El Portal	Within Encinitas Receiver Site
Stone Steps	Within Encinitas Receiver Site
Rosetas	Within Encinitas Receiver Site
Moonlight	Within Encinitas Receiver Site
D Street	Within Encinitas Receiver Site
Trees	Between Encinitas and Solana Beach Receiver Sites
Boneyards, outside Swamis	Between Encinitas and Solana Beach Receiver Sites
Swamis	Between Encinitas and Solana Beach Receiver Sites
Dabbers	Between Encinitas and Solana Beach Receiver Sites
Brown House	Between Encinitas and Solana Beach Receiver Sites
Pipes	Between Encinitas and Solana Beach Receiver Sites
Traps	Between Encinitas and Solana Beach Receiver Sites
Turtles	Between Encinitas and Solana Beach Receiver Sites
Barneys	Between Encinitas and Solana Beach Receiver Sites
85/60s	Between Encinitas and Solana Beach Receiver Sites
Tippers	Between Encinitas and Solana Beach Receiver Sites
Campgrounds	Between Encinitas and Solana Beach Receiver Sites
Suckouts, Lagoon Mouth	Between Encinitas and Solana Beach Receiver Sites
Cardiff Reef, South Peak	Between Encinitas and Solana Beach Receiver Sites
Evans	Between Encinitas and Solana Beach Receiver Sites
Georges, Cardiff Beach	Between Encinitas and Solana Beach Receiver Sites
Parking Lots	Between Encinitas and Solana Beach Receiver Sites
Seaside Reef	Between Encinitas and Solana Beach Receiver Sites
Pallies	Between Encinitas and Solana Beach Receiver Sites
Table Tops, Tide Beach Park	Within Solana Beach Receiver Site
Pillbox, Fletcher Cove	Within Solana Beach Receiver Site
South Side, Fletcher Cove	Within Solana Beach Receiver Site
Cherry Hill, Seascape Surf Beach	Within Solana Beach Receiver Site
Del Mar, 17^{th} – 20^{th} Street	South of Solana Beach Receiver Site
15^{th} Street	South of Solana Beach Receiver Site

Source: Detailed in Appendix B Table 11.3-1

Detailed descriptions of individual sites are provided in Appendix B9 of the Encinitas & Solana Beach Shoreline Study (USACE 2012).. Beginning in 2012, as part of the SANDAG RBSP II project, video monitoring of several surf spots will be initiated by SANDAG in conjunction with the Surfrider Foundation to establish a video-based Surf Monitoring Program.

Utilizing technology provided by CoastalCOMS, a company which specializes in video-based coastal monitoring, this new Surfrider program will establish a baseline for surf quality at six San Diego County beaches where RBSP II beach fills are to occur, and will include daily observations of surf quality with the help of a newly-installed video monitoring system.

Cameras monitoring the RBSP II project will create a long-term video archive, assess changes in beach width and shoreline position, and track potential changes in surf quality and "surfability." The beaches to be monitored in the project study area from south to north, are:

- Fletcher Cove in Solana Beach;
- Seaside Reef at the boundary of Solana Beach and Encinitas;
- Cardiff Reef in Encinitas; and,
- Moonlight Beach / D St. in Encinitas.

Surf quality parameters will be measured from live video monitoring using analytics designed to detect breaking wave face heights, break zone activity level, and wave locations. Volunteers will also utilize CoastalCOMS software to review video archives for an assessment of conditions at each surf spot.

4.14 Public Safety

For purposes of this EIS/EIR, public health and safety issues are defined as those that directly affect the continued ability to protect and preserve life and property at locations within the project study area and along the proposed borrow sites to consider recreational safety, and vessel safety.

4.14.1 Public Access to Beaches

This section includes current conditions relating to public access in each receiver site. The city of Encinitas has approximately 2,566 public parking spots including street-side parking within a reasonable walking distance of nine different public access locations.[12] The distance between public access points varies from one-tenth to three-quarters mile. The city of Solana Beach has approximately 2,061 public parking spaces including street-side parking within a reasonable walking distance of four public access points. The distance between access points is approximately ¼ to ½ mile. Even if only half of these parking spaces are available to beach visitors, over 10,000 daily visitors could arrive by vehicle at each city. Therefore each beach has more than sufficient parking capacity near public access points to accommodate the 300-400 increase in daily visitations that have been projected for different beach fill and hybrid (beach fill plus notch fill) alternatives.

Public Access

Encinitas Receiver Site – 700 Block, Neptune Avenue to West H Street

Stairs at Stonesteps Beach located at 350 South El Portal allow public access. Public access consists of a concrete and wooden staircase surrounded by shortcrete.

Public access is found at Moonlight State Beach (B and C Streets) and south at the D Street stairway. Public access to Moonlight Beach consists of parking lot, separate drop-off area, and additional parking on C Street, a paved pedestrian ramp to beach level, and walkway along the beach. Public access to D Street Beach consists of benches on the top of the bluff and a

[12] A reasonable walking distance is defined as no more than 1/3 of a mile. Parking and public access at San Elijo lagoon is included in this total. San Elijo lagoon has 835 parking spaces.

wooden staircase leading from the top of the bluff to the beach. There is riprap along the north section of Moonlight Beach.

At the Moonlight Beach, the lifeguards utilize an access point just south of the volleyball courts and at the main headquarters. A permanent lifeguard stand is located at the south end of Moonlight Beach at C Street and a temporary tower is placed at the north end of the beach at B Street. Both are situated on the berm above the low tide beach, and neither tower is moved during the winter season (SANDAG 2011).

Solana Beach Receiver Site – Tide Park to Solana Beach Southern City Limit

In the City of Solana Beach there are eight vertical access points that provide access to the beach below. No additional access points are planned. Four of the access points are public and four are private. Public access points exist at Tide Park, Fletcher Cove, SeaScape Sur, and adjacent to Del Mar Shores Terrace. Private access points, all in the southern half of Solana Beach receiver site and associated with higher density residential condominiums exist at Solana Palisades, Seascape Shores, Seascape I, and at the Del Mar Beach Club. These access points all consist of stairs except for Fletcher Cove which has a ramp (City of Solana Beach 2011).

There are four temporary lifeguard towers located within this receiver site: one at Fletcher Cove, a Junior Lifeguard tower at 350 S. Sierra Avenue, one at the base of the Seascape Surf access point, and one at 825 S. Sierra Avenue. All of the towers are annually placed on the beach the weekend before Memorial Day and removed the weekend after Labor Day (SANDAG 2011a).

4.14.2 Access for Emergency Services

This section describes existing access points to reaches by emergency personnel (fire, police, ambulance, etc.).

<u>Emergency Service Access</u>

Encinitas Receiver Site – 700 Block, Neptune Avenue to West H Street

Vehicular access is located on Carlsbad Boulevard at the South end of Batiquitos Lagoon and slightly north of Carlsbad State Beach and at Moonlight Beach, 400 B Street.

Solana Beach Receiver Site – Tide Park to Solana Beach Southern City Limit

Vehicle assess is located at Seaside State Beach and at Fletcher Cove.

4.14.3 Safety for Commercial Fishing and Recreation Vessels and Personnel

Commercial boats, fishing boats, and recreational vessels currently traverse the overall project area along the coastline. Most local vessels operate out of Oceanside Harbor, Mission Bay, and San Diego Bay.

4.14.4 Safety for Divers

Snorkeling activity is common off of Del Mar Shores and Seascape Surf, south of Fletcher Cove, in Solana Beach receiver site.

Diving activity is common near Swami's Beach in Encinitas receiver site, and at Tide Beach Park in Solana Beach receiver site.

The Encinitas coastline contains several beach areas, kelp beds, and marine sanctuaries that are ideal for SCUBA Diving.

4.14.5 Bluff Safety

This section highlights past and recent conditions for bluff safety within the two study receiver sites.

Erosion of the bluff toe occurs at the base of the bluff where waves impact, and results in a "notch" at the base of the bluff which can grow to many ft in depth. When this notch reach a sufficient depth, the weight of the overhanging bluff exceeds the cohesive support of the soil, and the bluff collapses without warning. Due to the nature of soil cementation and stress factors, these collapses usually occur when the soil is drying out in the summer months, when there is little rainfall or wave activity but more people crowded onto the narrow strip of eroded beach. This combination of high recreational user density and spontaneous catastrophic failure has resulted in five fatalities since 1995. In the last few years when people on the beach were crushed by sudden bluff collapses. Although to date there has been sufficient warning to evacuate occupants from within structures on the bluff top before they were undermined and collapsed onto the beach, the potential exists for loss of life in this scenario, particularly if the bluff collapse is large enough and occurs without warning. **Table 2.1-1** shows recent major bluff collapses in the study area.

4.15 <u>Public Utilities</u>

This section identifies the location of the existing structures and utilities within each reach in the study area. The description of structures and utilities is based on limited field surveys and prior environmental documentation (U.S. Navy 1997a and b and SANDAG 2011a).

For the purpose of this EIS/EIR, public utilities services are defined as sewer outfalls, access stairs and ramps, storm/sewer drains, and lifeguard towers.

4.15.1 Utilities Near Sand Receiver Sites and Offshore Borrow Sites

<u>Utilities near Sand Receiver Sites</u>

Encinitas Receiver Site – 700 Block, Neptune Avenue to West H Street

One 36-inch, one 60-inch, and three 48-inch storm drainpipes are located at the end of B Street at Moonlight State Beach. The City of Encinitas has excavated several ft around the outlets to expose the pipes and allow proper drainage flow.

A permanent lifeguard stand is located at the south end of Moonlight Beach at C Street and a temporary tower is placed at the north end of the beach at B Street. Both towers are situated on the berm above the low tide beach, and neither tower is moved during the winter season (SANDAG 2011a). A ramp provides access to Moonlight Beach and a paved road extends from the base of the ramp to the permanent lifeguard tower for emergency vehicles only.

The offshore sand borrow sites were identified in **Figure 3.3-1** through **Figure 3.3-3**. Offshore sand sources contain no utilities within their boundaries. There is a sewer outfall pipe offshore of the San Elijo Lagoon.

There are no known public facilities offshore in the vicinity of the borrow sites.

Solana Beach Receiver Site – Tide Park to Solana Beach Southern City Limit

A 60-inch energy dissipater storm drainpipe is located at the west end of Plaza Street immediately adjacent to the Fletcher Cove ramp. Another substantially smaller storm drain outlet is located at Seascape Surf, to the south of Fletcher Cove. This storm drain emerges from the bluff face at approximately 9 to 10 ft above MSL. None of the drainpipes are directly on the beach.

There are four temporary lifeguard towers located within the proposed receiver site: one at Fletcher Cove, a Junior Lifeguard tower at 350 S. Sierra Avenue, one at the base of the Seascape Surf access point, and one at 825 S. Sierra Avenue. All of the towers are annually placed on the beach the weekend before Memorial Day and removed the weekend after Labor Day (SANDAG 2011a). A paved ramp provides access to the beach and facilities at Fletcher Cove.

In the City of Solana Beach there are eight vertical access points that provide access to the beach below. Four of these vertical access points are public and four are private. Public access points exist at Tide Park, Fletcher Cove, SeaScape Sur, and adjacent to Del Mar Shores Terrace. These public access points are located from 1,000 to 2,000 ft of one another and other public access points, such as Cardiff State Beach in Encinitas. Private access points exist at Solana Palisades, Seascape Shores, Seascape I, and at the Del Mar Beach Club.

5 ENVIRONMENTAL CONSEQUENCES

The environmental consequences of the various action alternatives, as well as the no action alternative, are evaluated in this section. Several federal and state regulations and local ordinances and policies were considered in the assessment of environmental consequences. Federal, state, and local regulations were described in Subsection 2.7, and applicable local regulations were described in Section 4 according to relevant technical issue area.

Consistent with federal and state regulations and guidelines (40 C.F.R. § 1508.27; CEQA Guidelines § 15064,15126.2[a]); direct, indirect, and cumulative impacts were evaluated.

5.1 Geology and Topography

The analysis in this section is based on information contained in Appendices B and C. The receiver sites are the same for all alternatives and measure 7,800 ft and 7,200 linear ft in length respectively for Encinitas and Solana Beach.

5.1.1 Impact Significance Criteria

The project would result in a potentially significant if it would:

- Substantially and adversely modify any unique geologic or physical features;
- Substantially and adversely increase bluff erosion due to wave attack; and/or
- Substantially and adversely modify beach or near shore bottom topography.

5.1.2 Encinitas

Alternatives EN-1A and EN-1B consists of sand placement along the shoreline in Encinitas. Alternatives EN-2A and EN-2B also include notch fills along the shoreline, in addition to beach nourishment, to provide protection against wave action. The notch fill process is further described in the Section 3.3.5.

Borrow Sites

Initial Placement

Under Alternatives EN-1A and EN-1B, sand would be dredged from a previously surveyed and mined offshore sites (designated SO-6), and placed directly onto the receiver site in Encinitas. This offshore borrow site is a relic or ancient beach indicating the position of the shoreline approximately 10,000 years ago during the last ice age when sea level was approximately 400 ft lower.

All of the offshore borrow sites that would be used by this project are located beyond the “depth of closure”. Depth of closure is the depth beyond which no significant longshore or cross-shore transports take place due to littoral transport processes. The closure depth is therefore defined as the depth which marks the seaward boundary of the littoral zone.

Table 3.4-2 presents data for the initial dredging and placement of material from borrow site SO-6 under both the low and high sea level rise scenarios for Alternative EN-1A. It should be noted that the volume dredged and the volume placed are not equal. This is the case because it is estimated that during dredging and sand placement activities there are operational losses equal to approximately 10-20 percent. As described in Section 3.3.1 an alternative source of sand could be used should suitable material become available. Depending on timing and material suitability and subject to the appropriate and necessary environmental review and evaluation, sand dredged as part of the San Elijo Lagoon Restoration Project (SELRP) may be substituted or may supplement sand from the offshore borrow sites. This material could be used for either the initial fill or for subsequent/future renourishment efforts. Because the timing, volume and compatibility of such material is not known at this time, this analysis assumes that only the identified offshore borrow site would be dredged.

Alternative EN-1A dredge site deepening would alter local bathymetry by up to 20 ft under both the low and high sea level rise scenarios over approximately two acres. However, the proposed dredging activities would be conducted following accepted marine engineering practices regarding construction and geotechnical limitations associated with borrow site cut slopes. In addition, the proposed dredging activities are outside the depth of closure and would therefore not intercept the sand that typically rebuilds the beaches in the summer. As a result, the change to borrow site bathymetry under Alternative EN-1A, under both low and high sea level rise scenarios, is not expected to significantly impact site topography or geology.

Alternative EN-1B would be similar to Alternative EN-1A, but would dredge approximately half of the area (approximately one acre) to the same depth of dredge cut. The change to borrow site bathymetry is not expected to significantly impact site topography or geology.

Alternative EN-2A would be similar to Alternative EN-1A, and would dredge approximately the same area (approximately two acres) to the same depth of dredge cut. The change to borrow site bathymetry is not expected to significantly impact site topography or geology.

Alternative EN-2B would be similar to Alternative EN-1B, and would dredge approximately the same area (approximately one acre) to the same depth of dredge cut. The change to borrow site bathymetry is not expected to significantly impact site topography or geology.

Renourishment

The SO-6 site would be used to provide material for Encinitas until the capacity of suitable material from SO-6 is exhausted, at which time SO-5 would provide material to both Encinitas and Solana Beach. The timing of the switch from SO-6 to SO-5 as the primary source for material is subject to a number of variables including the alternative implemented, any actual future changes to sea level and whether or not material from the SELRP is utilized by this project.

Alternative EN-1A has a five-year renourishment cycle. **Table 3.4-3** shows the dredging volume data for the five-year renourishment cycles and the total borrow volume over the life of the project under the low and high sea level rise scenarios. Renourishment impacts are approximately half of the area (approximately one acre) of the initial placement to the same depth of dredge cut. The change to borrow site bathymetry is not expected to significantly impact site topography or geology.

Alternative EN-1B has a five-year renourishment cycle. **Table 3.4-7** shows the dredging volume data for the five-year renourishment cycles and the total borrow volume over the life of the project under the low and high sea level rise scenarios. Renourishment impacts are approximately half of the area (approximately one half acre) of the initial placement to the same depth of dredge cut. The change to borrow site bathymetry is not expected to significantly impact site topography or geology.

Alternative EN-2A has a ten-year renourishment cycle. **Table 3.4-11** shows the dredging volume data for the ten-year renourishment cycles and the total borrow volume over the life of the project under the low and high sea level rise scenarios. Renourishment impacts are approximately equal in the area (approximately two acres) of the initial placement to the same depth of dredge cut. The change to borrow site bathymetry is not expected to significantly impact site topography or geology.

Alternative EN-2B has a five-year renourishment cycle. **Table 3.4-15** shows the dredging volume data for the five-year renourishment cycles and the total borrow volume over the life of the project under the low and high sea level rise scenarios. Renourishment impacts are approximately e half of the area (approximately one half acre) of the initial placement to the same depth of dredge cut. The change to borrow site bathymetry is not expected to significantly impact site topography or geology.

<u>Notch Fills</u>

Notch fills would be constructed landward of the face of the coastal bluff using engineered concrete that fills the notch in the bluff such that it is flush with the seaward edge of the surrounding bluff. Constructing notch fills would result in an alteration of the site geology and would structurally stabilize the lower coastal bluff making it more resistant to erosional forces from storm wave damage. This structural shoreline protective measure provides a much more stable geological environment providing a positive public safety effect within the study area, as it would result in additional bluff protection and reduce the likelihood of a major bluff failure onto the public beach below. Additionally, state policy requires that notch fills be constructed of concrete that erodes at a similar rate to the sandstone bluffs. This means that the plugs will erode at the same rate as the remainder of the bluff. Therefore, notch fills under Alternative 2A would have no significant adverse impacts to the site geology.

Alternative EN-2A would have no significant adverse impacts to the site geology.

Alternative EN-2B would have no significant adverse impacts to the site geology.

<u>Receiver Sites</u>

The beach fill location in Encinitas is approximately 7,800 ft in length, and sand placement would occur along the entire reach of the receiver site. Nourishment activities would result in a change in shoreline topography and an increase in the beach sand profile above and below the mean high tide line. The increased beach sand profile would result in a net benefit by preventing bluff erosion and is not considered an adverse impact to topography.

Alternative EN-1A would result in an additional beach mean sea level (MSL) width of 100 ft. **Table 3.4-4** presents the volume of material to be placed on the receiver sites under Alternative EN-1A for the low and high sea level rise scenarios. Renourishment cycle is anticipated to be five years under this alternative. Implementation of this alternative would not substantially and adversely modify any unique geologic or physical features, as it would add compatible sand to existing sandy shoreline. Implementation of this alternative would not substantially and adversely increase bluff erosion due to wave attack, because the very intent of the alternative is to provide protection of the bluffs from such forces by increasing beach width to reduce the wave energy at the bluffs. Implementation of this alternative would increase the beach width and potentially cover near shore reef areas immediately after placement events. These changes would be temporary and the coastal processes, as discussed in Section 5.2, are dynamic over the seasons producing variable impacts. Therefore, beach nourishment activities proposed under Alternative EN-1A are not expected to result in substantial adverse impacts.

Alternative EN-1B would result in an additional beach mean sea level (MSL) width of 50 ft. **Table 3.4-8** presents the volume of material to be placed on the receiver sites under Alternative EN-1B for the low and high sea level rise scenarios. Beach nourishment activities build a beach half the width of Alternative EN-1A. Therefore, beach nourishment activities proposed under Alternative EN-1B are not expected to result in substantial adverse impacts.

Alternative EN-2A would result in an additional beach mean sea level (MSL) width of 100 ft. **Table 3.4-12** presents the volume of material to be placed on the receiver sites under Alternative EN-2A for the low and high sea level rise scenarios. Beach nourishment activities build a beach the same width of Alternative EN-1A. Therefore, beach nourishment activities proposed under Alternative EN-1B are not expected to result in substantial adverse impacts.

Alternative EN-2B would result in an additional beach mean sea level (MSL) width of 50 ft. **Table 3.4-16** presents the volume of material to be placed on the receiver sites under Alternative EN-2B for the low and high sea level rise scenarios. Beach nourishment activities build a beach half the width of Alternative EN-1A. Therefore, beach nourishment activities proposed under Alternative EN-1B are not expected to result in substantial adverse impacts.

5.1.3 Solana Beach

Alternatives SB-1A, SB-1B, and SB-1C consist of sand placement along the shoreline in Solana Beach. Alternatives SB-2A and SB-2B also include notch fills along the shoreline, in addition to beach nourishment, to provide protection against wave action. The notch fill process is further described in the Section 3.3.5.

<u>Borrow Sites</u>

Initial Placement

Under Alternatives SB-1A, SB-1B, and SB-1C, sand would be dredged from a previously surveyed and mined offshore sites (designated SO-5), and placed directly onto the receiver site in Solana Beach. This offshore borrow site is a relic or ancient beach indicating the position of the shoreline approximately 10,000 years ago during the last ice age when sea level was approximately 400 ft lower. Borrow site MB-1 would be used for Solana Beach when SO-5 is exhausted under the high sea level rise scenario over the life of the project, but would not be used for initial placement.

All of the offshore borrow sites that would be used by this project are located beyond the “depth of closure”. Depth of closure is the depth beyond which no significant longshore or cross-shore transports take place due to littoral transport processes. The closure depth is therefore defined as the depth which marks the seaward boundary of the littoral zone.

Table 3.4-18 presents data for the initial dredging and placement of material from borrow site SO-5 under both the low and high sea level rise scenarios for Alternative SB-1A. It should be noted that the volume dredged and the volume placed are not equal. This is the case because it is estimated that during dredging and sand placement activities there are operational losses equal to approximately 10-20 percent. As described in Section 3.3.1 an alternative source of sand could be used should suitable material become available. Depending on timing and material suitability and subject to the appropriate and necessary environmental review and evaluation, sand dredged as part of the San Elijo Lagoon Restoration Project (SELRP) may be substituted or may supplement sand from the offshore borrow sites. This material could be used for either the initial fill or for subsequent/future renourishment efforts. Because the timing, volume and compatibility of such material is not known at this time, this analysis assumes that only the identified offshore borrow sites would be dredged.

Alternative SB-1A dredge site deepening would alter local bathymetry by up to 20 ft under both the low and high sea level rise scenarios over approximately one acre. However, the proposed dredging activities would be conducted following accepted marine engineering practices regarding construction and geotechnical limitations associated with borrow site cut slopes. In addition, the proposed dredging activities are outside the depth of closure and would therefore not intercept the sand that typically rebuilds the beaches in the summer. As a result, the change to borrow site bathymetry under Alternative SB-1A, under both low and high sea level rise scenarios, is not expected to significantly impact site topography or geology.

Alternative SB-1B would be similar to Alternative SB-1A, but would dredge approximately half of the area (approximately one half acre) to the same depth of dredge cut. The change to borrow site bathymetry is not expected to significantly impact site topography or geology.

Alternative SB-1C would be similar to Alternative SB-1B, but would dredge a slightly smaller area (approximately one half acre) to the same depth of dredge cut. The change to borrow site bathymetry is not expected to significantly impact site topography or geology.

Alternative SB-2A would be similar to Alternative SB-1B, and would dredge approximately the same area (approximately one half acre) to the same depth of dredge cut. The change to borrow site bathymetry is not expected to significantly impact site topography or geology.

Alternative EN-2B would be similar to Alternative SB-1B, and would dredge approximately the same area (approximately one half acre) to the same depth of dredge cut. The change to borrow site bathymetry is not expected to significantly impact site topography or geology.

Renourishment

The SO-5 site would be used to provide material for Solana Beach until the capacity of suitable material from SO-5 is exhausted, at which time MB-1 would provide material to both Encinitas and Solana Beach. The timing of the switch from SO-5 to MB-1 as the primary source for material is subject to a number of variables including the alternative implemented, any actual future changes to sea level and whether or not material from the SELRP is utilized by this project.

Alternative SB-1A has a thirteen-fourteen year renourishment cycle. **Table 3.4-19** shows the dredging volume data for the renourishment cycles and the total borrow volume over the life of the project under the low and high sea level rise scenarios. Renourishment impacts are approximately half of the area (approximately one half acre) of the initial placement to the same depth of dredge cut. The change to borrow site bathymetry is not expected to significantly impact site topography or geology.

Alternative SB-1B has a ten-year renourishment cycle. **Table 3.4-23** shows the dredging volume data for the ten-year renourishment cycles and the total borrow volume over the life of the project under the low and high sea level rise scenarios. Renourishment impacts are approximately half of the area (approximately one half acre) of the initial placement to the same depth of dredge cut. The change to borrow site bathymetry is not expected to significantly impact site topography or geology.

Alternative SB-1C has a ten-year renourishment cycle. **Table 3.4-27** shows the dredging volume data for the ten-year renourishment cycles and the total borrow volume over the life of the project under the low and high sea level rise scenarios. Renourishment impacts are approximately half of the area (approximately one quarter acre) of the initial placement to the same depth of dredge cut. The change to borrow site bathymetry is not expected to significantly impact site topography or geology.

Alternative SB-2A has a ten-year renourishment cycle. **Table 3.4-31** shows the dredging volume data for the ten-year renourishment cycles and the total borrow volume over the life of the project under the low and high sea level rise scenarios. Renourishment impacts are approximately half of the area (approximately one quarter acre) of the initial placement to the same depth of dredge cut. The change to borrow site bathymetry is not expected to significantly impact site topography or geology.

Alternative SB-2B has a ten-year renourishment cycle. **Table 3.4-35** shows the dredging volume data for the ten-year renourishment cycles and the total borrow volume over the life of the project under the low and high sea level rise scenarios. Renourishment impacts are approximately e half of the area (approximately one quarter acre) of the initial placement to the same depth of dredge cut. The change to borrow site bathymetry is not expected to significantly impact site topography or geology.

<u>Notch Fills</u>

Notch fills would be constructed landward of the face of the coastal bluff using engineered concrete that fills the notch in the bluff such that it is flush with the seaward edge of the surrounding bluff. Constructing notch fills would result in an alteration of the site geology and would structurally stabilize the lower coastal bluff making it more resistant to erosional forces from storm wave damage. This structural shoreline protective measure provides a much more stable geological environment providing a positive public safety effect within the study area, as it would result in additional bluff protection and reduce the likelihood of a major bluff failure onto the public beach below. Additionally, state policy requires that notch fills be constructed of concrete that erodes at a similar rate to the sandstone bluffs. This means that the plugs will erode at the same rate as the remainder of the bluff. Therefore, notch fills under Alternative 2A would have no significant adverse impacts to the site geology.

Alternative SB-2A would have no significant adverse impacts to the site geology.

Alternative SB-2B would have no significant adverse impacts to the site geology.

Receiver Sites

The Solana Beach receiver site is approximately 7,200 ft in length, and sand placement would occur along the entire length. Nourishment activities would result in a change in shoreline topography and an increase in the beach sand profile above and below the mean high tide line. The increased beach sand profile would result in a net benefit by preventing bluff erosion and is not considered an adverse impact to topography.

Alternative SB-1A would result in a change in shoreline topography and an increase in the beach sand profile above and below the MHTL. Under the low sea level rise scenario, sand placement would result in an additional beach width of 200 ft measured at MSL. Under the high sea level rise scenario, sand placement would result in an additional 300 ft of beach width as measured at MSL. **Table 3.4-20** presents the volume of material to be placed on the receiver sites under Alternative SB-1A for the low and high sea level rise scenarios. The increased shoreline would result in a net benefit by preventing bluff erosion and is not considered an adverse impact to topography. Implementation of this alternative would not substantially and adversely modify any unique geologic or physical features, as it would add compatible sand to existing sandy shoreline. Implementation of this alternative would not substantially and adversely increase bluff erosion due to wave attack, because the very intent of the alternative is to provide protection of the bluffs from such forces by increasing beach width to reduce the wave energy at the bluffs. Implementation of this alternative would increase the beach width and potentially cover near shore reef areas immediately after placement events. These changes would be temporary and the coastal processes, as discussed in Section 5.2, are dynamic over the seasons producing variable impacts. Therefore, beach nourishment activities proposed under Alternative SB-1A are not expected to result in substantial adverse impacts.

Alternative SB-1B would result in an additional beach mean sea level (MSL) width of 150 ft. **Table 3.4-24** presents the volume of material to be placed on the receiver site under Alternative SB-1B for the low and high sea level rise scenarios. Beach nourishment activities build a beach half the width of Alternative EN-1A. Therefore, beach nourishment activities proposed under Alternative SB-1B are not expected to result in substantial adverse impacts.

Alternative SB-1C would result in an additional beach mean sea level (MSL) width of 100 ft. **Table 3.4-28** presents the volume of material to be placed on the receiver site under Alternative SB-1C for the low and high sea level rise scenarios. Beach nourishment activities build a beach one third to one half the width of Alternative SB-1A. Therefore, beach nourishment activities proposed under Alternative SB-1B are not expected to result in substantial adverse impacts.

Alternative SB-2A would result in an additional beach mean sea level (MSL) width of 150 ft. **Table 3.4-32** presents the volume of material to be placed on the receiver site under Alternative SB-2A for the low and high sea level rise scenarios. Beach nourishment activities build a beach half the width of Alternative SB-1A. Therefore, beach nourishment activities proposed under Alternative SB-2A are not expected to result in substantial adverse impacts.

Alternative SB-2B would result in an additional beach mean sea level (MSL) width of 100 ft. **Table 3.4-36** presents the volume of material to be placed on the receiver site under Alternative SB-2B for the low and high sea level rise scenarios. Beach nourishment activities build a beach half the width of Alternative SB-1A. Therefore, beach nourishment activities proposed under Alternative EN-1B are not expected to result in substantial adverse impacts.

5.1.4 Potential Environmental Impacts of the No Action Alternatives (EN-3 and SB-3)

Under Alternatives EN-3 and SB-3, the No Action Alternative, baseline conditions and trends are assumed to continue over the next 50 years. This alternative assumes the continued piecemeal approach to shoreline protection, including maintenance of existing structures and construction of seawalls along all remaining unprotected segments of shoreline in Encinitas and Solana Beach. Under certain sea level rise predictions, the No-Project Alternative would result in a complete loss of the beaches (for shoreline protective and recreational benefit) and accelerated shoreline and bluff erosion.

Routine maintenance dredging of local lagoons and associated beach replenishment would also be expected to continue. With the exception of the possible future SELRP, routine lagoon maintenance dredge events do not add any new sand to the littoral cell and therefore do not have a major long-term benefit to the shoreline in the study area.

It is assumed that under the No Action Alternative, the shoreline, near-shore and offshore areas would eventually revert to the pre-RBSP I and II conditions. At this time it is unknown if SANDAG will implement a third RBSP. It is expected that the Oceanside littoral cell sediment budget would continue to be in a deficit condition, resulting in ongoing loss of beach sand depth and width. The denuded beaches would provide little to no protection to the seaward face of coastal bluffs, and the coastal bluffs would be subject to wave action under all tidal and seasonal conditions. Erosion of the coastal bluffs, block falls, slumping, and in some cases catastrophic failures, would also be expected to continue to occur in the absence of a comprehensive and long term sea level rise adaptation strategy such as that proposed by the USACE and the Cities of Encinitas and Solana Beach. Further discussion as well as model simulations forecasting future conditions under the no action alternative are provided in Appendix B. The expected increase in seawalls to protect individual properties along the beaches would continue to occur.

5.1.5 Summary of Potential Impacts to Geology and Topography

As described, while the project would result in temporary changes to nearshore features such as rocky outcroppings (reefs) and other hard and soft bottom substrate, these changes would not modify the underlying geology. Therefore, the project would not substantially adversely modify any unique geologic or physical features of the beach or seafloor.

The project is designed and intended to reduce erosion of the toe of the bluffs as caused by wave action, by placing a large volume of sand to create beach. Therefore, the project would not substantially adversely increase bluff erosion due to wave attack.

As described, the project would widen the beaches of Solana Beach and Encinitas as well as deepen the offshore borrow sites SO-5 and SO-6 and MB-1. The modifications to the offshore borrow sites would not be substantial. The modifications to the beach would be beneficial because they would increase beach width and, function, and bluff protection. Therefore, the project would not substantially and adversely modify beach or near shore bottom topography.

No significant adverse impacts to geology or topography features are anticipated for all Alternatives.

5.1.6 Mitigation Measures

No mitigation would be required as no significant impacts have been identified.

5.1.7 Potential Effects of Mitigation Reef

The mitigation reef would result in the conversion of 16.8 acres (maximum) of natural soft sandy seafloor substrate to rocky substrate. The conversion would result in a permanent change to the seafloor topography. However, the percentage of soft sandy substrate habitat is much greater than the percentage of hard substrate in the area, and therefore, the creation of a mitigation reef is only expected to convert a small amount of soft sandy substrate seafloor to hard rocky substrate relative to the total amount of seafloor in the region. Reef construction would be temporary and short-term, and is expected to be completed in 34 days. Any adverse effects from construction would be temporary and short-term.

Due to the relatively small size of the mitigation reef in comparison to the overall offshore region, the mitigation reef is not expected to cause a substantial long-term or permanent adverse effect to offshore geology or topography.

5.2 Oceanographic and Coastal Processes

The analysis in this section is based on information provided in the Appendix B - Coastal Engineering and the Appendix C - Geotechnical Engineering.

5.2.1 Impact Significance Criteria

Potential effects on coastal processes, sediment sources, sedimentation, and transport were considered in the evaluation of impacts. Oceanographic and coastal processes could potentially be impacted by project activities, particularly those actions that lead to seafloor bathymetric modifications, such as dredging, direct sand placement, and indirect sand deposition as the beach fill reaches dynamic equilibrium. The particular oceanographic and coastal processes that could be affected are listed below, and the potential impacts of the project alternatives are discussed starting in section 5.2.2. Potential surfing impacts and analyses are detailed in **Section 5.12**.

- **Waves.** As waves move from offshore to nearshore they undergo “wave transformation,” a process that defines the shape of the wave. Wave transformation includes two distinct processes – refraction and shoaling. Refraction refers to the bending of a wave crest as the portion of the wave in deeper water moves faster than the portion in shallow water. Shoaling is the process by which waves increase in height as they move into shallow water until reaching a point of instability and, ultimately, breaking. Both refraction and shoaling are dependent on the depth of the water over which the waves move.
- **Nearshore currents, tides, and circulation.** Nearshore currents, including wave-induced littoral drift and localized cross-shore rip currents, could potentially be impacted by project activities.
- **Littoral transport**. Littoral transport is driven primarily by nearshore waves, littoral drift currents, and cross-shore currents. Project related impacts to the seafloor bathymetry could block or interfere with littoral transport by affecting any or all of these processes.

An impact would be significant if it would:

- Substantially and adversely alter nearshore wave characteristics;
- Substantially impact nearshore currents;
- Block or substantially interfere with nearshore sediment transport

5.2.2 Borrow Sites

Waves

Over the life of the project, the maximum dredge cut is expected to be 20 ft at both borrow sites. The maximum surface area impacted at SO-5 is expected to be 2.07 acres, and 0.94 acres at SO-6. The dredge cut would be a gradual change over the long-term project span of 50 years. As well, both dredge sites are designed to be shallow and broad with gentle side slopes for a subtle bathymetric change. Because they would all be located outside of the depth of closure (the zone of sediment transport) they are, by definition, outside of the zone of substantial wave energy impinging on the seabed. By being outside of this wave energy zone, waves are anticipated to pass over the seabed unattenuated by the moderate bathymetric depression made by dredging.

The prior RBSP I project (2001) offers a case-study of a borrow site (referred to as SO-7) with a 25 ft deep bathymetric change but still no measurable effect on wave metrics. SO-7 is located 2,500 ft offshore from Batiquitos Lagoon and provided approximately 1.1 million cy of material for the Regional Beach Sand Project I (RBSP I) with sand dredged and placed on beaches from Oceanside south to Encinitas. The proposed project dredge would be a maximum of 20 ft in depth. The beaches adjacent to the RBSP I borrow site were monitored after borrow site dredging. No discernible changes to waves approaching the beaches, or to the lagoon mouth have been documented. Similarly, no substantial changes to wave energy or wave properties are anticipated to occur from the proposed project dredging.

Given the relatively small size of the affected area in relation to the entire offshore and nearshore area as well as the modest increase in water depth, removal of sands from the borrow sites is not expected to have a significant adverse impact on nearshore wave characteristics.

Nearshore Currents (Tides and Circulation)

During the initial sand placement, dredging would be conducted at both the SO-5 and SO-6 sand borrow sites. Both offshore borrow sites are designed to be dredged to create shallow contours and broad with gentle side slopes and would all be located outside of the depth of closure. Due to these factors, dredging at the borrow sites or the resultant depressions are not expected to cause a significant adverse impact to currents, tides, or circulation in the nearshore project area.

Littoral Transport

As is discussed above, both offshore borrow sites would be designed to be shallow and broad with gentle side slopes and are located outside of the depth of closure. It is expected that the dredged and placed sand would generally remain within the Oceanside littoral cell, and therefore material is not expected to be lost. The dredged and placed sand is anticipated to enter the seasonal cycle of onshore and offshore movement. Therefore, dredging at the borrow sites would not result in a significant adverse impact to littoral transport.

Shoreline Erosion

The primary goal of the project is to reduce shoreline erosion in the project area by placing sand along the shoreline. Dredging activities at the borrow sites are not expected to cause a significant adverse impact to waves, nearshore currents, or littoral transport, and would thus not increase shoreline erosion. Therefore, no significant adverse impacts to shoreline erosion are expected to result from sand dredging or placement activities.

5.2.3 Encinitas

Waves

The beach would be widened by the addition of sand, pushing the shoreline seaward and allowing waves to break on the beach farther away from the bluff face.

Following initial sand placement, a portion of the sand would move upcoast, downcoast, and offshore depending on the magnitude, direction, and period of wave action and other weather and oceanographic influences. The migrating sand is anticipated to alter local offshore bathymetry in the vicinity of the receiver sites by changing the local shoreline profile. Changes in bathymetry have the potential to modify wave characteristics.

Beach profile measurements presented in the SANDAG Regional Beach Monitoring Program (RBMP) indicated that the sand that moved into nearshore waters from the RBSP I during the first three years following the initial sand placement produced fluctuations in the beach profiles that were within the range of beach profiles that occurred prior to the RBSP I (Coastal Frontiers Corporation 2005). This suggests that alteration to the local bathymetry that resulted from offshore migrating sand during the RBSP I was within the historical ranges that existed prior to the RBSP.

The RBSP I previously estimated that San Diego County beaches have suffered from a sand volume deficit of over 31 million cy (SANDAG 1993).

One effect of this beach sand deficit has been to reduce average beach widths and beach profiles along Solana Beach and Encinitas. The increased beach widths associated with placement of sand would fall within historical ranges and it would be expected that the nearshore bathymetry (beach profiles) would also fall within historical ranges. Beach profile transect data has been gathered in San Diego county since 1934.

Given that the beach profile variations associated with the sand placement are expected to fall within historical ranges, any modifications to the nearshore wave characteristics are expected to fall within historical ranges also.

Alternative EN-1A

Beach width increases associated with Alternatives EN-1A would fall within historical ranges, however Alternative EN-1A would involve the placement of a larger volume of sand than the RBSP I, making direct comparisons between these projects difficult. Under Alternative EN-1A, a total of between approximately 3,200,000 cy and 3,980,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. The renourishment cycle is five years under Alternative EN-1A. Therefore, sand placement activities are not expected to have a significant adverse impact on the nearshore wave characteristics.

Alternative EN-1B

The sand volumes placed under Alternative EN-1B would be less than under Alternative EN-1A. Under Alternative EN-1B, a total of between approximately 2,320,000 cy and 3,100,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. Alternative EN-1B would require less sand volume over the life of the project than Alternative EN-1A, there is a lower potential for substantial adverse impacts under Alternative EN-1B. The renourishment cycle is five years under Alternative EN-1B. Therefore, sand placement activities are not expected to have a significant adverse impact on the nearshore wave characteristics.

Alternative EN-2A

Under Alternative EN-2A, total sand volume dredged and placed over the 50 year life of the project would be less than under Alternative EN-1A. Under Alternative EN-2A, a total of between approximately 3,100,000 cy and 3,800,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. The renourishment cycle is ten years under Alternative EN-2A. Considering the lower total volume and the reduced impact from the longer renourishment cycle, there is a lower potential for substantial adverse impacts to nearshore wave characteristics. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore wave characteristics. Therefore, sand placement activities are not expected to have a significant adverse impact on the nearshore wave characteristics.

Alternative EN-2B

Initial and future renourishment sand volumes, as well as the renourishment cycle timeline, would be identical under Alternative EN-2B at Encinitas to Alternative EN-1B as described above. Under Alternative EN-2B, a total of between approximately 2,320,000 cy and 3,100,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore wave characteristics. The renourishment cycle is five years under Alternative EN-2B. Therefore, sand placement activities are not expected to have a significant adverse impact on the nearshore wave characteristics.

<u>Nearshore Currents (Tides and Circulation)</u>

The primary objective of the project is to create a wider beach through the placement of sand, thus pushing the shoreline seaward. Logically, wave-induced littoral drift current would also be pushed seaward. The redistribution of sand following the initial placement might also result in modification of the cross-shore currents (e.g., rip currents) in the immediate vicinity of the project activities. These modifications are not expected to result in adverse impacts because the nearshore currents are primarily a function of the nearshore waves, which would not be directly affected by the project. As discussed above (see Waves), the impacts to nearshore wave characteristics are not expected.

Alternative EN-1A

Under Alternative EN-1A, added beach width of 100 ft would be constructed. The renourishment cycle is five years under Alternative EN-1A. Sand placement activities are not expected to have a significant adverse impact on the nearshore currents.

Alternative EN-1B

Added beach width under Alternative EN-1B would be less than under Alternative EN-1A. Under Alternative EN-1B, added beach width of 50 ft would be constructed. The renourishment cycle is five years under Alternative EN-1B. Sand placement activities are not expected to have a significant adverse impact on the nearshore currents.

Alternative EN-2A

Under Alternative EN-2A, added beach width would be the same as Alternative EN-1A. Under Alternative EN-1B, added beach width of 100 ft would be constructed. The renourishment cycle is ten years under Alternative EN-2A. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore wave characteristics. Sand placement activities are not expected to have a significant adverse impact on the nearshore currents.

Alternative EN-2B

Under Alternative EN-2B, added beach width would be the same as Alternative EN-1B. Under Alternative EN-2B, added beach width of 50 ft would be constructed. The renourishment cycle is ten years under Alternative EN-2B. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore wave characteristics. Sand placement activities are not expected to have a significant adverse impact on the nearshore currents.

<u>Littoral Transport</u>

No “hard” structures would be constructed under in the nearshore area that could substantially interfere with nearshore sediment transport. As discussed previously, beach nourishment is not expected to cause a significant adverse impact to nearshore wave characteristics. In addition, beach nourishment is not expected to cause a significant adverse impact to nearshore currents. Therefore, beach nourishment is not expected to block or substantially interfere with nearshore littoral sediment transport during initial sand placement activities nor during replenishment.

Alternative EN-1A

Under Alternative EN-1A, added beach width of 100 ft would be constructed. The renourishment cycle is five years under Alternative EN-1A. Sand placement activities are not expected to have a significant adverse impact on littoral sediment transport.

Alternative EN-1B

Added beach width under Alternative EN-1B would be less than under Alternative EN-1A. Under Alternative EN-1B, added beach width of 50 ft would be constructed. The renourishment cycle is five years under Alternative EN-1B. Sand placement activities are not expected to have a significant adverse impact on littoral sediment transport.

Alternative EN-2A

Under Alternative EN-2A, added beach width would be the same as Alternative EN-1A. Under Alternative EN-1B, added beach width of 100 ft would be constructed. The renourishment cycle is ten years under Alternative EN-2A. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore wave characteristics. Sand placement activities are not expected to have a significant adverse impact on littoral sediment transport.

Alternative EN-2B

Under Alternative EN-2B, added beach width would be the same as Alternative EN-1B. Under Alternative EN-2B, added beach width of 50 ft would be constructed. The renourishment cycle is ten years under Alternative EN-2B. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore wave characteristics. Sand placement activities are not expected to have a significant adverse impact on littoral sediment transport.

5.2.4 Solana Beach

Waves

The beach would be widened by the addition of sand, pushing the shoreline seaward and allowing waves to break on the beach farther away from the bluff face.

Following initial sand placement, a portion of the sand would move upcoast, downcoast, and offshore depending on the magnitude, direction, and period of wave action and other weather and oceanographic influences. The migrating sand is anticipated to alter local offshore bathymetry in the vicinity of the receiver sites by changing the local shoreline profile. Changes in bathymetry have the potential to modify wave characteristics.

Beach profile measurements presented in the SANDAG Regional Beach Monitoring Program (RBMP) indicated that the sand that moved into nearshore waters from the RBSP I during the first three years following the initial sand placement produced fluctuations in the beach profiles that were within the range of beach profiles that occurred prior to the RBSP I (Coastal Frontiers Corporation 2005). This suggests that alteration to the local bathymetry that resulted from offshore migrating sand during the RBSP I was within the historical ranges that existed prior to the RBSP.

The RBSP I previously estimated that San Diego County beaches have suffered from a sand volume deficit of over 31 million cy (SANDAG 1993).

One effect of this beach sand deficit has been to reduce average beach widths and beach profiles along Solana Beach and Encinitas. The increased beach widths associated with placement of sand would fall within historical ranges and it would be expected that the nearshore bathymetry (beach profiles) would also fall within historical ranges. Beach profile transect data has been gathered in San Diego county since 1934.

Given that the beach profile variations associated with the sand placement are expected to fall within historical ranges, any modifications to the nearshore wave characteristics are expected to fall within historical ranges also.

Alternative SB-1A

Beach width increases associated with Alternatives SB-1A would fall within historical ranges, however Alternative SB-1A would involve the placement of a larger volume of sand than the RBSP I, making direct comparisons between these projects difficult. Under Alternative SB-1A, a total of between approximately 2,210,000 cy and 3,360,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. The renourishment cycle is thirteen years under Alternative SB-1A. Therefore, sand placement activities are not expected to have a significant adverse impact on the nearshore wave characteristics.

Alternative SB-1B

The sand volumes placed under Alternative SB-1B would be less than under Alternative SB-1A. Under Alternative SB-1B, a total of between approximately 1,870,000 cy and 2,540,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. Alternative SB-1B would require less sand volume over the life of the project than Alternative SB-1A, there is a lower potential for substantial adverse impacts under Alternative SB-1B. The renourishment cycle is ten years under Alternative SB-1B. Therefore, sand placement activities are not expected to have a significant adverse impact on the nearshore wave characteristics.

Alternative SB-1C

The sand volumes placed under Alternative SB-1C would be less than under Alternatives SB-1A and SB-1B. Under Alternative SB-1C, a total of between approximately 1,470,000 cy and 2,130,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. Alternative SB-1C would require less sand volume over the life of the project than Alternatives SB-1A and SB-1B, there is a lower potential for substantial adverse impacts under Alternative SB-1C. The renourishment cycle is ten years under Alternative SB-1C. Therefore, sand placement activities are not expected to have a significant adverse impact on the nearshore wave characteristics.

Alternative SB-2A

Under Alternative SB-2A, total sand volume dredged and placed over the 50 year life of the project would be less than under Alternative SB-1A. Under Alternative SB-2A, a total of between approximately 1,870,000 cy and 2,540,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. The renourishment cycle is ten years under Alternative SB-2A. Considering the lower total volume and the reduced impact from the longer renourishment cycle, there is a lower potential for substantial adverse impacts to nearshore wave characteristics. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore wave characteristics. Therefore, sand placement activities are not expected to have a significant adverse impact on the nearshore wave characteristics.

Alternative SB-2B

Initial and future renourishment sand volumes, as well as the renourishment cycle timeline, would be identical under Alternative SB-2B at Encinitas to Alternative SB-1B as described above. Under Alternative SB-2B, a total of between approximately 1,470,000 cy and 2,130,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore wave characteristics. The renourishment cycle is ten years under Alternative SB-2B. Therefore, sand placement activities are not expected to have a significant adverse impact on the nearshore wave characteristics.

<u>Nearshore Currents (Tides and Circulation)</u>

The primary objective of the project is to create a wider beach through the placement of sand, thus pushing the shoreline seaward. Logically, wave-induced littoral drift current would also be pushed seaward. The redistribution of sand following the initial placement might also result in modification of the cross-shore currents (e.g., rip currents) in the immediate vicinity of the project activities. These modifications are not expected to result in adverse impacts because the nearshore currents are primarily a function of the nearshore waves, which would not be directly affected by the project. As discussed above (see Waves), the impacts to nearshore wave characteristics are not expected.

Alternative SB-1A

Under Alternative SB-1A, added beach width of 200 ft would be constructed. The renourishment cycle is thirteen years under Alternative SB-1A. Sand placement activities are not expected to have a significant adverse impact on the nearshore currents.

Alternative SB-1B

Added beach width under Alternative SB-1B would be less than under Alternative SB-1A. Under Alternative SB-1B, added beach width of 150 ft would be constructed. The renourishment cycle is ten years under Alternative SB-1B. Sand placement activities are not expected to have a significant adverse impact on the nearshore currents.

Alternative SB-1C

Added beach width under Alternative SB-1C would be less than under Alternatives SB-1A and SB-1B. Under Alternative SB-1C, added beach width of 100 ft would be constructed. The renourishment cycle is ten years under Alternative SB-1C. Sand placement activities are not expected to have a significant adverse impact on the nearshore currents.

Alternative SB-2A

Under Alternative SB-2A, added beach width would be the same as Alternative SB-1B. Under Alternative SB-1A, added beach width of 150 ft would be constructed. The renourishment cycle is ten years under Alternative SB-2A. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore wave characteristics. Sand placement activities are not expected to have a significant adverse impact on the nearshore currents.

Alternative SB-2B

Under Alternative SB-2B, added beach width would be the same as Alternative SB-1C. Under Alternative SB-2B, added beach width of 100 ft would be constructed. The renourishment cycle is ten years under Alternative SB-2B. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore wave characteristics. Sand placement activities are not expected to have a significant adverse impact on the nearshore currents.

Littoral Transport

No “hard” structures would be constructed under in the nearshore area that could substantially interfere with nearshore sediment transport. As discussed previously, beach nourishment is not expected to cause a significant adverse impact to nearshore wave characteristics. In addition, beach nourishment is not expected to cause a significant adverse impact to nearshore currents. Therefore, beach nourishment is not expected to block or substantially interfere with nearshore littoral sediment transport during initial sand placement activities nor during replenishment.

Alternative SB-1A

Under Alternative SB-1A, added beach width of 200 ft would be constructed. The renourishment cycle is thirteen years under Alternative SB-1A. Sand placement activities are not expected to have a significant adverse impact on littoral sediment transport.

Alternative SB-1B

Added beach width under Alternative SB-1B would be less than under Alternative SB-1A. Under Alternative SB-1B, added beach width of 150 ft would be constructed. The renourishment cycle is ten years under Alternative SB-1B. Sand placement activities are not expected to have a significant adverse impact on littoral sediment transport.

Alternative SB-1C

Added beach width under Alternative SB-1C would be less than under Alternatives SB-1A and SB-1B. Under Alternative SB-1C, added beach width of 100 ft would be constructed. The renourishment cycle is ten years under Alternative SB-1C. Sand placement activities are not expected to have a significant adverse impact on littoral sediment transport.

Alternative SB-2A

Under Alternative SB-2A, added beach width would be the same as Alternative SB-1B. Under Alternative SB-2A, added beach width of 150 ft would be constructed. The renourishment cycle is ten years under Alternative SB-2A. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore wave characteristics. Sand placement activities are not expected to have a significant adverse impact on littoral sediment transport.

Alternative SB-2B

Under Alternative SB-2B, added beach width would be the same as Alternative SB-1C. Under Alternative SB-2B, added beach width of 100 ft would be constructed. The renourishment cycle is ten years under Alternative SB-2B. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore wave characteristics. Sand placement activities are not expected to have a significant adverse impact on littoral sediment transport.

5.2.5 Impacts of the No Action Alternatives (EN-3 and SB-3)

The No Action Alternative assumes that baseline conditions and trends would continue over the next 50 years. This alternative assumes the continued piecemeal approach to shoreline protection, including maintenance of existing structures. Routine maintenance dredging of local lagoons and associated beach replenishment would also be expected to continue, including the SELRP and SCOUP projects. These routine maintenance dredging projects would add approximately 1 million cy per year of material to the littoral cell.

Waves

Under the No Action Alternative, a piecemeal and ad-hoc approach to shoreline protection would continue. This could cause an increase in wave refraction rate and strength, and thus further accelerate beach erosion. Over time, shoreline erosion would be expected to continue, and thus wave action would hit more seawalls potentially accelerating erosion. This effect would be further exaggerated under the high sea level rise scenario, as the increase in ocean water levels would provide easier access to the seawalls and cliff faces.

Nearshore Currents (Tides and Circulation)

In the future, water levels are expected to be marginally higher due to sea level rise. California Interim Guidelines for sea level rise assessment include a range of potential future scenarios. By 2050, models predict a range of between 10 and 17 inches of sea level rise, and by 2070 models predict between 17 and 32 inches of sea level rise. . This could exacerbate wave setup and height associated with storms, particularly under El Niño conditions. The No Action Alternative would not provide any potential adaptation strategies for the cities to address and avoid impacts associated with future sea level rise.

Littoral Transport

Under the No Action Alternative, no additional major sources of sand would be introduced to the Oceanside Littoral Cell beyond that associated with sand bypassing of Oceanside Harbor and maintenance dredging of coastal lagoons and the SELRP. It is unknown at this time if SANDAG will implement a third RBSP. The sand volumes and frequency associated with maintenance dredging activities provide only localized and short-term beach widening, and would not contribute to any substantial beach widening within the study area under the future 50-year without project condition. Sand would continue to be incrementally lost from the littoral cell from offshore transport during severe storms and transport to submarine canyons at both the north and south boundaries of the Oceanside littoral cell.

Shoreline Erosion

As is discussed in Section 5.1 Geology and Topography, it is assumed that under the No Action Alternative, the shoreline, near-shore and offshore areas would likely revert to the pre-RBSP I and II conditions, and it is expected that due to the ongoing sediment budget deficit, shoreline erosion would continue. A piecemeal and ad-hoc approach to coastal protection would be expected to continue, including the construction and maintenance of seawalls to protect currently unprotected sections of the coastal bluffs. As shoreline erosion continues, the coastal bluffs would be further subject to attack from wave action and storm surge. In places where seawalls are not constructed, a phenomenon called "flanking" may cause increased bluff erosion rates around and adjacent to existing seawalls or other protective structures. Under the No Action Alternative, shoreline erosion would continue, causing a substantial adverse impact. Piecemeal and ad-hoc bluff protection measures are expected to limit bluff failure and collapse. As such, limited sand would be contributed from bluff failure, and shoreline erosion would not be halted.

Summary of Potential Effects to Oceanography and Coastal Processes for Alternative 3 No Action

As is discussed, the No Action Alternative may ultimately lead to an increase in wave refraction rates and strength, thus further accelerating coastal erosion.

Nearshore currents are a function of wave action, and as is discussed, the No Action Alternative may over time lead to an increase in wave refraction strength and frequency. This may in turn alter local circulation patterns.

Under the No Action Alternative, sand would be incrementally lost to littoral transport, and would not be replaced.

The No Action Alternative would lead to ongoing and substantial adverse impacts to shoreline erosion. Without regular sand replacement or other mitigating measures, the beaches would continue to erode, further exposing the coastal bluffs to wave attack.

5.2.6 Summary of Potential Effects to Oceanographic and Coastal Processes

Due to the location of the borrow sites beyond the depth of closure, and the broad and shallow design of the borrow pits, project dredging is not expected to alter nearshore wave characteristics.

Placement of sand on the beaches may result in long-term sedimentation within the nearshore coastal zone, but the volume and thickness of migratory sand is not expected to exceed historical ranges. Monitoring studies from previous beach nourishment projects have determined that wave characteristics are not impacted by the placement of moderate amounts of sand on the beach. Given these factors, beach nourishment activities are not expected to have a significant adverse impact on nearshore wave characteristics. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore wave characteristics.

Nearshore currents are primarily a function of wave action, and beach nourishment activities are not expected to permanently alter or change wave characteristics. Considering the moderate migratory nearshore sedimentation that could result from the sand placement, no significant adverse impacts to nearshore currents are expected from beach nourishment activities. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore currents.

No hard structures would be constructed with beach nourishment activities in the nearshore area that could block or substantially interfere with nearshore sediment transport. It is expected that the dredged and placed sand would generally remain within the Oceanside littoral cell, and therefore material is not expected to be lost. As a result, beach nourishment activities are not expected to block or substantially interfere with nearshore sediment transport in the Oceanside littoral cell. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore sediment transport.

No significant adverse impacts to oceanographic and coastal processes are anticipated for beach nourishment activities alone or in combination with notch fill activities.

5.2.7 Potential Effects of Mitigation Reef

The mitigation reef would result in the conversion of 16.8 acres (maximum) of natural soft sandy seafloor substrate to rocky substrate. The reef height would vary, but is generally expected to be approximately 3 ft in height, on average. The mitigation reef would be constructed offshore in waters of -30 to -40 ft MLLW. Reef construction would be temporary and short-term, and is expected to be completed in 34 days.

Due to offshore location and the relatively low height comparable to the rocky reef nearby, and areal extent of the mitigation reef, no substantial adverse effects are expected from the reef on sediment transport, wave characteristics, or nearshore currents. The mitigation reef is also not expected to adversely affect shoreline erosion because it would be comparable in height and form to existing adjacent reef. Any adverse effects from construction would be temporary and short-term. No significant long-term or permanent adverse impact to oceanographic or coastal processes is expected from the mitigation reef.

5.3 Water and Sediment Quality

5.3.1 Impact Significance Criteria

Impacts to water resources were considered in terms of physical processes, regulated thresholds, water quality conditions that do not have formal standards (e.g., turbidity) but could be harmful to aquatic life, and guidance thresholds for sediment quality.

An impact would be significant if it would:

- Violate water quality objectives or compromise beneficial uses listed in the San Diego Region Basin Plan (Basin Plan; RWQCB 1994); or
- Result in water or sediment quality conditions that could be harmful to aquatic life or human health.

Factors considered in the evaluation of significant impacts relative to existing conditions were based on the expected magnitude of the change and duration of the impact (i.e., short- or long-term). Significant impacts would include violations of water quality criteria in the Basin Plan and/or long-term substantial decrease in water quality over existing conditions. Short-term decreases in water quality were considered an adverse but not significant impact.

Impacts to water and sediment quality from the project are expected to be similar to those for beach nourishment projects performed as part of the RBSP I and RBSP II, specifically, the borrow sites proposed for this project (SO-5 and SO-6). The potential and measured impacts to water and sediment quality, which are described in a series of reports (SANDAG 2011a, AMEC 2002b), are used to assist in assessing the potential impacts for this project, where appropriate.

Water quality monitoring will be conducted at the dredge sites as well as the beach receiver sites. Monitoring will include turbidity, dissolved oxygen, water temperature, salinity, and pH.

5.3.2 Borrow Sites

<u>Water Quality</u>

The primary potential for degradation of water quality from the proposed beach nourishment is through the generation of turbidity during dredging and sediment discharge to the beach. Turbidity at the borrow sites can be influenced by many factors, including sediment resuspension (primarily determined by the type of dredge), characteristics of dredged material, water depth, and hydrodynamic forces (mixing, currents, etc.). The degree of turbidity depends largely on the size of the sediment particles. Coarse-grained materials, such as sands contained in all three borrow sites, tend to settle on the order of several minutes at similar depths (SANDAG 2000a) resulting in very small turbidity clouds. Use of bottom mounted hydraulic dredges (hopper and hydraulic dredge) result in turbidity that is limited to the bottom and is rarely visible at the surface. The exception would be from overflow of water from a hopper dredge. This process results in the discharge of turbid water during filling of the hopper to ensure that a full load of sand is carried to the beach and not fluid material that is approximately 90% water. This turbidity is closely tied to the hopper dredge and will rarely exceed a 50-foot diameter when dredging sands. Unlike a cutterhead dredge, which would create a continuous plume during dredge operation, a hopper dredge would create intermittent plumes during the dredging and disposal cycles.

Resuspension of bottom sediments can consume oxygen, resulting in decreases in dissolved oxygen concentration. However, sediments at the borrow sites consist primarily of coarse-grained sands with low oxygen demand, as indicated by low total organic carbon (TOC) concentrations and nondetectable levels of dissolved sulfides. Water quality monitoring at the borrow sites during RBSP I did not detect any exceedances in permit limits for dissolved oxygen concentrations (AMEC 2002b). Given the similarity, resuspension of bottom sediments during dredging would not substantially reduce dissolved oxygen concentrations in receiving waters. Further, natural mixing from currents, winds, and waves would minimize the potential for dredging operations at the borrow sites to reduce the dissolved oxygen concentrations below Ocean Plan levels.

Dredging clean marine sediments from the borrow sites would not add or reintroduce any materials to the ocean with the potential for altering the pH of borrow site waters. Further, natural mixing from currents, winds, and waves would minimize the potential for dredging operations at the borrow sites to alter the pH of site waters to an extent that would exceed the Basin Plan limits. Water quality monitoring at the borrow sites during RBSP I did not detect any exceedances in permit limits for pH (AMEC 2002b). Thus, dredging at the borrow sites would not cause significant changes in pH levels.

The borrow sites are located inshore and thousands of ft from wastewater outfalls. Site SO-6 is the closest and is over 4,000 ft inshore and northeast of the discharge location of the San Elijo outfall. Because of the distance between the borrow sites and bacterial sources (i.e., wastewater outfalls), the poor survival of fecal indicator bacteria in the marine environment, and the grain size characteristics of the borrow site sediments, there is little potential for release of pathogens due to dredging. Monitoring during RBSP I showed that bacteria concentrations in the nearshore waters adjacent to the receiver beaches typically were below permit limits (AMEC 2002b).

Dredging at the borrow sites would include the same sites (SO-5 and SO-6) and similar dredging methods as those evaluated in the RBSP I and RBSP II (SANDAG 2011a). Sediment at these borrow sites are primarily sand, which would be expected to have low organic carbon levels, low contaminant levels, low oxygen demand, and to remain oxygenated due to a well-mixed water column. Concentrations of contaminants in the borrow areas indicated no probability of adverse biological effects due to contaminant release during sediment resuspension (SANDAG 2011a). The low TOC of the sediment along with the mixing and dilution capacity of the open water at the borrow sites would be sufficient to ensure concentrations that phytoplankton blooms would not occur (SANDAG 2011a).

Impacts to water quality associated with dredging activities at the borrow sites would not violate water quality objectives or compromise beneficial uses listed in the Basin Plan; therefore, the impact would be less than significant.

<u>Sediment Quality</u>

Potential impacts to sediment quality at the borrow sites could occur if dredging exposed and/or distributed contaminated surface or subsurface sediments to areas within or outside the borrow areas. Based on a chemical and physical characterization of the sediment at these sites performed by SANDAG (2011a) for RBSP II, sediment characteristics at SO-6 and SO-5 are generally uniform within the borrow sites and dredging would not be expected to expose or distribute contaminated sediment within or outside the borrow sites. Sand in resuspended dredged material would settle quickly and would not be expected to leave the borrow site. Therefore, dredging at any of the borrow sites would not alter sediment quality that would be harmful to aquatic life or human health, and any impacts would be less than significant.

5.3.3 Receiver Sites

<u>Water Quality</u>

Potential impacts to water quality at the receiving sites are dependent upon the quality of the sediments placed on the beaches. Potential impacts to water quality include reduction in dissolved oxygen, changes in pH, and/or decreases in water clarity. Sediment in the borrow sites SO-6 and SO-5 was characterized as part of RBSP II (SANDAG 2011a), and based on the results of the sediment characterization, SANDAG concluded that water quality at the receiver sites would not exceed the criteria established in the Basin Plan for bacteria, dissolved oxygen, contaminants, sulfides, nutrients, or pH as a result of suspended sediments. Thus, placement of sediment from the borrow areas at the receiver sites would not release pollutants, cause substantial toxicity in aquatic life, or pose a human health hazard.

Turbidity at receiving sites has been identified as a concern similar to other beach nourishment projects near the study area (SANDAG 2011a).

The potential impact of placement at receiver sites on turbidity would also be influenced by the frequency and duration of dredged material placement at the receiver sites during initial construction and subsequent renourishment events. The frequency of placement operations would vary depending on the type of dredge. Use of a cutterhead dredge would result in nearly continuous turbidity effects at the receiver sites, while a hopper dredge would be associated with turbidity pulses at the receiver sites as sediment would be transported from the borrow sites to a monobuoy or the receiver site. The duration of dredged material placement at the receiver sites will primarily be a function of the amount of material to be placed at the site and the production rate of the dredge. Natural ocean processes would also influence the potential impact of turbidity on water quality associated with dredging. Turbulence (e.g., wave action) would serve to slow the settling rate of particles, while currents would distribute the resuspended particles over a greater distance before settling. Turbulence also creates naturally high levels of turbidity in the surf zone as wave action stirs up sand already present. These naturally high turbidity levels are almost always indistinguishable from turbidity caused by beach nourishment activities.

The proposed construction methods are nearly identical to those evaluated in the RBSP I and RBSP II (SANDAG 2011a). Increases in suspended sediments along the shore could occur as a result of placing dredged material at the receiver sites. Slurry of sediment and water would be pumped directly onto the beach from offshore. Return water would be allowed to enter the surf zone subsequent to pumping. Training dikes would be used to decrease water velocity and increase the travel path of discharged dredged material; thereby allowing the maximum amount of sediment particles to settle out of the discharge slurry before entering the surf zone. Suspended sediment remaining in the return water would contribute to natural turbidity at the receiving site.

Previous beach nourishment projects in the project area have included modeling and monitoring efforts to evaluate the potential impact of suspended sediments on turbidity at the receiver and borrow sites. Receiver site surveys conducted during RBSP I monitored turbidity in the surf zone by estimating the length and distance offshore of the plumes as determined by an onshore observer. Turbidity plumes typically were confined to the surf zone adjacent to the receiver site, except when rip currents were present that transported portions of the plume offshore. In most cases, the horizontal extent of the plumes was less than the permit-specified areal limit for turbidity plumes to protect least tern foraging. Additionally, bacteria concentrations in the nearshore waters adjacent to the receiver beaches typically were below the permit limits (AMEC 200b).

<u>Sediment Quality</u>

Potential impacts to sediment quality at receiver sites could result from contaminants in dredged material or differences in physical characteristics of dredged material. SANDAG did not identify any significant impacts to sediment quality at receiver sites located within the project area based on the characterization of the SO-6 and SO-5 borrow sites. Sediment placed at Segments 1 and 2 would not exceed ER-L or ER-M guidelines (see **Table 4.4-6**), and both borrow and receiver sites have similar median grain size, proportions of sand, proportions of silt/clays, and TOC content. Thus, placing dredged material from SO-5 and SO-6 at the receiver sites would not affect sediment quality. Therefore, placement of sand would not alter sediment quality at the receiver sites that would be harmful to aquatic life or human health, and any impacts would be less than significant.

5.3.4 Encinitas

In Encinitas, sand placement would occur along 7,800 ft of the 1.5 miles long segment. Turbidity plumes are expected to remain in the surf zone unless rip currents carry them offshore.

Alternative EN-1A

This receiver site would initially receive 680,000 cy of dredged material. Dredge material placement at Encinitas would take approximately 82 days to complete. Under Alternative EN-1A, a total of between approximately 3,200,000 cy and 3,980,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. The renourishment cycle is five years under Alternative EN-1A. Therefore, sand placement activities are not expected to have a significant adverse impact on water or sediment quality.

Alternative EN-1B

This receiver site would initially receive 340,000 cy of dredged material. Dredge material placement at Encinitas would take approximately 62 days to complete. Under Alternative EN-1B, a total of between approximately 2,320,000 cy and 3,100,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. Alternative EN-1B would require less sand volume over the life of the project than Alternative EN-1A, there is a lower potential for substantial adverse impacts under Alternative EN-1B. The renourishment cycle is five years under Alternative EN-1B. Therefore, sand placement activities are not expected to have a significant adverse impact on water or sediment quality.

Alternative EN-2A

This receiver site would initially receive 700,000 cy of dredged material. Dredge material placement at Encinitas would take approximately 84 days to complete. Total construction, including notch fill activities would be 180 days. Under Alternative EN-2A, a total of between approximately 3,100,000 cy and 3,800,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. The renourishment cycle is ten years under Alternative EN-2A. The inclusion of notch fill along the coastal bluff face is not expected to impact water or sediment quality. Therefore, sand placement and notch fill activities are not expected to have a significant adverse impact on water or sediment quality.

Alternative EN-2B

Initial and future renourishment sand volumes, as well as the renourishment cycle timeline, would be identical under Alternative EN-2B at Encinitas to Alternative EN-1B as described above. This receiver site would initially receive 340,000 cy of dredged material. Dredge material placement at Encinitas would take approximately 41 days to complete. Total construction, including notch fill activities would be 180 days. Under Alternative EN-2B, a total of between approximately 2,320,000 cy and 3,100,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore wave characteristics. The renourishment cycle is five years under Alternative EN-2B. Therefore, sand placement and notch fill activities are not expected to have a significant adverse impact on water or sediment quality.

5.3.5 Solana Beach

In Solana Beach, sand placement would occur along 7,200 ft of the segment. Turbidity plumes are expected to remain in the surf zone unless rip currents carried them offshore.

Mitigation reef construction would result in short-term elevated turbidity levels and suspended sediment concentrations. No appreciable long-term changes in water quality parameters, including dissolved oxygen, pH, nutrients, bacteria, or chemical contaminants would be expected. Sediment characteristics at proposed mitigation locations would not be expected to include contaminated sediment and construction would not expose or distribute contaminated sediment within or outside the construction site. Resuspended sand would settle quickly and would not be expected to leave the construction area. Implementation of the mitigation reef would not result in significant adverse impacts to water or sediment quality.

<u>Alternative SB-1A</u>

This receiver site would initially receive 960,000 cy of dredged material. Dredge material placement at Encinitas would take approximately 139 days to complete. Under Alternative SB-1A, a total of between approximately 2,210,000 cy and 3,360,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. The renourishment cycle is thirteen years under Alternative SB-1A. Mitigation for this alternative would be the creation of 16.8 acres of rocky reef habitat, requiring 34 days of construction time two years following completion of initial beach fill. Therefore, sand placement and notch fill activities are not expected to have a significant adverse impact on water or sediment quality.

<u>Alternative SB-1B</u>

This receiver site would initially receive 700,000 cy of dredged material. Dredge material placement at Encinitas would take approximately 86 days to complete. Under Alternative SB-1B, a total of between approximately 1,870,000 cy and 2,540,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. Alternative SB-1B would require less sand volume over the life of the project than Alternative SB-1A, there is a lower potential for substantial adverse impacts under Alternative SB-1B. The renourishment cycle is ten years under Alternative SB-1B. Mitigation for this alternative would be the creation of 13.8 acres of rocky reef habitat, requiring 28 days of construction time two years following completion of initial beach fill. Therefore, sand placement and notch fill activities are not expected to have a significant adverse impact on water or sediment quality.

<u>Alternative SB-1C</u>

This receiver site would initially receive 440,000 cy of dredged material. Dredge material placement at Encinitas would take approximately 55 days to complete. Under Alternative SB-

1C, a total of between approximately 1,470,000 cy and 2,130,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. Alternative SB-1C would require less sand volume over the life of the project than Alternatives SB-1A and SB-1B, there is a lower potential for substantial adverse impacts under Alternative SB-1C. The renourishment cycle is ten years under Alternative SB-1C. Mitigation for this alternative would be the creation of 3.2 acres of rocky reef habitat, requiring 7 days of construction time two years following completion of initial beach fill. Therefore, sand placement and notch fill activities are not expected to have a significant adverse impact on water or sediment quality.

Alternative SB-2A

This receiver site would initially receive 700,000 cy of dredged material. Dredge material placement at Encinitas would take approximately 86 days to complete. Total construction, including notch fill activities would be 180 days. Under Alternative SB-2A, total sand volume dredged and placed over the 50 year life of the project would be would be the same as Alternative SB-1B and less than under Alternative SB-1A. Under Alternative SB-2A, a total of between approximately 1,870,000 cy and 2,540,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. The renourishment cycle is ten years under Alternative SB-2A. Considering the lower total volume and the reduced impact from the longer renourishment cycle, there is a lower potential for substantial adverse impacts. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore wave characteristics. Mitigation for this alternative would be the creation of 13.8 acres of rocky reef habitat, requiring 28 days of construction time two years following completion of initial beach fill. Therefore, sand placement and notch fill activities are not expected to have a significant adverse impact on water or sediment quality.

Alternative SB-2B

This receiver site would initially receive 440,000 cy of dredged material. Dredge material placement at Encinitas would take approximately 55 days to complete. Total construction, including notch fill activities would be 180 days. Initial and future renourishment sand volumes, as well as the renourishment cycle timeline, would be identical under Alternative SB-2B at Encinitas to Alternative SB-1C as described above. Under Alternative SB-2B, a total of between approximately 1,470,000 cy and 2,130,000 cy, depending on the sea level rise scenario and actual beach erosion rates, would be placed on receiver sites over the life of the project. The inclusion of notch fill along the coastal bluff face is not expected to impact nearshore wave characteristics. The renourishment cycle is ten years under Alternative SB-2B. Mitigation for this alternative would be the creation of 3.2 acres of rocky reef habitat, requiring 7 days of construction time two years following completion of initial beach fill. Therefore, sand placement and notch fill activities are not expected to have a significant adverse impact on water or sediment quality.

5.3.6 Other Potential Construction-Related Impacts

The installation of the pipeline or monobuoy would result in minimal impacts to water quality. It is anticipated that tug boats and barges would be used to lower pipes and placement of anchors would be required for a monobuoy. Vessel operations in relatively shallow water may result in localized turbidity plumes; however, any turbidity plume would be expected to be very localized and persist for a short period.

Standard earthmoving equipment would be used to spread sand during placement of material on the receiver sites. Vehicles and equipment have some potential to release contaminants to surface water during construction activities through accidental spills of hydraulic fluid, fuels, etc. No significant impacts are anticipated from such an accidental release as the probability of such an event is considered low when appropriate BMPs are followed. Fuel oil or other contaminant releases from vessels could potentially occur during dredging and transport of the dredged material. Again, the probability of such events is not considered significant. In addition, the dredging contractor would be required to develop and implement a Spill Prevention Control and Counter-Measure Plan (SPCC Plan) prior to construction.

Notch fill would be used to stabilize the lower bluff areas to protect from erosion. A quick-drying, erodible shotcrete would be applied by spraying the lower bluff areas. Approximately 1.0 mile of bluff would receive this treatment. Potential impacts to water quality during notch fill operations could occur due to increased risk of accidental spills of fuel or hydraulic fluid from construction vehicles or accidental release of notch fill material during construction. Accidental release of fuel or hydraulic fluid is considered insignificant as no large volumes would be present on-site and the dredging contractor would be required to have a SCPP Plan in place prior to construction. Accidental release of shotcrete would be limited to 8 cy (one dump truck load) and would be easily contained due to the quick-drying properties of the material. As construction would occur during low-tide, release of shotcrete to surface water would not be expected. Therefore, the application of notch fill to the cliff base would not violate water quality objectives or compromise beneficial uses listed in the Basin Plan; therefore, the impact would be less than significant.

The impact would be less than significant.

5.3.7 Summary of Potential Impacts to Water Quality

Dredging of sands from the borrow sites and placement of material at the receiver sites would result in short-term elevated turbidity levels and suspended sediment concentrations, but no appreciable long-term changes in other water quality parameters, including dissolved oxygen, pH, nutrients, bacteria, or chemical contaminants. Factors considered in this assessment include the relatively localized nature of the expected turbidity plumes for the majority of the dredging period and rapid diluting capacity of the receiving environment. Water quality monitoring would be required as part of the overall project. If monitoring indicated that suspended particulate concentrations outside the zone of initial dilution exceeded permissible limits, dredge operations would be modified to reduce turbidity to permissible levels. Therefore, impacts to water quality from dredging at the borrow sites and placement of material at the receiver sites would not violate water quality objectives or compromise beneficial uses listed in the Basin Plan; therefore, the impact would be less than significant.

Potential impacts to sediment quality at receiver sites could result from contaminants in dredged material or differences in physical characteristics of dredged material. SANDAG did not identify any significant impacts to sediment quality at receiver sites located within the project area based on the characterization of the SO-6 and SO-5 borrow sites. Sediment placed at Segments 1 and 2 would not exceed ER-L or ER-M guidelines (see Table 4.3-7), and both borrow and receiver sites have similar median grain size, proportions of sand, proportions of silt/clays, and TOC content. Thus, placing dredged material from SO-5 and SO-6 at the receiver sites would not affect sediment quality. Therefore, placement of sand would not alter sediment quality at the receiver sites that would be harmful to aquatic life or human health, and any impacts would be less than significant.

There would be no significant impacts to water or sediment quality, and accordingly, no mitigation measures are necessary. However, turbidity monitoring will be undertaken during dredging and placement of fill to determine if measures are necessary to reduce impacts during construction.

5.3.8 Water Quality Monitoring Plan

The Water Quality Monitoring Plan will include weekly monitoring at the dredge and beach receiver sites for salinity, pH, temperature, dissolved oxygen, and light transmissivity; monthly water samples will be taken and analyzed for total dissolved solids. Dredging will be controlled to keep water quality impacts to acceptable levels. Controls include modifying the dredging operation. Turbidity will limited to a 40% decrease in light transmittance, dissolved oxygen will be maintained at a minimum of 5 mg/l, and contaminants will be less then California water quality standards.

Water quality monitoring will ensure that turbidity impacts will remain at insignificant levels. This is the standard monitoring program used by the Corps for dredging and beach nourishment projects within the Los Angeles District. Water quality surveys should be conducted on a weekly basis during construction activities, in addition to pre-construction and post-construction surveys, which should be conducted within a week before and after construction activities, respectively. The sampled parameters include dissolved oxygen (DO), temperature (degrees Celsius), salinity (ppt), light transmittance, and pH. All data should be collected using instrumentation deployed remotely from a survey vessel at one-meter intervals from the water's surface to the seafloor. Monthly mid-depth seawater grab samples should be collected at all eight stations to be analyzed for Total Suspended Solids (TSS) and Total Recoverable Petroleum Hydrocarbons (TRPH). TSS analyses will be used to confirm turbidity as measured by light transmissivity. Instrument measurements provide immediate notification of potential problems without having to wait for laboratory analyses of water samples. Light transmissivity has been shown to be an acceptable analog for turbidity. Locations of the eight survey stations are described below:

A. 100 ft up current of the dredging operations, safety permitting.
B. 100 ft down current of the dredging operations, safety permitting.
C. 300 ft down current of the dredging operations.
D. 300 ft up current - Control site (area not affected by dredging operations).
E. 100 ft north of the beach placement just off of the beach at approximately the -20 ft isobath.
F. 100 ft south of the beach placement just off of the beach at approximately the -20 ft isobath.
G. 300 ft south of the beach placement just off of the beach at approximately the -20 ft isobath.
H. Control site 300 ft north of the beach placement site (area not affected by disposal operations) at approximately the -20 ft isobath.

If monitoring detects high levels of turbidity, best management practice (BMP) measures will be taken to reduce turbidity to within acceptable levels. Measures to reduce turbidity at the dredge include modifications to the dredging operation to reduce turbidity such as ensuring that the dredge remains on the bottom and doesn't bounce or that the dredge is shut off when raising or lowering the dredge cutterhead to the sea bottom. Measures to reduce turbidity at the beach site include discharging sand behind berms that channel runoff into a single point resulting in a longer path for water to run before entering the ocean allowing for more sand to settle and reducing turbidity.

5.3.9 No Action Alternative

Construction impacts would not occur. Emergency construction of sea walls would continue with potential water quality impacts similar to those described for notch fills.

5.4 Biological Resources

5.4.1 Impact Significance Criteria

Direct impacts to marine biological resources may occur through burial or smothering of organisms during sand placement at receiver sites; equipment-related damage to habitats or animals during construction activities; removal of sediment and organisms at borrow sites during dredging; or resuspension of sediment during the dredging, transport, and placement of dredged materials. Indirect impacts may result from reductions in marine water quality associated with dredging and sand placement activities, sediment transport related to movement of sands from the receiver sites, noise from construction equipment, or interference of normal movement or behaviors of animals due to temporary construction activities or long term changes in the environment. Indirect impacts may result in reduction in habitat quality, interference with foraging or impaired growth, diminished reproduction, or interruption of wildlife movement. Direct and indirect impacts from the project on biological resources are assessed in this section.

An impact to biological resources would be considered significant if a project alternative results in:

- A direct adverse effect on the population of a threatened or endangered species or the loss or disturbance of important habitat for a listed species;
- A long-term net loss in the habitat value of a sensitive biological habitat. For the purposes of this analysis, kelp beds, and well-developed rocky intertidal and surfgrass beds are considered sensitive biological habitats;
- Substantial impedance to the breeding, movement or migration of fish or wildlife;
- Substantial loss to the population of any native fish, wildlife or vegetation for a period of five years or more; and/or
- Substantial adverse impact on Essential Fish Habitat.

5.4.2 Borrow Sites

Material from borrow site SO-5, would be used for Segment 2 (Solana Beach) and material from borrow site SO-6 (see **Figure 5.4-1**) would be used for Segment 1 (Encinitas) until exhausted at which time SO-5 and MB-1 (**Figure 5.4-2**) would provide material for both Encinitas and Solana Beach receiver sites. Potential impacts from dredging include direct effects of removal and transport of sediment and associated organisms, indirect effects on the forage base for other animals, and indirect effects associated with operation of the dredge equipment such as increased turbidity and noise.

Dredging sediments from the borrow sites would impact marine biota through the direct removal of organisms and alteration of habitat. Benthic invertebrates living within or on the sediment would be killed during the dredging process. The extent of impact would be directly proportional to the actual physical area dredged and the amount of sediment removed at each site. There also would be some direct uptake or entrainment, of organisms in the suction field generated by the hydraulic dredge. This generally occurs if pumps are on when the cutterhead or hopper dredge drag arm are above the sediment surface. Entrainment of aquatic and surface-dwelling organisms within the suction field of the hydraulic dredge may occur when the cutterhead or hopper dredge drag arm is being raised or lowered to the sea floor while pumps are on. This is a relatively rare event and is not expected to cause substantial impacts.

There would be a temporary reduction in benthic invertebrate biomass and a temporary alteration of the benthic community species composition at the borrow sites associated with the sediment removal. Studies indicate that recovery of the benthic invertebrate community after borrow site dredging depends on several factors such as dredging method, local environmental conditions, hydrodynamics, and sediment infill rates (SAIC 2007b). Recovery is quicker when relatively shallow dredging is conducted rather than creation of deep pits, dredging occurs in areas where sand movement naturally occurs, and sediments at dredged depths are similar to surrounding sediment. The design of the borrow sites for this project includes a limitation of dredge depths to a maximum of 20 ft. Benthic recovery at these depths would be expected to be similar to RBSP I (SANDAG 2011).

Given the various renourishment cycles, it is possible for the borrow sites to be at various stages of recovery, as those sites dredged more frequently (i.e., every 5 years) may not have the opportunity to fully recover following dredging, compared to a borrow site where renourishment would not occur for a relatively long period (i.e., every 13 years). However, the impact would be less than significant on a regional level. It is anticipated that the impact also would be less than significant on a local level given that no long-term alteration of the benthic community was found 9 years after implementation of RBSP I. Although full recovery of the benthic community after dredging may take a few years (Merkel & Associates 2010), the forage base would begin to establish almost immediately after cessation of dredging by migration of invertebrates from unaffected surrounding areas as well as settlement from the plankton.

Dredging would result in turbidity, noise, and disturbance effects with the potential to affect organisms and habitats. As noted in Section 5.3, dredging of the borrow sites would cause temporary and localized turbidity plumes during construction. No long-term reductions in water clarity or quality would be expected however after dredge sand placement activities have concluded. Turbidity can have a number of adverse effects on marine biota. Reduction of water clarity or ambient light levels can impact primary production of plankton, inhibit plant growth or recruitment of plants in vegetated habitats, reduce foraging efficiency of a variety of animals, or cause physiological stress in organisms unable to move away from the turbid water. Sedimentation associated with the settlement of suspended sediment from turbidity plumes has the potential to impact organisms or plant recruitment in hard-bottom habitats. Sedimentation generally is less of a concern for soft-bottom habitats unless within spawning grounds.

The location and footprint of each borrow site were designed to minimize indirect impacts to sensitive habitat areas from dredging operations. As noted in Section 5.3, localized turbidity plumes would be expected under typical current speeds but may extend up to 500 ft under maximum current speeds and certain oceanographic conditions. A minimum 500-ft buffer would be provided as a project design feature between the dredge area and natural hard-bottom habitats in the vicinity of SO-6 and SO-5. Therefore, potential turbidity effects to hard-bottom habitats would be less than significant.

The 500-ft buffer between dredging and hard-bottom areas also would minimize the potential for adverse effects associated with increased noise levels. Demersal fish that reside near the bottom would be expected to move from the borrow site area during dredging to avoid elevated turbidity and noise levels. Underwater noise levels associated with hopper dredges may range from 140 to 160 dB at a distance of 50 ft (Dickerson et. al. 2001). These values are below thresholds that cause injury to marine mammals and fishes (Caltrans 2007), and therefore no significant impacts from noise are expected to occur within or outside the borrow site.

The placement of temporary pipelines, anchoring, and installation of mono buoys, and vessel transport have the potential to impact sensitive resources. Similar to RBSP I and II, it is assumed that project specifications would include requirements to avoid sensitive resources such as kelp, reefs, and structures such as outfalls. Discharge lines would also be placed to prevent vessels from traversing kelp beds and designated vessel transit corridors also would avoid kelp beds. In addition, an anchor plan would be prepared during the project implementation and design phase for each mono buoy to avoid sensitive resources in the area. Implementation of these design features would minimize potential impacts to below a level of significance.

Operation of dredges and support vessels has the potential to introduce contaminants to the marine environment from minor spills and leaks. The potential for accidental discharge also could result from collision with or by another vessel. The probability of both types of accidental discharges is considered low. The dredging contractor would be required to develop a Spill Prevention Control and Containment plan (SPCC) prior to initiating construction. For these reasons, impacts to biological resources from accidental discharges would be expected to be less than significant.

5.4.3 Receiver Sites

Potential impacts discussed in this section apply to both receiver sites. Impacts specific to a given receiver site are discussed separately in sections 5.4.4 and 5.4.5 below.

Beach nourishment would result in direct impacts due to sand placement within the receiver site footprints. Other direct impacts may result from construction vehicle or equipment damage during construction activities. Indirect impacts would occur from turbidity generated during construction of the receiver sites, construction noise and activity disturbance to wildlife, and transport of sand away from the site via natural coastal processes up and down the coast and on and offshore. After construction, sandy beach organisms would recover from the disturbance. The sandy beach habitat would be enhanced relative to existing conditions. Generally, wider beaches and deeper sand across seasons provide greater sandy beach habitat quality. These wider, more persistent beaches support functions for fish and wildlife more effectively than beaches where habitat quality is more variable.

The primary direct impact associated with beach nourishment is the potential for burial of beach invertebrates (e.g., clams, sand crabs, worms) living within the substrate at the receiver site. Impacts to California grunion individuals or eggs have the potential to occur if sand placement or site mobilization activities take place within 10 to 14 days of a spawning run and grunion are present. Other direct impacts may result from equipment damage associated with placement of pipelines to pump sediment to the beaches, operation of vehicles to move and spread sand at the receiver sites, and movement of vehicles and equipment during access to and from the receiver site.

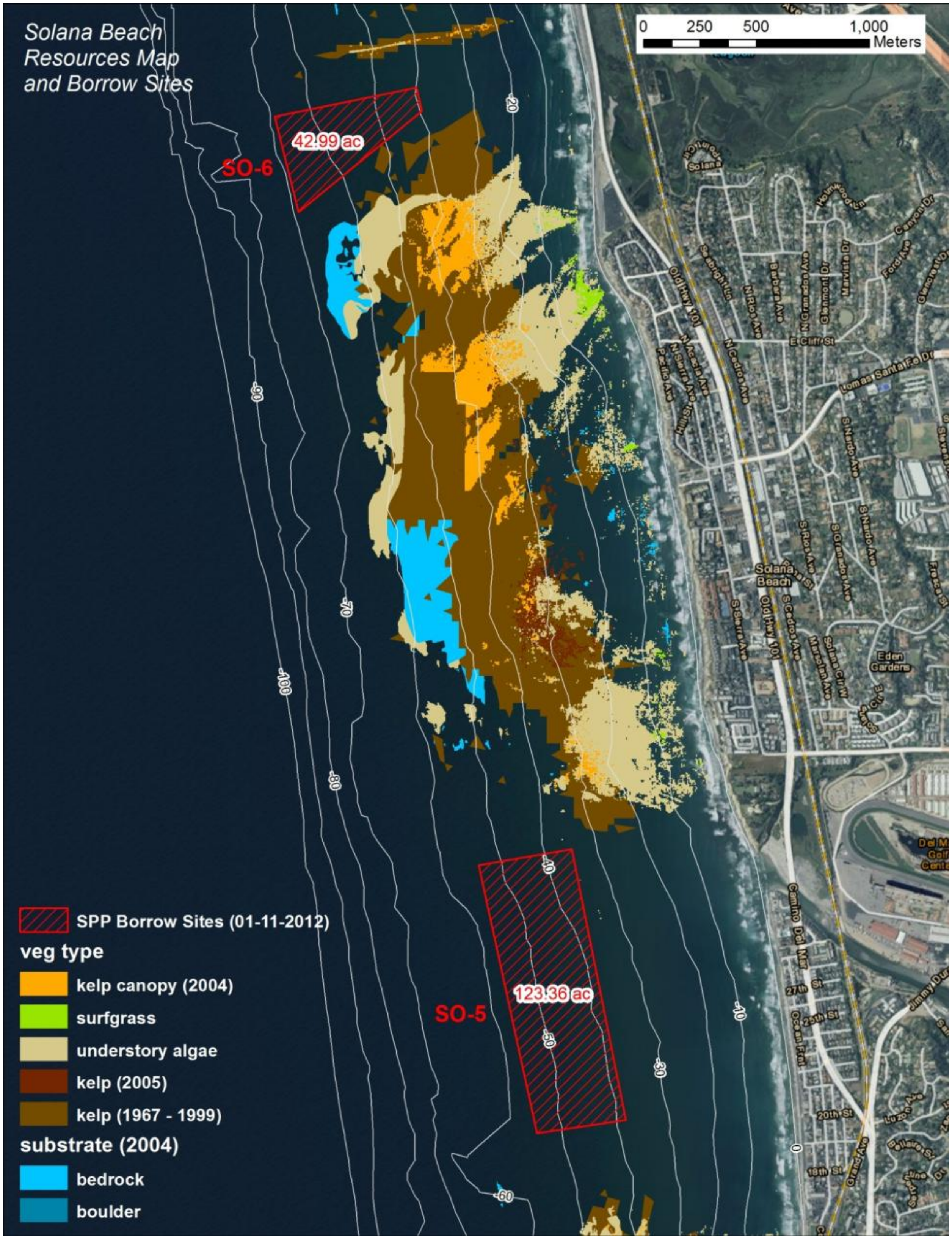


Figure 5.4-1 Nearshore resources in vicinity of SO-5 and SO-6 borrow sites.

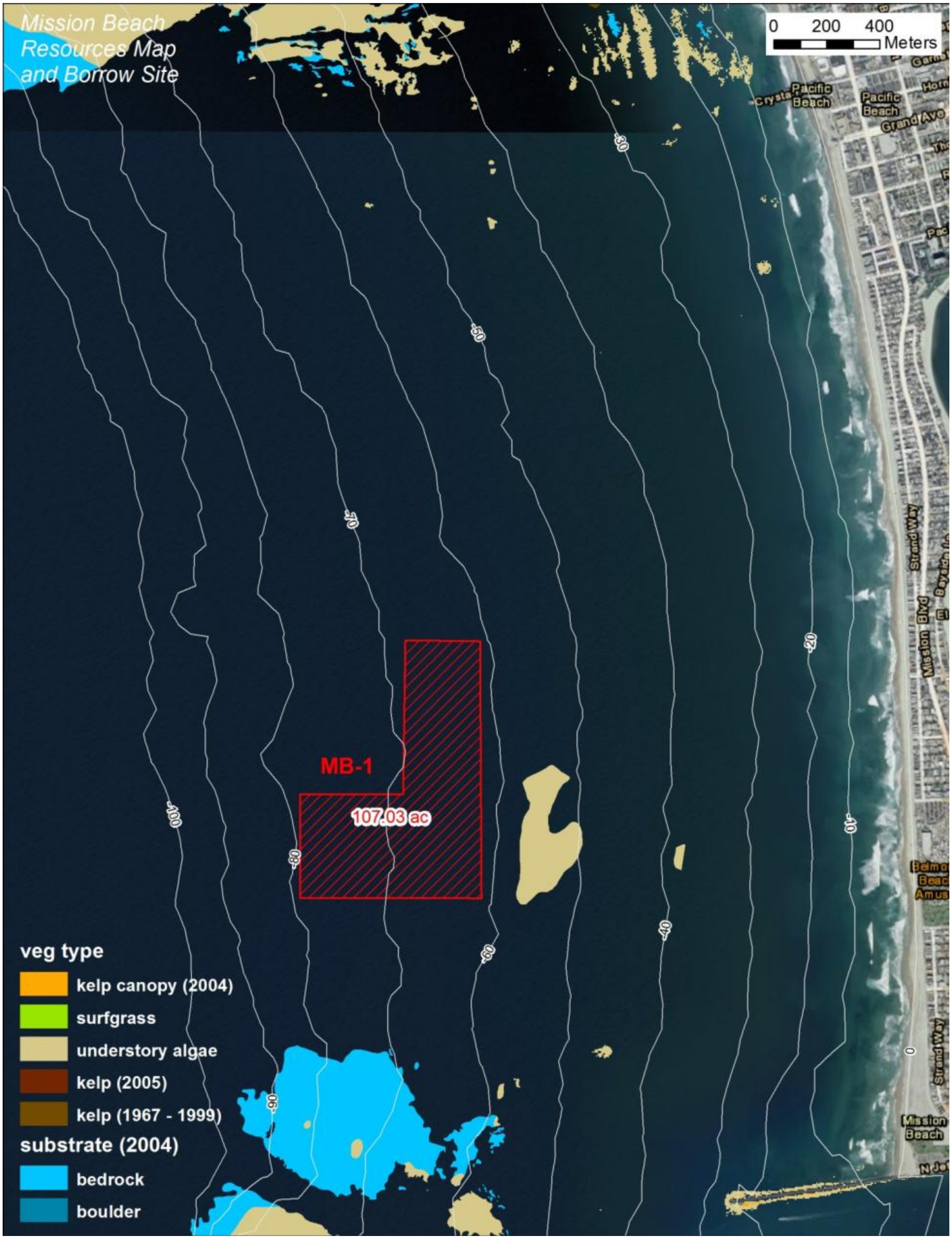


Figure 5.4-2 Nearshore resources in vicinity of MB-1 borrow site

Sand Placement

The area of direct impact to beach habitat and invertebrate resources was conservatively estimated by calculation of area that includes the entire fill site from the top of the back beach to the toe of the slope. Actual impact to biological resources would be less given that marine invertebrates do not inhabit back beach nontidal areas and some would escape mortality along the constructed slope and leading edge of the fill. Temporary habitat disturbance would not be significant on a regional basis because sandy beach habitat is the dominant shoreline habitat in San Diego County. Furthermore, construction would be sequential for the initial placement, and affect a single receiver site at any one time. The potential effects of construction on fish and wildlife largely would be localized rather than regional in scope.

The initial receiver site footprints were designed to avoid all sensitive resources in the area (e.g. rocky reef and surf grass beds).

Construction of the beach receiver sites would result in burial impacts to marine biota. During beach nourishment, large volumes of sand are placed above and through the intertidal zone, smothering benthic organisms. The loss of benthic organisms within the receiver site footprint is an expected and unavoidable impact of beach replenishment projects. Most invertebrates within the receiver site footprint are not expected to survive, but some mobile animals would be able to burrow out from the outer or leading edges of the beach fills where overburden depths are 2 ft or less.

Numerous studies have demonstrated that recovery of sandy beach invertebrates begins almost immediately after cessation of construction. Recovery occurs via two mechanisms—one by animals that migrate to the affected area from surrounding habitat, and the second from recruitment from plankton. Sandy beaches normally have higher invertebrate abundance in spring and summer coincident with recruitment and movement patterns of dominant species between the shallow subtidal and beach habitat. Consequently, the timing of projects may influence the speed of recovery times. Recovery (e.g., species, abundance, biomass) periods on the order of weeks have been reported with projects completed in winter–early spring prior to the onset of the spring–early summer peak recruitment period. Complete recovery may take several months if construction is completed in summer–fall and recruitment is delayed until the next season. An indirect effect of the temporary reduction in sandy beach invertebrate populations would be a reduction in forage base for fish and shorebirds that feed upon invertebrates under appropriate tidal conditions. Nevertheless, colonization of the sands would begin almost immediately and the development of the invertebrate prey base would proceed naturally via the two mechanisms mentioned above and would be complete in less than 1 year (e.g., weeks to months). Due to the relatively small area affected, and the widespread occurrence and relatively rapid recovery rates of sandy beach invertebrates, direct impacts to marine invertebrates within the receiver site footprints are expected to be less than significant.

California grunion spawn on sandy beaches in the San Diego region March through August and have the potential to be affected by sand placement activities. While grunion are not listed as threatened or endangered species under either the California or federal Endangered Species Act, efforts are recommended to minimize impacts to this managed fishery species. A habitat suitability survey would be conducted prior to construction and monitoring would occur during construction, as appropriate, to minimize potential impacts to the species. If suitable grunion spawning habitat is observed, a Grunion Protection Plan will be prepared in consultation with NMFS, CDFG, and CCC.

It is important to note that this project has the potential to enhance or increase persistence of sandy beach habitat at erosive beaches. This would be beneficial for grunion at receiver sites where either dense cobble or narrow beach width limits spawning habitat under existing conditions. Incorporation of preconstruction suitability surveys and the monitoring plan into the project design would minimize effects to this species, and less than significant impacts would occur.

Pipeline/Equipment Placement

Placement of pipelines would occur across the beach face or along the back of the beach. No sensitive habitats occur in these areas within the onshore receiver sites. A preconstruction survey would be conducted of all pipeline routes to confirm no sensitive resources would be directly impacted by the placement and, if necessary, pipelines would be rerouted to avoid direct impacts. This is consistent with the approach successfully used for RBSP I and II.

Vehicle access to each receiver site has the potential to result in direct impacts to invertebrates and grunion eggs if present. Vehicle effects on invertebrate biota generally are minor in the low and middle intertidal where invertebrates are buried by sand. During the grunion season, vehicle use has the potential to damage eggs in the upper intertidal, if eggs are present. Preconstruction habitat suitability assessment and monitoring would be used to minimize adverse effects to grunion during their spawning season, and impacts would be less than significant.

Indirect Impacts

The following types of potential indirect impacts may result from sand placement:

- forage reduction or alteration;
- disturbance, displacement, or interference;
- turbidity;
- sedimentation; and
- other construction issues.

In addition, benefits also would occur to sandy habitats after placement of additional sand on beaches. Monitoring after RBSP I demonstrated that beach nourishment enhanced sandy beach habitat functions at several beaches (SAIC 2006). This was most noticeable at beaches that transitioned from either cobble-covered beaches supporting few biological resources or beaches with highly seasonal periods of productivity coincident with seasonal sand accretion and erosion. The primary benefit was to increase the persistence of sandy beach habitat across seasons such that habitat was suitable early in the season to support the onset of the grunion spawning season and invertebrate recruitment period. This enhancement resulted in increased invertebrate diversity earlier in the season, increased bird use across tide conditions, and enhanced habitat for grunion spawning (e.g., increased beach width and reduction in cobble) Similar beneficial impacts would be anticipated after implementation of this project regardless of the alternative selected.

Each type of indirect impact is assessed for habitats and general wildlife. Potential indirect impacts to federally listed or state-listed endangered or threatened species are summarized at the end of this section. Many of the impacts can be generalized across the project receiver sites and are therefore not specifically discussed with respect to each site. Indirect impacts to nearshore resources due to project sedimentation could have localized effects, however, and these potential effects are discussed according to receiver site below.

Forage Reduction, Alteration, or Modification

There is potential for indirect effects to shorebird foraging from burial of invertebrates within the footprint of the receiver site. This impact would be less than significant since each receiver site has unaffected shoreline nearby and recolonization of the receiver site by invertebrates would be rapid (e.g., weeks to months) following the conclusion of sand placement activities.

Temporary attraction of birds, particularly gulls, to the discharge location is anticipated based on observations from RBSP I and other beach nourishment projects. The birds are attracted to the sand-slurry pumped onto the beach or its return water, where they opportunistically forage on deceased invertebrates and organic debris originating from the borrow site. Similarly, fish that feed on plankton or small organic particles may be attracted to turbidity plumes associated with hydraulic dredge-pump sediment projects; presumably to feed on discharged organic particulates. Fish-feeding birds may be attracted in turn to an increased concentration of fish where water clarity is sufficient for them to locate their prey. Such effects are temporary and less than significant.

No adverse effects on seabird or waterbird foraging were observed with implementation of RBSP I (AMEC 2002b). Bird surveys in areas of the borrow and receiver sites identified no obvious effects of dredging or discharge turbidity on bird foraging behavior or locations. Because turbidity plumes are expected to be similar to those experienced during RBSP I, project-related effects on seabird and waterbird foraging are expected to be less than significant.

Disturbance, Displacement, or Interference

Operational noise from equipment and activities has the potential to disturb shorebirds, gulls, and other coastal birds that may forage or rest on beaches at or near receiver sites. This impact would not be significant because (1) disturbance effects would be temporary and limited to the period of construction; (2) the proximity of unaffected shoreline adjacent to the receiver sites that provides foraging opportunities; and, the (3) the forage base at the receiver site would rapidly recover following the conclusion of sand placement activities.

Artificial night lighting has the potential to disturb or attract wildlife. Grunion have been documented to spawn in the vicinity of beach disposal operations, including RBSP I. Some reports suggest that grunion spawning may be reduced in well-lighted areas, while other reports document spawning near lighted areas such as piers. It is not well understood to what extent grunion may be attracted or displaced from spawning at a beach from artificial lighting or other equipment-related disturbance. Impacts to grunion would be less than significant because habitat suitability assessments and monitoring during construction as discussed above would be used to minimize impacts to the species to less than significant.

Turbidity

Turbidity has the potential to indirectly impact plankton, fish, marine mammals, kelp, and vegetated reefs. Turbidity within the ocean environment is naturally variable depending on wave climate and season. Monitoring data from seven California beach nourishment projects indicate that turbidity measurements with a nephelometer were below or within ranges measured during storm or high wave conditions (SAIC 2007b). As discussed in Section 5.3, turbidity would be expected to be localized to the discharge location, generally within 500 ft or less. Plumes would be expected to be largely confined within the surf zone but may be incorporated by rip currents and carried farther offshore. Because the borrow sediments are sandy with relatively large average grain size, project-related turbidity is expected to quickly settle and plumes would be temporary. Plumes within the surf zone are generally indistinguishable from naturally-occurring turbidity as noted for other beach nourishment projects, including RBSP I.

If a hopper dredge is used, elevated turbidity would occur in pulses and would be expected to return to background conditions during cycle times of the dredge moving between the borrow and receiver site. Elevated turbidity has the potential to be more prolonged with use of a cutterhead dredge, which would pump sediments directly from the borrow site. The duration of exposure at any offshore location would vary from relatively higher to lower as the beach building moves along the length of the receiver site. Therefore, exposure durations to elevated turbidity at any particular nearshore location generally would be on the order of days to a week. Exposure durations would be substantially less (e.g., minutes, hours) for mobile organisms.

Turbidity would be minimized by the construction of training dikes that would promote settlement of sediment on the beach and lower the amount of suspended sediment that is lost to the return waters. This design feature was implemented during RBSP I (and will be implemented by the RBSP II in 2012) and found to be effective for minimizing turbidity plumes at the receiver sites. With this project design feature, suspended sediment concentrations would be reduced, thereby minimizing potential effects associated with the range of exposure durations that may occur depending on equipment type and differences in receiver site configurations.

Plankton, Pelagic Fish, and Marine Mammals

As discussed above, the effects of suspended particulates on plankton are generally considered negligible because of the limited area affected and short exposure time as they drift through the affected areas. Similarly, potential effects on fish would be limited and temporary in nature, and a number of studies have documented variable responses by fish that range from attraction to avoidance. Pelagic fish offshore of the receiver sites, and any marine mammals that ventured close to shore, would not be expected to be adversely affected because the turbidity would remain localized and short term, and similar to conditions that may be experienced during storm events. No significant impacts are anticipated to plankton, fish, or marine mammals as a result of turbidity.

Kelp

Kelp beds occur from approximately 2,000 ft offshore of the receiver sites, which is outside the distance that turbidity plumes would be expected to travel offshore unless carried by rip currents. In the unlikely event that turbidity did extend that far offshore, the particulate concentration would be expected to be so low as to have a negligible effect on the kelp bed. Therefore, no significant indirect impacts to kelp beds are anticipated from turbidity generated from receiver site construction.

Vegetated Reefs

Nearshore vegetated reefs have the potential to be impacted by reduced light transmittance and siltation associated with turbidity plumes. Turbidity also has the potential to cause physiological stress, reduced feeding, or displacement of mobile marine invertebrates or fish in reef areas.

Actual effects would depend on the concentration and duration of turbidity. While marine invertebrates and bottom-associated fish are generally tolerant of high turbidity such as naturally occurs during high wave or storm conditions, adverse effects may result from exposure to very high concentrations or moderate to high concentrations for prolonged periods. As noted, turbidity plumes associated with the project would be relatively small, localized, and of short duration. Furthermore, suspended sediment concentrations in turbidity plumes would be minimized by use of training dikes, a key project design feature. Therefore, turbidity impacts would be expected to be less than significant on reef habitat and resources offshore of the receiver sites and within the distance of the expected turbidity plumes.

Sedimentation

Beach sand placed on receiver sites would eventually be washed by waves and redistributed offshore and alongshore through natural processes. There is the potential for sand introduced into the system to indirectly impact sensitive habitats and resources if sand deposits on those resources occur at sufficient depth and persistence to result in burial or degradation of those resources. To estimate potential impacts to sensitive habitats, a suite of indicator species of relatively higher quality reef habitats has been identified. As defined in Section 4.4, sensitive indicator species consist of surfgrass, feather boa kelp, sea fans, sea palms, and giant kelp.

Evaluating potential indirect sedimentation impacts is complex and impact conclusions must be determined in light of the dynamic ocean system, where seasonal and annual changes in sand elevation naturally occur, and an understanding must be developed of the life history of sensitive species and their relative distribution on nearshore reefs. A key feature of the shoreline morphology analysis was consideration of the results of the coastal numerical modeling predictions of the influence of the project on sand elevation in the vicinity of the receiver sites over time (Appendix B). Additionally, empirical observations from RBSP I and other biological surveys conducted in the project area were considered to inform the conclusions.

The approach for analysis of indirect sedimentation impacts involved the following steps:

1. Review of project-specific modeling predictions to identify sand elevation changes over time after project implementation at historical beach profile locations in the study area.
2. Review of historical average sand elevation differences between spring and fall beach profiles according to distance offshore.
3. Review of empirical observations of nearshore reef heights and biological resources based on dive surveys conducted between 2006-2010 in the project area.
4. Review of empirical data on reef heights from the 2004 LiDAR bathymetry survey.
5. Comparison of average sand level increase predictions with reef heights and resources to identify the potential for increased sedimentation impacts.
6. Comparison of the RBSP II modeling predictions and impact estimates with those of RBSP I.
7. Review of the results of the RBSP I monitoring of nearshore reefs and kelp beds relative to impact estimates.

A detailed evaluation of potential effects of sediment transport, based on the above steps, is included in Appendix H. This summary is provided to summarize the methodologies and results of the analyses.

Sediment transport modeling was used to predict the influence of the project on sand elevations in the vicinity of the receiver sites over time (see Appendix B). A GIS-based methodology was developed to automate what was done for previous efforts (i.e., RBSP I and II, and the Encinitas-Solana Beach Shoreline Feasibility Study from 2005 through 2007). This methodology was developed in coordination with three resource agencies (CDFG, NMFS, and USFWS). Similar to the previous method used for the Encinitas-Solana Beach Shoreline Feasibility Study, the 2004 LiDAR data (post-RBSP I) was used as base bathymetry upon which changes in sand thickness were added. Substrate and vegetation data were added as a layer to provide a spatial representation (areal coverage) of the resources; a mosaic of habitat types (e.g., sandy areas, rocky reef) and resources (e.g., surfgrass, kelp) that also includes reef elevation. To estimate sedimentation and potential impacts to resources based on natural variation, a sand layer was created from empirical data provided from the 1996 to 2008 coastal profile dataset (SANDAG 2011). This sand layer was overlaid onto the baseline layer similar to the modeled sedimentation results, and the criteria described below were applied, and the area potentially impacted was calculated.

For this project, a burial criteria of greater or equal to 12 inches was used since similar criteria were used to assess impacts on biological resources for previous beach nourishment projects (e.g., RBSP I and II). Given the dynamic nature of the coastal environment and natural seasonal sediment transport, rocky habitat less than 12 inches typically supports ephemeral species due to sediment scour. Therefore, project-related impacts above this level were considered to have potential impacts on perennial/indicator species and habitat. Seasonal impacts were determined based on Year 2 results, and averaged to determine the most probable potential impact. The potential project-related impact was determined by subtracting the most probable impact from natural variation.

Site conditions vary by receiver site as described in Section 4.4, and sedimentation would have different effects on each site depending on these conditions. The effect of predicted additional sand influence on resources located in proximity to each receiver site are discussed separately below for each of the receiver sites.

Threatened and Endangered Species

<u>California least tern</u>

The receiver and borrow sites are located far from nesting site locations that may be seasonally used by endangered least terns during their April 15–September 15 breeding season. Dredging at the borrow sites and placement of sand at the receiver sites would generate turbidity that would be expected to be localized and rapidly dissipate based on the sandy nature of the sediment. The three borrow sites are located off shore in deep water. Few terns are expected to forage so far offshore. Recent and ongoing monitoring of least terns near a Corps dredging project at Marina del Rey has recorded numerous observations of least terns foraging within 100 to 200 feet of dredging when the dredge is actively removing sediments and depositing them in a scow (Keane, preliminary data). Similar observations have been made on an anecdotal basis for dredging elsewhere within the boundaries of the Los Angeles District. These observations suggest that, when prey fish are available, least terns forage near dredging operations similarly to other in-water obstructions such as boats and docks. This behavior indicates that the presence of the dredge does not impose any stressors on those few, individual birds that may forage in the proposed borrow sites.

The Encinitas receiver site is located more than two miles south of the least tern nesting site located within the Batiquitos Lagoon Ecological Reserve and 2-1/2 miles north of the San Elijo Lagoon Ecological Reserve. The Solana Beach receiver site is approximately one mile south of the San Elijo Lagoon Ecological Reserve and one mile north of the San Dieguito Lagoon Ecological Reserve. The Batiquitos site supports a large population of nesting terns while the San Elijo site has not had a nest since 2005 and no nest sites have ever been recorded for the San Dieguito Lagoon. Beach nourishment activities would not directly affect any nest sites owing to distance. Turbidity from beach nourishment activities would not be expected to affect foraging of the species based on the localized nature of turbidity plumes expected during construction and their confinement to the naturally turbid surf zone where least terns do not forage (see Section 5.3). The Corps, therefore has determined that the project will not affect California least tern.

<u>*Western snowy plover*</u>

The Encinitas receiver site is located approximately 1.3 miles from snowy plover critical habitat located adjacent to Batiquitos Lagoon. This species nests at Batiquitos Lagoon, and has been observed to forage at the beach in the vicinity of the Batiquitos receiver site. Since no construction would occur within designated or proposed critical habitat, the Corps has determined that the project will not affect western snowy plover.

Essential Fish Habitat

As discussed in Section 4.4, the proposed project would encompass designated EFH, including nearshore areas adjacent to receiver sites, as well as the borrow sites located farther offshore. In addition to EFH designations, certain areas may also be designated as Habitat Areas of Particular Concern (HAPCs). HAPCs are discrete subsets of EFH that provide important ecological functions. HAPCs are vulnerable to degradation (50 C.F.R. 600.815[a][8]). Regional Fishery Management Councils may designate a specific habitat area as an HAPC in the FMP based on one or more of the following reasons: (1) importance of the ecological function provided by the habitat; (2) the extent to which the habitat is sensitive to human-induced environmental degradation; (3) whether, and to what extent, development activities are, or will be, stressing the habitat type; and (4) rarity of the habitat type (50 C.F.R. 600.815[a][8]). The HAPC designation does not confer additional protection or restrictions upon an area but can help prioritize conservation efforts.

Impacts to EFH are typically determined based on whether a project reduces quality and/or quantity of EFH, regardless of the degree to which that impact occurs. Based on the Magnuson-Stevens Act, adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species, and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 C.F.R. 600.810(a)). By definition, the threshold to have an adverse impact to EFH is low; however, the nature of the impact can be further qualified based on the type of impact (e.g., temporary or permanent). This is distinctly different from an adverse or significant impact determination made under NEPA and CEQA, which takes into account the context and intensity of a potential impact. Therefore, this section refers to impacts to EFH in terms of compliance with the Magnuson-Stevens Act and does not reflect impact severity as defined under NEPA, although a significant or permanent adverse impact to EFH would qualify as a significant impact under NEPA.

Less than substantial impacts to water column EFH and benthic habitat at the borrow sites are anticipated and would constitute temporary adverse impacts (e.g., temporary turbidity plume due to dredging or loss of prey items at borrow or receiver sites due to dredging or nourishment). Similarly, temporary adverse impacts to life stages of managed species are expected to occur as a result of the project. Protective measures have been implemented to avoid and/or minimize these impacts. However, based on the analysis in the preceding sections, substantial adverse effects to quality or quantity of benthic habitat EFH and HAPCs (e.g., rocky reefs) are suggested by modeling predictions of sand level changes at year 2 following project implementation for Solana Beach only.

5.4.4 Encinitas

Sedimentation

For Encinitas modeling estimates indicated no project-related impact to nearshore resources for all alternatives under consideration. The need for renourishment would be based on the equilibrium beach width that would be implemented (e.g., if a 100 ft beach width is proposed for the initial placement, renourishment volume would be based on maintaining a 100 ft beach width), thus no additional impacts are anticipated from renourishment, as any impact to nearshore resources would be expected during the initial beach fill. In addition, an adaptive management and monitoring program is proposed for the project to account for potential cumulative effects associated with other beach nourishment activities (e.g., opportunistic programs, lagoon maintenance dredgings and the SELRP). While the analysis relies on predicted impacts, actual impacts would be assessed by implementation of a construction monitoring program (see Appendix H). Mitigation would be triggered only if certain conditions occur during, and persist through, the two year post-construction monitoring period. If mitigation is implemented, mitigation monitoring would also be conducted. The specifics of monitoring and mitigation would be determined in consultation with the resource and regulatory agencies. Based on model predicted estimates, impacts to nearshore resources at Encinitas would be less than significant.

Alternative EN-1A

Under Alternative EN-1A, a maximum of approximately 93 acres of beach habitat would be disturbed by construction at Encinitas (**Figure 5.4-3**). Estimated duration of construction is 103 days.

Alternative EN-1B

Compared to Alternative EN-1A, the area of direct impact to beach habitat and invertebrate resources would be the smaller at Encinitas; approximately 54 acres (**Figure 5.4-4**). Estimated duration of construction is 41 days.

Alternative EN-2A

Compared to Alternative EN-1A, the area of direct impact to beach habitat and invertebrate resources would be the same at Encinitas; approximately 93 acres (**Figure 5.4-3**). Estimated duration of dredging and sand placement is 84 days. Estimated duration of construction is 180 days. The construction of notch fills at the base of the bluff would not affect marine resources.

Alternative EN-2B

Compared to Alternative EN-1B, the area of direct impact to beach habitat and invertebrate resources would be the same at Encinitas; approximately 54 acres (**Figure 5.4-4**). Estimated duration of dredging and sand placement is 41 days. Estimated duration of construction is 180 days. The construction of notch fills at the base of the bluff would not affect marine resources.

5.4.5 Solana Beach

Sedimentation

For Solana Beach, modeling estimates indicate a potentially significant impact to intertidal reef platform and reefs with other indicator species (**Table 5.4-1**) for all alternatives under consideration. No impacts to reefs supporting surfgrass were predicted. The need for renourishment would be based on the equilibrium beach width that would be implemented, thus no additional impacts are anticipated from renourishment. Any impact to nearshore resources would be expected during the initial beach fill as all subsequent nourishments would occur in the same footprint and would be a reduced volume relative to the initial fill. In addition, an adaptive monitoring program is proposed for the project to also account for potential cumulative effects associated with other beach nourishment activities (e.g., opportunistic programs, lagoon maintenance, and the SELRP). While the analysis relies on predicted impacts, actual impacts would be assessed by implementation of a construction monitoring program (see Appendix H). Mitigation would be triggered only if certain conditions occur during, and persist through, the two year post-construction monitoring period. If mitigation is implemented, mitigation monitoring would also be conducted. The specifics of monitoring and mitigation would be determined in consultation with the resource and regulatory agencies. However, based on model predicted estimates, impacts to nearshore resources at Solana Beach would be significant for all alternatives under consideration and mitigation would be required. Proposed mitigation measures are discussed below.

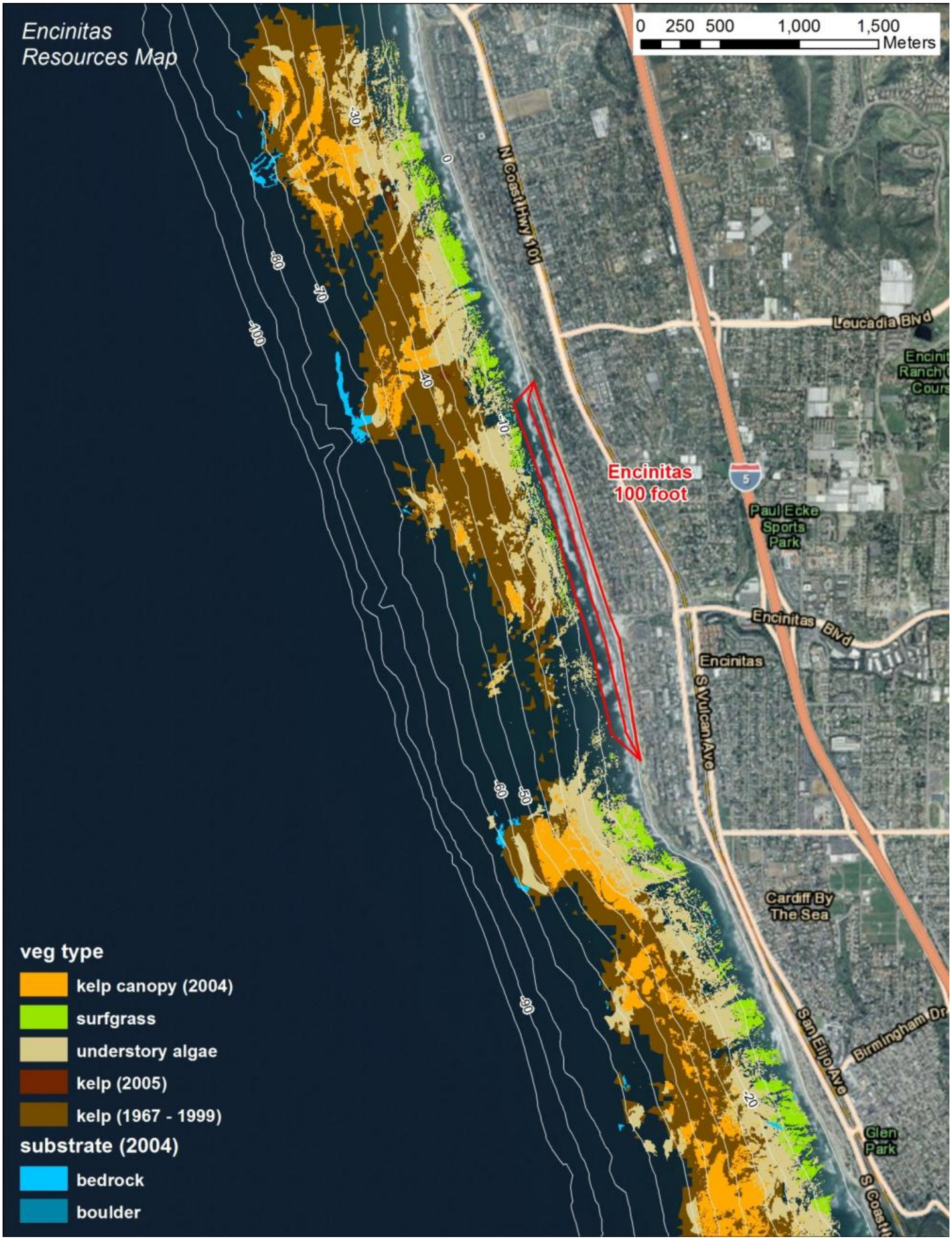


Figure 5.4-3 Encinitas receiver site under Alternatives EN-1A and EN-2A

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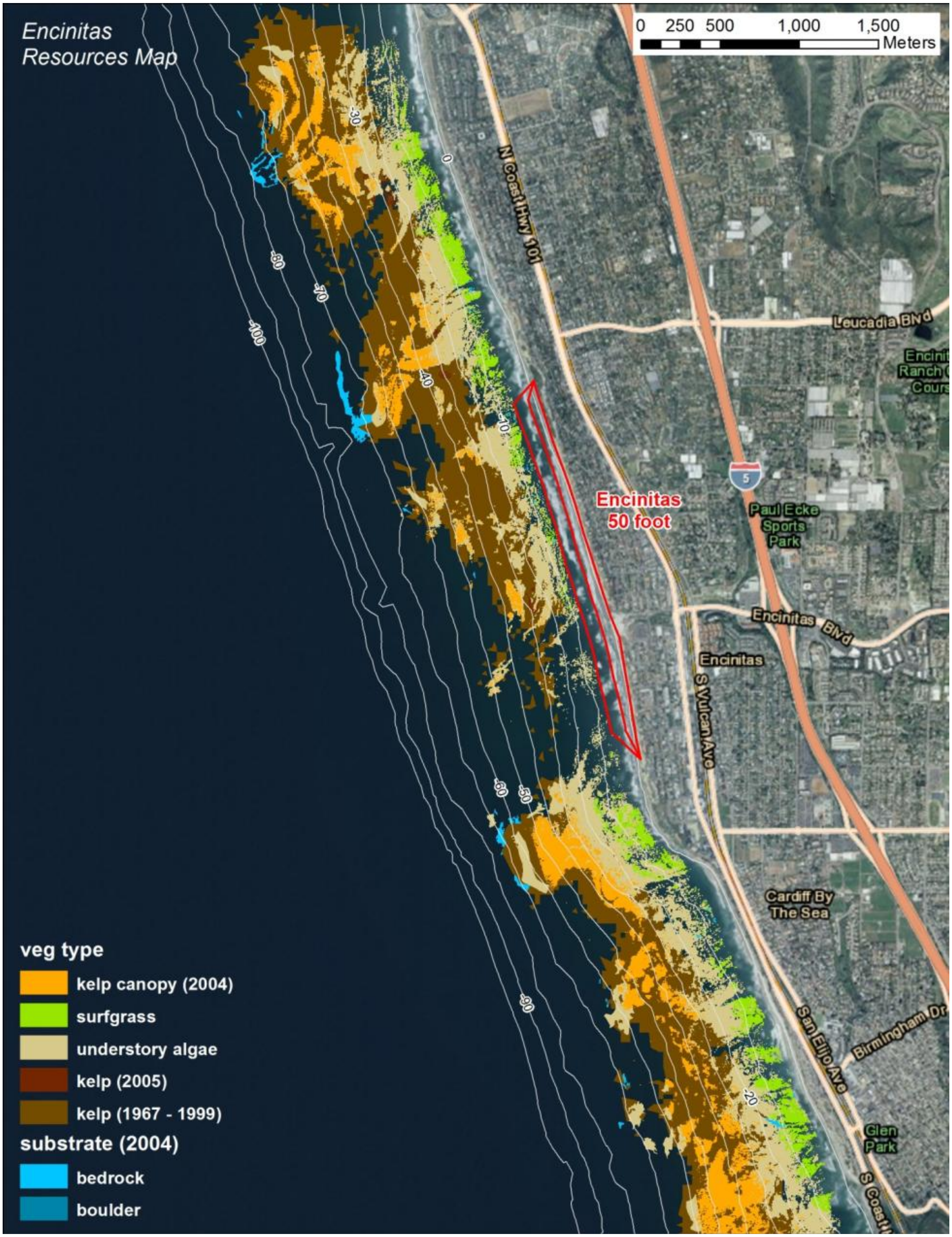

Figure 5.4-4 Encinitas receiver site under Alternatives EN-1B and EN-2B

Table 5.4-1 Estimated year 2 impact to nearshore resources (in acres) for Solana Beach

	Project-Related Impact (acres)
Alternative 1A: 200 ft beach width	
Intertidal Reef Platform	0.4
Reefs with Surfgrass	No impact*
Reefs with Other Indicators	8.0
Alternatives 1B & 2A: 150 ft beach width	
Intertidal Reef Platform	0.3
Reefs with Surfgrass	No impact*
Reefs with Other Indicators	6.5
Alternatives 1C & 2C: 100 ft beach width	
Intertidal Reef Platform	0.1
Reefs with Surfgrass	No impact*
Reefs with Other Indicators	1.5

*Project-related impact less than natural variation

Mitigation Construction

Potential mitigation areas offshore of Solana Beach have been identified (approximately 26 acres) that consist primarily of sandy bottom habitat. Direct mortality to sessile benthic organisms would be expected within each foot; however, sandy habitat does not support sensitive marine biological resources. Mitigation reef construction would result in persistent rocky reef habitat that would support sensitive marine biological resources. No significant adverse impacts to biological resources would result from implementation of the mitigation reef.

Table 5.4-2 Estimated mitigation characteristics for Solana Beach

Alternative	Estimated Impact	Mitigation Area	Construction Duration
SB-1A	8.4 ac	16.8 ac	34 days
SB-1B & SB-2A	6.9 ac	13.8 ac	28 days
SB-1C & SB-2B	1.6 ac	3.2 ac	7 days

Alternative SB-1A

Under Alternative SB-1A, a maximum of approximately 63 acres of beach habitat would be disturbed by construction at Solana Beach (**Figure 5.4-5** and **Figure 5.4-6**). Approximately 8.4 acres of rocky reef habitat could be indirectly buried. Mitigation for this level of impact would be the creation of 16.8 acres of rocky reef habitat, requiring 34 days of construction time two years following completion of initial beach fill. Mitigation details are below.

Alternative SB-1B

Compared to Alternative SB-1A, the area of direct impact to beach habitat and invertebrate resources would be the smaller at Solana Beach; approximately 41 acres (**Figure 5.4-7**). Approximately 6.9 acres of rocky reef habitat could be indirectly buried. Mitigation for this level of impact would be the creation of 13.8 acres of rocky reef habitat, requiring 28 days of construction time two years following completion of initial beach fill. Mitigation details are below.

Alternative SB-1C

Compared to Alternatives SB-1A and SB-1B, the area of direct impact to beach habitat and invertebrate resources would be smaller at Solana Beach; approximately 40 acres (**Figure 5.4-8**). Approximately 1.6 acres of rocky reef habitat could be indirectly buried. Mitigation for this level of impact would be the creation of 3.2 acres of rocky reef habitat, requiring 7 days of construction time two years following completion of initial beach fill. Mitigation details are below.

Alternative SB-2A

Compared to Alternative SB-1B, the area of direct impact to beach habitat and invertebrate resources would be the same at Solana Beach; approximately 41 acres (**Figure 5.4-7**). The construction of notch-fills at the base of the bluff would not affect marine resources. Approximately 6.9 acres of rocky reef habitat could be indirectly buried. Mitigation for this level of impact would be the creation of 13.8 acres of rocky reef habitat, requiring 28 days of construction time two years following completion of initial beach fill. Mitigation details are below.

Alternative SB-2B

Compared to Alternative SB-1C, the area of direct impact to beach habitat and invertebrate resources would be the same at Solana Beach; approximately 40 acres (**Figure 5.4-8**). The construction of notch-fills at the base of the bluff would not affect marine resources. Approximately 1.6 acres of rocky reef habitat could be indirectly buried. Mitigation for this level of impact would be the creation of 3.2 acres of rocky reef habitat, requiring 7 days of construction time two years following completion of initial beach fill. Mitigation details are below.

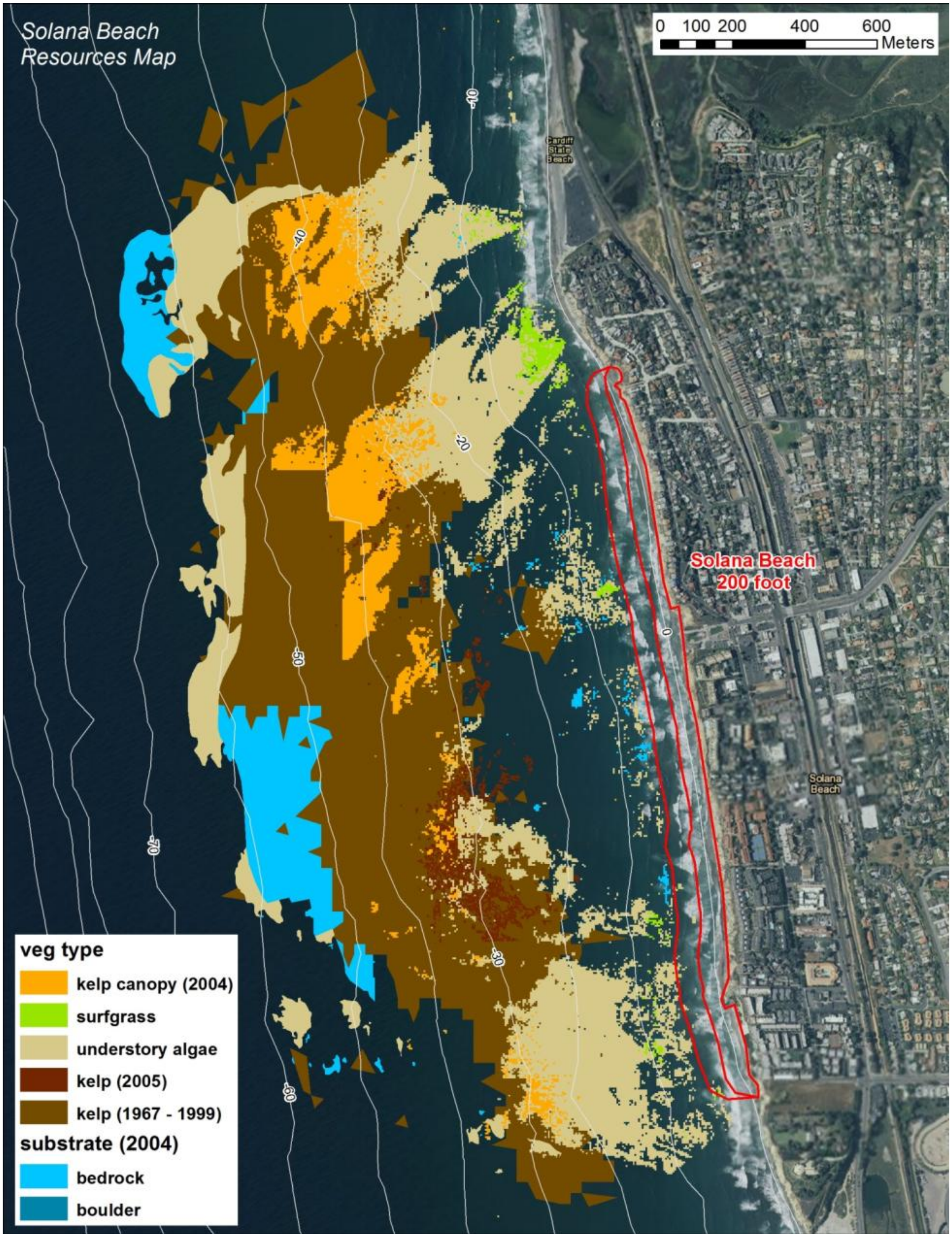

Figure 5.4-5 Solana Beach receiver site under Alternative SB-1A- low sea level rise

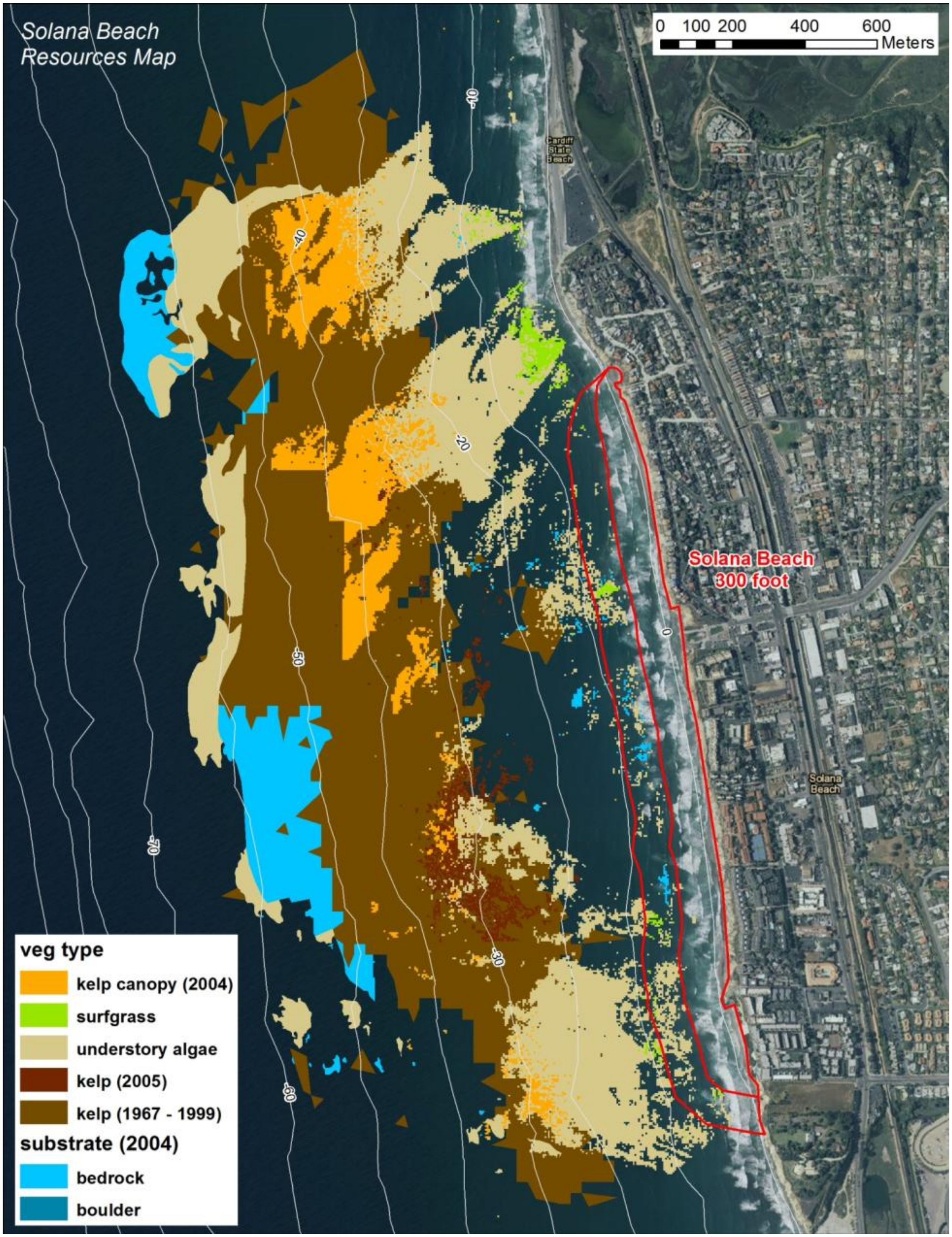

Figure 5.4-6 Solana Beach receiver site under Alternative SB-1A- high sea level rise

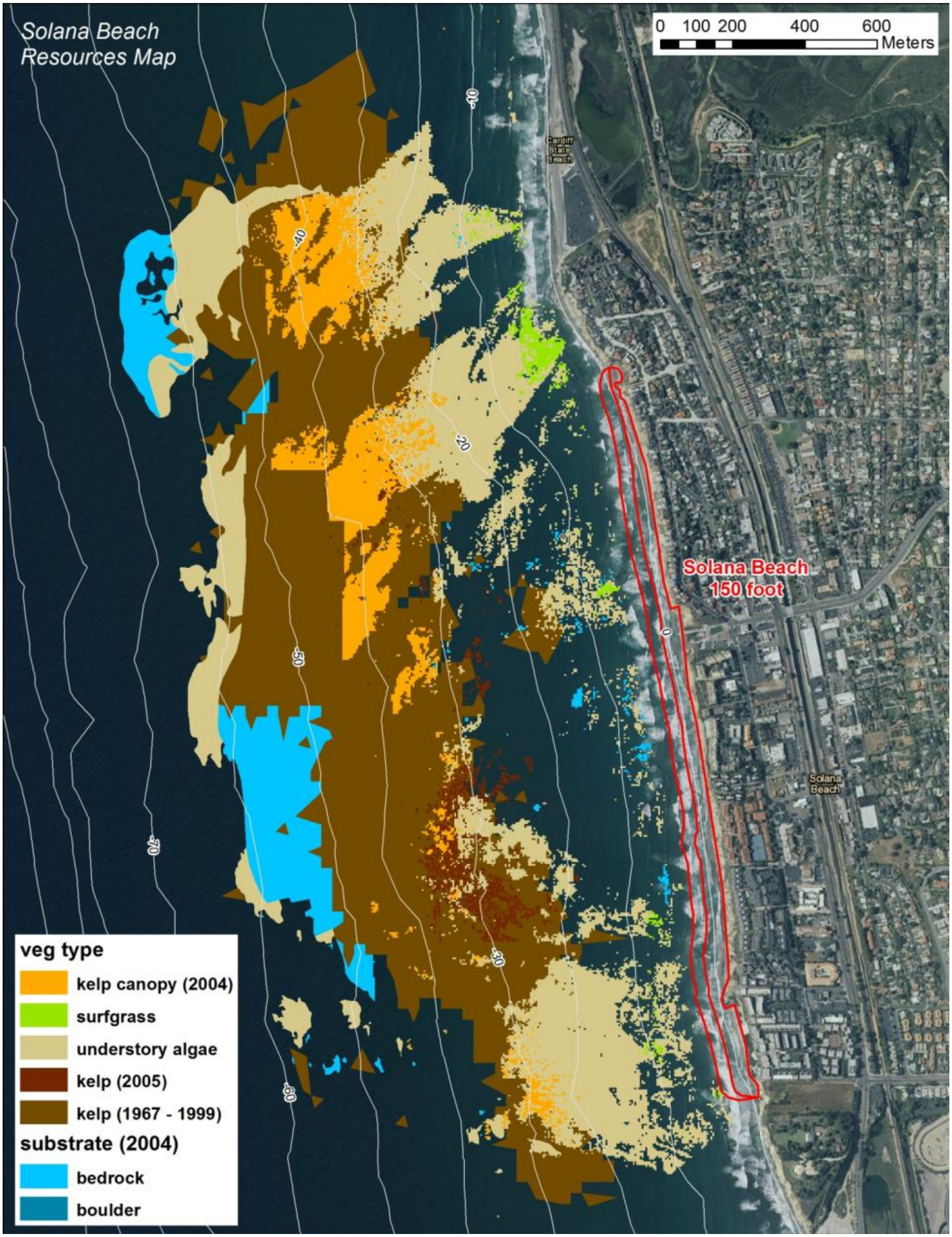

Figure 5.4-7 Solana Beach receiver site under Alternative SB-1B and SB-2A

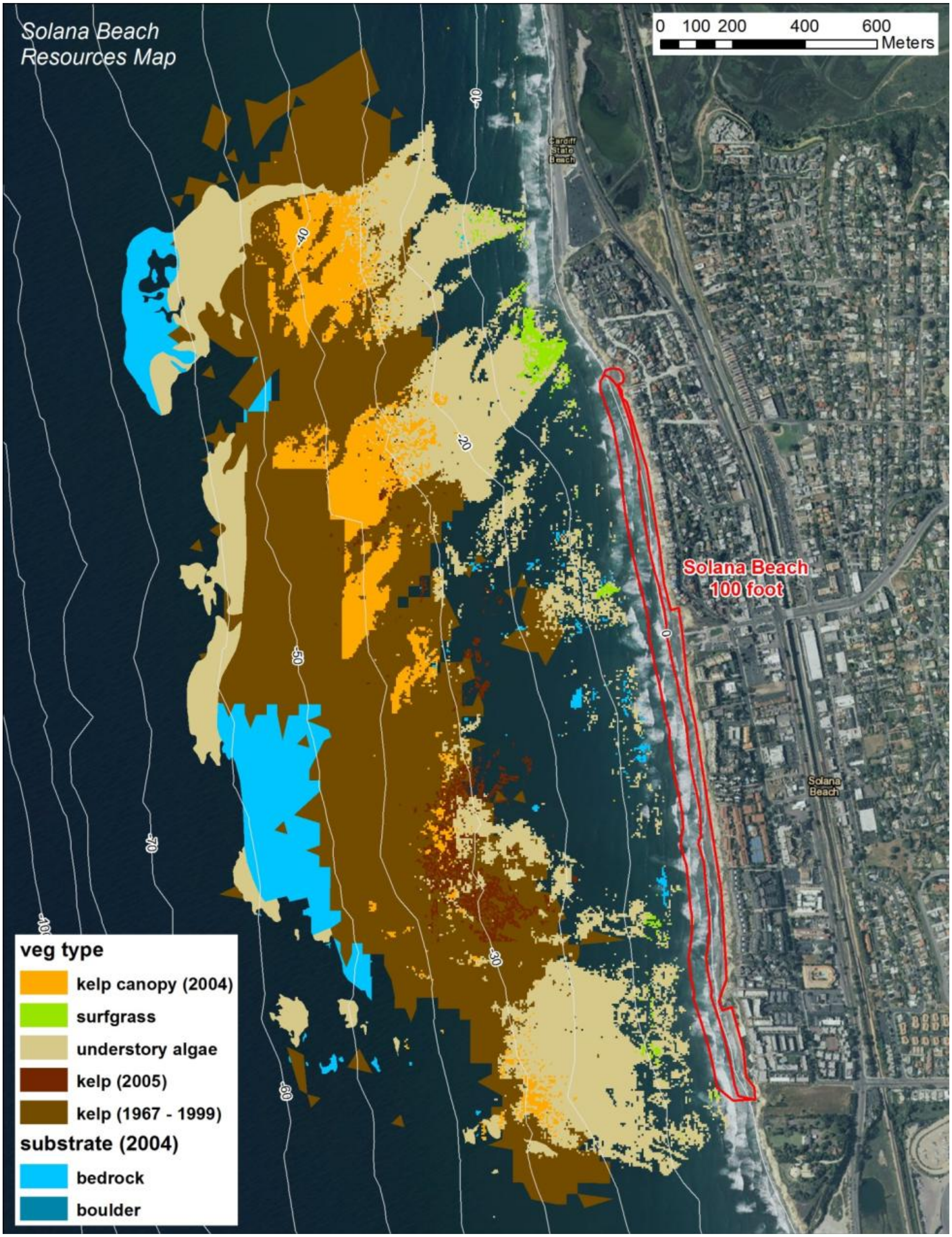

Figure 5.4-8 Solana Beach receiver site under Alternative SB-1C and SB-2B

5.4.6 Summary of Potential Impacts to Biological Resources

Direct impacts from dredging at the borrow sites would include removal of sediment and associated organisms, while construction at the receiver sites would result in burial impacts to marine biota; however, these impacts are considered short-term and localized. Due to the relatively small area affected, and the widespread occurrence and relatively rapid recovery rates of marine invertebrates, direct impacts to marine invertebrates within the borrow and receiver sites are expected to be less than significant. Receiver site construction may also potentially impact grunion spawning; however habitat suitability surveys and construction monitoring would to minimize impacts to the species. Restoration and maintenance of stable, wide beaches would be expected to enhance grunion spawning habitat as well as general sandy beach habitat.

Indirect effects associated with removal on the forage base for other animals, and indirect effects associated with operation of the dredge equipment such as increased turbidity and noise are also considered short-term and localized and less than significant. However, there is the potential for sand introduced into the system to indirectly impact sensitive habitats and resources if sand deposits on those resources occur at sufficient depth and persistence to result in burial or degradation of those resources. Results from sediment transport modeling predict potential significant impacts to sensitive nearshore resources only at Solana Beach. Mitigation would be required to reduce the impact to less than significant.

Significant Impact BR-1: Solana Beach. Sand introduced into the system would indirectly impact marine biological resources (quality or quantity of benthic habitat EFH and HAPCs) as a result of burial or degradation of sensitive habitats and resources.

5.4.7 Mitigation Measure BR-1: Solana Beach

Due to inherent uncertainties associated with estimating impacts based on model predictions, a monitoring program would be implemented to assess actual impacts two years following construction. Mitigation would be triggered only if certain conditions occur during, and persist through, the two year post-construction monitoring period. The two-year post-construction was established in consultation with the National Marine Fisheries Service and the California Department of Fish and Game to allow sand to equilibrate in the study area and to prevent mitigating for short-term impacts. The final mitigation and monitoring plan will be prepared during the pre-construction engineering design phase of the project in consultation with resource and regulatory agencies.

The general approach for assessing impacts would be similar to that used to identify potential project-related impacts to eelgrass as per the Southern California Eelgrass Mitigation Policy (SCEMP; NMFS 1991) and the monitoring protocol used for the RBSP (Engle 2005). The project area and control site(s) will be surveyed prior to construction, and two years following construction. Given the relatively high natural variation, it is suggested that multiple control sites be sampled. Potential control areas, chosen for their similarity to potential impact sites, in the general project area include North Carlsbad (in the vicinity of Tamarack Boulevard) and South Carlsbad (north of Palomar Airport Road). Pre-construction (baseline) areal coverage will be compared to Year 2 (post-construction) areal coverage, taking into account any natural variation at control areas to identify potential project-related impacts.

The expected monitoring schedule includes:

Pre-construction baseline monitoring (year prior to construction):

- Spring Survey
- Fall Survey

Post-construction (two years following construction):

- Spring Survey
- Fall Survey

If mitigation were required based on results of the post-construction monitoring, rocky reef and surfgrass mitigation shall each be conducted at a 2:1 functional equivalent as discussed in Appendix H. Because it will take at least two years to identify impacts, some temporal loss of habitat, if impacts were to occur, is unavoidable. Recovery of impacted habitats may also occur as sand is redistributed within the littoral cell; some observed burial of reef or surfgrass habitat would be temporary because sand would be expected to move out of the project area. Additionally, if impacts were to occur, future beach fills would be modified to avoid future impacts.

Mitigation would be implemented in the project area at sites to be determined in consultation with the resource and regulatory agencies. Since potential impacts were identified under all alternatives for Solana Beach (except for the Alternative SB-3 - No Action), potential mitigation areas offshore of Solana Beach were identified (approximately 26 acres) and includes areas that consist primarily of sandy bottom habitat Figure 5.4-9. No estimated impacts were predicted for Encinitas under all proposed alternatives, and therefore no potential mitigation areas were identified offshore of Encinitas.

The Functional Assessment is used to provide a quantitative valuation of existing and mitigation features to support a mitigation functional equivalent to offset unavoidable losses to rocky reef habitat resulting from the Project as described in Appendix M.

USACE guidance for establishing mitigation requirements in the Civil Works Program is provided in ER 1105-2-100. “Mitigation planning objectives are clearly written statements that prescribe specific actions to be taken to avoid and minimize adverse impacts, and identifies specific amounts (units of measurement, e.g., habitat units) of compensation required to replace or substitute for remaining, significant unavoidable losses” [ER 1105-2-100, App C, Paragraph C-3.b (13) 22 April 2000] and “habitat-based evaluation methodologies…shall be used to describe and evaluate ecological resources and impacts” [ER 1105-2-100, App C, Paragraph C-3.d (5)]

This guidance requires that USACE not use standardized ratios, but instead a scientific-based approach through the use of habitat evaluation through functional assessment (FA).

Following consultations with resource agencies in March 2012, USACE decided to proceed with a process based, in part, on the National Oceanic and Atmospheric Administration (NOAA) mitigation calculator (King & Price, 2004). USACE also assembled an expert panel to assist in populating the mitigation calculator and is detailed in Appendix M.

This process was chosen because it allows for a structured procedure tailored to the project site, it allows for a quantified assessment of mitigation, and it results in a written documentation of the determination process.

Reef habitat mitigation shall consist of shallow-water, mid-water, or deep-water reef at a 2:1 functional equivalent to the area of reef impacted. Shallow water reef would be for any surfgrass mitigation, mid-water reef would be located inshore of the existing kelp beds, and deep-water reef would be located offshore of the existing kelp beds. The mid-water reef would be the first priority as it is most like the reef being impacted and is thus closer to an in-kind mitigation. However, deep-water reef mitigation may be required.

Separate mitigation requirements were established for each reef type. Each of the three reef types have differing locations and characteristics that result in different functional values. No impacts to surfgrass were identified from the project. Mitigation is proposed, however, should post-construction monitoring show unexpected impacts to surfgrass occurred.

Shallow-water reef would be constructed inshore of the mid-depth mitigation sites shown on Figure 5.4-6 in water shallow enough to support surfgrass. The top of the constructed mitigation reef would be at a final top elevation of -10 to -14 ft MLLW and deep water reef would be constructed at approximately -40 ft MLLW along the outside edge of the existing reefs. Shallow-water reef shall be constructed with a final top elevation of -10 to -14 ft MLLW. Construction of a reef that is shallower than that is not proposed because construction methods would not be practical (e.g., a barge with the reef construction materials would not be able to operate in very shallow water). Although the surfgrass mitigation reef would be deeper than the impacted area, if surfgrass transplants are successful, the slightly deeper reef would replace the lost surfgrass resource.

Although several studies currently are being conducted to determine how to successfully transplant surfgrass and may show potential for success, success rates to date have not been consistent (Reed and Holbrook 2003, Reed et al. 1999). Due to the absence of an established, successful method for mitigation of surfgrass loss, proposed mitigation currently is focused upon restoration of the rocky reef that surfgrass currently uses as habitat. However, as previously described, if it is determined that surfgrass has been affected by the project and a change is shown not to be due to natural variation, an experimental surfgrass transplant shall be implemented in addition to the construction of a shallow-water rocky reef.

Currently, surfgrass transplant success is much higher for subtidal than for intertidal conditions and, therefore, surfgrass mitigation efforts for this project will focus on subtidal transplants only. The methodology for the surfgrass transplant shall be the transplant of sprigs from a donor bed to the new reef using the method developed by Bull et al. (2004). Alternative transplant methods may be proposed if evidence can be presented that the alternative method has as great or greater chance of success as the sprig transplant method. To avoid harvesting effects to the subject surfgrass bed, donor material will be taken from a larger area of surfgrass.

A portion of the shallow-water reef shall be test planted with surfgrass. The transplant will be conducted in the late summer/early fall, the time of year when most surfgrass seeds are released and germinate in southern California. An area equal to approximately 25 percent of the surfgrass impact area (not to exceed 0.1 acre) will be test planted. Success of the transplant shall be determined after six months based on survivorship, percentage change in the number of leaves and the amount of areal coverage. The experimental transplant will be considered successful if the sprigs survive and there is a net increase in number of leaves and areal coverage. Experimental surfgrass transects have shown that if the transplant is not successful, the transplants die and the reef is bare. If the transplants survive, surfgrass grows. If the test transplant is successful, the remainder of the surfgrass impact area will be planted on the shallow-water reef with surfgrass. If the test transplant is unsuccessful, mitigation will be conducted out-of-kind using kelp transplant on the shallow-water reef at an equivalent functional value.

If the surfgrass test planting is not successful, then out-of-kind and potentially off-site compensatory mitigation that has an equivalent functional value to the area of surfgrass impacted is to occur via kelp planting on the shallow-water reef constructed during the previous project mitigation. Using the example of 1 acre of reef impacts and 1 acre of surfgrass impacts, if the surfgrass transplant is not successful, 2 acres of shallow-water kelp (e.g., *Egregia menziesii* and *Eisenia arborea*) will be transplanted on the 2 acres of shallow-water reef built during the project mitigation. All mitigation shall be monitored for 5 years using permanent transects established on the mitigation reef and at a reference site (control area) of similar depth.

Mitigation for shallow water reef was based on the functional equivalent to mitigate the actual impacts on a functional basis and relates to the uncertainty of transplanting surfgrass and difficulty of constructing a rocky reef in shallow water.

Mid-depth reef would be constructed at sites shown on **Figure 5.4-9** at approximately -30 ft MLLW and is the preferred reef mitigation as it is closest to in-kind replacement. Mid- and deep-water reef shall be constructed similar to the SCE Wheeler North Reef constructed as mitigation for the impacts of the San Onofre Nuclear Generating Station.

Mitigation for a mid-depth reef is proposed at a 2:1 functional equivalent owing to the similarity in habitat and the difficulty of constructing reef habitat.

Deep water reef would be constructed at approximately -40 ft MLLW along the outside edge of the existing reefs. Mitigation using a deep water reef is proposed at a 1.5:1 functional equivalent owing to the higher habitat value for deep water reefs and easier construction in deeper water that is closer to the SCE Wheeler North Reef. This reef would only be constructed if insufficient area of mid-depth reef were available to fully mitigate for observed losses to rocky reef habitat.

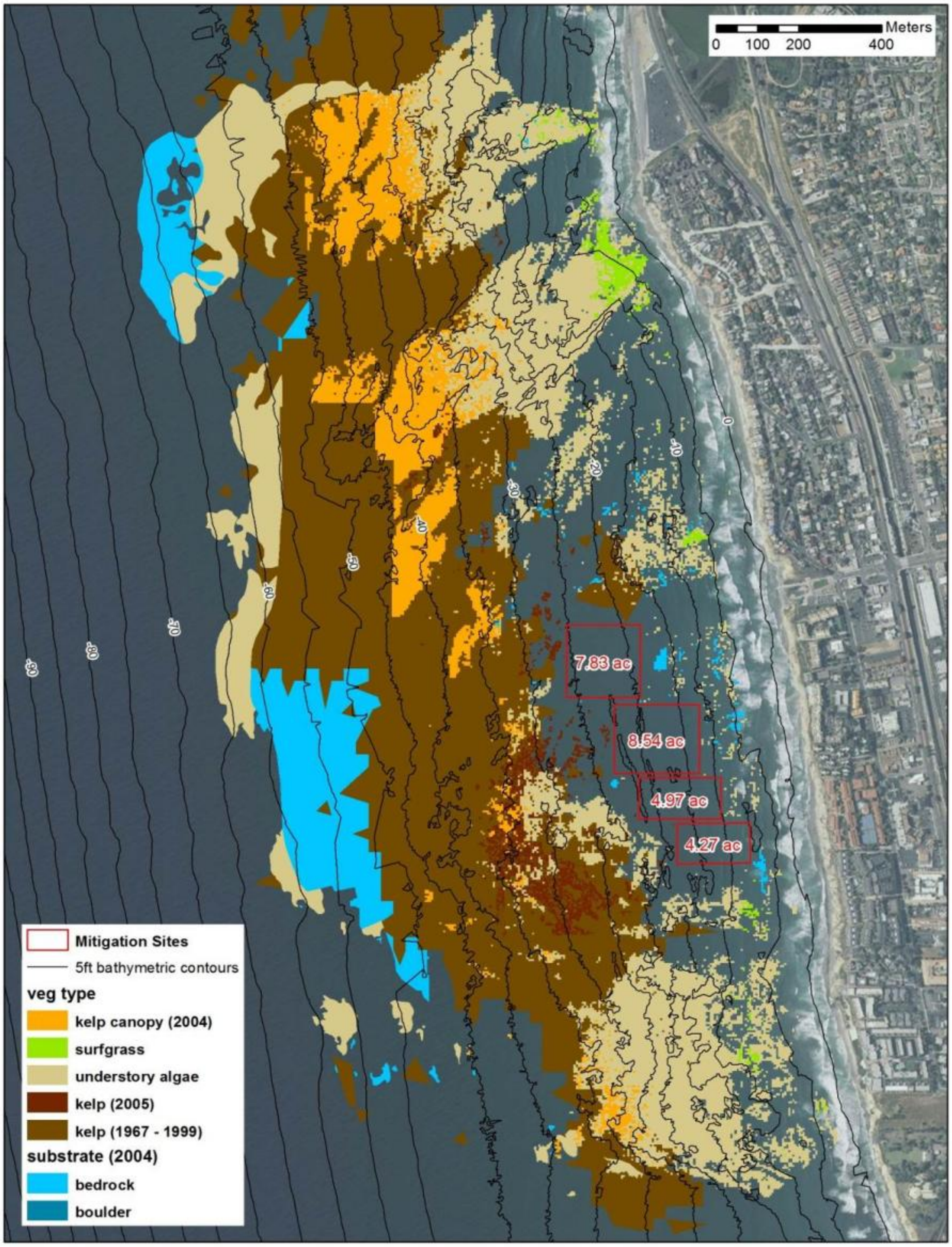

Figure 5.4-10 Potential mitigation areas off Solana Beach

5.4.8 No Action Alternatives (EN-3 and SB-3)

Under the No Action Alternative, there would be no potential for project-related construction disturbance and/or sedimentation effects on marine habitats (surfgrass, feather boa kelp, sea palms, giant kelp) as a result of beach nourishment. The existing practice of piecemeal seawall construction would continue and all remaining unprotected segments of shoreline in the project study area are assumed to be fully armored by 2065.

Nearshore reefs and beach habitats will continue to experience seasonal sand accretion and erosion. Habitat for grunion is limited under the baseline condition, which is characterized by narrow and sand depleted beaches. Continued beach erosion under the No Action Alternative, particularly in light of predicted sea level rise would result in additional loss of sand depth and width, which could further decrease potential habitat for grunion under the 50-year without project condition. Under the No Action Alternative, there would be no potential for improved habitat for grunion as a result of beach enhancement. There would be no potential for improved foraging and/or resting opportunities for shorebirds and seabirds as a result of beach enhancement. As portions of coastal bluffs continue to erode over the next 50 years, there would be disturbance and some loss of habitat for wildlife. Therefore, the value of the beaches, nearshore and coastal bluffs for wildlife may decline slightly under the No Action Alternative.

5.5 Air Quality

Air pollutant emissions associated with the project would occur over the short-term during dredging and beach replenishment activities, with beach replenishment activities that would occur at regular intervals.

The primary sources of pollutant emissions include:

- Combustion emissions from diesel engines used in dredging operations;
- Combustion emissions from diesel engines used in booster pumps and sand conveyance;
- Combustion emissions from on-shore heavy equipment used to install, position, remove conveyance piping and pumps, and to construct retaining berms and distribute sand at receiver sites;
- Construction emissions from on-shore equipment used to construct notch fills;
- Vehicle and vessel combustion emissions used by workers that access the site and dredge; and
- Fugitive dust from sand moving operations.

Construction activities would generate temporary (short-term) emissions primarily as exhaust emissions (NO_X, SO_X, CO, ROG, $PM_{2.5}$, and PM_{10}) from the operation of construction equipment and vehicles; fugitive dust emissions (PM_{10} and $PM_{2.5}$) from sand-moving activities would occur, but to a lesser extent because the sand would be wet or damp. The sediment to be dredged would be underwater, pumped to and deposited on the receiver sites as slurry, and spread as drained but wet sand at the receiver sites.

Generally, air quality is a regional issue, and potential impacts to air quality are evaluated on a regional basis. Localized impacts may be considered in cases of severe traffic congestion or the release of toxic air pollutants. Neither of these cases is applicable to the proposed action.

Therefore, the air quality analysis considers the regional impacts of each of the project alternatives as a whole.

A single project or action is unlikely to have a significant impact on greenhouse gasses (GHGs) and the subsequent contribution to climate change. However, the cumulative effects of various human activities involving emissions of GHGs have been clearly linked to quantifiable changes in the composition of the atmosphere, which in turn have been shown to be the main cause of global climate change (IPCC 2007). Therefore, the analysis of the environmental effects of GHG emissions from the action is addressed as a cumulative impact analysis because, although it is extremely unlikely that a single action would contribute significantly to climate change, cumulative emissions from many projects could affect global GHG concentrations and the climate system.

5.5.1 Impact Significance Criteria

The impact of the proposed action related to air quality would be considered significant for the purposes of CEQA if it would result in any of the following:

- Conflict with or obstruct implementation of the applicable air quality plan;
- Violate any air quality standard or contribute to an existing or projected air quality violation;
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors);
- Expose sensitive receptors to substantial pollutant concentrations;
- Create objectionable odors affecting a substantial number of people;
- generate GHG emissions, either directly or indirectly, that may have a significant cumulative impact on the environment; or
- conflict with an applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the emissions of GHGs.

The SDAPCD does not provide quantitative thresholds for determining the significance of construction or mobile source-related impacts. However, the SDAPCD specifies Air Quality Impact Analysis (AQIA) trigger levels for new or modified stationary sources as included in the SDAPCD Rule 20.3. If these incremental levels for stationary sources are exceeded, an AQIA must be performed for the proposed new or modified source. Although these trigger levels do not generally apply to mobile sources or general land development projects, for comparative purposes San Diego County has established AQIAs as screening-level thresholds (SLTs). The County has stated that the SLTs may be used to evaluate the increased emissions which would be discharged to the SDAB from proposed land development projects. The SLTs applicable to the proposed action are shown in **Table 5.5-1**.

Table 5.5-1 Regional Pollutant Emissions Screening Level Thresholds of Significance

Units	VOC	NO_X	CO	SO_X	PM_{10}	$PM_{2.5}$	Pb
Pounds per Day	75 [a]	250	550	250	100	55	3.2
Tons per Year	13.7	40	100	40	15	10	0.6

[a] Threshold for volatile organic compounds (VOC) based on the threshold of significance for VOC from the South Coast Air Quality Management District (SCAQMD) for Coachella Valley.

Source: County of San Diego 2007

Conformance to the SIP is demonstrated by obtaining appropriate permits from the APCD, or by demonstrating that emissions would be less than *de minimis* thresholds. Project impact significance was determined by comparing the total annual emissions of applicable pollutants of each project alternative against the SDAPCD thresholds mentioned earlier and the CAA General Conformity *de minimis* thresholds shown in **Table 5.5-2**.

Table 5.5-2 De minimis Thresholds

Pollutant	Emission Threshold (tons/year)
CO	100
NO_X	100
ROG	100
SO_X	100
PM_{10}	100
$PM_{2.5}$	100

Source: 40 C.F.R. Part 93

This analysis does not directly evaluate lead because little to no quantifiable and foreseeable emissions of these substances would be generated by the proposed action. While there would be quantifiable CO emissions, the principal concern for CO emissions is localized concentrations of CO resulting from congested traffic conditions, which is not an issue for the proposed action. Therefore, there would be no adverse CO impact, and traffic-generated CO hotspots are not evaluated further in this DEIR/DEIS.

At the time of this writing, no federal, state, regional, or local air quality regulatory agency had adopted a quantitative threshold of significance for construction-related GHG emissions.

5.5.2 Daily Emissions Estimates

<u>Borrow Sites</u>

The principal source of off-shore emissions from construction activities would be from diesel engines used for tugboat engines, dredge propulsion and driving dredge pumps. Tugboats and dredges are either registered through the state or permitted at the district level based on hours of annual operation, not on a project-specific basis. Tugboats and dredges can be registered under the ARB's Portable Equipment Registration Program or would be subject to the ARB Commercial Harbor Craft Regulation. Equipment can also be permitted through SDAPCD. When applying for a permit, SDAPCD conducts an analysis based on the projected activity of the dredge annually. Because an air quality evaluation is conducted separately by the ARB or SDAPCD and any emissions are already accounted for in agency projections, project-specific off-shore emissions related to dredge operations are provided for informational purposes only and are not compared to the significance thresholds.

Cutterhead dredges are extremely variable in their power ratings, and can range from approximately 3,000 horsepower (hp) to 6,000 hp. An auxiliary generator may also be used. The specific equipment mix for the project was not available; therefore, this analysis assumes the use of a 5,000 hp primary engine and a 1,500 hp auxiliary generator.

Receiver Sites

A booster pump, located on the beach, would be necessary to convey the slurry to the shore. Additional on-shore equipment would include two bulldozers and a back hoe located on the beach, which are assumed to each operate 12 hours per day. On-road mobile source emissions would be associated with the beach crew of up to 10 workers per day.

Table 5.5-3 Alternative EN-1A - Estimated Daily Construction Emissions

Emission Source	Air Pollutant Emissions (pounds/day)					
	VOC	**NO_X**	**CO**	**SO_X**	**PM_{10}**	**$PM_{2.5}$**
Off-Shore Equipment (Dredge/Pumps)	*106.68*	*774.99*	*585.17*	*N/A*	*39.22*	*36.08*
Construction Off-Road Equipment	11.84	111.42	47.17	0.15	10.45	4.71
On-Road Motor Vehicles	0.15	3.54	1.36	0.01	0.14	0.09
Total On-Shore Emissions	11.99	114.96	48.53	0.16	10.59	4.8
SDAPCD Thresholds	75	250	550	250	100	55
Exceed SDAPCD Thresholds?	No	No	No	No	No	No

Source: AECOM 2012

Daily emissions for periodic renourishment events would be the same as for the initial fill event.

As shown in **Table 5.5-3**, construction-related emissions of VOC, NO_X, CO, SO_X, PM_{10}, and $PM_{2.5}$ would not exceed the County's SLT and would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Therefore, construction emissions would have a ***less-than-significant*** direct impact to regional air quality.

Mitigation Construction

Barge operations to place reef rocks subject to separate permitting requirement similar to the dredging operations. Daily construction-related emissions were estimated at 103 pounds of VOC, 748 pounds of NOX, 564 pounds of CO, 38 pounds of PM10, and 35 pounds of PM2.5. Annual construction-related emissions were estimated at 2 tons of VOC, 13 tons of NOX, 10 tons of CO, 1 tons of PM10, and 1 ton of PM2.5. Barge operations would result in daily construction-related emissions of 103 pounds of VOC, 748 pounds of NOX, 564 pounds of CO, 38 pounds of PM10, and 35 pounds of PM2.5. These amounts would largely be related to off-shore tug emissions; as discussed in the EIR/EIS, these off-shore emissions are not compared to the thresholds of significance as the vessels are subject to permitting by APCD / CARB.

Notch Fills

Hybrid alternatives would also include notch fill using concrete that is trucked to the project site. These activities could require that as many as 15 trucks bring concrete to the site on a daily basis. A high pressure pump is assumed to be used in concrete placement. **Table 5.5-4** outlines the projected emissions associated with the use of the off-shore and related onshore equipment for both the low sea level rise and high sea level rise scenarios.

Table 5.5-4 Hybrid Alternatives - Estimated Daily Construction Emissions

Emission Source	Air Pollutant Emissions (pounds/day)					
	VOC	NO_X	CO	SO_X	PM_{10}	$PM_{2.5}$
Off-Shore Equipment (Dredge/Pumps)	106.68	774.99	585.17		39.22	36.08
Construction Off-Road Equipment	13.43	122.22	56.60	0.17	11.05	5.27
On-Road Motor Vehicles	0.54	15.40	3.14	0.03	0.44	0.30
Total On-Shore Emissions	13.97	137.61	59.73	0.20	11.49	5.56
SDAPCD Thresholds	75	250	550	250	100	55
Exceed SDAPCD Thresholds?	No	No	No	No	No	No

Source: AECOM 2012

As shown in **Table 5.5-4**, construction-related emissions of VOC, NO_X, CO, SO_X, PM_{10}, and $PM_{2.5}$ would not exceed the County's SLT and would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Therefore, construction emissions would have a ***less-than-significant*** direct impact to regional air quality.

Fugitive Dust Emissions

Another potential impact is from the PM_{10} and $PM_{2.5}$ associated with fugitive dust. While onshore operations would require the movement of sand on the local beach, the material is pumped to the beach as slurry with high water content, and any dust associated with its movement would be extremely limited. Fugitive dust emissions were estimated using emission factors available from EPA's AP 42, Compilation of Air Pollutant Emission Factors. As the material is pumped onto the beach and deposited behind the berm, the sand would be spread using two bulldozers and one front-end loader to direct the flow of the sand slurry and form a gradual slope to the existing beach elevation. The estimates are based on a PM_{10} emission factor of 0.26 pounds per hour and $PM_{2.5}$ emission factor of 0.04 pounds per hour (See Appendix A for details). The analysis assumes that bulldozing activities would occur for 12 hours per day. The estimates of fugitive dust emissions for PM_{10} and $PM_{2.5}$ would be approximately 6 pounds per day and 1 pound per day, respectively. Actual fugitive dust emissions associated with the movement of this sand could be far less as the sand is pumped as a slurry with a high water content; the emission factor assumes a soil with a lower moisture content than would be anticipated with the sand on the local beach. The daily emissions would be similar with both the low and high sea level rise scenarios.

Odor Emissions

Sediments to be placed on the beach in populated areas would not contain a high level of organic debris and thus, while an odor may be noted, it would be typical of any odor associated with low tide conditions.

Potential sources that may emit odors during construction activities include equipment exhaust. Odors from equipment exhaust would be localized and generally confined to the immediate area surrounding the project site. Alternative EN-1A would use typical construction techniques, and the odors would be temporary and typical of most construction sites. Alternative EN-1A would not contain any major sources of odor and would not be located in an area with existing odors.

Therefore, Alternative EN-1A would not create objectionable odors affecting a substantial number of people. This impact would be less than significant.

Toxic Air Contaminants – Diesel Particulate Matter

Construction of the proposed action would result in short-term diesel exhaust emissions from on-site heavy-duty equipment. Particulate matter exhaust emissions from diesel-fueled engines (diesel PM) were identified as a TAC by ARB in 1998 (ARB 1998). Project construction would result in the generation of diesel PM emissions from the use of off-road diesel construction equipment required for clearing, grading and any earthmoving, trenching, materials handling and installation, and other construction activities. Other construction-related sources of diesel PM are material delivery trucks and may include construction worker vehicles. However, not all construction worker vehicles would be diesel-fueled, and most diesel PM emissions associated with material delivery trucks and construction worker vehicles would occur off-site.

Generation of diesel PM from construction projects typically occurs in a single area for a short period. The dose of TACs receptors are exposed to is the primary factor used to determine health risk. Dose is a function of the concentration of a substance or substances in the environment and the extent of exposure a person has with the substance. Dose is positively correlated with time, meaning that a longer exposure period to a fixed amount of emissions results in a higher exposure level and higher health risks for the maximally exposed individual. According to the Office of Environmental Health Hazard Assessment's health risk assessments program (OEHHA 2003), which is used to determine the exposure of sensitive receptors to TAC emissions, risk should be based on a 70-year exposure period; however, such assessments can be limited to the period/duration of activities associated with the project. The longest period that construction activities would occur at a distance reasonably considered to have an effect on a sensitive receptor is associated with the high level rise scenario and is approximately 1 year. The low sea level rise scenario would occur for a shorter duration of time. Thus, if the maximum duration of potentially harmful construction activities near a sensitive receptor is 1 year, then the exposure would be approximately 1% of the total exposure period used for typical health risk calculations (i.e., 70 years).

Because the use of off-road heavy-duty diesel equipment would be temporary and because further reductions in exhaust emissions would be made, construction-related emissions of TACs would not expose sensitive receptors to substantial emissions of TACs. Therefore, construction-related TAC impacts to sensitive receptors for both the low and high sea level rise scenarios associated with Alternative EN-1A would be less than significant.

Greenhouse Gases

Emissions of greenhouse gases (GHG) are estimated based on total project emissions. Daily rates were not estimated. See individual alternatives for estimates of greenhouse gases. GHG emissions generated by construction would be primarily in the form of CO2. Although emissions of other GHGs, such as CH4 and N2O, are important with respect to global climate change, the emission levels of these other GHGs from on- and off-road vehicles used during construction are relatively small compared with the level of CO2 emissions, even when factoring in the relatively larger global warming potential of CH4 and N2O.

Construction-related GHG exhaust emissions would be generated by operation of the dredge, pumps, off-road equipment, and on-road motor vehicles. The initial beach replenishment is anticipated to occur in 2015. Exhaust emission rates of the construction equipment fleet in

California are expected to decrease over time due to efforts led by ARB. It is anticipated that in later years, advancements in engine technology, retrofits, and turnover in the equipment fleet would result in increased fuel efficiency, potentially more alternatively fueled equipment, and lower levels of GHG emissions associated with future replenishment activities.

Mitigation Construction

Barge engines would contribute GHG emission though not to a level that would contribute a significant level of GHG emissions. The estimated construction emissions from the tugboats, crew vessel, and loader would equal approximately 1,540 MT CO_2e per year. Amortized over 30 years, this would equal 51 MT CO_2e per year, well below the 10,000 MT CO_2e per year threshold.

5.5.3 Encinitas

Alternative EN-1A

Table 5.5-5 summarizes the projected annual emissions associated with construction of Alternative EN-1A. Initial placement would require approximately 103 days. Renourishment would take approximately 42 days in the low sea level rise scenario and approximately 49 days during the high sea level rise scenario.

Table 5.5-5 Alternative EN-1A - General Conformity Analysis

Emission Source	Air Pollutant Emissions (tons/year)					
	ROG	**NO_X**	**CO**	**SO_X**	**PM_{10}**	**$PM_{2.5}$**
Off-Shore Equipment (Dredge/Pumps)	4.37	31.77	23.99	*N/A*	1.61	1.48
Construction Off-Road Equipment	0.61	5.74	2.43	0.01	0.75	0.44
On-Road Motor Vehicles	0.00	0.02	0.05	0.00	0.00	0.00
Total On-Shore Emissions	0.61	5.76	2.48	0.01	0.76	0.44
De minimis Thresholds(1)	*100*	*100*	*100*	*100*	*100*	*100*
Exceed *de minimis* Thresholds?	No	No	No	No	No	No

(1) *De minimis* thresholds for General Conformity of SDAB nonattainment pollutants VOC and NO_X, and maintenance pollutant CO; and for NEPA significance determinations of SDAB nonattainment pollutants, and SDAB attainment pollutants SO_X, PM_{10}, and $PM_{2.5}$.
(2) *De minimis* thresholds for SDAB nonattainment pollutants VOC and NO_X, and maintenance pollutant CO are used.

As shown in **Table 5.5-5**, the estimated emissions associated with Alternative EN-1A are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative EN-1A would conform with the SIP, and a formal conformity analysis would not be required.

As shown in **Table 5.5-6**, construction-related GHG emissions that would occur as a result of implementation of the Alternative EN-1A would total 4,531 metric tons of CO2. Standard emissions control measures would be implemented during construction, including limiting idling of construction vehicles to 5 minutes.

Table 5.5-6 Alternative EN-1A - GHG Emissions

Emission Source	CO_2e (MT per year)
Off-Shore Equipment (Dredge/Pumps)	3,796
Construction Off-Road Equipment	720
On-Road Motor Vehicles	15
Total	4,531

Source: Modeling performed by AECOM in 2012
Notes: [1]Construction emissions were amortized over a 5-year period based on the most frequent schedule for renourishment activities.

The CEQ has provided guidance for determining when agencies should evaluate climate change impacts. Specifically, the guidance states that if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO_2 on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. Emissions from the proposed action are well below the metric provided by CEQ and would not require additional analysis.

Summary of Potential Impacts

During construction, criteria air pollutant and precursor emissions would be temporarily and intermittently generated from a variety of sources. Daily emissions associated with the use of the off-shore and related onshore equipment for both the low sea level rise and high sea level rise scenarios would be the same as those presented in **Table 5.5-3**. As shown in **Table 5.5-3**, construction-related emissions of VOC, NO_X, CO, SO_X, PM_{10}, and $PM_{2.5}$ would not exceed the County's SLT and would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Therefore, construction emissions would have a ***less-than-significant*** direct impact to regional air quality.

As shown in **Table 5.5-5**, the estimated emissions associated with Alternative EN-1A are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative EN-1A would conform with the SIP, and a formal conformity analysis would not be required.

Mitigation Measures for Alternatives EN-1A

No mitigation would be required as no significant impacts have been identified.

Alternative EN-1B

Table 5.5-7 summarizes the projected annual emissions associated with construction of Alternative EN-1B. Initial placement would require approximately 62 days. Renourishment would take approximately 39 days in the low sea level rise scenario and approximately 53 days during the high sea level rise scenario.

Table 5.5-7 Alternative EN-1B –General Conformity Analysis

Emission Source	Air Pollutant Emissions (tons/year)					
	ROG	NO_X	CO	SO_X	PM_{10}	$PM_{2.5}$
Off-Shore Equipment (Dredge/Pumps)	2.19	15.89	12.00		0.80	0.74

Construction Off-Road Equipment	0.37	3.45	1.46	0.00	0.45	0.26
On-Road Motor Vehicles	0.00	0.01	0.03	0.00	0.00	0.00
Total On-Shore Emissions	0.37	3.47	1.49	0.00	0.45	0.27
De minimis Thresholds(1)	*100*	*100*	*100*	*100*	*100*	*100*
Exceed *de minimis* Thresholds?	No	No	No	No	No	No

(1) *De minimis* thresholds for General Conformity of SDAB nonattainment pollutants VOC and NO_X, and maintenance pollutant CO; and for NEPA significance determinations of SDAB nonattainment pollutants, and SDAB attainment pollutants SO_X, PM_{10}, and $PM_{2.5}$.
(2) *De minimis* thresholds for SDAB nonattainment pollutants VOC and NO_X, and maintenance pollutant CO are used.

As shown in **Table 5.5-7**, the estimated emissions associated with Alternative EN-1B are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative EN-1B would conform with the SIP, and a formal conformity analysis would not be required.

As shown in **Table 5.5-8**, construction-related GHG emissions that would occur as a result of implementation of the Alternative EN-1B would total 2,340 metric tons of CO2. Standard emissions control measures would be implemented during construction, including limiting idling of construction vehicles to 5 minutes.

Table 5.5-8 Alternative EN-1B - GHG Emissions

Emission Source	CO_2e (MT per year)
Off-Shore Equipment (Dredge/Pumps)	1,898
Construction Off-Road Equipment	433
On-Road Motor Vehicles	9
Total	2,340

Source: Modeling performed by AECOM in 2012
Notes: [1] Construction emissions were amortized over a 5-year period based on the most frequent schedule for renourishment activities.

The CEQ has provided guidance for determining when agencies should evaluate climate change impacts. Specifically, the guidance states that if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO_2 on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. Emissions from the proposed action are well below the metric provided by CEQ and would not require additional analysis.

Summary of Potential Impacts

During construction, criteria air pollutant and precursor emissions would be temporarily and intermittently generated from a variety of sources. Daily emissions associated with the use of the off-shore and related onshore equipment for both the low sea level rise and high sea level rise scenarios would be the same as those presented in **Table 5.5-3**. As shown in **Table 5.5-3**, construction-related emissions of VOC, NO_X, CO, SO_X, PM_{10}, and $PM_{2.5}$ would not exceed the County's SLT and would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Therefore, construction emissions would have a ***less-than-significant*** direct impact to regional air quality.

As shown in **Table 5.5-7**, the estimated emissions associated with Alternative EN-1B are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative EN-1B would conform with the SIP, and a formal conformity analysis would not be required.

Mitigation Measures for Alternatives EN-1B

No mitigation would be required as no significant impacts have been identified.

<u>Alternative EN-2A</u>

Table 5.5-9 summarizes the projected annual emissions associated with construction of Alternative EN-2A. Initial placement would require approximately 180 days. Renourishment would take approximately 154 days in the low sea level rise scenario and approximately 188 days during the high sea level rise scenario.

Table 5.5-9 Alternative EN-2A - Estimated Daily Construction Emissions

Emission Source	Air Pollutant Emissions (pounds/day)					
	VOC	**NO_X**	**CO**	**SO_X**	**PM_{10}**	**$PM_{2.5}$**
Off-Shore Equipment (Dredge/Pumps)	106.68	774.99	585.17		39.22	36.08
Construction Off-Road Equipment	13.43	122.22	56.60	0.17	11.05	5.27
On-Road Motor Vehicles	0.54	15.40	3.14	0.03	0.44	0.30
Total On-Shore Emissions	13.97	137.61	59.73	0.20	11.49	5.56
SDAPCD Thresholds	75	250	550	250	100	55
Exceed SDAPCD Thresholds?	No	No	No	No	No	No

Source: AECOM 2012

As shown in **Table 5.5-9**, the estimated emissions associated with Alternative EN-2A are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative EN-2A would conform with the SIP, and a formal conformity analysis would not be required.

As shown in **Table** 5.5-10, construction-related GHG emissions that would occur as a result of implementation of the Alternative EN-2A would total 4,824 metric tons of CO2. Standard emissions control measures would be implemented during construction, including limiting idling of construction vehicles to 5 minutes.

Table 5.5-10 Alternative SB-2A - GHG Emissions

Emission Source	CO_2e (MT per year)
Off-Shore Equipment (Dredge/Pumps)	3,982
Construction Off-Road Equipment	780
On-Road Motor Vehicles	62
Total	4,824

Source: Modeling performed by AECOM in 2012
Notes: [1]Construction emissions were amortized over a 10-year period based on the most frequent schedule for renourishment activities.

The CEQ has provided guidance for determining when agencies should evaluate climate change impacts. Specifically, the guidance states that if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO_2 on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. Emissions from the proposed action are well below the metric provided by CEQ and would not require additional analysis.

Summary of Potential Impacts

During construction, criteria air pollutant and precursor emissions would be temporarily and intermittently generated from a variety of sources. Daily emissions associated with the use of the off-shore and related onshore equipment for both the low sea level rise and high sea level rise scenarios would be the same as those presented in **Table 5.5-4**. As shown in **Table 5.5-4**, construction-related emissions of VOC, NO_X, CO, SO_X, PM_{10}, and $PM_{2.5}$ would not exceed the County's SLT and would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Therefore, construction emissions would have a ***less-than-significant*** direct impact to regional air quality.

As shown in **Table 5.5-9**, the estimated emissions associated with Alternative EN-2A are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative EN-2A would conform with the SIP, and a formal conformity analysis would not be required.

Mitigation Measures for Alternatives EN-2A

No mitigation would be required as no significant impacts have been identified.

<u>Alternative EN-2B</u>

Table 5.5-11 summarizes the projected annual emissions associated with construction of Alternative EN-2B. Initial placement would require approximately 88 days. Renourishment would take approximately 56 days in the low sea level rise scenario and approximately 86 days during the high sea level rise scenario.

Table 5.5-11 Alternative EN-2B - General Conformity Analysis

Emission Source	Air Pollutant Emissions (tons/year)					
	ROG	NO_X	CO	SO_X	PM_{10}	$PM_{2.5}$
Off-Shore Equipment (Dredge/Pumps)	2.19	15.89	12.00		0.80	0.74
Construction Off-Road Equipment	0.40	3.70	1.68	0.01	0.49	0.29
On-Road Motor Vehicles	0.01	0.29	0.07	0.00	0.01	0.01
Total On-Shore Emissions	0.41	3.99	1.75	0.01	0.49	0.30
De minimis Thresholds(1)	*100*	*100*	*100*	*100*	*100*	*100*
Exceed *de minimis* Thresholds?	No	No	No	No	No	No

(1) *De minimis* thresholds for General Conformity of SDAB nonattainment pollutants VOC and NO_X, and maintenance pollutant CO; and for NEPA significance determinations of SDAB nonattainment pollutants, and SDAB attainment pollutants SO_X, PM_{10}, and $PM_{2.5}$.
(2) *De minimis* thresholds for SDAB nonattainment pollutants VOC and NO_X, and maintenance pollutant CO are used.

As shown in **Table** 5.5-11, the estimated emissions associated with Alternative EN-2B are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative EN-2B would conform with the SIP, and a formal conformity analysis would not be required.

As shown in **Table 5.5-12**, construction-related GHG emissions that would occur as a result of implementation of the Alternative EN-2B would total 2,420 metric tons of CO2. Standard emissions control measures would be implemented during construction, including limiting idling of construction vehicles to 5 minutes.

Table 5.5-12 Alternative EN-2B - GHG Emissions

Emission Source	CO_2e (MT per year)
Off-Shore Equipment (Dredge/Pumps)	1,898
Construction Off-Road Equipment	466
On-Road Motor Vehicles	56
Total	2,420

Source: Modeling performed by AECOM in 2012
Notes: [1]Construction emissions were amortized over a 5-year period based on the most frequent schedule for renourishment activities.

The CEQ has provided guidance for determining when agencies should evaluate climate change impacts. Specifically, the guidance states that if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO_2 on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. Emissions from the proposed action are well below the metric provided by CEQ and would not require additional analysis.

Summary of Potential Impacts

During construction, criteria air pollutant and precursor emissions would be temporarily and intermittently generated from a variety of sources. Daily emissions associated with the use of the off-shore and related onshore equipment for both the low sea level rise and high sea level rise scenarios would be the same as those presented in **Table 5.5-4**. As shown in **Table 5.5-4**, construction-related emissions of VOC, NO_X, CO, SO_X, PM_{10}, and $PM_{2.5}$ would not exceed the County's SLT and would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Therefore, construction emissions would have a ***less-than-significant*** direct impact to regional air quality.

As shown in **Table** 5.5-11, the estimated emissions associated with Alternative EN-2B are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative EN-2B would conform with the SIP, and a formal conformity analysis would not be required.

Mitigation Measures for Alternatives EN-2B

No mitigation would be required as no significant impacts have been identified.

5.5.4 Solana Beach

Alternative SB-1A

Table 5.5-13 summarizes the projected annual emissions associated with construction of Alternative SB-1A. Initial placement would require approximately 139 days. Renourishment would take approximately 118 days in the low sea level rise scenario and approximately 49 days during the high sea level rise scenario.

Table 5.5-13 Alternative SB-1A - General Conformity Analysis

Emission Source	Air Pollutant Emissions (tons/year)					
	ROG	**NO_X**	**CO**	**SO_X**	**PM_{10}**	**$PM_{2.5}$**
Off-Shore Equipment (Dredge/Pumps)	6.29	45.72	34.52		2.31	2.13
Construction Off-Road Equipment	0.82	7.74	3.28	0.01	1.02	0.59
On-Road Motor Vehicles	0.00	0.03	0.06	0.00	0.00	0.00
Total On-Shore Emissions	0.83	7.77	3.34	0.01	1.02	0.60
De minimis Thresholds[1]	*100*	*100*	*100*	*100*	*100*	*100*
Exceed *de minimis* Thresholds?	No	No	No	No	No	No

[1] *De minimis* thresholds for General Conformity of SDAB nonattainment pollutants VOC and NO_X, and maintenance pollutant CO; and for NEPA significance determinations of SDAB nonattainment pollutants, and SDAB attainment pollutants SO_X, PM_{10}, and $PM_{2.5}$.
[2] *De minimis* thresholds for SDAB nonattainment pollutants VOC and NO_X, and maintenance pollutant CO are used.

As shown in **Table 5.5-13**, the estimated emissions associated with Alternative SB-1A are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative SB-1A would conform with the SIP, and a formal conformity analysis would not be required.

As shown in **Table 5.5-14**, construction-related GHG emissions that would occur as a result of implementation of the Alternative SB-1A would total 6,454 metric tons of CO2. Standard emissions control measures would be implemented during construction, including limiting idling of construction vehicles to 5 minutes.

Table 5.5-14 Alternative SB-1A - GHG Emissions

Emission Source	CO_2e (MT per year)
Off-Shore Equipment (Dredge/Pumps)	5,463
Construction Off-Road Equipment	971
On-Road Motor Vehicles	20
Total	6,454

Source: Modeling performed by AECOM in 2012
Notes: [1]Construction emissions were amortized over a 13-year period based on the most frequent schedule for renourishment activities.

The CEQ has provided guidance for determining when agencies should evaluate climate change impacts. Specifically, the guidance states that if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO_2 on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. Emissions from the proposed action are well below the metric provided by CEQ and would not require additional analysis.

Summary of Potential Impacts

During construction, criteria air pollutant and precursor emissions would be temporarily and intermittently generated from a variety of sources. Daily emissions associated with the use of the off-shore and related onshore equipment for both the low sea level rise and high sea level rise scenarios would be the same as those presented in **Table 5.5-3**. As shown in **Table 5.5-3**, construction-related emissions of VOC, NO_X, CO, SO_X, PM_{10}, and $PM_{2.5}$ would not exceed the County's SLT and would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Therefore, construction emissions would have a ***less-than-significant*** direct impact to regional air quality.

As shown in **Table 5.5-13**, the estimated emissions associated with Alternative SB-1A are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative SB-1A would conform with the SIP, and a formal conformity analysis would not be required.

Mitigation Measures for Alternatives SB-1A

No mitigation would be required as no significant impacts have been identified.

Alternative SB-1B

Table 5.5-15 summarizes the projected annual emissions associated with construction of Alternative SB-1B. Initial placement would require approximately 107 days. Renourishment would take approximately 44 days in the low sea level rise scenario and approximately 63 days during the high sea level rise scenario.

Table 5.5-15 Alternative SB-1B - General Conformity Analysis

Emission Source	Air Pollutant Emissions (tons/year)					
	ROG	**NO_X**	**CO**	**SO_X**	**PM_{10}**	**$PM_{2.5}$**
Off-Shore Equipment (Dredge/Pumps)	4.59	33.32	25.16	*N/A*	1.69	1.55
Construction Off-Road Equipment	1.19	11.20	4.74	0.02	1.47	0.86
On-Road Motor Vehicles	0.00	0.04	0.09	0.00	0.01	0.00
Total On-Shore Emissions	1.19	11.24	4.83	0.02	1.47	0.86
De minimis Thresholds(1)	*100*	*100*	*100*	*100*	*100*	*100*
Exceed *de minimis* Thresholds?	No	No	No	No	No	No

(1) *De minimis* thresholds for General Conformity of SDAB nonattainment pollutants VOC and NO_X, and maintenance pollutant CO; and for NEPA significance determinations of SDAB nonattainment pollutants, and SDAB attainment pollutants SO_X, PM_{10}, and $PM_{2.5}$.
(2) *De minimis* thresholds for SDAB nonattainment pollutants VOC and NO_X, and maintenance pollutant CO are used.

As shown in **Table 5.5-15**, the estimated emissions associated with Alternative SB-1B are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative SB-1B would conform with the SIP, and a formal conformity analysis would not be required.

As shown in **Table 5.5-16**, construction-related GHG emissions that would occur as a result of implementation of the Alternative SB-1B would total 5,414 metric tons of CO2. Standard emissions control measures would be implemented during construction, including limiting idling of construction vehicles to 5 minutes.

Table 5.5-16 Alternative SB-1B - GHG Emissions

Emission Source	**CO_2e (MT per year)**
Off-Shore Equipment (Dredge/Pumps)	3,982
Construction Off-Road Equipment	1,404
On-Road Motor Vehicles	28
Total	5,414

Source: Modeling performed by AECOM in 2012
Notes: [1]Construction emissions were amortized over a 10-year period based on the most frequent schedule for renourishment activities.

The CEQ has provided guidance for determining when agencies should evaluate climate change impacts. Specifically, the guidance states that if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO_2 on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. Emissions from the proposed action are well below the metric provided by CEQ and would not require additional analysis.

Summary of Potential Impacts

During construction, criteria air pollutant and precursor emissions would be temporarily and intermittently generated from a variety of sources. Daily emissions associated with the use of the off-shore and related onshore equipment for both the low sea level rise and high sea level rise scenarios would be the same as those presented in **Table 5.5-3**. As shown in **Table 5.5-3**, construction-related emissions of VOC, NO_X, CO, SO_X, PM_{10}, and $PM_{2.5}$ would not exceed the County's SLT and would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Therefore, construction emissions would have a ***less-than-significant*** direct impact to regional air quality.

As shown in **Table 5.5-15**, the estimated emissions associated with Alternative SB-1B are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative SB-1B would conform with the SIP, and a formal conformity analysis would not be required.

Mitigation Measures for Alternatives SB-1B

No mitigation would be required as no significant impacts have been identified.

<u>Alternative SB-1C</u>

Table 5.5-17 summarizes the projected annual emissions associated with construction of Alternative SB-1C. Initial placement would require approximately 76 days. Renourishment would take approximately 36 days in the low sea level rise scenario and approximately 65 days during the high sea level rise scenario.

As shown in **Table 5.5-17**, the estimated emissions associated with Alternative SB-1C are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative SB-1C would conform with the SIP, and a formal conformity analysis would not be required

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As shown in **Table 5.5-18**, construction-related GHG emissions that would occur as a result of implementation of the Alternative SB-1C would total 3,088 metric tons of CO2. Standard emissions control measures would be implemented during construction, including limiting idling of construction vehicles to 5 minutes.

Table 5.5-17 Alternative SB-1C - General Conformity Analysis

Emission Source	Air Pollutant Emissions (tons/year)					
	ROG	**NO_X**	**CO**	**SO_X**	**PM_{10}**	**$PM_{2.5}$**
Off-Shore Equipment (Dredge/Pumps)	2.93	21.31	16.09		1.08	0.99
Construction Off-Road Equipment	0.45	4.23	1.79	0.01	0.56	0.32
On-Road Motor Vehicles	0.00	0.02	0.03	0.00	0.00	0.00
Total On-Shore Emissions	0.45	4.25	1.83	0.01	0.56	0.33
De minimis Thresholds(1)	*100*	*100*	*100*	*100*	*100*	*100*
Exceed *de minimis* Thresholds?	No	No	No	No	No	No

(1) *De minimis* thresholds for General Conformity of SDAB nonattainment pollutants VOC and NO_X, and maintenance pollutant CO; and for NEPA significance determinations of SDAB nonattainment pollutants, and SDAB attainment pollutants SO_X, PM_{10}, and $PM_{2.5}$.

(2) *De minimis* thresholds for SDAB nonattainment pollutants VOC and NO_X, and maintenance pollutant CO are used.

Table 5.5-18 Alternative SB-1C - GHG Emissions

Emission Source	CO_2e (MT per year)
Off-Shore Equipment (Dredge/Pumps)	2,546
Construction Off-Road Equipment	531
On-Road Motor Vehicles	11
Total	3,088

Source: Modeling performed by AECOM in 2012

Notes: [1]Construction emissions were amortized over a 10-year period based on the most frequent schedule for renourishment activities.

The CEQ has provided guidance for determining when agencies should evaluate climate change impacts. Specifically, the guidance states that if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO_2 on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. Emissions from the proposed action are well below the metric provided by CEQ and would not require additional analysis.

Summary of Potential Impacts

During construction, criteria air pollutant and precursor emissions would be temporarily and intermittently generated from a variety of sources. Daily emissions associated with the use of the off-shore and related onshore equipment for both the low sea level rise and high sea level rise scenarios would be the same as those presented in **Table 5.5-3**. As shown in **Table 5.5-3**, construction-related emissions of VOC, NO_X, CO, SO_X, PM_{10}, and $PM_{2.5}$ would not exceed the County's SLT and would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Therefore, construction emissions would have a ***less-than-significant*** direct impact to regional air quality.

As shown in **.**, Table 5.5-17, the estimated emissions associated with Alternative SB-1C are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative SB-1C would conform with the SIP, and a formal conformity analysis would not be required.

Table 5.5-17, the estimated emissions associated with Alternative SB-1C are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative SB-1C would conform with the SIP, and a formal conformity analysis would not be required.

Mitigation Measures for Alternatives SB-1C

No mitigation would be required as no significant impacts have been identified.

Alternative SB-2A

Table 5.5-19 summarizes the projected annual emissions associated with construction of Alternative SB-2A. Initial placement would require approximately 180 days. Renourishment would take approximately 155 days in the low sea level rise scenario and approximately 213 days during the high sea level rise scenario.

Table 5.5-19 Alternative SB-2A –General Conformity Analysis

Emission Source	Air Pollutant Emissions (tons/year)					
	ROG	**NO_X**	**CO**	**SO_X**	**PM_{10}**	**$PM_{2.5}$**
Off-Shore Equipment (Dredge/Pumps)	4.59	33.32	25.16		1.69	1.55
Construction Off-Road Equipment	0.67	6.21	2.74	0.01	0.83	0.50
On-Road Motor Vehicles	0.01	0.30	0.09	0.00	0.01	0.01
Total On-Shore Emissions	0.68	6.51	2.83	0.01	0.84	0.51
De minimis Thresholds(1)	*100*	*100*	*100*	*100*	*100*	*100*
Exceed *de minimis* Thresholds?	No	No	No	No	No	No

(1) *De minimis* thresholds for General Conformity of SDAB nonattainment pollutants VOC and NO_X, and maintenance pollutant CO; and for NEPA significance determinations of SDAB nonattainment pollutants, and SDAB attainment pollutants SO_X, PM_{10}, and $PM_{2.5}$.
(2) *De minimis* thresholds for SDAB nonattainment pollutants VOC and NO_X, and maintenance pollutant CO are used.

As shown in **Table 5.5-19**, the estimated emissions associated with Alternative SB-2A are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative SB-2A would conform with the SIP, and a formal conformity analysis would not be required.

As shown in **Table 5.5-20**, construction-related GHG emissions that would occur as a result of implementation of the Alternative SB-2A would total 4,824 metric tons of CO2. Standard emissions control measures would be implemented during construction, including limiting idling of construction vehicles to 5 minutes.

Table 5.5-20 Alternative SB-2A - GHG Emissions

Emission Source	CO_2e (MT per year)
Off-Shore Equipment (Dredge/Pumps)	3,982
Construction Off-Road Equipment	780
On-Road Motor Vehicles	62
Total	4,824

Source: Modeling performed by AECOM in 2012
Notes: [1]Construction emissions were amortized over a 10-year period based on the most frequent schedule for renourishment activities.

The CEQ has provided guidance for determining when agencies should evaluate climate change impacts. Specifically, the guidance states that if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO_2 on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. Emissions from the proposed action are well below the metric provided by CEQ and would not require additional analysis.

Summary of Potential Impacts

During construction, criteria air pollutant and precursor emissions would be temporarily and intermittently generated from a variety of sources. Daily emissions associated with the use of the off-shore and related onshore equipment for both the low sea level rise and high sea level rise scenarios would be the same as those presented in **Table 5.5-4**. As shown in **Table 5.5-4**, construction-related emissions of VOC, NO_X, CO, SO_X, PM_{10}, and $PM_{2.5}$ would not exceed the County's SLT and would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Therefore, construction emissions would have a ***less-than-significant*** direct impact to regional air quality.

As shown in **Table 5.5-19**, the estimated emissions associated with Alternative SB-2A are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative SB-2A would conform with the SIP, and a formal conformity analysis would not be required.

Mitigation Measures for Alternatives SB-2A

No mitigation would be required as no significant impacts have been identified.

<u>Alternative SB-2B</u>

Table 5.5-21 summarizes the projected annual emissions associated with construction of Alternative SB-2B. Initial placement would require approximately 76 days. Renourishment would take approximately 78 days in the low sea level rise scenario and approximately 49 days during the high sea level rise scenario.

Table 5.5-21 Alternative SB-2A –General Conformity Analysis

Emission Source	Air Pollutant Emissions (tons/year)					
	ROG	**NO_X**	**CO**	**SO_X**	**PM_{10}**	**$PM_{2.5}$**
Off-Shore Equipment (Dredge/Pumps)	2.93	21.31	16.09		1.08	0.99
Construction Off-Road Equipment	0.49	4.48	2.01	0.01	0.59	0.36
On-Road Motor Vehicles	0.01	0.29	0.08	0.00	0.01	0.01
Total On-Shore Emissions	0.50	4.77	2.08	0.01	0.60	0.36
De minimis Thresholds(1)	*100*	*100*	*100*	*100*	*100*	*100*
Exceed *de minimis* Thresholds?	No	No	No	No	No	No

(1) *De minimis* thresholds for General Conformity of SDAB nonattainment pollutants VOC and NO_X, and maintenance pollutant CO; and for NEPA significance determinations of SDAB nonattainment pollutants, and SDAB attainment pollutants SO_X, PM_{10}, and $PM_{2.5}$.

(2) *De minimis* thresholds for SDAB nonattainment pollutants VOC and NO_X, and maintenance pollutant CO are used.

As shown in **Table** 5.5-21, the estimated emissions associated with Alternative SB-2B are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative SB-2B would conform with the SIP, and a formal conformity analysis would not be required.

As shown in **Table 5.5-22**, construction-related GHG emissions that would occur as a result of implementation of the Alternative SB-2B would total 2,420 metric tons of CO2. Standard emissions control measures would be implemented during construction, including limiting idling of construction vehicles to 5 minutes.

Table 5.5-22 Alternative EN-2B –GHG Emissions

Emission Source	CO_2e (MT per year)
Off-Shore Equipment (Dredge/Pumps)	1,898
Construction Off-Road Equipment	466
On-Road Motor Vehicles	56
Total	2,420

Source: Modeling performed by AECOM in 2012

Notes: [1]Construction emissions were amortized over a 5-year period based on the most frequent schedule for renourishment activities.

The CEQ has provided guidance for determining when agencies should evaluate climate change impacts. Specifically, the guidance states that if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO_2 on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. Emissions from the proposed action are well below the metric provided by CEQ and would not require additional analysis.

Summary of Potential Impacts

During construction, criteria air pollutant and precursor emissions would be temporarily and intermittently generated from a variety of sources. Daily emissions associated with the use of the off-shore and related onshore equipment for both the low sea level rise and high sea level rise scenarios would be the same as those presented in **Table 5.5-4**. As shown in **Table 5.5-4**, construction-related emissions of VOC, NO_X, CO, SO_X, PM_{10}, and $PM_{2.5}$ would not exceed the County's SLT and would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Therefore, construction emissions would have a ***less-than-significant*** direct impact to regional air quality.

As shown in **Table** 5.5-21, the estimated emissions associated with Alternative SB-2B are less than the General Conformity *de minimis* thresholds. Therefore, emissions associated with Alternative SB-2B would conform with the SIP, and a formal conformity analysis would not be required.

Mitigation Measures for Alternatives SB-2B

No mitigation would be required as no significant impacts have been identified.

5.5.5 Potential Environmental Impacts of Alternative EN-3 and SB-3 – No Action

Under Alternative 3, no significant beach replenishment activities would occur within the vicinity except for those associated with routinely authorized maintenance dredging (i.e., Oceanside sand bypass, Agua Hedionda Lagoon maintenance dredging, Batiquitos Lagoon maintenance dredging, and San Elijo Lagoon entrance maintenance) unrelated to the project. Existing conditions and practices would continue throughout the future. Historically, man-made structures have been constructed in localized areas by cities, residents, and business owners to protect coastal structures whose vulnerability has increased with increased beach erosion. Alternative 3 assumes continued piecemeal protection of the bluff by private landowners under emergency permits, including maintenance of existing structures and construction of new seawalls and other protective structures. Because no construction or maintenance activities related to the proposed action would occur, no air quality impacts would occur and no mitigation would be necessary. There would be no increase in GHG emissions, no climate change impacts would occur.

5.6 Aesthetics

The purpose of this section is to determine the degree of visual and aesthetic impacts that would be attributable to the proposed action. The character of the existing visual environment, as described in Section 4.7, was documented through field reconnaissance, photographic records, and aerial photograph interpretation. The description of the visual environment of the project site provides a baseline against which the effects of the proposed project on key views are assessed. The analysis in this section is also based on information provided in Appendices B and C.

5.6.1 Impact Significance Criteria

The Encinitas and Solana Beach coastal beaches are some of San Diego region's most important visual resources. These coastal areas are therefore considered visual resources of high sensitivity. Maintaining coastal bluffs in their natural state as a scenic resource is encouraged by both cities. In addition, land use policies regulate development in areas of high scenic value to ensure exclusion of incompatible structures and uses. The quality of aesthetic resources relates to the degree of deviation from the natural condition, and includes consideration of the scale and size of a project, design, color and texture contrast, and social considerations. Social considerations are addressed as visual sensitivity; whereby, the public would be expected to react strongly to a potential change in visual quality.

An impact to visual aesthetics would be considered significant if the action would:

- Have a substantial adverse effect on a scenic vista;
- Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway;
- Substantially degrade the existing visual character or quality of the site and its surroundings;
- Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area.

5.6.2 Encinitas

Borrow Sites

Material from borrow site SO-6 would be used for Encinitas. Borrow site SO-6 is located approximately 1 mile offshore. Depending on the type of dredge, the view would be slightly different. Construction equipment would be temporarily visible from scenic vistas of the shoreline, though distant and no more intrusive than existing marine vessels that traverse the shoreline or established marine activities that occur in the waters. The cutterhead dredge would appear as a boat working in one area for a period of time, and then moving to a nearby location, all while remaining offshore. While visible, it would appear on the horizon much like other boats which are active along the coast and pump dredged sand via pipeline to the shore. The cutterhead dredge would not be highly evident or dominate the landscape and would not damage any scenic resources. The hopper dredge would come to shore periodically at each receiver site in order to deposit dredged sand, which would make it more visible. While dredging activities would increase mechanical equipment on the water and shoreline, dredging would be temporary and would not substantially degrade the existing visual character of the shoreline. Dredging activities may require nighttime lighting; however, lighting would be temporary, distant and visible faintly from the shoreline such that no substantial light or glare would be generated that could affected nighttime views. Since the construction activity is short term, and no substantial permanent changes to the character of the beach or the blockage of any viewshed would occur, impacts would be less than significant.

Receiver Sites

Approximately 150 to 325 ft of beach at the Encinitas receiver site would be inaccessible to the public around the discharge pipeline and berms, and intermittent restrictions on access for distances of about 350 ft on either side of the discharge zone. Beach users on either side of the restricted areas would see the ongoing construction activities, as well as bluff top private residences that may have views of the beach. Activities would include a pipeline discharging fill material and grading equipment and construction views moving the sand along the beach. If the hopper dredge is used, then it would be seen making periodic trips to deliver sand to the site, anchored just offshore while the sand is delivered via pipeline. If a cutterhead dredge is used, delivery would be made entirely via pipeline, since this type of dredge has the capability to deliver sand longer distances by pumping from the borrow source. While construction equipment would be visible to beach users and residents from nearby scenic vistas, the short-term visual change from construction would not be considered significant or substantially damage scenic resources. Ultimately, the enhanced beach would result in a visual benefit.

Dredged fill material may also appear as a slightly different color than the existing sand. As is typical of beach nourishment projects, as the sand is washed and reworked by the waves it will mix with the underlying sand and blend in. In addition, the fill material would also bleach out from sun exposure and turn a lighter color. The material used for Encinitas would come from borrow site SO-6, which has relatively light-colored material, resulting in little contrast with the existing sand. Therefore, existing visual character and quality of the Encinitas receiver site would not be substantially degraded by placement of dredged fill material.

Dredging and beach nourishment placement activities area expected to occur 24/7. However, operation of sand spreading equipment will be limited to 12 hours a day to minimize impacts to local residents. Those hours of operation would extend beyond the hours of operation allowed by the city noise ordinances, and would require a variance. Encinitas city noise ordinance limit noise to 7 AM to 7 PM weekdays and Saturdays. Solana Beach city noise ordinance limit noise to 7 AM to 7 PM weekdays and 8 AM to 7 PM on Saturday. Sand spreading equipment would be stored on the beach or in temporary construction staging area(s). Protective walls would not be needed as beach nourishment activities would take place at the foot of a tall bluff that provides noise abatement. Construction lighting would be placed at the beach to allow for the nighttime construction. This lighting would be angled in a downward direction from the source so as to illuminate the construction activity. As such, it would be directed away from the residences located on the bluff top and would not create a new source of light or glare that would adversely affect views in the area. Construction lighting would be considered a short term, adverse, but less than significant impact.

Construction activity would continually progress down the beach, along the Encinitas receiver site. Since construction activities would be continually moving down the receiver site placing sand, the overall visual impact on the viewer at a single spot on the coast would be temporary in nature. Construction staging for equipment and crew is proposed at Moonlight Beach and would remain in place for the duration of the work. However, there would only be an occasional need for a staging area since construction equipment would be used on a 24/7 basis. Subsequent to construction, the Encinitas receiver site would be enhanced by the effects of sand nourishment creating a wider and more aesthetically pleasing beach, and reducing eroded coastal areas. Since the construction activity is temporary and would not result in permanent blockage of any viewshed, impacts related to aesthetics would be less than significant.

<u>Notch Fills</u>

Notch fill activities in the Encinitas receiver site would require approximately 10 to 15 trucks of concrete per day. The total volume of concrete required to fill notches in the bluff base would be determined by the specific site conditions at the time of project construction. These additional concrete trucks would not result in a permanent impact to the character of the beach or the blockage of any viewshed; therefore, impacts would be less than significant.

Alternative EN-1A

Construction duration for this alternative is 103 days. Aesthetic impacts to borrow sites and receiver sites as described above would occur over this time period.

Summary of Potential Impacts for Alternative EN-1A

The construction activity would be short term and impacts from construction equipment and activities would be less than significant. This alternative would not result in permanent adverse impacts to the visual character and would not result in a significant impact.

Mitigation Measures for Alternative EN-1A

No mitigation would be required as no significant impacts have been identified.

Alternative EN-1B

Construction duration for this alternative is 62 days. Aesthetic impacts to borrow sites and receiver sites as described above would occur over this time period.

Summary of Potential Impacts for Alternative EN-1B

The construction activity would be short term and impacts from construction equipment and activities would be less than significant. This alternative would not result in permanent adverse impacts to the visual character and would not result in a significant impact.

Mitigation Measures for Alternative EN-1B

No mitigation would be required as no significant impacts have been identified.

Alternative EN-2A

Construction duration for this alternative is 180 days. Aesthetic impacts to borrow sites and receiver sites as described above would occur over this time period. Notch fills are generally smaller and less conspicuous than seawalls. Notch fill materials and colors would match the existing bluff consistent with existing notch fill areas within the receiver sites. In most cases beach fill sands will cover the notch fills rendering them invisible. The resulting visual change would be permanent; however, due to the unobtrusive nature of notch fill, the visual change would not be considered significant.

Summary of Potential Impacts for Alternative EN-2A

The construction activity would be short term and impacts from construction equipment and activities would be less than significant. This alternative would not result in permanent adverse impacts to the visual character and would not result in a significant impact.

Mitigation Measures for Alternative EN-2A

No mitigation would be required as no significant impacts have been identified.

Alternative EN-2B

Construction duration for this alternative is 180 days. Aesthetic impacts to borrow sites and receiver sites as described above would occur over this time period. Notch fills are generally smaller and less conspicuous than seawalls. Notch fill materials and colors would match the existing bluff consistent with existing notch fill areas within the receiver sites. In most cases beach fill sands will cover the notch fills rendering them invisible. The resulting visual change would be permanent; however, due to the unobtrusive nature of notch fill, the visual change would not be considered significant.

Summary of Potential Impacts for Alternative EN-2B

The construction activity would be short term and impacts from construction equipment and activities would be less than significant. This alternative would not result in permanent adverse impacts to the visual character and would not result in a significant impact.

Mitigation Measures for Alternative EN-2B

No mitigation would be required as no significant impacts have been identified.

5.6.3 Solana Beach

Borrow Sites

Material from borrow site SO-5 would be used for Solana Beach. Borrow site SO-5 is located approximately 1 mile offshore. Depending on the type of dredge, the view would be slightly different. Construction equipment would be temporarily visible from scenic vistas of the shoreline, though distant and no more intrusive than existing marine vessels that traverse the shoreline or established marine activities that occur in the waters. The cutterhead dredge would appear as a boat working in one area for a period of time, and then moving to a nearby location, all while remaining offshore. While visible, it would appear on the horizon much like other boats which are active along the coast and pump dredged sand via pipeline to the shore. The cutterhead dredge would not be highly evident or dominate the landscape and would not damage any scenic resources. The hopper dredge would come to shore periodically at each receiver site in order to deposit dredged sand, which would make it more visible. While dredging activities would increase mechanical equipment on the water and shoreline, dredging would be temporary and would not substantially degrade the existing visual character of the shoreline. Dredging activities may require nighttime lighting; however, lighting would be temporary, distant and visible faintly from the shoreline such that no substantial light or glare would be generated that could affected nighttime views. Since the construction activity is short term, and no substantial permanent changes to the character of the beach or the blockage of any viewshed would occur, impacts would be less than significant.

Receiver Sites

Approximately 200 ft of beach at the Solana Beach receiver site would be inaccessible to the public around the discharge pipeline and berms, and intermittent restrictions on access for distances of up to 350 ft on either side of the discharge zone. Beachgoers and bluff top residents would experience temporary impacts to visual resources as a result of construction activities. While construction equipment would be visible to beach users and residents from nearby scenic vistas, the short-term visual change from construction would not be considered significant or substantially damage scenic resources. The existing visual character and quality of the Solana Beach receiver site would not be substantially degraded by placement of dredged fill material. Construction lighting would be placed at the beach to allow for the nighttime construction but would be angled downward to minimize adverse effects to nighttime views in the area. Ultimately, the enhanced beach would result in a visual benefit.

In addition, construction staging for equipment and crew is proposed at Fletcher Cove, and would remain in place for the duration of work in the Solana Beach receiver site. However, there would only be an occasional need for a staging area since construction equipment would be used on a 24/7 basis. Since the construction activity is short term, and no substantial permanent changes to the character of the beach or the blockage of any viewshed would occur, impacts would be less than significant. Ultimately, the enhanced beach would result in a visual benefit.

Dredged fill material may also appear as a slightly different color than the existing sand. As is typical of beach nourishment projects, as the sand is washed and reworked by the waves it will mix with the underlying sand and blend in. In addition, the fill material would also bleach out from sun exposure and turn a lighter color. The material used for the Encinitas receiver site would come from borrow site SO-6, which has relatively light-colored material, resulting in little contrast with the existing sand. Therefore, existing visual character and quality of the Encinitas receiver site would not be substantially degraded by placement of dredged fill material.

Construction lighting would be placed at the beach to allow for the nighttime construction. This lighting would be angled in a downward direction from the source so as to illuminate the construction activity. As such, it would be directed away from the residences located on the bluff top and would not create a new source of light or glare that would adversely affect views in the area. Construction lighting would be considered a short term, adverse, but less than significant impact.

Construction activity would continually progress down the beach along the Encinitas receiver site. Since construction activities would be continually moving down the beach placing sand, the overall visual impact on the viewer at a single spot on the coast would be temporary in nature.

Alternative SB-1A

Construction duration for this alternative is 139 days. Aesthetic impacts to borrow sites and receiver sites as described above would occur over this time period.

Summary of Potential Impacts for Alternative SB-1A

The construction activity would be short term and impacts from construction equipment and activities would be less than significant. This alternative would not result in permanent adverse impacts to the visual character and would not result in a significant impact.

Mitigation Measures for Alternative SB-1A

No mitigation would be required as no significant impacts have been identified.

Alternative SB-1B

Construction duration for this alternative is 107 days. Aesthetic impacts to borrow sites and receiver sites as described above would occur over this time period.

Summary of Potential Impacts for Alternative SB-1B

The construction activity would be short term and impacts from construction equipment and activities would be less than significant. This alternative would not result in permanent adverse impacts to the visual character and would not result in a significant impact.

Mitigation Measures for Alternative SB-1B

No mitigation would be required as no significant impacts have been identified.

Alternative SB-1C

Construction duration for this alternative is 76 days. Aesthetic impacts to borrow sites and receiver sites as described above would occur over this time period.

Summary of Potential Impacts for Alternative SB-1C

The construction activity would be short term and impacts from construction equipment and activities would be less than significant. This alternative would not result in permanent adverse impacts to the visual character and would not result in a significant impact.

Mitigation Measures for Alternative SB-1C

No mitigation would be required as no significant impacts have been identified.

Alternative SB-2A

Construction duration for this alternative is 180 days. Aesthetic impacts to borrow sites and receiver sites as described above would occur over this time period. Notch fills are generally smaller and less conspicuous than seawalls. Notch fill materials and colors would match the existing bluff consistent with existing notch fill areas within the receiver sites. In most cases beach fill sands will cover the notch fills rendering them invisible. The resulting visual change would be permanent; however, due to the unobtrusive nature of notch fill, the visual change would not be considered significant.

Summary of Potential Impacts for Alternative SB-2A

The construction activity would be short term and impacts from construction equipment and activities would be less than significant. This alternative would not result in permanent adverse impacts to the visual character and would not result in a significant impact.

Mitigation Measures for Alternative SB-2A

No mitigation would be required as no significant impacts have been identified.

<u>Alternative SB-2B</u>

Construction duration for this alternative is 180 days. Aesthetic impacts to borrow sites and receiver sites as described above would occur over this time period. Notch fills are generally smaller and less conspicuous than seawalls. Notch fill materials and colors would match the existing bluff consistent with existing notch fill areas within the receiver sites. In most cases beach fill sands will cover the notch fills rendering them invisible. The resulting visual change would be permanent; however, due to the unobtrusive nature of notch fill, the visual change would not be considered significant.

Summary of Potential Impacts for Alternative SB-2B

The construction activity would be short term and impacts from construction equipment and activities would be less than significant. This alternative would not result in permanent adverse impacts to the visual character and would not result in a significant impact.

Mitigation Measures for Alternative SB-2B

No mitigation would be required as no significant impacts have been identified.

5.6.4 No Action Alternative

Under the No Action Alternative, there would be limited potential to impact existing views along the coast and the current practice of continuing to piecemeal protective measures for emergency protection along the bluff would occur under this alternative. Views along the beach would be altered when new bluff protection structures were built under emergency permits, and/or bluff failures or slumping resulted in an altered appearance of the coastal bluffs.

With the No Action Alternative, the beaches would not be enhanced. Visible cobbles would remain and narrow beaches would not be widened. Adjacent residents and beach users would not experience the disturbance of construction or views of the pipeline; however, they would not experience the benefits of widened beaches.

5.6.5 Potential Effects of Mitigation Reef

Construction equipment for the mitigation reef would consist of a barge with a bull dozer onboard, a supply barge, two tugboats and a crew vessel. These construction vessels would be temporarily visible from scenic vistas of the shoreline for approximately one month. While visible, the construction vessels would appear on the horizon much like other boats which are active along the coast. While construction activities would increase mechanical equipment on the water and shoreline, construction of the mitigation reef would be temporary and would not substantially degrade the existing visual character of the shoreline. Construction activities may require nighttime lighting; however, lighting would be temporary, distant and visible faintly from the shoreline such that no substantial light or glare would be generated that could affected nighttime views. Since the construction activity is short term, and no substantial permanent changes to the character of the beach or the blockage of any viewshed would occur, impacts would be less than significant. In addition, the mitigation reef would be submerged and would not result in any operational aesthetics impacts.

5.7 Cultural Resources

At the receiver sites, the potential for impacts is limited due to (1) the absence of any known identified cultural resources within the sites, and (2) the low potential for the placement of sand to affect existing cultural resources that have not been identified. However, there is potential for impacts at the proposed project borrow sites based on the results of previous geoarchaeological investigations (Pettus and Hildebrand 2000; Hildebrand and York 2010). Furthermore, previous documents including the RBSP I and II EA/EIRs have reported concentrations of submerged artifacts off the San Diego coastline including locally in Solana Beach and Del Mar, with the primary concentrations around La Jolla Cove and La Jolla shores. This evaluation therefore focuses on potential impacts to cultural resources at the borrow sites.

5.7.1 Impact Significance Criteria

The proposed project would have a significant impact on cultural resources if it would:

- Cause an adverse change in significance of a historical resource as defined in §15064.3;
- Cause an adverse change in significance of an archaeological resource as defined in §15064.3;
- Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature; or
- Disturb any human remains, including those interred outside of formal cemeteries.

The federal criteria used to evaluate resources that may be affected by this project are those provided in the NHPA. The NRHP criteria are presented in 36 C.F.R.60 as follows:

The quality of significance in American history, architecture, archaeology, and culture is present in districts, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

a) That are associate with events that have made a significant contribution to the broad patterns of our history; or
b) That are associated with the lives of persons significant in our past; or
c) That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
d) That yield or may be likely to yield, information important in prehistory or history.

A cultural resource is considered "historically significant" under CEQA if the resource meets the criteria for listing in the California Register of Historical Resources (CRHR). These criteria define an "important" archaeological resource as one which:

a) Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage; or
b) Is associated with the lives of persons important in our past; or

c) Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possess high artistic values; or
d) Has yielded, or may be likely to yield, information important in prehistory or history.

5.7.2 Encinitas

<u>Borrow Sites</u>

Evaluations of potential impacts to cultural resources within proposed borrow sites can be considered in terms of (1) prehistoric resources, where previously exposed river valleys were available for human habitation and remaining artifacts would be contained in now buried materials; and (2) historic resources, where shipwrecks and other more modern human artifacts may be located. The sensitivity of prehistoric resources within each borrow site may vary laterally based on the occurrence of submerged landforms, and vertically, based on the types of sediments revealed by the vibracore sample. Because the sensitivity assessments are generalized from the relatively limited data provided by vibracores and seismic studies, it is possible that cultural deposits are preserved in contexts that are assessed generally as of low sensitivity (see **Table 5.7-1**). While the sensitivity of contexts around the borrow sites are generally assessed as low, there is the potential for discovery and/or loss of sensitive cultural resources during dredging activities.

Table 5.7-1 Summary of Cultural Resource Sensitivity for Borrow Sites

Borrow Site	Potential for Occurrence of Prehistoric Materials in Dredge Area	Potential for Occurrence of Historic Resources in Dredge Area
SO-6	Low to 8 ft; moderate below 8 ft	No side scan sonar available
SO-5	Low	Low

Significant Impact CR-1 (<u>Cultural Resources Discovery)</u>

There is the potential for discovery of significant cultural resources during dredging activities. The loss of such resources would be a significant impact.

<u>Receiver Sites</u>

No impacts to NRHP or CRHR-eligible cultural resources at the receiver sites would occur as a result of the Alternatives.

Alternative EN-1A

<u>*Summary of Potential Impacts for Alternative EN-1A*</u>

Significant impacts to cultural resources (Significant Impact CR-1) could occur as a result of implementation of this alternative under the High sea level rise scenario.

<u>*Mitigation Measures for Alternatives EN-1A*</u>

Implement Mitigation Measure CR-1 (Cultural Resources Discover) to avoid potentially significant impacts that includes a monitoring program designed to identify cultural resources encountered during dredging operations. Monitoring procedures would be specified in a monitoring plan that is approved before dredging is initiated. The monitoring would be conducted by a qualified archaeologist and would be instituted as material is dredged from each borrow site. Monitoring would consist of periodic spot-checking of materials dredged from low- and moderate-sensitivity contexts and continuous monitoring of materials from high-sensitivity contexts. If monitoring reveals cultural materials indicating that dredging had entered into an archaeological deposit, construction in that area should cease until the requirements of 36 CFR 800.13(b) are met. Then the dredging operation would be permanently relocated away from that site and a 250-ft-wide buffer would be established around the site. Underwater investigations will be conducted prior to disturbance; if cultural resources are found, they will be evaluated for National Register eligibility.

With implementation of the mitigation measure CR-1 above, potential impacts to sensitive cultural resources would be reduced to less than significant.

Alternative EN-1B

The impacts under this alternative would be similar to those of Alternative EN-1A.

Summary of Potential Impacts for Alternative EN-1B

Significant impacts to cultural resources (Significant Impact CR-1) could occur as a result of implementation of Alternative EN-1B.

Mitigation Measures for Alternatives EN-1B

With implementation of the mitigation measure CR-1 above, potential impacts to sensitive cultural resources would be reduced to less than significant.

Alternative EN-2A

The impacts Alternative EN-2A would be similar to those of Alternative EN-1A.

Summary of Potential Impacts for Alternative EN-2A

Significant impacts to cultural resources (Significant Impact CR-1) could occur as a result of implementation of Alternative EN-2A.

Mitigation Measures for Alternatives EN-2A

With implementation of the mitigation measure CR-1 above, potential impacts to sensitive cultural resources would be reduced to less than significant.

Alternative EN-2B

The impacts Alternative EN-2B would be similar to those of Alternative EN-1A.

Summary of Potential Impacts for Alternative EN-2B

Significant impacts to cultural resources (Significant Impact CR-1) could occur as a result of implementation of Alternative EN-2B.

Mitigation Measures for Alternatives EN-2B

With implementation of the mitigation measure CR-1 above, potential impacts to sensitive cultural resources would be reduced to less than significant.

5.7.3 Solana Beach

Borrow Sites

Evaluations of potential impacts to cultural resources within proposed borrow sites can be considered in terms of (1) prehistoric resources, where previously exposed river valleys were available for human habitation and remaining artifacts would be contained in now buried materials; and (2) historic resources, where shipwrecks and other more modern human artifacts may be located. The sensitivity of prehistoric resources within each borrow site may vary laterally based on the occurrence of submerged landforms, and vertically, based on the types of sediments revealed by the vibracore sample. Because the sensitivity assessments are generalized from the relatively limited data provided by vibracores and seismic studies, it is possible that cultural deposits are preserved in contexts that are assessed generally as of low sensitivity (see **Table 5.7-1**). While the sensitivity of contexts around the borrow sites are generally assessed as low, there is the potential for discovery and/or loss of sensitive cultural resources during dredging activities.

Receiver Sites

No impacts to NRHP or CRHR-eligible cultural resources at the receiver sites would occur as a result of Alternatives EN-1A and SB-1A.

Alternative SB-1A

Summary of Potential Impacts for Alternative SB-1A

Significant impacts to cultural resources (Significant Impact CR-1) could occur as a result of implementation of this alternative under the High sea level rise scenario.

Mitigation Measures for Alternatives SB-1A

Implement Mitigation Measure CR-1 (Cultural Resources Discover) to avoid potentially significant impacts that includes a monitoring program designed to identify cultural resources encountered during dredging operations. Monitoring procedures would be specified in a monitoring plan that is approved before dredging is initiated. The monitoring would be conducted by a qualified archaeologist and would be instituted as material is dredged from each borrow site. Monitoring would consist of periodic spot-checking of materials dredged from low- and moderate-sensitivity contexts and continuous monitoring of materials from high-sensitivity contexts. If monitoring reveals cultural materials indicating that dredging had entered into an archaeological deposit, construction in that area should cease until the requirements of 36 CFR 800.13(b) are met. Then the dredging operation would be permanently relocated away from that site and a 250-ft-wide buffer would be established around the site. Underwater investigations will be conducted prior to disturbance; if cultural resources are found, they will be evaluated for National Register eligibility.

Alternative SB-1B

The impacts under this alternative would be similar to those of Alternative SB-1A.

Summary of Potential Impacts for Alternative SB-1B

*S*ignificant impacts to cultural resources (Significant Impact CR-1) could occur as a result of implementation of Alternative SB-1B.

Mitigation Measures for Alternatives SB-1B

With implementation of the mitigation measure CR-1 above, potential impacts to sensitive cultural resources would be reduced to less than significant.

Alternative SB-1C

The impacts under this alternative would be similar to those of Alternative SB-1A.

Summary of Potential Impacts for Alternative SB-1C

Significant impacts to cultural resources (Significant Impact CR-1) could occur as a result of implementation of Alternative SB-1C.

Mitigation Measures for Alternative SB-1C

With implementation of the mitigation measure CR-1 above, potential impacts to sensitive cultural resources would be reduced to less than significant.

Alternative SB-2A

The impacts under this alternative would be similar to those of Alternative SB-1A.

Summary of Potential Impacts for Alternative SB-2A

Significant impacts to cultural resources (Significant Impact CR-1) could occur as a result of implementation of Alternative SB-2A.

Mitigation Measures for Alternative SB-2A

With implementation of the mitigation measure CR-1 above, potential impacts to sensitive cultural resources would be reduced to less than significant.

Alternative SB-2B

The impacts under this alternative would be similar to those of Alternative SB-1A.

Summary of Potential Impacts for Alternative SB-2B

Significant impacts to cultural resources (Significant Impact CR-1) could occur as a result of implementation of Alternative SB-2B.

Mitigation Measures for Alternative SB-2B

With implementation of the mitigation measure CR-1 above, potential impacts to sensitive cultural resources would be reduced to less than significant.

5.7.4 No Action Alternative

No dredging would occur under this alternative, therefore no impacts to cultural resources at borrow sites or receiver sites would occur.

Alternative EN-3

Summary of Potential Impacts for Alternative EN-3

With implementation of Alternative EN-3, there would be no significant impacts to cultural resources.

Mitigation Measures for Alternative EN-3

No significant impacts are identified for this alternative and as such no mitigation is required.

Alternative SB-3

Summary of Potential Impacts for Alternative SB-3

With implementation of Alternative SB-3, there would be no significant impacts to cultural resources.

Mitigation Measures for Alternative SB-3

No significant impacts are identified for this alternative and as such no mitigation is required.

5.7.5 Potential Effects of Mitigation Reef

There are no recorded shipwrecks or known historic resources in the area. The proposed reef sites are not located within submerged river valleys and as such the potential for intact prehistoric cultural resources is very low. The placement of rocks would not be anticipated to disturb sediments to such depths that potential for disturbance to undiscovered resources would occur. No significant adverse impacts to cultural resources would result from implementation of the mitigation reef.

5.7.6 Cultural Resource Surveys

If cultural resource survey(s) are needed prior to initiation of construction, they will be conducted during the Preconstruction, Engineering and Design phase. If any resources are found, they will be avoided. If resources cannot be avoided, they will be evaluated for National Register of Historical Places eligibility. The project is not in compliance with the National Historic Preservation Act at this time.

5.8 Noise

The project consists of the dredging of sand, import of that sand to the beach site, and the use of heavy equipment to spread the sand. Alternatives include a variety of beach nourishment quantities as well as possible construction of notch fills at the base of the bluffs. All of these activities would use heavy diesel-powered equipment. Vehicles would also be used for the transport of workers and, in some cases, construction materials to and from the beach sites. After construction, the equipment would be removed and haul activities would cease.

5.8.1 Impact Significance Criteria

Construction noise is regulated at the local level. Noise impacts would be considered significant if the action would:

- Result in daytime noise levels at any residential property line in excess of 75 dBA for more than 8 hours in any 24-hour period,
- Produce a noise level in excess of 50 dBA between the hours of 7:00 p.m. and 10:00 p.m. or 45 dBA between the hours of 10:00 p.m. and 7:00 a.m. at any residential property line, or

5.8.2 Potential Environmental Impacts

Under Alternatives EN-1A and SB-1A, construction activities at the Encinitas receiver site are estimated at approximately 103 days (low SLR scenario) and 109 days (high SLR scenario). Construction activities at the Solana Beach receiver site would last approximately 201 days (low SLR) and 220 days (high SLR). Onshore short-term noise impacts could occur from material and equipment delivery, worker commutes, equipment movement, and sand relocation activities. Offshore short-term noise impacts could occur from dredging activities.

Cutterhead Dredge Operations

The dredge would use diesel engines for propulsion, dredging activities, and to provide on-board electric power. Dredge operations are projected to occur 24/7. Either the dredge would be self-powered or a tug boat would be used to position the unit.

The noise produced by the cutterhead dredge is based on data obtained by Mestre Greve and documented by Helix Environmental (1996). According to the report, use of a 500 hp hydraulic dredge generated a noise level of 67 dBA at 100 ft. A cutterhead dredge is as much as 10 times more powerful than the unit measured by Helix. Assuming that the noise level is directly related to the power level, dredge noise would be approximately 10 dBA louder than that measured by Helix. Thus, a value of 77 dBA at 100 ft is assumed for cutterhead dredging operations in this analysis.

This level is also confirmed based on data included in the *Phase I 2020 Plan and Feasibility Study Channel Improvements and Landfill Development EIS/EIR* (September 1990). The 2020 Plan monitored the noise associated with an 18,000 hp dredge at 81 dBA at 100 ft. Again assuming that the noise level is directly related to the horsepower level, a 5,000 hp dredge would be approximately 5.6 dBA quieter, or about 75.4 dBA at 100 ft. As such, the use of a value of 77 dBA at 100 ft represents a reasonable estimate of projected dredging noise.

Cutterhead dredging operations require booster pumps to convey slurry up and down the beach once it is conveyed to the shore. As noted in **Table 5.8-1**, these units are assumed to emit a noise level of 67 dBA at 100 ft (FTA 2006). The pumps could be used 24 hours a day and would exceed the most stringent noise standard (i.e., 45 dBA) at approximately 1,300 ft.

Table 5.8-1 Dredge and Booster Pump Noise at Various Distances

Distance in ft	Noise Level (dBA)
Dredge Operations	
100	77
398	65
708	60
1,259	55
2,239	50
3,981	45
Booster Pump Operations	
100	67
126	65
224	60
398	55
708	50
1,259	45

SO-5 and SO-6 borrow sites are approximately 4,500 ft offshore and MB-1 is approximately 3,000 ft offshore at their closest points. SO-6 is off the coast near Cardiff, SO-5 off the coast in Del Mar and MB-1 off the coast in Mission Beach. Beachfront residents that line the shore could be exposed to potential noise from dredge activities at the sites. Noise due to dredge activities at the borrow site would attenuate at these distances due to spreading of energy and atmospheric effects. As shown in **Table 5.8-1**, the noise level would be less than 50 dBA at the nearest shoreline which would be much less than the normal ambient noise level from wave activity on the beach (63 to 71 dBa). Noise from the dredge at the borrow site would not be expected to be audible to shoreline residents.

Booster pumps are anticipated to be required and located on the receiver sites. The possible noise effects are discussed under Onshore Beach Equipment.

<u>Hopper Dredge Operations</u>

As an alternative to the cutterhead dredge, dredging could be performed using a hopper dredge. The noise created by a hopper dredge may be projected by measurements documented by Helix Environmental (October 1996). However, the proposed hopper dredge would be expected to operate at less horsepower than a cutterhead dredge, and it would be reasonable to assume that the noise associated with a hopper dredge would not exceed that discussed for the cutterhead dredge above (i.e., 77 dBA at 100 ft). Accordingly, noise from the dredge would not be expected to be audible to receptors at the shoreline.

The hopper dredge does not require the use of booster pumps, but it does involve use of a monobuoy for conveyance of material in the hopper hold to the beach via a pipeline. That is addressed in onshore equipment.

Onshore Beach Equipment

Noise would also be generated from heavy equipment spreading sand across the receiver sites, but would only occur between the hours of 0700 and 1900. Local residents would be subject to elevated noise levels due to the operation of this equipment. **Table 5.8-2** lists typical construction equipment noise levels recommended for noise impact assessment at a distance of 50 ft.

Typical operating cycles may involve one or two minutes of full power operation followed by three to four minutes at lower power settings. Noise levels at 50 ft from earthmoving equipment range from 73 to 96 dBA maximum noise level. For three pieces of equipment operating for 40% of an hour, average hourly noise levels would be approximately 78 dBA L_{eq} at 50 ft (FTA 2006).

Table 5.8-2 Noise Levels Generated by Typical Construction Equipment

Equipment	Noise Level at 50 ft	Typical Duty Cycle
Auger Drill Rig	85	20%
Backhoe	80	40%
Clam Shovel	93	20%
Compactor (ground)	80	20%
Concrete Mixer Truck	85	40%
Concrete Pump	82	20%
Crane (mobile or stationary)	85	20%
Dozer	85	40%
Dump Truck	84	40%
Excavator	85	40%
Front End Loader	80	40%
Generator (25 KVA or less)	70	50%
Generator (more than 25 KVA)	82	50%
Grader	85	40%
Pumps	77	50%
Scraper	85	40%
Tractor	84	40%

KVA = kilovolt amps
Source: FHWA 2008

The project would use two dozers and a backhoe loader to place the pipe and spread sand on the beach. As noted above, composite construction noise is estimated at about 78 dBA L_{eq} at 50 ft from the construction effort. The equipment is continually moved down the beach at a rate of about 100 ft per day. Assuming a distance 100 ft to the nearest residential units, this noise would be attenuated to about 70 dBA L_{eq} on a worst-case day. During the vast majority of the construction period, however, noise levels would be 10 to 20 dBA lower, due to the movement of the equipment from the near boundary, lower power settings, and sound attenuation provided by longer distances and partial blocking from the bluff (where applicable). Residential units that do not have a direct view of the construction activities due to the slope would receive additional noise shielding; interior levels could be reduced by over 20 dBA from these values.

Project construction would also result in a short-term increase in traffic on the local area's roadway network, but this increase would not be sufficient to increase traffic noise levels a substantial amount. Typically, traffic volumes must double to create an increase in perceptible (3 dBA) traffic noise (Caltrans 2009). The addition of 10 construction-related trips to the roadway network would not double existing traffic levels and therefore would not increase traffic noise by 3 dBA. Noise impacts from construction worker traffic would be less than significant.

Encinitas Receiver Site

The nearest borrow site is located in excess of 4,000 ft from the nearest residents in the Encinitas receiver site. At that distance, noise from dredging activities with a cutterhead dredge would be less than 45 dBA L_{eq} (**Table 5.8-1**) so there would be no audible sound above ambient from the dredge operation itself. Under the hopper option, the dredge would transport the sand to the monobuoy for off-loading. This buoy would be a minimum of 2,500 ft offshore from the receiver site. Based on this distance, hopper dredge monobuoy noise would be estimated at no more than 40 dBA L_{eq}. Because the hopper dredge would basically be operating as a booster pump; drag arms and associated machinery would not be operating. Noise impacts would be less than significant.

Booster pumps could be located on the beach if the cutterhead dredge is used. The nearest residents are located at a distance of about 100 ft and pump noise at the residents is estimated at approximately 67 dBA. Residential units that do not have a direct view of the construction activities due to the slope would receive additional noise shielding; interior levels could be reduced by over 20 dBA from these values. This level would not exceed the daytime standard of 50 dBA L_{eq} between the hours of 7:00 p.m. and 10:00 p.m. (when construction is not exempt from the noise standards), although it could exceed the 45 dBA L_{eq} nighttime standard. Booster pumps, however, would not be distinguishable over the sound of surf. This impact is considered to be insignificant.

Onshore activities from sand movement would occur between the hours of 0700 and 1900 Noise levels from these activities at the nearest residences would be approximately 70 dBA L_{eq} under the worst case condition. In addition, due to the movement of construction equipment along the beach, noise levels would likely only reach 70 dBA L_{eq} at a specific location for one day. Therefore, since onshore activities would not exceed 75 dBA L_{eq} for a cumulative period of 8 hours in a 24-hour period this impact would be less than significant.

Solana Beach Receiver Site

The nearest borrow site to the Solana Beach receiver site is located in excess of 4,000 ft from the nearest residents and the impacts of offshore dredging (both cutterhead and hopper) are the same as those described for Encinitas. Booster pump impacts associated with a cutterhead dredge and operation of the monobuoy are the same as those described for Encinitas and would be insignificant.

Notch Fills

Notch fill construction utilizes typical concrete work equipment such as pumps, generators, and trucks. Notch fill equipment would be smaller and quieter than that used in the active movement of sand, however because the equipment would be less mobile with the noise emanating from a more centralized location; noise from notch fill activities is estimated at about 78 dBA L_{eq} at 50 ft. Assuming a distance of 100 ft to the nearest residential units, this noise would be attenuated to about 72 dBA L_{eq} on a worst-case day. Notch fill activities would generate approximately 72 dBA L_{eq} at the nearest receptors and would only operate between 7:00 a.m. and 7:00 p.m.

As with beach fill activities, in most cases noise levels would be 10 to 20 dBA lower, due to the sound attenuation provided by longer distances and partial blocking from the slope. Again, those residents that do not have a direct view of the construction activities due to the slope, would receive noise shielding and in all cases interior levels could be reduced by over 20 dBA from these values.

Notch fill construction would also result in a short-term increase in traffic on the local area's roadway network above as construction workers commuted to the site. As with sand replenishment this increase would not be sufficient to increase traffic noise levels a substantial amount. Typically, traffic volumes must double to create an increase in perceptible (3 dBA) traffic noise (Caltrans 2009). The addition of 30 construction-related trips to the roadway network for notch fill construction would not double existing traffic levels and therefore would not increase traffic noise by 3 dBA.

Combined noise levels from sand replacement and notch fill activities of 70 and 72 dBA L_{eq} at 100 ft would be approximately 74 dBA L_{eq}. In addition, notch fill activities would only occur for about 6 hours on any given day due to tides. As such, noise levels at the nearest residential property lines would not be expected to exceed the 75 dBA threshold applied to construction noise that lasts for a cumulative period of 8 hours in a 24 hour period. This construction noise impact would be less than significant.

5.8.3 Encinitas

<u>Alternative EN-1A</u>

Under Alternative EN-1A, construction activities at the Encinitas receiver site are estimated at approximately 103 days. Onshore short-term noise impacts could occur from material and equipment delivery, worker commutes, equipment movement, and sand relocation activities. Offshore short-term noise impacts could occur from dredging activities.

Summary of Potential Impacts to Noise

The construction activity would be short term and impacts from construction equipment and activities would be less than significant.

<u>Alternative EN-1B</u>

Under Alternative EN-1B, construction activities at the Encinitas receiver site are estimated at approximately 62 days. Onshore short-term noise impacts could occur from material and equipment delivery, worker commutes, equipment movement, and sand relocation activities. Offshore short-term noise impacts could occur from dredging activities.

Summary of Potential Impacts to Noise

The construction activity would be short term and impacts from construction equipment and activities would be less than significant.

<u>Alternative EN-2A</u>

Under Alternative EN-2A, construction activities at the Encinitas receiver site are estimated at approximately 180 days. Onshore short-term noise impacts could occur from material and equipment delivery, worker commutes, equipment movement, sand relocation, and notch fill activities. Offshore short-term noise impacts could occur from dredging activities.

Summary of Potential Impacts to Noise

The construction activity would be short term and impacts from construction equipment and activities would be less than significant.

<u>Alternative EN-2B</u>

Under Alternative EN-2B, construction activities at the Encinitas receiver site are estimated at approximately 180 days. Onshore short-term noise impacts could occur from material and equipment delivery, worker commutes, equipment movement, sand relocation, and notch fill activities. Offshore short-term noise impacts could occur from dredging activities.

Summary of Potential Impacts to Noise

The construction activity would be short term and impacts from construction equipment and activities would be less than significant.

5.8.4 Solana Beach

<u>Alternative SB-1A</u>

Under Alternative SB-1A, construction activities at the Encinitas receiver site are estimated at approximately 139 days. Onshore short-term noise impacts could occur from material and equipment delivery, worker commutes, equipment movement, and sand relocation activities. Offshore short-term noise impacts could occur from dredging activities.

Summary of Potential Impacts to Noise

The construction activity would be short term and impacts from construction equipment and activities would be less than significant.

<u>Alternative SB-1B</u>

Under Alternative SB-1B, construction activities at the Encinitas receiver site are estimated at approximately 107 days. Onshore short-term noise impacts could occur from material and equipment delivery, worker commutes, equipment movement, and sand relocation activities. Offshore short-term noise impacts could occur from dredging activities.

Summary of Potential Impacts to Noise

The construction activity would be short term and impacts from construction equipment and activities would be less than significant.

Alternative SB-1C

Under Alternative SB-1C, construction activities at the Encinitas receiver site are estimated at approximately 76 days. Onshore short-term noise impacts could occur from material and equipment delivery, worker commutes, equipment movement, and sand relocation activities. Offshore short-term noise impacts could occur from dredging activities.

Summary of Potential Impacts to Noise

The construction activity would be short term and impacts from construction equipment and activities would be less than significant.

Alternative SB-2A

Under Alternative EN-2A, construction activities at the Encinitas receiver site are estimated at approximately 180 days. Onshore short-term noise impacts could occur from material and equipment delivery, worker commutes, equipment movement, sand relocation, and notch fill activities. Offshore short-term noise impacts could occur from dredging activities.

Summary of Potential Impacts to Noise

The construction activity would be short term and impacts from construction equipment and activities would be less than significant.

Alternative SB-2B

Under Alternative EN-2B, construction activities at the Encinitas receiver site are estimated at approximately 180 days. Onshore short-term noise impacts could occur from material and equipment delivery, worker commutes, equipment movement, sand relocation, and notch fill activities. Offshore short-term noise impacts could occur from dredging activities.

Summary of Potential Impacts to Noise

The construction activity would be short term and impacts from construction equipment and activities would be less than significant.

5.8.5 Mitigation and Monitoring Measures

While significant noise impacts are not expected, the following measures should be included to minimize noise impacts. The source of the significant noise impact would vary depending on the type of dredge (cutterhead or monobuoy) but the mitigation measures would be identical.

N-1 Noise monitoring shall be performed during all beach construction activities to verify that noise levels remain below significant levels. If noise levels exceed significant levels, the contractor shall be required to modify operations to reduce noise levels.

N-2 All construction equipment shall be properly maintained and tuned to minimize noise emissions.

N-3 All equipment shall be fitted with properly operating mufflers, air intake silencers, and engine shrouds no less effective that as originally equipped.

N-4 Stationary noise sources (e.g., booster pumps, generators, and compressors) shall be located as far from residential receptor locations as is feasible, ideally 250 ft or greater.

N-5 Where feasible, use an electric motor to drive the booster pump, rather than a diesel engine.

N-6 For work in Encinitas, a noise variance shall be obtained under Section 9.32.424 of the City of Encinitas Municipal Code prior to the commencement of any work.

N-7 For work in Solana Beach, a noise variance shall be obtained from the City of Solana Beach under Section 7.34.240 of the City Municipal Code.

5.8.6 Potential Environmental Impacts of No Action Alternatives (EN-3 and SB-3)

Under the No Action Alternative, no beach replenishment activities would occur within the vicinity except for those associated with routinely authorized maintenance dredging unrelated to the project. Because no project construction or maintenance would occur, no project noise would be generated by these activities. No mitigation would be necessary.

5.8.7 Potential Effects of Mitigation Reef

Beachfront residents that line the shore could be exposed to potential noise from construction activities (boats and barges). Noise would attenuate due to spreading of energy and atmospheric effects so the noise level at the nearest shoreline would be below the normal ambient noise level from wave activity on the beach (63 to 71 dBA). Noise from the construction activity would not be expected to result in significant adverse impacts.

5.9 Socioeconomics / Environmental Justice

As stated in Section 4.10, NEPA requires consideration of “economic” and “social” effects (40 CFR § 1508.8) but CEQA only requires evaluation of population and housing such that increased population or housing results in physical impacts.

5.9.1 Impact Significance Criteria

In accordance with generally accepted CEQA criteria and Executive Order 12898 for federal projects, significant socioeconomic/environmental justice impacts would occur if:

- The project would adversely induce substantial growth either directly or indirectly;
- The project would displace existing housing or cause a substantial increased demand for housing through population growth; and/or

- Disproportionately high and adverse impacts on minorities, low-income residences

NEPA does not specifically establish criteria for determining socioeconomic impacts. However, 40 C.F.R. § 1502.16 requires consideration of social and economic effects. Therefore, the following additional factors were considered, and significant economic impacts would be indicated if:

- The project resulted in substantial losses to commercial fisheries either through loss of fishing gear, movement of commercial resources from the project area, or reduction in populations of commercial species;
- The project resulted in substantial losses to kelp harvesting either through loss of harvesting gear, movement of kelp resources from the project area, or reduction in kelp beds;
- The project resulted in a substantial reduction in tourism and/or local population use of beaches and coastal parks; and/or
- There was substantial economic loss associated with damage and/or devaluation of coastal properties.

Executive Order 12898 requires that Federal projects consider a project's impact on minority and low-income populations. An impact to environmental justice would occur if a significant, unmitigable impact would have a disproportionate effect on a minority or low-income population.

5.9.2 Encinitas

Borrow Sites

Socioeconomics/Environmental Justice

No significant direct population or housing impacts are expected to result from the offshore construction activities, either on a local basis or regional basis. No adverse impacts to minority or low-income residents would occur under the Alternatives.

Commercial Fisheries

Local nearshore trap fisheries most likely to be affected by dredging and offshore construction associated with the Alternatives include lobster, urchins, crab and sheephead. A majority of trap fisheries are placed at a depth of -90 ft MLLW, as stated in Section 4.11. The initial placement depth of the Alternatives is less than -3.3 ft MLLW, resulting in no direct adverse impacts to adult trap fisheries are anticipated. Therefore, the Alternatives would not result in substantial losses to nearshore trap fisheries.

Juvenile lobsters spend 1 to 2 years in the nearshore and hard bottom reefs and are dependent on surfgrass and hard-bottom reef habitats as a nursery area and a refuge from predators. The effects of initial placement and renourishment (every 5 years) and subsequent redistribution of the sands upon these habitats has the potential to cause loss of commercial resources. The project has been designed to avoid indirect impacts to intertidal surfgrass, which would minimize potential impacts to lobster nursery areas (Section 5.4). However, some nearshore low-lying reefs, including a few with nearshore surfgrass, may be affected temporarily by sand redistribution and this could cause a short-term loss of habitat for juvenile lobsters. The significance of this effect upon juvenile lobsters is difficult to determine, but it is judged to be less than significant based upon the sand transport modeling predictions that suggest only limited sedimentation of reef heights that support surfgrass. While increases in turbidity and sand burial would occur with the Alternatives, these effects are similar to those of beach replenishment projects that have been ongoing for over four decades with no apparent effect on resources. Therefore, the proposed project may have an adverse impact on the area's ability to function as a juvenile lobster habitat; however, this effect would be short term and less than significant. Localized impacts are predicted to occur over small areas of reef supporting surfgrass, kelp, and feather boa that may experience partial sedimentation under worst-case assumptions but are not expected to result in a significant impact to lobsters at the local population level. Therefore, no indirect impacts to long-term commercial lobster fisheries are anticipated. However, as a precautionary measure pre- and post-construction monitoring will occur within the areas initial beach fill placement in the nearshore area out to -40 ft MLLW. Monitoring would consist of preconstruction surveys of reef and vegetation habitats within the area of influence and would minimize substantial losses to commercial fisheries.

Offshore construction operations (vessel traffic and dredging) may have the potential to conflict with local commercial fishing operations during winter months. Such conflicts may include gear/equipment damage and the disruption of fishing locations; however, impacts would be temporary. To minimize impacts to gear/equipment, the local Encinitas and Solana Beach commercial fishermen's association shall be provided with written notification of the intended start date of onshore and offshore construction, maps of the project related to vessel transportation routes, and construction duration. Noticing shall include a point of contact throughout the entire construction phase to respond to concerns regarding interference and/or other issues associated with local commercial fishing operations. Residual impacts would be considered less than significant.

Kelp Harvesting

The Alternatives have been designed to minimize effects on kelp and kelp habitat. Dredging of the borrow sites would cause localized turbidity and siltation. However, the borrow sites have been designed to provide a minimum 500-ft buffer zone from kelp beds and potential kelp habitat (Section 4.4). This buffer zone would be sufficient since dredging would generally occur at distances greater than 500 ft from these resources; the duration of turbidity would be intermittent and reach potential resources for only a few days at most. Therefore, substantial losses to kelp harvesting would be less than significant.

Tourism/Use of Beaches and Coastal Parks

Dredging activities at the borrow sites during construction would occur offshore and would not adversely affect tourism or local use of beaches and coastal parks.

Coastal Properties

Coastal properties would not be damaged or devalued during construction or implementation of the Alternatives.

Receiver Sites

Socioeconomics/Environmental Justice

No new homes, businesses or infrastructure area associated with the Alternatives; therefore, no significant direct population or housing impacts are expected to result from the proposed action, either on a local basis or regional basis. Although the shoreline protection improvements may increase opportunities for development near the shoreline, the project alone would not indirectly increase the need for housing in the area. As no existing housing or people live within the project footprint, substantial numbers of existing housing or people would not be displaced under the Alternatives.

The socioeconomic effects of beach replenishment at Encinitas and Solana Beach receiver sites would be considered a beneficial impact. The wider sandier beaches at the receiver sites provide greater recreation opportunity, opportunity for public access, enhance tourism in the region, and increase local recreation revenue due to increased numbers of visitors to the beaches. In addition, the creation of construction jobs associated with the shoreline improvements would be a beneficial impact to the study area.

The project area, as described in Section 4.10, shows that both Encinitas and Solana Beach have low percentages of minority race and Hispanic or Latino origin populations, and a low percentage of the population living below the poverty level as compared to San Diego County or the State. In addition, this project would reduce structural property damage during winter storms, which could indirectly improve the desirability of the area for residential and commercial investment. Given City policies for maintaining the small town character of the area and the project's consistency with these policies, the project would not be expected to have any negative effect on minority or low-income populations. In addition, the expansion of the beach width would be a public improvement that would benefit all of the residences of Encinitas and Solana Beach.

Commercial Fisheries

No direct adverse impacts to adult trap fisheries are expected under the Alternatives and no adverse impacts are expected to occur due to onshore and offshore sand migration. Preconstruction and postconstruction monitoring will occur within the initial beach fill placement areas in the nearshore to -40 ft MLLW. Monitoring will consist of preconstruction surveys of reef and vegetation habitats within the area of influence. The notification requirements discussed previously would reduce potentially significant impacts to local commercial fishing operations. Residual impacts would be considered less than significant.

Kelp Harvesting

Onshore construction activities and implementation of the Alternatives would not impact kelp and kelp habitat.

Tourism/Use of Beaches and Coastal Parks

Replenishment operations would require that portions of each receiver site be closed temporarily to the public during construction due to the public safety concerns associated with heavy equipment operations on the beach. However, it should be noted that the total reach of beach within the receiver site would not be closed for the entire duration of construction.

Closure areas would shift as replenishment activities move along the shoreline, and temporary beach closures would be limited to short lengths of beach in which active construction is occurring. Access restriction would result in a temporary redistribution of beach activities to surrounding areas; however, major local recreational beach activities would be avoided. Tourism and local use of the beaches and coastal areas would be temporarily affected but would not result in a significant adverse impact.

Coastal Properties

Coastal properties would not be damaged or devalued during construction or implementation of the Alternatives.

<u>Alternative EN-1A</u>

Summary of Potential Impacts for Alternative EN-1A

No significant direct impacts to socioeconomic/environmental justice, commercial fisheries, kelp harvesting, tourism/use of beaches and coastal parks, and coastal properties are expected to result from Alternative EN-1A. This alternative would not result in permanent impacts.

Mitigation Measures for Alternatives EN-1A

No mitigation would be required as no significant impacts have been identified.

<u>Alternative EN-1B</u>

Socioeconomics/environmental justice, commercial fisheries, kelp harvesting, tourist/use of beaches and coastal parks, and coastal properties impacts for Alternative EN-1B would be similar to Alternative EN-1A.

Summary of Potential Impacts for Alternative EN-1B

No significant direct impacts to socioeconomic/environmental justice, commercial fisheries, kelp harvesting, tourism/use of beaches and coastal parks, and coastal properties are expected to result from Alternative EN-1B.

Mitigation Measures for Alternatives EN-1B

No mitigation would be required as no significant impacts have been identified.

<u>Alternative EN-2A</u>

Summary of Potential Impacts for Alternative EN-2A

No significant direct impacts to socioeconomic/environmental justice, commercial fisheries, kelp harvesting, tourism/use of beaches and coastal parks, and coastal properties are expected to result from Alternative EN-2A. This alternative would not result in permanent impacts.

Mitigation Measures for Alternatives EN-2A

No mitigation would be required as no significant impacts have been identified.

Alternative EN-2B

Socioeconomic/environmental justice, commercial fisheries, kelp harvesting, tourism/use of beaches and coastal parks, and coastal properties impacts for Alternative EN-2B would be similar to Alternative EN-2A.

Summary of Potential Impacts for Alternative EN-2B

No significant direct impacts to socioeconomic/environmental justice, commercial fisheries, kelp harvesting, tourism/use of beaches and coastal parks, and coastal properties are expected to result from Alternative EN-2B. This alternative would not result in permanent impacts.

Mitigation Measures for Alternatives EN-2B

No mitigation would be required as no significant impacts have been identified.

5.9.3 Solana Beach

Borrow Sites

Socioeconomics/Environmental Justice

No significant direct population or housing impacts are expected to result from the offshore construction activities, either on a local basis or regional basis. No adverse impacts to minority or low-income residents would occur under the Alternatives.

Commercial Fisheries

Local nearshore trap fisheries most likely to be affected by dredging and offshore construction associated with the Alternatives include lobster, urchins, crab and sheephead. A majority of trap fisheries are placed at a depth of -90 ft MLLW, as stated in Section 4.10. The initial placement depth of the Alternatives is less than -3.3 ft MLLW, resulting in no direct adverse impacts to adult trap fisheries are anticipated. Therefore, the Alternatives would not result in substantial losses to nearshore trap fisheries.

Juvenile lobsters spend 1 to 2 years in the nearshore and hard bottom reefs and are dependent on surfgrass and hard-bottom reef habitats as a nursery area and a refuge from predators. The effects of initial placement and renourishment (every 5 years) and subsequent redistribution of the sands upon these habitats has the potential to cause loss of commercial resources. The project has been designed to avoid indirect impacts to intertidal surfgrass, which would minimize potential impacts to lobster nursery areas (Section 5.4). However, some nearshore low-lying reefs, including a few with nearshore surfgrass, may be affected temporarily by sand redistribution and this could cause a short-term loss of habitat for juvenile lobsters. The significance of this effect upon juvenile lobsters is difficult to determine, but it is judged to be less than significant based upon the sand transport modeling predictions that suggest only limited sedimentation of reef heights that support surfgrass. While increases in turbidity and sand burial would occur with the Alternatives, these effects are similar to those of beach replenishment projects that have been ongoing for over four decades with no apparent effect on resources. Therefore, the proposed project may have an adverse impact on the area's ability to function as a juvenile lobster habitat; however, this effect would be short term and less than significant. Localized impacts are predicted to occur over small areas of reef supporting surfgrass, kelp, and feather boa that may experience partial sedimentation under worst-case assumptions but are not expected to result in a significant impact to lobsters at the local population level. Therefore, no indirect impacts to long-term commercial lobster fisheries are anticipated. However, as a precautionary measure pre- and post-construction monitoring will occur within the areas initial beach fill placement in the nearshore area out to -40 ft MLLW. Monitoring would consist of preconstruction surveys of reef and vegetation habitats within the area of influence and would minimize substantial losses to commercial fisheries.

Offshore construction operations (vessel traffic and dredging) may have the potential to conflict with local commercial fishing operations during winter months. Such conflicts may include gear/equipment damage and the disruption of fishing locations; however, impacts would be temporary. To minimize impacts to gear/equipment, the local Encinitas and Solana Beach commercial fishermen's association shall be provided with written notification of the intended start date of onshore and offshore construction, maps of the project related to vessel transportation routes, and construction duration. Noticing shall include a point of contact throughout the entire construction phase to respond to concerns regarding interference and/or other issues associated with local commercial fishing operations. Residual impacts would be considered less than significant.

Kelp Harvesting

The Alternatives have been designed to minimize effects on kelp and kelp habitat. Dredging of the borrow sites would cause localized turbidity and siltation. However, the borrow sites have been designed to provide a minimum 500-ft buffer zone from kelp beds and potential kelp habitat (Section 4.5). This buffer zone would be sufficient since dredging would generally occur at distances greater than 500 ft from these resources; the duration of turbidity would be intermittent and reach potential resources for only a few days at most. Therefore, substantial losses to kelp harvesting would be less than significant.

Tourism/Use of Beaches and Coastal Parks

Dredging activities at the borrow sites during construction would occur offshore and would not adversely affect tourism or local use of beaches and coastal parks.

Coastal Properties

Coastal properties would not be damaged or devalued during construction or implementation of the Alternatives.

Impacts for the Alternatives would be less than significant.

Receiver Sites

Socioeconomics/Environmental Justice

No new homes, businesses or infrastructure area associated with the Alternatives; therefore, no significant direct population or housing impacts are expected to result from the proposed action, either on a local basis or regional basis. Although the shoreline protection improvements may increase opportunities for development near the shoreline, the project alone would not indirectly increase the need for housing in the area. As no existing housing or people live within the project footprint, substantial numbers of existing housing or people would not be displaced under the Alternative.

Commercial Fisheries

No direct adverse impacts to adult trap fisheries are expected under the Alternatives and no adverse impacts are expected to occur due to onshore and offshore sand migration. Preconstruction and postconstruction monitoring will occur within the initial beach fill placement areas in the nearshore to -40 ft MLLW. Monitoring will consist of preconstruction surveys of reef and vegetation habitats within the area of influence. The notification requirements discussed previously would reduce potentially significant impacts to local commercial fishing operations. Residual impacts would be considered less than significant.

Kelp Harvesting

Onshore construction activities and implementation of the Alternatives would not impact kelp and kelp habitat.

Tourism/Use of Beaches and Coastal Parks

Replenishment operations would require that portions of each receiver site be closed temporarily to the public during construction due to the public safety concerns associated with heavy equipment operations on the beach. However, it should be noted that the total reach of beach within the receiver site would not be closed for the entire duration of construction. Closure areas would shift as replenishment activities move along the shoreline, and temporary beach closures would be limited to short lengths of beach in which active construction is occurring. Access restriction would result in a temporary redistribution of beach activities to surrounding areas; however, major local recreational beach activities would be avoided. Tourism and local use of the beaches and coastal areas would be temporarily affected but would not result in a significant adverse impact.

Coastal Properties

Coastal properties would not be damaged or devalued during construction or implementation of the Alternatives.

Alternative SB-1A

Summary of Potential Impacts for Alternative SB-1A

No significant direct impacts to socioeconomic/environmental justice, commercial fisheries, kelp harvesting, tourism/use of beaches and coastal parks, and coastal properties are expected to result from Alternative SB-1A. This alternative would not result in permanent impacts.

Mitigation Measures for Alternatives SB-1A

No mitigation would be required as no significant impacts have been identified.

Alternative SB-1B

Summary of Potential Impacts for Alternative SB-1B

No significant direct impacts to socioeconomic/environmental justice, commercial fisheries, kelp harvesting, tourism/use of beaches and coastal parks, and coastal properties are expected to result from Alternative SB-1B. This alternative would not result in permanent impacts.

Mitigation Measures for Alternatives SB-1B

No mitigation would be required as no significant impacts have been identified.

Alternative SB-1C

Summary of Potential Impacts for Alternative SB-1C

No significant direct impacts to socioeconomic/environmental justice, commercial fisheries, kelp harvesting, tourism/use of beaches and coastal parks, and coastal properties are expected to result from Alternative SB-1C. This alternative would not result in permanent impacts.

Mitigation Measures for Alternative SB-1C

No mitigation would be required as no significant impacts have been identified.

Alternative SB-2A

Summary of Potential Impacts for Alternative SB-2A

No significant direct impacts to socioeconomic/environmental justice, commercial fisheries, kelp harvesting, tourism/use of beaches and coastal parks, and coastal properties are expected to result from Alternative SB-2A. This alternative would not result in permanent impacts.

Mitigation Measures for Alternative SB-2A

No mitigation would be required as no significant impacts have been identified.

Alternative SB-2B

Summary of Potential Impacts for Alternative SB-2B

No significant direct impacts to socioeconomic/environmental justice, commercial fisheries, kelp harvesting, tourism/use of beaches and coastal parks, and coastal properties are expected to result from Alternative SB-2B. This alternative would not result in permanent impacts.

Mitigation Measures for Alternative SB-2B

No mitigation would be required as no significant impacts have been identified.

5.9.4 No Action Alternative

Under the No Action Alternative, there would be no adverse impacts to commercial fisheries from construction-related disturbance and/or sedimentation effects on lobster nursery habitats (surfgrass) or kelp beds. However, the No Action Alternative would not provide a social or economic benefit to the region and the erosion of the region's beaches would continue without intervention. Tourism value would not experience a beneficial impact.

5.9.5 Potential Effects of Mitigation Reef

Construction of the mitigation reef would occur entirely offshore beyond the surfzone and would not result in significant direct population or housing impacts or adverse effects to minority or low-income residents. Construction activities would occur offshore and would not adversely affect tourism or local use of beaches and coastal parks, and coastal properties would not be damaged or devalued during construction or implementation of the mitigation reef. In terms of local and regional socioeconomics, implementation of the mitigation reef may represent a long-term benefit by increasing the vegetated reef area and associated benefits to fish populations. Construction activities would occur at -10 to -40 ft MLLW; therefore, local nearshore trap fisheries would not be adversely affected since the majority of trap fisheries are placed at a depth of -90 ft MLLW. No indirect impacts to long-term commercial lobster fisheries are anticipated. Offshore construction operations may have the potential to conflict with local commercial fishing operations during winter months. Such conflicts may include gear/equipment damage and the disruption of fishing locations; however, impacts would be temporary and residual impacts would be less than significant. The mitigation reef would be designed to minimize effects on kelp and kelp habitat, although construction activities may cause localized turbidity and siltation; however, the duration of turbidity would be intermittent and reach potential resources for only a few days at most. Impacts to kelp and kelp habitat would be less than significant.

5.10 Transportation

This section addresses the potential for the various alternatives to impact existing vehicular traffic and parking conditions in the vicinity of the receiver sites.

5.10.1 Impact Significance Criteria

A significant impact to traffic would occur if:

- The addition of project related traffic would substantially add vehicle trips to cause an increase in Level of Service on local roadways; and/or
- The project would substantially interfere with or restrict traffic flow.

5.10.2 Encinitas

Borrow Sites

Material from borrow sites SO-6, SO-5 and MB-1 would be used for Encinitas. Crew for the dredge would be minimal and no traffic impact would occur. The dredge crew would park at the port of operations for the dredge. A crew boat would be used to shuttle workers between the shore and the dredge.

Receiver Sites

Implementation would require delivery of construction equipment and work crews to the receiver sites. As the material is deposited behind the berm, the sand would be spread using two bulldozers and one front-end loader. Beach access for the construction equipment and crew would be at Moonlight Beach. During construction, Moonlight Beach would be used for staging area for 10 cars and construction equipment. Construction vehicles would be driven to the beach work site and kept on site for the duration of beach replenishment. Since the work would not be done during winter storms, and because the construction equipment would be used on a 24/7 basis, there would be only occasional need for a staging area. Should equipment need to be temporarily moved off the beach, it would be stored in parking lots at the access points. Public parking areas are available for use by the construction crew. The shore crew of approximately 10 people would park in available public parking lots near the beach access points and would not create significant parking impacts given the small number of spaces required at each site. The increase in ground traffic would not be substantial in relation to the existing traffic load or capacity of the street system.

Beach replenishment activities would not significantly affect traffic, as the activity would generate a minimal amount of trips per day (approximately 10 worker round trips). This small increase in traffic volumes would be localized and temporary and would not substantially add vehicle trips to cause an increase in Level of Service (LOS) on local roadways; nor substantially interfere with or restrict traffic flow. Long-term, a minor shift in beach use and parking may occur with the improved beach condition. This would be minor, and would be mixed with projected long-term growth and those associated traffic issues. No significant long-term impacts would occur.

Potential impacts to public beach access would occur at the point of discharge. Approximately 150 to 325 ft of the receiver site would be inaccessible to the public around the discharge pipeline and berms. In addition, there would be intermittent restrictions on public access for approximately 540 ft on either side of this discharge zone. This space would be needed for maneuvering heavy equipment during construction of the temporary berms and for relocating discharge pipelines. Major local recreational beach activities would be avoided.

Subsequent to the completion of sand replenishment, some change in traffic would occur. The replenishment of receiver sites where there is currently little sand could make these locations more attractive to both residents and tourists, and it is expected that traffic could increase accordingly. The use of parking would also increase. Some of the increase would come from new users, and some would come from users of adjacent, currently sandy, but less convenient beaches. In the latter case, there would be some decrease in traffic at the adjacent beaches. The replenishment of beaches with the most existing sand would also increase the attractiveness of the beach. However, the increase in use is likely to be less pronounced than at the currently rocky beaches, and increases in traffic and parking congestion would also be less.

The most severe traffic and parking congestion would continue to occur on summer weekends and holidays, and the improvement of the specific beaches with sand replenishment may induce additional use that would marginally increase the congestion. The city of Encinitas has approximately 2,566 public parking spots including street-side parking within a reasonable walking distance of nine different public access locations. The distance between public access points varies from one-tenth to three-quarters mile. Encinitas does have sufficient parking capacity near public access points to accommodate the anticipated increase in daily visitations that have been projected for the alternatives. In addition to parking spaces, the area is also served by regular bus lines and a light rail line that stops next to Moonlight Beach. Many local residents have also been observed bicycling to and from the beaches. Therefore some of the additional induced visits will occur through these modes of transit easing overcapacity issues for those traveling by private vehicles. The long-term impact of the proposed beach sand replenishment on traffic and parking would not be significant.

Notch Fill

The construction equipment required for filling notches includes a trailer-mounted high-pressured nozzle for concrete fill, two concrete trucks, and powered hand tools. A shore crew of five people for the notch fill activities would be required. Site constraints due to high tides would limit the construction period for notch fill activities to approximately 2 weeks per month and 6 hours per day. Beach fill operations would occur on a 24/7 basis. The exact sequence of notch fills and beach fills would be up to the construction contractor depending on site conditions, equipment, and access. This would be done concurrently, but not co-located, with beach replenishment.

Potential impacts to public beach access would occur at the point of discharge. Approximately 200 ft of receiver site would be closed per day. Public access would be restricted for a radius of approximately 150 ft around the notch fill operations. This zone would move approximately 100 ft per day so no single location be impacted more than a few days.

Alternative EN-1A

Beach replenishment activities, including: dredging, placing, and dispersing approximately 680,000 cy of sand and an additional two weeks of dredging preparation and decommissioning, would require approximately 103 days. Construction activities are expected to occur throughout the calendar year.

Renourishment would occur every 5 years. Renourishment construction activities would be similar to the initial placement construction activities. The only difference would be shorter duration of construction activities. Therefore, impacts to transportation associated with renourishment would be less than significant.

Summary of Potential Impacts for Alternative EN-1A

With the exception of local residents experiencing a minor short-term increase in traffic, no significant impacts related to construction and renourishment activities would occur from Alternative EN-1A. The addition of project related traffic would not increase the LOS on local roadways and would not substantially interfere with or restrict traffic flow. Therefore, construction and maintenance impacts to traffic would be less than significant.

Mitigation Measures for Alternatives EN-1A

No mitigation would be required as no significant impacts have been identified.

<u>Alternative EN-1B</u>

Beach replenishment activities, including: dredging, placing, and dispersing approximately 340,000 cy of sand and an additional two weeks of dredging preparation and decommissioning, would require approximately 62 days. Construction activities are expected to occur throughout the calendar year.

Renourishment would occur every 5 years. Renourishment construction activities would be similar to the initial placement construction activities. The only difference would be shorter duration of construction activities. Therefore, impacts to transportation associated with renourishment would be less than significant.

Summary of Potential Impacts for Alternative EN-1B

As with Alternative EN-1A, with the exception of local residents experiencing a minor short-term increase in traffic, no significant impacts related to construction and renourishment activities would occur. The addition of project related traffic would not increase the LOS on local roadways and would not substantially interfere with or restrict traffic flow. Therefore, construction and maintenance impacts to traffic would be less than significant.

Mitigation Measures for Alternatives EN-1B

No mitigation would be required as no significant impacts have been identified.

<u>Alternative EN-2A</u>

Alternative EN-2A includes notch fill, which would require approximately 10 to 15 trucks of concrete per day. Approximately 180 days would be required to complete the notch fill. Beach replenishment activities at the receiver site would not significantly affect traffic, as the activity would generate a minimal amount of trips per day (approximately 15 worker round trips and 15 concrete truck round trips). The construction crew would park at the staging areas used under Alternative EN-1A. Staging for 15 cars would be required as well as potential equipment staging. Compared to Alternative EN-1A, there would be a slightly more adverse affect on traffic, but this small increase in traffic volume would be temporary and would not substantially add vehicle trips to cause an increase in LOS on local roadways; nor substantially interfere with or restrict traffic flow. Long-term, a minor shift in beach use and parking may occur with the improved beach condition. This would be minor, and would be mixed with projected long-term growth and those associated traffic issues. No significant long-term impacts would occur.

Beach replenishment activities would include: dredging, placing, and dispersing approximately 700,000 cy of sand and an additional two weeks of dredging preparation and decommissioning. Duration of sand placement construction would be 84 days. Construction activities are expected to occur throughout the calendar year.

Renourishment would occur every 10 years. Renourishment construction activities would be similar to the initial placement construction activities. The only difference would be shorter duration of construction activities. Therefore, impacts to transportation associated with renourishment would be less than significant.

Summary of Potential Impacts for Alternative EN-2A

With the exception of local residents experiencing a minor short-term increase in traffic, no significant impacts related to construction and renourishment activities would occur from Alternative EN-2A. The addition of project related traffic would not increase the LOS on local roadways and would not substantially interfere with or restrict traffic flow. Therefore, construction and maintenance impacts to traffic would be less than significant for low sea level rise scenario.

Mitigation Measures for Alternatives EN-2A

No mitigation would be required as no significant impacts have been identified.

Alternative EN-2B

Alternative EN-2B includes notch fill, which would require approximately 10 to 15 trucks of concrete per day. Approximately 180 days would be required to complete the notch fill. Similar to Alternative EN-2A, beach replenishment activities would not significantly affect traffic, as the activity would generate a minimal amount of trips per day (approximately 15 worker round trips and 15 concrete truck round trips). The construction crew would park at the staging areas used under Alternative EN-2A. Staging for 15 cars would be required as well as potential equipment staging. Compared to Alternative EN-1A, there would be a slightly more adverse affect on traffic, but this small increase in traffic volumes would be temporary and would not substantially add vehicle trips to cause an increase in LOS on local roadways; nor substantially interfere with or restrict traffic flow. Long-term, a minor shift in beach use and parking may occur with the improved beach condition. This would be minor, and would be mixed with projected long-term growth and those associated traffic issues. No significant long-term impacts would occur.

Beach replenishment activities would include: dredging, placing, and dispersing approximately 340,000 cy of sand and an additional two weeks of dredging preparation and decommissioning. Duration of sand placement construction would be 41 days. Construction activities are expected to occur throughout the calendar year.

Renourishment would occur every 5 years. Renourishment construction activities would be similar to the initial placement construction activities. The only difference would be shorter duration of construction activities. Therefore, impacts to transportation associated with renourishment would be less than significant.

Summary of Potential Impacts for Alternative EN-2B

With the exception of local residents experiencing a minor short-term increase in traffic, no significant impacts related to construction and renourishment activities would occur from Alternative EN-2B. The addition of project related traffic would not increase the LOS on local roadways and would not substantially interfere with or restrict traffic flow. Therefore, construction and maintenance impacts to traffic would be less than significant.

Mitigation Measures for Alternatives EN-2B

No mitigation would be required as no significant impacts have been identified.

5.10.3 Solana Beach

Borrow Sites

Material from borrow sites SO-5 and MB-1 would be used for Solana Beach. Crew for the dredge would be minimal and no traffic impact would occur. The dredge crew would park at the port of operations for the dredge. A crew boat would be used to shuttle workers between the shore and the dredge.

Receiver Sites

Implementation would require delivery of construction equipment and work crews to the receiver sites. As the material is deposited behind the berm, the sand would be spread using two bulldozers and one front-end loader. Beach access for the construction equipment and crew at the Solana Beach receiver site would be at Fletcher Cove. Approximately 200 ft of the receiver site would be inaccessible to the public around the discharge pipeline and berms. During construction, Fletcher Cove would be used for staging area for 10 cars and construction equipment. Construction vehicles would be driven to the beach work site and kept on site for the duration of beach replenishment. Since the work would not be done during winter storms, and because the construction equipment would be used on a 24/7 basis, there would be only occasional need for a staging area. Should equipment need to be temporarily moved off the beach, it would be stored in parking lots at the access points. Public parking areas are available for use by the construction crew. The shore crew of approximately 10 people would park in available public parking lots near the beach access points and would not create significant parking impacts given the small number of spaces required at each site. The increase in ground traffic would not be substantial in relation to the existing traffic load or capacity of the street system.

Beach replenishment activities would not significantly affect traffic, as the activity would generate a minimal amount of trips per day (approximately 10 worker round trips). This small increase in traffic volumes would be localized and temporary and would not substantially add vehicle trips to cause an increase in Level of Service (LOS) on local roadways; nor substantially interfere with or restrict traffic flow. Long-term, a minor shift in beach use and parking may occur with the improved beach condition. This would be minor, and would be mixed with projected long-term growth and those associated traffic issues. No significant long-term impacts would occur.

Potential impacts to public beach access would occur at the point of discharge. Approximately 150 to 325 ft of the receiver site would be inaccessible to the public around the discharge pipeline and berms. In addition, there would be intermittent restrictions on public access for approximately 540 ft on either side of this discharge zone. This space would be needed for maneuvering heavy equipment during construction of the temporary berms and for relocating discharge pipelines. Major local recreational beach activities would be avoided.

Subsequent to the completion of sand replenishment, some change in traffic would occur. The replenishment of receiver sites where there is currently little sand could make these locations more attractive to both residents and tourists, and it is expected that traffic could increase accordingly. The use of parking would also increase. Some of the increase would come from new users, and some would come from users of adjacent, currently sandy, but less convenient beaches. In the latter case, there would be some decrease in traffic at the adjacent beaches. The replenishment of beaches with the most existing sand would also increase the attractiveness of the beach. However, the increase in use is likely to be less pronounced than at the currently rocky beaches, and increases in traffic and parking congestion would also be less.

The most severe traffic and parking congestion would continue to occur on summer weekends and holidays, and the improvement of the specific beaches with sand replenishment may induce additional use that would marginally increase the congestion. The city of Solana Beach has approximately 2,061 public parking spaces including street-side parking within a reasonable walking distance of four public access points. The distance between access points is approximately ¼ to ½ mile. Solana Beach does have sufficient parking capacity near public access points to accommodate the anticipated increase in daily visitations that have been projected for the alternatives. In addition to parking spaces, the area is also served by regular bus lines and a light rail line that stops next to Fletcher Cove. Many local residents have also been observed bicycling to and from the beaches. Therefore some of the additional induced visits will occur through these modes of transit easing overcapacity issues for those traveling by private vehicles. The long-term impact of the proposed beach sand replenishment on traffic and parking would not be significant.

<u>Notch Fill</u>

The construction equipment required for filling notches includes a trailer-mounted high-pressured nozzle for concrete fill, two concrete trucks, and powered hand tools. A shore crew of five people for the notch fill activities would be required. Site constraints due to high tides would limit the construction period for notch fill activities to approximately 2 weeks per month and 6 hours per day. Beach fill operations would occur on a 24/7 basis. The exact sequence of notch fills and beach fills would be up to the construction contractor depending on site conditions, equipment, and access. This would be done concurrently, but not co-located, with beach replenishment.

Potential impacts to public beach access would occur at the point of discharge. Approximately 200 ft of receiver site would be closed per day. Public access would be restricted for a radius of approximately 150 ft around the notch fill operations. This zone would move approximately 100 ft per day so no single location be impacted more than a few days.

Alternative SB-1A

Beach replenishment activities, including: dredging, placing, and dispersing approximately 960,000 cy of sand and an additional two weeks of dredging preparation and decommissioning, would require approximately 139 days.

Renourishment at Solana Beach would occur every 13 years. Renourishment construction activities would be similar to the initial placement construction activities. The only difference would be shorter duration of construction activities. Therefore, impacts to transportation associated with renourishment would be less than significant.

Summary of Potential Impacts for Alternative SB-1A

With the exception of local residents experiencing a minor short-term increase in traffic, no significant impacts related to construction and renourishment activities would occur from Alternative SB-1A. The addition of project related traffic would not increase the LOS on local roadways and would not substantially interfere with or restrict traffic flow. Therefore, construction and maintenance impacts to traffic would be less than significant.

Mitigation Measures for Alternatives SB-1A

No mitigation would be required as no significant impacts have been identified.

Alternative SB-1B

Beach replenishment activities, including: dredging, placing, and dispersing approximately 700,000 cy of sand and an additional two weeks of dredging preparation and decommissioning, would require approximately 107 days. Construction activities are expected to occur throughout the calendar year.

Renourishment at the Solana Beach receiver site would occur every 10 years. Renourishment construction activities would be similar to the initial placement construction activities. The only difference would be shorter duration of construction activities. Therefore, impacts to transportation associated with renourishment would be less than significant.

Summary of Potential Impacts for Alternative SB-1B

As with Alternative SB-1A, with the exception of local residents experiencing a minor short-term increase in traffic, no significant impacts related to construction and renourishment activities would occur from Alternative SB-1B. The addition of project related traffic would not increase the LOS on local roadways and would not substantially interfere with or restrict traffic flow. Therefore, construction and maintenance impacts to traffic would be less than significant.

Mitigation Measures for Alternatives SB-1B

No mitigation would be required as no significant impacts have been identified.

Alternative SB-1C

Alternative SB-1C would be similar to Alternatives SB-1A and SB-1B except the volume of beach fill material is further reduced. The footprint would be also further reduced to reduce or minimize potential environmental impacts. Beach replenishment activities, including: dredging, placing, and dispersing approximately 440,000 cy of sand and an additional two weeks of dredging preparation and decommissioning, would require approximately 76 days.

Renourishment at the Solana Beach receiver site would occur every 10 years. Renourishment construction activities would be similar to the initial placement construction activities. The only difference would be shorter duration of construction activities. Therefore, impacts to transportation associated with renourishment would be less than significant.

Summary of Potential Impacts for Alternative SB-1C

With the exception of local residents experiencing a minor short-term increase in traffic, no significant impacts related to construction and renourishment activities would occur from Alternative SB-1C. The addition of project related traffic would not increase the LOS on local roadways and would not substantially interfere with or restrict traffic flow. Therefore, construction and maintenance impacts to traffic would be less than significant for the low sea level rise scenario.

Mitigation Measures for Alternative SB-1C

No mitigation would be required as no significant impacts have been identified.

Alternative SB-2A

Alternative SB-2A also includes notch fills in addition to beach nourishment. The notch fill construction would require approximately 10 to 15 trucks of concrete per day. Approximately 180 days would be required to complete the notch fill.

Beach replenishment activities would include: dredging, placing, and dispersing approximately 700,000 cy of sand and an additional two weeks of dredging preparation and decommissioning. Duration of sand placement construction would be 84 days. Construction activities are expected to occur throughout the calendar year.

Renourishment would occur every 10 years. Renourishment construction activities would be similar to the initial placement construction activities. The only difference would be shorter duration of construction activities. Therefore, impacts to transportation associated with renourishment would be less than significant.

Summary of Potential Impacts for Alternative SB-2A

With the exception of local residents experiencing a minor short-term increase in traffic, no significant impacts related to construction and renourishment activities would occur from Alternative SB-2A. The addition of project related traffic would not increase the LOS on local roadways and would not substantially interfere with or restrict traffic flow. Therefore, construction and maintenance impacts to traffic would be less than significant.

Mitigation Measures for Alternative SB-2A

No mitigation would be required as no significant impacts have been identified.

<u>Alternative SB-2B</u>

Alternative SB-2A also includes notch fills in addition to beach nourishment. The notch fill construction would require approximately 10 to 15 trucks of concrete per day. Approximately 180 days would be required to complete the notch fill.

Beach replenishment activities would include: dredging, placing, and dispersing approximately 440,000 cy of sand and an additional two weeks of dredging preparation and decommissioning. Duration of sand placement construction would be 55 days. Construction activities are expected to occur throughout the calendar year.

Renourishment would occur every 13 years. Renourishment construction activities would be similar to the initial placement construction activities. The only difference would be shorter duration of construction activities. Therefore, impacts to transportation associated with renourishment would be less than significant.

Summary of Potential Impacts for Alternative SB-2B

With the exception of local residents experiencing a minor short-term increase in traffic, no significant impacts related to construction and renourishment activities would occur from Alternative SB-2B. The addition of project related traffic would not increase the LOS on local roadways and would not substantially interfere with or restrict traffic flow. Therefore, construction and maintenance impacts to traffic would be less than significant.

Mitigation Measures for Alternative SB-2B

No mitigation would be required as no significant impacts have been identified.

5.10.4 No Action Alternative

Under the No Action Alternative, there would be no potential significant impact to transportation. Short-term traffic increases related to project construction vehicles would not occur.

Overall, traffic in the study area would increase over the next 50 years based on the expectation that there would be a continuation of the trend demonstrated by SANDAG projects through the year 2050. Traffic volume comparisons between 2010 and 2050 are given below, and are considered representative of trends between baseline and future 50-year without project conditions.

<u>City of Encinitas</u>

As the City builds out in accordance with the General Plan and the San Diego region continues to grow, demands on the transportation system within the City would continue to increase over the next 50 years (**Table 5.10-1**). Some of this demand may be met by the 2050 Regional Transportation Plan (RTP), which focuses on the development of a regional transportation system to address projected traffic loads from future development (SANDAG 2011e).

Projected traffic volumes for local streets within the City of Encinitas for the year 2050 compared to 2010 volumes according to SANDAG are shown in **Table 5.10-2**. SANDAG's Series 12 2050 Traffic Volume Forecast, prepared by Transportation Forecast Information Center (TFIC), was used to obtain the 2050 project traffic volumes in **Table 5.10-1** through **Table 5.10-3**. TFIC gives a quick access to forecasted average weekday traffic volumes in thousands for freeways, ramps, and major and minor roads in an interactive map format. Series 12 forecasts were completed in October 2011 in support of the 2011 2050 RTP, utilizing the "Reasonably Expected" network as defined in the RTP, and the Final Series 12 2050 Regional Growth Forecast (SANDAG 2011f). Series 12 forecasts include more than one forecasted volume for each segment shown on **Table 5.10-1** through **Table 5.10-3** as different factors (such as future land uses, demographic forecasts, future projects) resulted in different forecasted volumes (Ortega 2012). Therefore, excluding the I-5 forecasted volumes (which does not provide more than one forecasted volumes), the 2050 projected traffic volumes shown in this section are an average of those forecasted volumes for each segment.

City of Solana Beach

Similar to the City of Encinitas, Solana Beach is largely built out. However, some additional growth in the City of Solana Beach and growth throughout the San Diego region would increase the demand on the city's transportation system over the next 20 years. According to the City's General Plan, the increase in dwelling units upon build out of the General Plan would add approximately 4,200 daily vehicle trips. Commercial development is expected to generate approximately 10,800 additional vehicles trip within the city. Vehicle trips are projected to increase by approximately 10 percent from 150,000 trips to approximately 165,000 daily trips upon build out of the General Plan (City of Solana Beach 2001). Traffic projections for the local primary access streets and State Highway within the City of Solana Beach are based upon build out of the General Plan compared to existing daily traffic volumes are shown below in **Table 5.10-3.** These forecasts are based on the San Dieguito Community Planning Area forecasts.

Table 5.10-1 Baseline and projected future traffic volumes on Interstate 5 and Highway 101 within the City of Encinitas

Segment	2010 Traffic Volumes	2050 Projected Traffic Volumes
I-5 between La Costa Ave. and Leucadia Ave.	204,800	304,300
I-5 between Leucadia Ave. and Encinitas Blvd.	211,600	304,600
I-5 between Encinitas Blvd. and Santa Fe Dr.	212,600	314,400
I-5 between Santa Fe Dr. and Birmingham Dr.	213,800	315,800
I-5 between Birmingham Dr. and Manchester Ave.	214,900	324,900
I-5 between Manchester Ave. and Lomas Santa Fe Dr.	239,800	389,700
Highway 101 between La Costa Ave. and Leucadia Blvd.	13,900	23,660
Highway 101 between Leucadia Blvd. and Encinitas Blvd.	15,500	21,820
Highway 101 between Encinitas Blvd. and H St.	1,700	17,700
Highway 101 between H St. and Chesterfield Dr.	13,400	19,120
Highway 101 between Chesterfield and Ocean St.	19,600	25,900

Source: SANDAG 2012 & 2011f

Table 5.10-2 Baseline and projected future traffic volumes on local streets within the City of Encinitas and County of San Diego

Segment	2010 Traffic Volumes	2050 Projected Traffic Volumes
La Costa Ave. between Vulcan Ave. and I-5	11,400	17,767
Leucadia Ave. between Vulcan Ave. and Orpheus Ave.	15,600	12,700
Encinitas Blvd. between Vulcan Ave. and I-5	25,800	40,033
Santa Fe Dr. between Rubenstein Ave. and I-5	12,200	13,350
Birmingham Dr. between San Elijo Ave. and Mackinnon Ave.	12,100	12,775
Manchester Ave. between San Elijo Ave. and I-5	8,800	15,650
Manchester Ave. between I-5 and El Camino Real	28,800	39,567
San Elijo Ave. between Santa Fe Dr. and Birmingham Dr.	7,800	9,567
El Camino Real between Santa Fe Dr. and Manchester Ave.	21,500	31,533
El Camino Real/La Noria (County of San Diego) between La Bajada and Linea Del Cielo	3,800	9,100
El Camino Real between Linea Del Cielo and Via De La Valle	3,900	4,950

Source: SANDAG 2012 & 2011f

Table 5.10-3 Baseline and projected future traffic volumes on local streets and highways within the City of Solana Beach

Segment	2010 Traffic Volumes	2050 Projected Traffic Volumes
Highway 101 between Ocean St. and Lomas Santa Fe Dr.	19,400	29,466
Highway 101 between Lomas Santa Fe Dr. and Via De La Valle	15,900	27,350
Lomas Santa Fe Dr. between Hwy 101 and Cedros Ave.	17,800	26,700
Lomas Santa Fe Dr. between Cedros Ave. and Stevens Ave.	22,500	26,900
Lomas Santa Fe Dr. between Stevens Ave. and Solana Hills Dr.	25,900	31,900
Lomas Santa Fe Dr. between Solana Hills Dr. and I-5	35,600	35,150
Lomas Santa Fe Dr. between I-5 and Marine View/Santa Helena	21,200	32,600
Lomas Santa Fe Dr. between Marine View/Santa Helena and Highland Dr.	11,000	24,375

Source: SANDAG 2012 & 2011f

5.10.5 Potential Effects of Mitigation Reef

Construction of the mitigation reef is temporary (maximum 34 days) and would not require substantial amount of crew and construction equipment that could cause a significant increased use of the existing public beach access and parking lots. Mitigation reef would be constructed offshore and undertaken using barges. Barges would collect rocks for the reef from suitable harbor, such as Oceanside or from Catalina Island. As there would be no onshore activities, construction would generate a minimal amount of trips per day and the small increase in traffic volumes would be localized and temporary. Therefore, construction of the mitigation reef would not generate substantial amount of traffic in short- and long-term that would increase the LOS on local roadways and interfere with or restrict traffic flow. The potential impact related to transportation would be less than significant.

5.11 Land Use

This analysis of land use impacts addresses the alternatives' compatibility with existing and planned land use, and conformance with local land use plans. Compatibility with existing land use is assessed to determine whether various components of the proposed project (i.e., dredging, beach replenishment, and/or notch fills) would conflict with existing, planned, and adjacent uses. Conformance with land use plans is based on consistency between the proposed use and adopted plans such as the general plans.

5.11.1 Impact Significance Criteria

A significant impact to land use would occur if:

- The project would result in long-term or permanent conversion of land to other uses;
- The project would result in long-term or permanent conflicts with adjacent land or water uses; and/or
- The project would conflict with existing or known future LUPs or policies.

5.11.2 Encinitas

Under the Alternatives, the beach nourishment activities would occur on a 24-hour, 7-day a week (24/7) basis, by operating three shifts per day. Movement of material across the beach would only occur during the day (12 hours), while dredging and placement operations would be 24/7. Sand discharge would be continuous as long as the dredge is operating. At the proposed receiver site, construction activities are expected to occur throughout the calendar year. Construction activity would progress through the receiver sites during the construction period.

Borrow Sites

Dredging would not affect land uses because it would occur at up to three designated offshore borrow sites, SO-5, SO-6, and MB-1. Uses in the vicinity of borrow sites include, recreational uses, kelp harvesting, and fishing. Kelp harvesting operations would not be affected because borrow locations have been specifically sited to avoid these resources. For information on impacts to kelp, refer to Section 5.4 (Biological Resources). Impacts to commercial fishing are discussed in Section 5.9 (Socioeconomics), which identifies that the borrow sites are not of higher value for fisheries than adjacent areas and dredging would not impact commercial fishing operations.

Recreation activities such as whale watching and boating would not be substantially adversely affected near any of the proposed borrow sites. While some access restrictions would be in place during active dredging, these would be localized to the specific borrow sites, temporary, and would not preclude boating in other offshore areas. The San Diego-La Jolla Underwater Park is located approximately 4 mi south of SO-6 and 2 mi south of borrow site SO-5. Due to the short-term nature of dredging and distance from the San Diego-La Jolla Underwater Park, no significant long-term impacts to the features within the lease area are anticipated. No other land use impacts would occur under the Alternatives.

On January 1, 2012, California State legislation went into effect establishing several dozen additional marine life protection and conservations areas. More specifically the Marine Life Protection Act (MLPA) created conservation based goals and guidelines for an area along the

Encinitas coastline now identified as the Swami's State Marine Conservation Area (SMCA) which includes borrow site SO-6. Regulations specific to the recently created SMCAs include an exception to specifically allow sand replenishment and sediment management activities for projects such as this. Given the previous monitoring of these type of projects, the further fine tuning of this project and the specific exception for these types of projects, no significant impacts or conflicts would result from implementation of this alternative.

Therefore, the dredging operations would not result in long-term or permanent conflicts with adjacent water uses.

Receiver Sites

As described in Section 4.12, the City of Encinitas recognizes the need to implement beach replenishment activities n conformance with the California Coastal Act, and the proposed project would be consistent with guiding documents at the receiver site. Adopted policies of the City's Resource Management Element of the General Plan 8.6 and 10.3, specifically support sand nourishment and erosion control. Nourishment with excavated sand is clearly identified as an acceptable response for erosion control. As discussed in Section 5.9 Noise, because temporary nourishment activities would continue through the nighttime, a waiver under Section 9.32.424 of the City of Encinitas Municipal Code would be necessary. The final MLPA regulations covering California's South Coast Study Region have been adopted as of December 15, 2010. While portions of the Encinitas receiver site are within the Swami's SMCA, regulations specific to the Swami's SMCA include an exception to allow sand replenishment and sediment management activities. Therefore, implementation of the project would not conflict with existing or known future LUPs or policies. Other potential impacts to recreational use and commercial fishing use of the waters near the receiver sites are discussed in sections 5.4 Biological Resources and 5.10 Socioeconomics respectively. Implementation would not result in long-term or permanent conflicts with adjacent water uses because of the temporary nature of the nourishment activities and because the long-term conditions (i.e. beach profile) would be consistent with historical conditions, as discussed further in Section 5.2 Oceanographic and Coastal Processes.

To ensure public safety during the use of heavy equipment on the beach, nourishment operations would require that portions of each receiver site and offshore area be closed temporarily to the public during construction. As described in Section 5.11, approximately 150 to 325 ft of the receiver site would be inaccessible to the public around the discharge pipeline and berms. In addition, there would be intermittent restrictions on public access for approximately 540 ft (under low sea level rise scenario) and 350 ft (under high sea level rise scenario) on either side of this discharge zone. This space would be needed for maneuvering heavy equipment during construction of the temporary berms and for relocating discharge pipelines. Major local recreational beach activity events would be avoided by coordinating scheduling with USACE and contractors. However, it should be noted that the total extent of beach within receiver sites would not be closed for the entire duration of construction. Closure areas would shift as nourishment activities move along the shoreline, and temporary beach closures would be limited to short lengths of beach in which active construction is occurring. The cumulative length of closure would vary by receiver site; greater volumes of sand would require longer periods of restricted access. Access restrictions would result in a temporary redistribution of beach activities to surrounding portions of the beach and neighboring beaches.

Once sand has been placed in the active construction zone, closure fencing would be shifted down the widened beach would be immediately open for public use. Pipeline segments remaining in open portions of the beach would be covered at consistent intervals to facilitate access across the beach. Horizontal access along the back beach or adjacent public corridors would be maintained to either side of the active sand placement area. When sand placement must extend to the back beach and no alternative horizontal access exists (e.g., where a wet beach directly abuts bluffs), horizontal access would be temporarily restricted. Closures along the back of the beach would be limited to the extent practicable during daytime hours. These beaches do not contain a large dry beach and are characterized by wet sand beaches. Therefore, sand placement along the footprint would immediately enhance the ability of the public to use the beaches for recreational uses.

Construction would be year round and the potential effect to beach users would be greatest during summer periods of high activity Access restriction would be a temporary localized effect and would not result in a permanent significant condition. Conversely, without beach replenishment, beach use could decline as beaches continue to deteriorate (i.e., erode). A long-term, beneficial impact would result from the increased sand and wider span of beach area, increasing the amount of usable recreation area, as well as safeguarding the bluff face and access stairways, increasing public safety, and thus, safeguarding the bluff top land uses. Therefore, implementation of the Alternatives would not result in long-term or permanent conflicts with adjacent land or water uses.

Renourishment construction activities would be similar to initial placement construction activities. The only difference would be shorter duration of construction activities. Therefore, implementation of the Alternatives would not result in significant land or water use impacts.

<u>Alternative EN-1A</u>

The Encinitas receiver site is an approximately 7,800-ft length of existing beach. Under both low and high sea level rise scenarios, the designed additional beach width is 100 ft, increasing beach width to 210 ft (110 ft existing plus 100 ft additional nourishment). A total of approximately 3,200,000 cy of sand would be placed under the low sea level rise scenario and 4,030,000 cy under the high sea level rise scenario (see **Table 3.4-1**). The placement of additional beach material on the existing beach to widen the beach would not result in long-term or permanent conversion of land to other uses.

Summary of Potential Impacts for Alternative EN-1A

Under the low and high sea level rise scenario, there would be no significant land use impacts related to construction and renourishment activities. The overall impact would be short term and less than significant. Existing land uses would be enhanced with the anticipated protection of the bluff and resultant reduction in loss of property. The proposed project would not result in long-term or permanent conversion of land to other uses; result in long-term or permanent conflicts with adjacent land or water uses; nor conflict with existing or known future LUPs or policies. Therefore, construction and maintenance would not result in significant impacts to land use under the low and high sea level rise scenario.

Mitigation Measures for Alternatives EN-1A

No mitigation would be required as no significant impacts have been identified.

Alternative EN-1B

Alternative EN-1B would be similar to Alternative EN-1A construction activities except the volume of beach fill material is reduced. The footprint would be also reduced to reduce or minimize potential environmental impacts.

Under both low and high sea level rise scenarios, the designed additional beach width is 100 ft, increasing beach width to 210 ft. A total of approximately 2,320,000 cy of sand would be placed under the low sea level rise scenario and 3,150,000 cy under the high sea level rise scenario (see **Table 3.4-5**). Under both scenarios, the sand placement would occur along the entire 7,800-ft receiver site. The placement of additional beach material on the existing beach to widen the beach would not result in long-term or permanent conversion of land to other uses.

Summary of Potential Impacts for Alternative EN-1B

Under low and high sea level rise scenarios, there would be no significant land use impacts related to construction and renourishment activities. The overall impact would be short term and less than significant. Existing land uses would be enhanced with the anticipated protection of the bluff and resultant reduction in loss of property. The proposed project would not result in long-term or permanent conversion of land to other uses; result in long-term or permanent conflicts with adjacent land or water uses; nor conflict with existing or known future LUPs or policies. Therefore, construction and maintenance would not result in significant impacts to land use under low and high sea level rise scenarios.

Mitigation Measures for Alternatives EN-1B

No mitigation would be required as no significant impacts have been identified.

Alternative EN-2A

In addition to the beach nourishment activities as described in Alternative EN-1A, Alternative EN-2A includes filling of bluff notches as the design for protection of the shoreline.

Under both low and high sea level rise scenarios, the designed additional beach width is 100 ft, increasing beach width to 210 ft, along the entire 7,800-ft receiver site. A total of approximately 3,090,000 cy of sand and 4,244 cy of notch fill material would be placed under the low sea level rise scenario and 3,900,000 cy of sand and 4,244 cy of notch fill material under the high sea level rise scenario (see **Table 3.4-9**). In addition, under both scenarios, length notch fill would be 6,356 ft and height would be 3 ft (low sea level rise) to 6 ft (high sea level rise). The placement of additional beach material on the existing beach to widen the beach, and completion of notch filling would not result in long-term or permanent conversion of land to other uses.

Summary of Potential Impacts for Alternative EN-2A

Under low and high sea level rise scenarios, there would be no significant land use impacts related to construction and renourishment activities. Construction of notch fill would not have any significant impacts to land use as well. The overall impact would be short term and less than significant. Existing land uses would be enhanced with the anticipated protection of the bluff and resultant reduction in loss of property. The proposed project would not result in long-term or permanent conversion of land to other uses; result in long-term or permanent conflicts with adjacent land or water uses; nor conflict with existing or known future LUPs or policies. Therefore, construction and maintenance would not result in significant impacts to land use under low and high sea level rise scenarios.

Mitigation Measures for Alternatives EN-2A

No mitigation would be required as no significant impacts have been identified.

<u>Alternative EN-2B</u>

Alternative EN-2B is similar to Alternative EN-2A with notch fills but with a reduced volume of sand dredged and placed on the receiver site, also reducing the footprint in an effort to further minimize potential environmental impacts.

Under both low and high sea level rise scenarios, the designed additional beach width is 50 ft, increasing beach width to 160 ft. A total of approximately 2,320,000 cy of sand and 4,244 cy of notch fill material would be placed under the low sea level rise scenario and 3,150,000 cy of sand and 4,244 cy of notch fill material under the high sea level rise scenario (see **Table 3.4-13**). In addition, under both scenarios, length of notch fill would be 6,356 ft and height would be 3 ft (low sea level rise) to 6 ft (high sea level rise).

Summary of Potential Impacts for Alternative EN-2B

Under low and high sea level rise scenarios, there would be no significant land use impacts related to construction and renourishment activities. Construction of notch fill would not have any significant impacts to land use as well. The overall impact would be short term and less than significant. Existing land uses would be enhanced with the anticipated protection of the bluff and resultant reduction in loss of property. The proposed project would not result in long-term or permanent conversion of land to other uses; result in long-term or permanent conflicts with adjacent land or water uses; nor conflict with existing or known future LUPs or policies. Therefore, construction and maintenance would not result in significant impacts to land use under low and high sea level rise scenarios.

Mitigation Measures for Alternatives EN-2B

No mitigation would be required as no significant impacts have been identified.

5.11.3 Solana Beach

Under Alternative SB-1A, the beach nourishment activities would occur on a 24-hour, 7-day a week (24/7) basis, by operating three shifts per day. Movement of material across the beach would only occur during the day (12 hours), while dredging and placement operations would be

24/7. Sand discharge would be continuous as long as the dredge is operating. At the proposed receiver site, construction activities are expected to occur throughout the calendar year. Construction activity would progress through the receiver sites during the construction period.

Borrow Sites

Dredging would not affect land uses because it would occur at up to three designated offshore borrow sites, SO-5, SO-6, and MB-1. Uses in the vicinity of borrow sites include, recreational uses, kelp harvesting, and fishing. Kelp harvesting operations would not be affected because borrow locations have been specifically sited to avoid these resources. For information on impacts to kelp, refer to Section 5.4 (Biological Resources). Impacts to commercial fishing are discussed in Section 5.9 (Socioeconomics), which identifies that the borrow sites are not of higher value for fisheries than adjacent areas and dredging would not impact commercial fishing operations.

Recreation activities such as whale watching and boating would not be substantially adversely affected near any of the proposed borrow sites. While some access restrictions would be in place during active dredging, these would be localized to the specific borrow sites, temporary, and would not preclude boating in other offshore areas. The San Diego-La Jolla Underwater Park is located approximately 4 miles south of SO-6 and 2 miles south of borrow site SO-5. Due to the short-term nature of dredging and distance from the San Diego-La Jolla Underwater Park, no significant long-term impacts to the features within the lease area are anticipated. No other land use impacts would occur under the Alternatives.

On January 1, 2012, California State legislation went into effect establishing several dozen additional marine life protection and conservations areas. More specifically the Marine Life Protection Act (MLPA) created conservation based goals and guidelines for an area along the Encinitas coastline now identified as the Swami's State Marine Conservation Area (SMCA) which includes borrow site SO-6. Regulations specific to the recently created SMCAs include an exception to specifically allow sand replenishment and sediment management activities for projects such as this. Given the previous monitoring of these type of projects, the further fine tuning of this project and the specific exception for these types of projects, no significant impacts or conflicts would result from implementation of this alternative.

Therefore, the dredging operations would not result in long-term or permanent conflicts with adjacent water uses.

Receiver Sites

The Solana Beach receiver site is an approximately 7,200-ft length of existing beach. Under the low sea level rise scenario, the designed additional beach width is 200 ft, increasing beach width to 270 ft. Under the high sea level rise scenario, the designed additional beach width is 300 ft, increasing beach width to 370 ft. A total of approximately 2,210,000 cy of sand would be placed under the low sea level rise scenario and 4,040,000 cy under the high sea level rise scenario (see **Table 3.4-17**). The placement of additional beach material on the existing beach to widen the beach would not result in long-term or permanent conversion of land to other uses.

As described in Section 4.12, City of Solana Beach identifies goals and polices regarding shoreline protection in Chapter 17.62 of the Municipal Code. In addition, the City of Solana Beach's LCP LUP was approved by CCC with suggested modifications on March 7, 2012 (CCC

2012). Chapter 4, section 2 of the LCP includes land use provisions, consistent with the California Coastal Act, that identify primary objectives including:

> "*Reducing the potential adverse effects of shoreline hazards include implementing a comprehensive and long-tem shoreline management strategies, policies and programs that promotes beach sand replenishment and retention and reduces the need for shoreline protection devices*".

Nourishment is clearly identified as an acceptable response for shoreline protection. As discussed in Section 5.8 Noise, because temporary nourishment activities would continue through the nighttime, a noise variance shall be obtained from the City of Solana Beach under Section 7.34.240 of the City Municipal Code would be necessary. Therefore, implementation of the project would not conflict with existing or known future LUPs or policies. Other potential impacts to recreational use and commercial fishing use of the waters near the receiver sites are discussed in sections 5.4 Biological Resources and 5.9 Socioeconomics respectively. Implementation would not result in long-term or permanent conflicts with adjacent water uses because of the temporary nature of the nourishment activities and because the long-term conditions (i.e. beach profile) would be consistent with historical conditions, as discussed further in Section 5.2 Oceanographic and Coastal Processes.

To ensure public safety during the use of heavy equipment on the beach, nourishment operations would require that portions of each receiver site and offshore area be closed temporarily to the public during construction. As described in Section 5.10, approximately 200 ft of the receiver site would be inaccessible to the public around the discharge pipeline and berms. In addition, there would be intermittent restrictions on public access for approximately 540 ft (under low sea level rise scenario) and 350 ft (under high sea level rise scenario) on either side of this discharge zone. This space would be needed for maneuvering heavy equipment during construction of the temporary berms and for relocating discharge pipelines. Major local recreational beach activity events would be avoided by coordinating scheduling with USACE and contractors. However, it should be noted that the total extent of beach within receiver sites would not be closed for the entire duration of construction. Closure areas would shift as nourishment activities move along the shoreline, and temporary beach closures would be limited to short lengths of beach in which active construction is occurring. The cumulative length of closure would vary by receiver site; greater volumes of sand would require longer periods of restricted access. Access restrictions would result in a temporary redistribution of beach activities to surrounding portions of the beach and neighboring beaches.

Once sand has been placed in the active construction zone, closure fencing would be shifted down the widened beach would be immediately open for public use. Pipeline segments remaining in open portions of the beach would be covered at consistent intervals to facilitate access across the beach. Horizontal access along the back beach or adjacent public corridors would be maintained to either side of the active sand placement area. When sand placement must extend to the back beach and no alternative horizontal access exists (e.g., where a wet beach directly abuts bluffs), horizontal access would be temporarily restricted. Closures along the back of the beach would be limited to the extent practicable during daytime hours. These beaches do not contain a large dry beach and are characterized by wet sand beaches. Therefore, sand placement along the footprint would immediately enhance the ability of the public to use the beaches for recreational uses.

Construction would be year round and the potential effect to beach users would be greatest during summer periods of high activity Access restriction would be a temporary localized effect and would not result in a permanent significant condition. Conversely, without beach replenishment, beach use could decline as beaches continue to deteriorate (i.e., erode). A long-term, beneficial impact would result from the increased sand and wider span of beach area, increasing the amount of usable recreation area, as well as safeguarding the bluff face and access stairways, increasing public safety, and thus, safeguarding the bluff top land uses. Therefore, implementation of Alternative SB-1A would not result in long-term or permanent conflicts with adjacent land or water uses.

Renourishment construction activities would be similar to initial placement construction activities. The only difference would be shorter duration of construction activities. Therefore, implementation of Alternative SB-1A would not result in significant land or water use impacts.

Alternative SB-1A

Summary of Potential Impacts for Alternative SB-1A

Under low and high sea level rise scenarios, there would be no significant land use impacts related to construction and renourishment activities. The overall impact would be short term and less than significant. Existing land uses would be enhanced with the anticipated protection of the bluff and resultant reduction in loss of property. The proposed project would not result in long-term or permanent conversion of land to other uses; result in long-term or permanent conflicts with adjacent land or water uses; nor conflict with existing or known future LUPs or policies. Therefore, construction and maintenance would not result in significant impacts to land use under low and high sea level rise scenarios.

Mitigation Measures for Alternatives SB-1A

No mitigation would be required as no significant impacts have been identified.

Alternative SB-1B

Alternative SB-1B would be similar to Alternative SB-1A construction activities except the volume of beach fill material is reduced. The footprint would be also reduced to reduce or minimize potential environmental impacts.

Under both low and high sea level rise scenarios, the designed additional beach width is 200 ft, increasing beach width to 270 ft, along the entire 7,200-ft receiver site. A total of approximately 1,870,000 cy of sand would be placed under the low sea level rise scenario and 2,630,000 cy under the high sea level rise scenario (see **Table 3.4-21)**. The placement of additional beach material on the existing beach to widen the beach would not result in long-term or permanent conversion of land to other uses.

Summary of Potential Impacts for Alternative SB-1B

Under low and high sea level rise scenarios, there would be no significant land use impacts related to construction and renourishment activities. The overall impact would be short term and less than significant. Existing land uses would be enhanced with the anticipated protection of the bluff and resultant reduction in loss of property. The proposed project would not result in long-term or permanent conversion of land to other uses; result in long-term or permanent conflicts with adjacent land or water uses; nor conflict with existing or known future LUPs or policies. Therefore, construction and maintenance would not result in significant impacts to land use under low and high sea level rise scenarios.

Mitigation Measures for Alternatives SB-1B

No mitigation would be required as no significant impacts have been identified.

Alternative SB-1C

Alternative SB-1C, which only applies to Solana Beach, would be similar to Alternatives SB-1A and SB-1B construction activities except the volume of beach fill material is reduced.

Under both low and high sea level rise scenarios, the designed additional beach width is 100 ft, increasing beach width to 170 ft, along the entire 7,200-ft receiver site. A total of approximately 1,470,000 cy of sand would be placed under the low sea level rise scenario and 2,230,000 cy under the high sea level rise scenario (see **Table 3.4-25).** The placement of additional beach material on the existing beach to widen the beach would not result in long-term or permanent conversion of land to other uses.

Summary of Potential Impacts for Alternative SB-1C

Under low and high sea level rise scenarios, there would be no significant land use impacts related to construction and renourishment activities. The overall impact would be short term and less than significant. Existing land uses would be enhanced with the anticipated protection of the bluff and resultant reduction in loss of property. The proposed project would not result in long-term or permanent conversion of land to other uses; result in long-term or permanent conflicts with adjacent land or water uses; nor conflict with existing or known future LUPs or policies. Therefore, construction and maintenance would not result in significant impacts to land use under low and high sea level rise scenarios.

Mitigation Measures for Alternative SB-1C

No mitigation would be required as no significant impacts have been identified.

Alternative SB-2A

In addition to the beach nourishment activities as described in Alternatives EN-1A and SB-1A, Alternatives EN-2A and SB-2A include filling of bluff notches as the design for protection of the shoreline. The construction activities would be allowed to proceed 24/7 but can only occur approximately 2 weeks per month and 6 hours per day due to tides.

Under both low and high sea level rise scenarios, the designed additional beach width is 150 ft, increasing beach width to 220 ft, along the entire 7,200-ft receiver site. A total of approximately 1,870,000 cy of sand and 3,558 cy of notch fill material would be placed under the low sea level rise scenario and 2,630,000 cy and 3,558 cy of notch fill material under the high sea level rise scenario (see **Table 3.4-29**). In addition, under both scenarios, the length notch fill would be 5,336 ft and the height would be 3 ft (low sea level rise) to 6 ft (high sea level rise). The placement of additional beach material on the existing beach to widen the beach and notch fills of existing bluffs would not result in long-term or permanent conversion of land to other uses.

Summary of Potential Impacts for Alternative SB-2A

Under low and high sea level rise scenarios, there would be no significant land use impacts related to construction and renourishment activities. Construction of notch fill would not have any significant impacts to land use as well. The overall impact would be short term and less than significant. Existing land uses would be enhanced with the anticipated protection of the bluff and resultant reduction in loss of property. The proposed project would not result in long-term or permanent conversion of land to other uses; result in long-term or permanent conflicts with adjacent land or water uses; nor conflict with existing or known future LUPs or policies. Therefore, construction and maintenance would not result in significant impacts to land use under low and high sea level rise scenarios.

Mitigation Measures for Alternative SB-2A

No mitigation would be required as no significant impacts have been identified.

<u>Alternative SB-2B</u>

Alternative SB-2B is similar to Alternative SB-2A with notch fills but with a reduced volume of sand dredged and placed on the receiver site, also reducing the footprint in an effort to further minimize potential environmental impacts.

Under both low and high sea level rise scenarios, the designed additional beach width is 100 ft, increasing beach width to 170 ft, along the entire 7,200-ft receiver site. A total of approximately 1,470,000 cy of sand and 3,558 cy of notch fill material would be placed under the low sea level rise scenario and 2,230,000 cy and 3,558 cy of notch fill material under the high sea level rise scenario (see **Table 3.4-33**). In addition, under both scenarios, length of notch fill would be 5,336 ft and height would be 3 ft (low sea level rise) to 6 ft (high sea level rise), respectively. The placement of additional beach material on the existing beach to widen the beach and notch fills of existing bluffs would not result in long-term or permanent conversion of land to other uses.

Summary of Potential Impacts for Alternative SB-2B

Under low and high sea level rise scenarios, there would be no significant land use impacts related to construction and renourishment activities. Construction of notch fill would not have any significant impacts to land use as well. The overall impact would be short term and less than significant. Existing land uses would be enhanced with the anticipated protection of the bluff and resultant reduction in loss of property. The proposed project would not result in long-term or permanent conversion of land to other uses; result in long-term or permanent conflicts with adjacent land or water uses; nor conflict with existing or known future LUPs or policies. Therefore, construction and maintenance would not result in significant impacts to land use under low and high sea level rise scenarios.

Mitigation Measures for Alternative SB-2B

No mitigation would be required as no significant impacts have been identified.

5.11.4 No Action Alternative

No dredging or beach replenishment activities would occur under the No Action Alternative. Under the No Action Alternative, continued beach loss and bluff erosion could result in danger to or damage of homes, commercial buildings, and recreational facilities (parks, coastal access) in the study area. Residential homes could be abandoned because of imminent danger from bluff erosion. Therefore, there would be a loss of land and recreation area under this alternative as a result of bluff collapses and beach erosion. No recreational beach area would be created and this alternative would not fulfill the goals and policies of the general plans and LCPs, as described in Section 4.12, nor would this alternate satisfy the project purpose and need. The rate of erosion and continued beach loss would occur at a faster pace in the high sea level rise compared to the low sea level rise scenario.

Land uses in the study area are expected to change over the next 50 years based on SANDAG's 2050 Cities/County Forecast. In general, open areas are expected to decrease and residential and commercial development is expected to increase (

Table 5.11-1**).**

City of Encinitas

The City of Encinitas is largely built out, with remaining native habitat areas restricted primarily to coastal lagoons and upland habitats along its periphery (City of Encinitas 2001). According to SANDAG's 2010 Population and Housing Estimates, the City has approximately 24,877 dwelling units supporting an estimated population of 65,171 persons (SANDAG 2010a). According to recent SANDAG demographic data, the City of Encinitas is projected to have a population of 76,675 and 28,484 housing units by 2050 (SANDAG 2011b). Planned (1995) land uses in Encinitas are dominated by residential uses, public facilities, and parks and open space.

Table 5.11-1 below provides projected land uses for the City from SANDAG's 2050 Regional Growth Forecast.

Table 5.11-1 Recent and future projected land use within the City of Encinitas

Land Use	2008 (Acres)	2050 (Acres)	Percent Change[1]
Developed Acres	11,651	12,488	7%
Low Density Single Family	1,435	1,853	29%
Single Family	3,871	4,387	13%
Multiple Family	172	215	25%
Mobile Homes	64	64	0%
Other Residential	36	36	0%
Mixed Use	0	68	--
Industrial	73	76	3%
Commercial/Services	737	775	5%
Office	67	75	12%
Schools	208	233	12%
Roads and Freeways	1,786	1,786	0%
Agricultural Extractive[2]	431	93	-79%
Parks and Military Use	2,771	2,828	2%
Vacant Developable Acres	871	35	-96%
Low Density Single Family	337	23	-93%
Single Family	339	5	-99%
Multiple Family	13	0	-100%
Mixed Use	8	0	-100%
Industrial	0	0	0%
Commercial/Services	82	0	-100%
Office	9	0	-100%
Schools	25	0	-100%
Parks and Other	51	0	-100%
Future Roads and Freeways	7	7	0%
Constrained Acres	6	6	0%

[1] Percentage based upon SANDAG total acres of 12,529 – percentages may not total 100% due to rounding.

[2] This is not a forecast of agricultural land, because the 2050 Regional Growth Forecast does not account for land that may become agricultural in the future; also, some types of development that occurs on agricultural land, such as low density single family residential, may allow for the continuation of existing agricultural use.

Source: SANDAG 2011b

<u>City of Solana Beach</u>

The City of Solana Beach has been developed extensively. Therefore, future development would consist of recycling currently developed properties and infill development of the few remaining vacant properties. Most of this type of future development is expected to occur west of I-5 (City of Solana Beach 2001). The limited vacant land availability would be a factor in limiting the amount of population growth in Solana Beach, which is expected to increase by 19 percent by the year 2050 (SANDAG 2011d). According to SANDAG's 2010 Population and Housing Estimates, the City has approximately 6,521 dwelling units supporting an estimated population of 13,783 persons (SANDAG 2010b). Projected changes in land uses by the year 2050 within the City of Solana Beach are shown below in

.

Table 5.11-2 Recent and future projected land use within the City of Solana Beach

Land Use	2008 (Acres)	2050 (Acres)	Percent Change[1]
Developed Acres	2,146	2,182	2%
Low Density Single Family	0	0	0%
Single Family	1,023	1,041	2%
Multiple Family	140	142	1%
Mobile Homes	1	0	-100%
Other Residential	0	0	0%
Mixed Use	0	32	--
Industrial	42	31	-27%
Commercial/Services	289	286	-1%
Office	40	41	2%
Schools	66	66	0%
Roads and Freeways	429	429	0%
Agricultural Extractive[2]	0	0	0%
Parks and Military Use	116	116	-1%
Vacant Developable Acres	37	0	-99%
Low Density Single Family	0	0	0%
Single Family	25	0	-99%
Multiple Family	2	0	-100%
Mixed Use	1	0	-100%
Industrial	0	0	0%
Commercial/Services	4	0	-100%
Office	5	0	-100%
Schools	0	0	0%
Parks and Other	0	0	0%
Future Roads and Freeways	0	0	0%
Constrained Acres	0	0	0%

[1] Percentage based upon SANDAG total acres of 2,183 – percentages may not total 100% due to rounding.

[2] This is not a forecast of agricultural land, because the 2050 Regional Growth Forecast does not account for land that may become agricultural in the future; also, some types of development that occurs on agricultural land, such as low density single family residential, may allow for the continuation of existing agricultural use.

Source: SANDAG 2011d

5.11.5 Potential Effects of Mitigation Reef

The temporary construction activities (maximum of 34 days) and maintenance of the mitigation reef would not result in long-term or permanent conversion of land to other uses. In addition, as it would be offshore outside the surfzone and at a depth beyond which boating concerns would arise, construction of the mitigation reef would not result in long-term or permanent conflicts with adjacent land or water uses. The mitigation reef would increase rock reef habitat as a benefit to the submerged coastal environment. Therefore, it would not conflict with the City of Solana Beach's LCP LUP. No significant adverse impacts to land use would result from implementation of the mitigation reef.

5.12 <u>Recreation</u>

This section addresses the potential impacts of the project alternatives to recreational experiences within the vicinity of the project.

5.12.1 Impact Significance Criteria

A recreation impact would be significant if the project resulted in:

- Substantial loss or interference with recreational uses during construction;
- Long term loss of recreational opportunities or long-term conflicts with recreational use; and/or
- Preclude the viability of existing or planned land or water activities (including surfing).

5.12.2 Encinitas

The beach nourishment activities could potentially occur over a 24/7 period with continuous sand discharge and grading as long as the dredge is operating. Both receiver sites provide recreational activities as presented in Subsection 4.13 including a variety of beach activities, some with adjacent park areas atop the bluff, as well as surf zone activities including surfing, windsailing, and shore fishing.

<u>Borrow Sites</u>

At proposed borrow sites, fishing, whale watching and other recreational activities would not be expected to be significantly affected by the proposed dredging activities. Borrow locations have been specifically sited to avoid resources such as kelp harvesting. While some access restrictions would be in place during dredging, these would be localized to the specific borrow sites and would not preclude boating in other offshore areas. Boaters would be restricted from areas directly in the vicinity of dredge sites and pipelines, but this would be a short-term effect to localized areas.

The San Diego-La Jolla Underwater Park is located approximately 2 mi south of SO-5 and 4 mi south of SO-6. Due to the short-term nature of dredging and distance from the San Diego-La Jolla Underwater Park, no impacts to the park would result. Dredging operations at MB-1 would only be necessary in the final renourishment cycle under the high sea level rise scenario. The dredging operations at MB-1 would restrict recreational users (boaters) in the immediate vicinity but would not interfere with boating channels or boaters' ability to access and enjoy the surrounding area and Mission Bay. Therefore, there would not be a significant loss or interference with recreational uses in the short-term or long term as a result of dredging activities.

<u>Receiver Sites</u>

A temporary loss or interference with recreational uses during construction would occur, under both low and high sea level rise scenarios. Over the long-term, the increased sand and wider span of beach area, would increase the amount of usable recreation area, as well as increase protection of the bluff face and access stairways.

<u>Water Activities</u>

Water activities including surfing could potentially be impacted by any of the following: modification of existing sandbars and reefs by sand placement and deposition, access being temporarily denied during construction, poor water quality caused either by turbidity generated during and after construction of the beach fill, or presently unanticipated contaminants being released into the surf zone by the fill material.

Surfing Change Analysis

Surfing is an important recreational activity for beaches in north San Diego County. A set of analyses were performed to ascertain the likely changes to surfing resulting from the Project. For the surf sites within the study area each of the following topics were addressed:

- Waves that reflect off the shore back to sea are known to surfers as backwash. The effect is most commonly known for making catching and riding waves more difficult. Changes in backwash were estimated from three different possible sources: 1) increased beach slopes from constructed beach fills, 2) increased surf zone slope from increased D_{50}, and 3) bluff reflection with sea level rise. The Project is expected to result in an overall improvement (decrease) in the amount of backwash.

- Wave breaking intensity is an indicator of how hollow the breaking wave is, with mushy waves having low intensity and hollow waves having high intensity. The breaking intensity is primarily determined by the seabed slope, which for beach breaks can change with D_{50}. If the nourishments result in no change to D_{50}, no change in wave breaking intensity is expected. However, if an increase in D_{50} is expected within the littoral zone, the breaking intensity is expected to increase slightly throughout the study area.

- Each reef break within the study area was analyzed with respect to Project induced changes in sedimentation. If a beach fill alternative fills in the low areas around a naturally high relief reef, this can change the way the wave breaks over the reef. A silted in reef can make a reef break behave more like a beach break, with lower breaking intensities, shorter ride lengths, lower peel angles, and more closed out conditions. For the beach nourishment options and sea level rise scenarios, changes are likely at some of the reefs.

- Nearshore currents in and around surf sites change the way surfers access the sites and change the way the waves break. Nearshore currents in the study area generally tend to be amorphous, constantly changing with wave, wind, and tide conditions, except near lagoon mouths where they are slightly more predictable. The beach fills are not expected to change these nearshore currents in any detectable amount.

- In addition to changes in wave quality, the location and frequency of these breaking waves is also important. The beach fill alternatives are expected to move the entire surf zone sea bed profile seaward, thus shifting the location of breaking waves seaward an associated distance. The beach fills are not expected to change the wave breaking frequency in any detectable amount.

Analysis and Results

The method for each type of analysis and results of that analysis are detailed in **Appendix B Seciton 11.4**. Analyses and discussion were performed for:

- Backwash changes,
- Breaking intensity for beach breaks,
- Sedimentation changes to reef breaks,
- Currents at surf sites, and
- Changes to surf break location and surfing frequency.

In general, the wider the beach nourishment option, and the greater the assumed sea level rise scenario, the more likely the alternative will have a measurable change on the reef break. Through this analysis, it was found that reef changes are equal between alternatives. Thus, the narrative descriptions below are applicable to reef changes for all Project alternative listed in **Appendix B Table 11.4-6.**

Grandview

Grandview is a typical reef-beach break in which the surf site is a nearshore beach break most of the time, and either breaks over the reef or focuses waves over an offshore reef during larger swell. Most of the beach break surfing at Grandview takes place from 300 to 800 feet from shore, in water depth shallower than 10 feet below MLLW. Profile SD-700 runs directly through Grandview. The year two, Project induced net change in profile volume under all alternatives analyzed are less than the profile volume standard deviation, so Project induced changes to surfing at this reef are not likely.

Beacons

North Beacons, Bamboos, and South Beacons have reefs that break on larger swells. The surf sites are not as clearly defined as a pure reef breaks since they are generally low relief reefs. Peaks are shifty, similar to a beach breaks, but there may be some reef focusing effect from the subtle variation in bottom contours. Therefore, these are characterized as reef-beach breaks. Bottom contours are generally parallel to shore, but a reef can seen beginning approximately 600 feet from shore and extending to deeper water**.** Most of the surfing takes place at Beacons from 300 to 700 feet from the profile origin. Larger swell can break in 15 feet of water, 1000 feet from shore. The nearest profile to North Beacons is SD-680. The year two, Project induced net change in profile volume under all alternatives analyzed are less than the profile volume standard deviation, so Project induced changes to surfing at this reef are not likely.

Stone Steps

There are conflicting reports on whether Stone Steps is a reef or beach break. WannaSurf.com and Surf-Forecast.com state that it is beach break, but with specific break locations during large swells. It is likely that this is a typical reef-beach break with rights and lefts. From the bathymetric contours it seems that whatever reef does exist is low relief. The surf site is not as clearly defined as a classical reef break since it is generally low relief. Peaks are more shifty, similar to a beach break, but there may be some reef focusing effect from the subtle variation in bottom contours. Bottom contours are mostly straight and parallel. The nearest profile is SD-675.

The total profile volume is greater than the profile volume standard deviation, so measurable Project induced changes to surfing at this reef are likely. Thus, this surf site would be expected to behave more like a beach break under the alternatives analyzed. As reefs change to more like beach breaks, the reef effect is expected to be reduced as it becomes buried by sand. For beginning surfers, who generally go straight towards shore and do not take advantage of the peeling breakers along reefs, there would be very little change to their surfing experience at Stone Steps. For other surfers, the change would likely result in reduced peel angles, more closeouts, reduced section lengths, shorter rides, and reduced surfability.

Trees

Trees is generally described as a reef break. The year two, Project induced net change in profile volume under all alternatives analyzed are less than the profile volume standard deviation, so Project induced changes to surfing at this reef are not likely.

Swamis and Boneyards

Swamis is the premier surf site within the project domain. The wave peels right over a bedrock reef for up to ¼ mile during large swell. The outside reef is known as Boneyards and only breaks during the largest west swells. During smaller days, a few lefts can be found. The breaking intensity is normally semi-hollow but can be mushy during south swells and during higher tides (Cleary and Stern, 1998). Since this is a well defined reef break, with waves breaking near the same location with regularity, it is possible to determine the peel angle and ride length. An analysis of four aerial photographs spanning 2003 through 2009 revealed peel angles ranging from 52 to 65 degrees with the median being 53 degrees and ride lengths from 170 to 980 feet. The peel line and wave crests for a long period west swell occurring on January 3, 2006. Surfers can be seen floating just to the south and west of the whitewash. Typical of shallow areas with broken waves, the LiDAR measured elevation contours reveal no data over the reef and in the surf zone, so detailed wave transformation is not possible here. The deep water wave energy polar spectral plot is provided by CDIP (2011) at the 100 Torrey Pines gage for the condition shown in the figure. The year two, Project induced net change in profile volume under all alternatives analyzed are less than the profile volume standard deviation, so Project induced changes to surfing at this reef are not likely.

Pipes, Traps, and Turtles

Pipes is mostly a reef break while Traps and Turtles are more reef-beach breaks. The bathymetric contours show some reef like features at these sites. The year two, Project induced net change in profile volume under all alternatives analyzed are less than the profile volume standard deviation, so Project induced changes to surfing at these reefs are not likely.

85/60s, Tippers, and Campgrounds

85/60s, Tippers, and Campgrounds are typical North County reef-beach breaks and are best represented by profile SD-630. The bathymetric contours for these surf sites shows mainly low relief reefs. The year two, Project induced net change in profile volume under all alternatives analyzed are less than the profile volume standard deviation, so Project induced changes to surfing at these reefs are not likely.

Suckouts through Pallies

Suckouts, Seaside Reef, Cardiff Reef, and Pallies are all reef breaks and are best represented by profil**e SD-630.** The reefs extend approximately 300 to 1000 feet from the back beach and surfing takes place approximately in this range as well. The year two, Project induced net change in profile volume under all alternatives analyzed are less than the profile volume standard deviation, so Project induced changes to surfing at these reefs are not likely.

Table Tops

Table Tops is a hollow right reef break and is best represented by profile SD-610. The total profile volume is greater than the profile volume standard deviation, so measurable reef changes are likely. If this surf site were measurably changed to more like a reef-beach break, it is expected that the reef exposure above the sandy bottom would become less pronounced and the break would become somewhat less hollow, with lower breaker intensities. This could be considered an improvement for intermediate surfers, but would likely be a detriment to more advanced surfers. If the sand thickness were further increased, the reef could become completely buried, changing the surf site to a beach break. If this were to occur, the rather unique albeit fickle nature of this surf site would be lost, changing it to yet another beach break. Since this is currently an advanced surf site and it is far from shore, beginning surfers are not likely to attempt this surf site and would not experience any change to their surfing experience. For other surfers however this would likely result in more closeouts, shorter rides, and reduced surfability.

Pillbox & Southside

Pillbox is a right-peeling reef-beach break and the surf spot called Southside is a left-peeling reef-beach break. These surf sites are best represented by profile SD-600. The total profile volume is greater than the profile volume standard deviation, so measurable reef changes are likely. With the added sand these two surf sites would become more like beach breaks, reducing their reef tendencies. Beginning surfers would not likely experience any change to their surfing experience, but for other surfers this would result in more closeouts, shorter rides, and less surfability.

15th Street

The surf site at 15th Street is a combination reef-beach break best represented by profile DM-560. The year two, Project induced net change in profile volume under all alternatives analyzed are less than the profile volume standard deviation, so Project induced changes to surfing at this reef are not likely.

Currents at Surf Sites

Ocean currents can change surfing by changing a surfer's ability to line up for and catch a wave and by changing the way waves break. The most frequent currents around these North County surf sites are rip currents and ebb and flood tidal currents associated with the various lagoon mouths. Some currents can also be expected near high relief reefs. All of these currents are expected to be highly variable, changing with swell, tide, and wind conditions.

As beaches widen with the Project alternatives, the break point of the surf sites are expected to move proportional distances seaward, bringing with them the various currents that exist under normal without Project conditions. These currents are not expected to change in magnitude or direction, but only relocate seaward. Therefore, the Project is not expected to measurably change currents or change surfing in any discernible way through changes to currents.

Changes to Surf Break Location and Surfing Frequency

As with ocean currents, the location of the break point of surf sites are expected to move seaward distances that are proportional to the amount of beach widening. For example, if a beach is expected to widen by 100 feet, it can be expected that the beach break fronting that shoreline would move a similar distance seaward, maintaining an unchanged distance between the break point and the shoreline. The primary change to surfing locations is that they would move seaward relative to geographic coordinates, but not change perceptibly relative to the shoreline.

With only minor changes to the surf zone seabed slope, most waves at beach breaks that would have been surfable prior to Project implementation would still likely be surfable under the Project condition. The above described changes to surfing quality can change the frequency of surfability as detailed in **Table 5.12-1**.

Table 5.12-1 Project Induced Changes to Surfing Frequency

Phenomenon	Project Induced Change	Change to Frequency of Surfability
Backwash	Decreased backwash	More frequent
Beach break breaking intensity	Spilling to plunging	Negligible
Sedimentation of Reef breaks	Reef break to beach break	Less frequent

An overall reduction in the amount of backwash (as a result of beach nourishment combined with sea level rise) would likely result in an increase in the frequency in which a site would be surfable over without Project conditions. Changing a surf site from spilling to more plunging is not expected to change the surfing frequency, only the ride and board type. Changing a surf site from a reef break to more of a beach break could reduce the surfing frequency, especially during walled conditions or windy conditions where the only surfable places tend to be reef breaks. Assuming the phenomena listed in **Table 5.12-1** are equally weighted, the overall frequency of surfable waves within the study area are not expected to change significantly as a result of the Project alternatives.

The project could add a relatively large sand volume to the system over a short time frame, thereby modifying existing sandbars and reefs by changing bottom conditions at the receiving beach sites as well as nearby beaches. Addition of sand to a beach break can steepen the nearshore beach profile, which can result in waves that closeout rather than peak on a more shallowly sloped nearshore bar. This impact could be adverse and significant if surfing is precluded by sand deposition causing waves to closeout over a long period of time (months) or result in a perpetual shorebreak at the beach rather than a nearshore bar for waves to break over. Shorebreak or closeout conditions may exist over a temporary short-term period while the sand is naturally redistributed over the bottom. The slight difference in grain size of sand proposed for placement as part of this project and existing beaches is not anticipated to substantially change these processes.

Both placement sites are located in proximity to reefs that may be temporarily impacted by sand. Placement of sand at both receiving beaches could result in sand being transported to nearby reef breaks. Some sediment accumulation is anticipated in reef areas; however, natural transport processes continually move sediments through these reef areas under normal conditions. Additional sand placed as part of the proposed project would not substantially alter sand transport patterns in these areas. Some sand may accumulate in localized portions of existing reefs on a seasonal or short-term basis, which could temporarily affect confined portions of existing reef surf breaks. Appendix B9 of Appendix B presents details regarding the potential changes at surf spots in the vicinity of the receiver sites, summarized in **Table 5.12-2** below. As described there may be short-term changes to the wave characteristics at individual surf breaks, these effects would be temporary as the sand is naturally distributed, and would not preclude the viability of the breaks.

The project may cause potentially beneficial impacts to surfing in some areas by contributing sand to the nearshore that would be deposited in bars throughout the receiving beach cities. More sand in the system provides material for enhanced sandbar formation and may result in larger or longer lasting bars, and improved surfing conditions. Informal qualitative observations regarding changes in surfing conditions after implementation of RBSP I have been offered by various beach users and city representatives. At Beacon's, surfers noted that the reef was temporarily overtopped, modifying surfing conditions for a period (Weldon 2011). Several other locations were noted to have shown improved surfing conditions due to sandbar formation offshore (Gonzalez 2009; Dedina 2010). Permanent impacts would not result from sand placement as bathymetric changes are short term and would ultimately revert to pre-project conditions after a relatively short period. Therefore, implementation of the Alternatives would not preclude the viability of existing or planned land or water activities (including surfing). These potential impacts are discussed below.

1 **Table 5.12-2 Summary of Potential Changes at Surf Breaks in the Vicinity of Encinitas**
2 **and Solana Beach Receiver Sites**

Surf Spot	Existing Type	Potential For Measureable Change	Change Summary
Grandview	Reef-beach break		Any potential changes experienced would be less than the standard deviation for variations at this break.
North Beacons	Reef-beach break	Not Likely	Any potential changes experienced would be less than the standard deviation for variations at this break.
Bamboos	Reef-beach break	Not Likely	Any potential changes experienced would be less than the standard deviation for variations at this break.
South Beacons	Reef-beach break	Not Likely	Any potential changes experienced would be less than the standard deviation for variations at this break.
Stones Steps	Reef-beach break	Likely	Break would become more beach break like with shorter rides and more closeouts. Beginners would not likely experience a change.
Trees	Reef break	Not Likely	Any potential changes experienced would be less than the standard deviation for variations at this break.
Boneyards	Reef break	Not Likely	Any potential changes experienced would be less than the standard deviation for variations at this break.
Swamis	Reef break	Not Likely	Any potential changes experienced would be less than the standard deviation for variations at this break.
Pipes	Reef break	Not Likely	Any potential changes experienced would be less than the standard deviation for variations at this break.
Traps	Reef-beach break	Not Likely	Any potential changes experienced would be less than the standard deviation for variations at this break.
Turtles	Reef-beach break	Not Likely	Any potential changes experienced would be less than the standard deviation for variations at this break.
85/60s	Reef-beach break	Not Likely	Any potential changes experienced would be less than the standard deviation for variations at this break.
Tippers	Reef-beach break	Not Likely	Any potential changes experienced would be less than the standard deviation for variations at this break.
Campgrounds	Reef-beach break	Not Likely	Any potential changes experienced would be less than the standard deviation for variations at this break.
Suckouts	Reef break	Not Likely	Any potential changes experienced would be less than the standard deviation for variations at this break.
Cardiff Reef	Reef break	Not Likely	Any potential changes experienced would be less than the standard deviation for variations at this break.
Seaside Reef	Reef break	Not Likely	Any potential changes experienced would be less than the standard deviation for variations at this break.
Pallies	Reef break	Not Likely	Any potential changes experienced would be less than the standard deviation for variations at this break.
Table Tops	Reef break	Likely	Break would become more reef-beach break like with shorter rides and more closeouts. While predominantly and advanced surfers spot, beginners would not likely experience a change.
Pillbox	Reef-beach break	Likely	Break would become more beach break like with shorter rides and more closeouts. Beginners would not likely experience a change.
South Side	Reef-beach break	Likely	Break would become more beach break like with shorter rides and more closeouts. Beginners would not likely experience a change.

3 Source: Appendix B – Table 11.4-7.
4

Alternative EN-1A

The construction activity at the Encinitas receiver site would continually progress down the beach. Recreational activities such as surfing and fishing, as well as other beach activities would be less accessible during the period of construction. Under both low and high sea level rise scenarios, approximately 150 to 325 ft of the receiver site would be inaccessible to the public around the discharge pipeline and berms. In addition, there would be intermittent restrictions on public access for approximately 540 ft for low sea level rise scenario and 350 ft for high sea level rise scenario on either side of this discharge zone. This space would be needed for maneuvering heavy equipment during construction of the temporary berms and for relocating discharge pipelines. The access restriction would result in a temporary redistribution of beach activities to the adjacent areas, or other portions of this receiver site. However, as the daily construction effort continues to travel down the beach, the public accessibility would also change and only result in temporary construction effects. In addition, if the construction has potential to disrupt any special events/planned activities sponsored by the City of Encinitas Parks Department, YMCA, and private/commercial beach during summer period, a temporary significant recreational impact would result. Therefore, construction would be scheduled around the special events activities; and ample notice would be given to the affected groups. If the affected groups are not able to temporarily move the activities to an adjacent location, then construction would be required to be rescheduled around these special activities. The sections of the receiver site restricted would be relatively small and construction would be managed to accommodate planned activities. Long-term, a beneficial impact would result from the increased sand and wider span of beach area, increasing the amount of usable recreation area, as well as safeguarding the bluff face and stairway.

Construction staging for equipment and crew is proposed at Moonlight Beach, which would result in intermittent placement of heavy equipment and crew parking. Moonlight Beach provides restrooms, showers, snack bar and picnic tables and is popular for surfing, fishing and other uses which would only be impacted during sand replenishment for that portion of the project. Otherwise, those amenities would remain open, even with staging activities. Access to portions of the receiving beaches would be restricted during construction, but this restriction would be short term and temporary, with access restored at completion of the project. The surf zone would not be closed during construction. Surfers would be able to access surfing sites entering the water from either end of the construction area.

Offshore sand sources were tested for chemistry in fall 2009 to verify material was free of contaminants (Moffatt & Nichol 2010a). The sediment testing results were compared to the National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Table (SQUIRT) Guidelines (Buchman 2008). The borrow site materials were found to be acceptable and the materials appropriate for beach nourishment. The consistency determination is pending formal approval by the USEPA and USACE in coordination with the RWQCB. Health threats to surfers and all beach goers would not result from material placed on the beach.

Turbidity would be generated by the project, which could result in temporary impacts to water clarity as discussed in Section 5.3. Turbidity would be monitored during construction in accordance with the project's RWQCB permit. Short-term turbidity would very likely occur during construction but would primarily be a public perception issue and not a health problem. This condition would only last as long as project construction and would return to normal shortly after completion. Therefore, the implementation of Alternative EN-1A would not result in a substantial loss or interference with recreational uses during construction.

The proposed beach fill would increase the width and hence size of the useable beach area, which would be an overall beneficial public benefit and effect and could lead to increased recreational usage of the beach fill sites. Once the receiver sites have been replenished, recreation activities would resume and be enhanced. Therefore, there would not be any long-term loss of recreational opportunities or long-term conflicts with recreational use as a result of implementation of Alternative EN-1A. Long-term, a beneficial impact would result from the increased sand and wider span of beach area, increasing the amount of usable recreation area, as well as safeguarding the bluff face and stairways.

Renourishment construction activities would be similar to initial placement construction activities. The only difference would be shorter duration of construction activities. Therefore, implementation of renourishment, would not result in significant impacts to recreation.

Summary of Potential Impacts for Alternative EN-1A

Beach recreational activities are closely related to beach width. Beach erosion decreases available recreation area. Long-term, a beneficial impact would result from the increased sand and wider span of beach area, increasing the amount of usable recreation area, as well as safeguarding the bluff face and stairways. Therefore, there would not be any long-term loss of recreational opportunities or long-term conflicts with recreational use as a result of implementation of Alternative EN-1A.

The nourishment would result in potential changes to existing water activities including surfing. However, the additional sand would not exceed the historical beach profile conditions and would become part of the natural variable system. Therefore, implementation of the Alternative EN-1A would not preclude the viability of existing or planned land or water activities (including surfing).Therefore, implementation of Alternative EN-1A, would not result in significant impacts to recreation under the low and high sea level rise scenario.

Mitigation Measures for Alternatives EN-1A

No mitigation would be required as no significant impacts have been identified.

<u>Alternative EN-1B</u>

Summary of Potential Impacts for Alternative EN-1B

Impacts to recreation would be very similar to Alternative EN-1A to an incrementally proportional lesser degree given the smaller amount of beach nourishment proposed. Therefore, there would not be any long-term loss of recreational opportunities or long-term conflicts with recreational use as a result of implementation of Alternative EN-1B. Long-term, a beneficial impact would result from the increased sand and wider span of beach area, increasing the amount of usable recreation area, as well as safeguarding the bluff face and stairways.

Implementation of the Alternative EN-1B would not preclude the viability of existing or planned land or water activities (including surfing). Therefore, implementation of Alternative EN-1B, would not result in significant impacts to recreation under the low and high sea level rise scenario.

Mitigation Measures for Alternatives EN-1B

No mitigation would be required as no significant impacts have been identified.

Alternative EN-2A

Summary of Potential Impacts for Alternative EN-2A

Alternative EN-2A includes beach replenishment as described for Alternatives EN-1A plus notch fills which would fill in notches or seacaves at the base of the bluff to stabilize the lower bluff. Impacts to recreation would be very similar to Alternative EN-1A to an incrementally proportional lesser degree given the smaller amount of beach nourishment proposed.

The nourishment would result in potential changes to existing water activities including surfing. However, the additional sand would not exceed the historical beach profile conditions and would become part of the natural variable system. Therefore, implementation of the Alternative EN-2A would not preclude the viability of existing or planned land or water activities (including surfing).Therefore, implementation of Alternative EN-2A, would not result in significant impacts to recreation under the low and high sea level rise scenario.

Mitigation Measures for Alternatives EN-2A

No mitigation would be required as no significant impacts have been identified.

Alternative EN-2B

Summary of Potential Impacts for Alternative EN-2B

Alternative EN-2B includes beach replenishment as described for Alternatives EN-1A, plus notch fills as described for Alternative EN-2A. Construction and maintenance activities of EN-2B would be similar to EN-1B, therefore, the implementation of Alternative EN-2B would not result in a substantial loss or interference with recreational uses during construction.

The nourishment would result in potential changes to existing water activities including surfing. However, the additional sand would not exceed the historical beach profile conditions and would become part of the natural variable system. Implementation of the Alternative EN-2B would not preclude the viability of existing or planned land or water activities (including surfing). Therefore, implementation of Alternative EN-2B, would not result in significant impacts to recreation under the low and high sea level rise scenario.

Mitigation Measures for Alternatives EN-2B

No mitigation would be required as no significant impacts have been identified.

5.12.3 Solana Beach

Borrow Sites

At proposed borrow sites, fishing, whale watching and other recreational activities would not be expected to be significantly affected by the proposed dredging activities. Borrow locations have been specifically sited to avoid resources such as kelp harvesting. While some access restrictions would be in place during dredging, these would be localized to the specific borrow sites and would not preclude boating in other offshore areas. Boaters would be restricted from areas directly in the vicinity of dredge sites and pipelines, but this would be a short-term effect to localized areas.

The San Diego-La Jolla Underwater Park is located approximately 2 miles south of SO-5 and 4 miles south of SO-6. Due to the short-term nature of dredging and distance from the San Diego-La Jolla Underwater Park, no impacts to the park would result. Dredging operations at MB-1 would only be necessary in the final renourishment cycle under the high sea level rise scenario. The dredging operations at MB-1 would restrict recreational users (boaters) in the immediate vicinity but would not interfere with boating channels or boaters' ability to access and enjoy the surrounding area and Mission Bay. Therefore, there would not be a significant loss or interference with recreational uses in the short-term or long term as a result of dredging activities.

<u>Receiver Sites</u>

A temporary loss or interference with recreational uses during construction would occur, under both low and high sea level rise scenarios. Over the long-term, the increased sand and wider span of beach area, would increase the amount of usable recreation area, as well as increase protection of the bluff face and access stairways.

<u>Alternative SB-1A</u>

The practical restriction and associated impacts to recreational uses as presented in Alternative EN-1A would also occur in Alternative SB-1A. Construction staging for equipment and crew is proposed at Fletcher Cove and South Cardiff. The Fletcher Cove amenities of restrooms, showers, picnic tables, basketball and volleyball may be closed periodically during sand nourishment. Access and activities impacted include Table Tops tidepool and Beach park. The existing narrow accessibility of the beach is dependent on tidal stage. Under both low and high sea level rise scenarios, nourishment activities would require daily closure of approximately 200 ft of receiver site. Construction and special events or activities schedules would be coordinated; and ample notice would be given to potentially affected groups. If the affected groups are not able to temporarily move the activities to an adjacent location, then construction would be required to be rescheduled around these special activities. The sections of the receiver site restricted would be relatively small and construction would be managed to accommodate planned activities. Therefore, implementation would not result in substantial loss or interference of recreational activities during construction.

Offshore sand sources were tested for chemistry in fall 2009 to verify material was free of contaminants (Moffatt & Nichol 2010a). The sediment testing results were compared to the National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Table (SQUIRT) Guidelines (Buchman 2008). The borrow site materials were found to be acceptable and the materials appropriate for beach nourishment. The consistency determination is pending formal approval by the USEPA and USACE in coordination with the RWQCB. Health threats to surfers and all beach goers would not result from material placed on the beach.

Turbidity would be generated by the project, which could result in temporary impacts to water clarity as discussed in Section 5.3. Turbidity would be monitored during construction in accordance with the project's RWQCB permit. Short-term turbidity would very likely occur during construction but would primarily be a public perception issue and not a health problem. This condition would only last as long as project construction and would return to normal shortly after completion. Therefore, the implementation of Alternative SB-1A would not result in a substantial loss or interference with recreational uses during construction.

The proposed beach fill would increase the width and hence size of the useable beach area, which would be an overall beneficial public benefit and effect and could lead to increased recreational usage of the beach fill sites. Once the receiver sites have been replenished, recreation activities would resume and be enhanced. Therefore, there would not be any long-term loss of recreational opportunities or long-term conflicts with recreational use as a result of implementation of Alternative SB-1A. Long-term, a beneficial impact would result from the increased sand and wider span of beach area, increasing the amount of usable recreation area, as well as safeguarding the bluff face and stairways.

Renourishment construction activities would be similar to initial placement construction activities. The only difference would be shorter duration of construction activities. Therefore, implementation of renourishment, would not result in significant impacts to recreation.

Summary of Potential Impacts for Alternative SB-1A

Construction and maintenance activities of SB-1A would not result in a substantial loss or interference with recreational uses during construction.

The nourishment would result in potential changes to existing water activities including surfing. However, the additional sand would not exceed the historical beach profile conditions and would become part of the natural variable system. Therefore, implementation of the Alternative SB-1A would not preclude the viability of existing or planned land or water activities (including surfing). Therefore, implementation of Alternative SB-1A, would not result in significant impacts to recreation under the low and high sea level rise scenario.

Mitigation Measures for Alternatives SB-1A

No mitigation would be required as no significant impacts have been identified.

<u>Alternative SB-1B</u>

Summary of Potential Impacts for Alternative SB-1B

Construction and maintenance activities of SB-1B would be similar to SB-1A, therefore, the implementation of Alternative SB-1B would not result in a substantial loss or interference with recreational uses during construction.

The nourishment would result in potential changes to existing water activities including surfing. However, the additional sand would not exceed the historical beach profile conditions and would become part of the natural variable system. Therefore, implementation of the Alternative SB-1B would not preclude the viability of existing or planned land or water activities (including surfing).Therefore, implementation of Alternative SB-1B, would not result in significant impacts to recreation under the low and high sea level rise scenario.

Mitigation Measures for Alternatives SB-1B

No mitigation would be required as no significant impacts have been identified.

<u>Alternative SB-1C</u>

Summary of Potential Impacts for Alternative SB-1C

Construction and maintenance activities of SB-1C would be similar to SB-1A, therefore, the implementation of Alternative SB-1C would not result in a substantial loss or interference with recreational uses during construction.

The nourishment would result in potential changes to existing water activities including surfing. However, the additional sand would not exceed the historical beach profile conditions and would become part of the natural variable system. Therefore, implementation of the Alternative SB-1C would not preclude the viability of existing or planned land or water activities (including surfing). Therefore, implementation of Alternative SB-1C, would not result in significant impacts to recreation under the low and high sea level rise scenario.

Mitigation Measures for Alternative SB-1C

No mitigation would be required, as no significant impacts have been identified.

<u>Alternative SB-2A</u>

Summary of Potential Impacts for Alternative SB-2A

Alternative SB-2A includes beach replenishment as described for Alternatives EN-1A and SB-1A, plus notch fills which would fill in notches or seacaves at the base of the bluff to stabilize the lower bluff. Therefore, the implementation of Alternative SB-2A would not result in a substantial loss or interference with recreational uses during construction.

The nourishment would result in potential changes to existing water activities including surfing. However, the additional sand would not exceed the historical beach profile conditions and would become part of the natural variable system. Implementation of the Alternative SB-2A would not preclude the viability of existing or planned land or water activities (including surfing). Therefore, implementation of Alternative SB-2A, would not result in significant impacts to recreation under the low and high sea level rise scenario.

Mitigation Measures for Alternative SB-2A

No mitigation would be required as no significant impacts have been identified.

<u>Alternative SB-2B</u>

Summary of Potential Impacts for Alternative SB-2B

Construction and maintenance activities of SB-2B would be similar to EN-2B, therefore, the implementation of Alternative SB-2B would not result in a substantial loss or interference with recreational uses during construction.

The nourishment would result in potential changes to existing water activities including surfing. However, the additional sand would not exceed the historical beach profile conditions and would become part of the natural variable system. Implementation of the Alternative SB-2B would not preclude the viability of existing or planned land or water activities (including surfing). Therefore, implementation of Alternative SB-2B, would not result in significant impacts to recreation under the low and high sea level rise scenario.

Mitigation Measures for Alternative SB-2B

No mitigation would be required as no significant impacts have been identified.

5.12.4 No Action Alternative

Under the No Action Alternative, there would be the potential for further loss of recreational uses as beaches continue to erode and coastal bluffs continue to retreat with corresponding individual seawall permit proposals over the next 50 years. Erosion of beaches would limit the amount of space on which beach goers can recreate. In some areas, loss of sand may limit access along the coastline. Beach and bluff erosion pose a threat to park facilities including beach access paths and stairs, parking areas, and other facilities close to the edge of the bluffs. It is probable that under the 50-year without project condition, one or more major storms would result in damage to coastal park facilities, coastal access paths, and/or stairs.

Loss or degradation of recreational opportunities under the No Action Alternative would increase the impacts within the next 50 years as demands for coastal recreation increase. Population growth, combined with a decrease in open space as residential and commercial development increase, means more people would be seeking recreational opportunities in the project area. Therefore, loss of recreational facilities under the No Action Alternative would affect increasing numbers of people. Furthermore, if some parking areas, beach access points, or beaches themselves are lost due to storm damage, the pressure on remaining parking and access areas would increase. The increased pressure on remaining areas would degrade the recreational experience for many, as parking becomes difficult to find and more people are crowded into smaller areas.

A substantial long term loss of recreational opportunities including surfing could result under the No Action Alternative.

5.12.5 Potential Effects of Mitigation Reef

Although construction activities may reduce offshore available area to swimmers and boaters in the short-term (maximum 34 days), it would not cause substantial loss or interference with recreational uses as the recreational opportunities would continue on adjacent areas. In the long term it would result in a benefit with the increase in vegetated reef area, which would increase the opportunities for recreational fishing and experiencing marine life, during diving and swimming. Therefore, there would be no long term loss of recreational opportunities or long-term conflicts with recreational use.

Due to the mitigation reef being located outside of the surfzone and at a depth beyond which boating concerns would arise, construction and maintenance activity would not preclude the viability of existing or planned land or water activities (including surfing). No significant adverse impacts to recreation would result from implementation of the mitigation reef.

5.13 Public Safety

This section evaluates the potential public health and safety effects of the proposed project and alternatives. Potential affects addressed in this section include: public access and safety during project construction, marine safety and lifeguard services, recreational safety, vessel traffic and safety, and potential public health and safety impacts resulting from the formation of beach escarpments (i.e., the seaward cut in the beach berm face caused by wave action).

5.13.1 Impact Significance Criteria

An impact to public health and safety would be considered potentially significant if it would:

- Create a health hazard or potential health hazard;
- Expose people to potential health hazards; and/or
- Create navigation hazards or result in unsafe conditions for vessel traffic.

5.13.2 Encinitas

Borrow Sites

During dredge operations, the potential for a vessel to collide with a dredge or support vessel would be extremely remote as the dredge would be equipped with markings and lights in accordance with established U.S. Coast Guard regulations. The location and operational schedule of the dredge would be published in the U.S. Coast Guard "Local Notice of Mariners" to inform local boaters of the presence and location of the dredge. A hopper dredge would travel at relatively slow speeds (approximately 1.7 knots) during actual dredging operations. The travel speed would also be slow (approximately 5 knots) during the transport of sand from borrow sites (SO-5 and SO-6) to the receiver sites. A cutterhead dredge would be considerably more stationary since the slurried sand would be transported to the beach via a fixed pipeline.

To maintain vessel safety, a 300-ft-radius buffer area would be established around the mono buoy in offshore waters, to allow proper anchoring and pump line operation. To ensure that no vessels would enter this restricted zone, the anchoring area would be included in the "Notice to Mariners". All pump lines used during beach replenishment efforts, including both floating and submerged, would be clearly marked as "navigational hazards". There would be a short-term and localized increase in vessel traffic in the area associated with project construction with a limited distance of travel to set and remove the pump line. Accordingly, there would not be any potentially significant impacts to public safety as a result of implementation of this alternative. Therefore, Alternatives would not create navigation hazards or result in unsafe conditions for vessel traffic.

Borrow sites have been tested for the suitability of the dredge materials to be placed on the receiver beaches. Although not anticipated, the possibility exists that unforeseen wastes and materials could be dredged from the offshore borrow sites from past illegal dumping activities. In the event that hazardous or otherwise dangerous materials are found in the dredge material, dredging and sand placement activities would immediately stop. An evaluation would be made to determine the extent of the contamination and most appropriate treatment of the site.

<u>Receiver Sites</u>

Implementation of the Alternatives is considered to be the preferred local sea level rise adaptation strategy (SLRAS). As sea levels rise, the region faces a multitude of threats from a rising ocean. Preparing for these changes through climate adaptation is necessary to fulfill the public obligation to protect public safety.

During the implementation of Alternatives, active construction zones at the receiver site would be temporarily closed to the public. Closing the area to the public will prevent any potential unsafe conditions for the public associated with the presence and operation of heavy equipment used to move the sand around on the beach. In addition, public access for swimmers, surfers and boaters would be restricted between the offshore activities and the receiver sites, where applicable. This closure would affect both the existing beach and offshore areas between the dredge (and its pipeline) and the receiver site. When all sand has been discharged and spread out on the closed section of the receiver site, the operation would shift along the receiver site to a new section of beach to be replenished. This would continue until the entire receiver site has been replenished.

Potential impacts to public beach access would occur at the point of discharge. Approximately 150 to 325 ft of the receiver site would be inaccessible to the public around the discharge pipeline and berms. In addition, there would be intermittent restrictions on public access for approximately 540 ft for low sea level rise scenario and 350 ft for high sea level rise scenario on either side of the discharge zone. This buffer area would be needed for maneuvering heavy equipment during construction of the temporary berms and for relocating discharge pipelines. As a project design feature, major local recreational beach activities would be avoided by the dredge and beach sand operations to the maximum extent practical.

Additionally, prior to beach replenishment activities, the construction contractor will develop a safety plan and provide all necessary safety measures in the vicinity of the receiver sites, including fencing, barricades, and safety personnel, to ensure public safety is maintained at all times. Fueling and/or maintenance activities would occur at the staging areas away from the beach, and the contractor would be required to prepare a Spill Prevention, Control, and Countermeasure (SPCC) plan for hazardous spill containment. Implementation of Alternatives would result in potential public health and safety benefits by increasing the beach widths which may limit the number of bluff failures affecting the public beach.

Scarps (or escarpments) develop naturally along beach profiles and vary in height due to substantial changes in the beach profile (i.e., drastic drop in elevation). Large scarps may result in safety hazards due to substantial changes in the beach profile (i.e., drastic drop in elevation). Scarp height is a function of the breaking wave height and the elevation of the existing beach berm. Because scarps are a function of beach berm height, placement of fill on the receiver sites would not increase scarp height, provided fill is placed to the height of the existing beach berm (U.S. Navy 1997b). The proposed project is anticipated to place beach fill above the height of the existing beach berm as the beaches are assumed to be largely devoid of sand at the time that the project commences. Therefore, potential safety impacts due to increased scarp heights may occur. As a project design feature, the Marine Safety departments in both cities would post signs advising the public of the presence of scarps should they develop on the nourished beaches. These scarps often occur naturally in the absence of beach nourishment and are usually short term and localized and would not be considered a significant adverse effect of the project.

In addition, renourishment construction activities would be similar to initial placement construction activities. The only difference would be shorter duration of construction activities associated with the reduced renourishment volumes relative to the initial fill volume. Public safety requirements will be the same for renourishment construction activities as for initial placement activities. Therefore, no significant public safety impacts associated with renourishment would occur.

Notch Fill

Notch fill consists of filling notches with structurally reinforced concrete at the base of the bluff. During the implementation of Alternative EN-2A, EN-2B, SB-2A and SB-2B notch filling, the active construction zones at the two receiver sites would be closed to prevent public access and avoid any unsafe conditions associated with heavy equipment during construction operations. It is estimated that approximately 200 ft of beach would be closed at one time. As notch fill construction activities are completed and deemed safe for public access, beaches would be re-opened. Prior to notch fill operations, a safety plan would be implemented to ensure public safety. The plan would provide for all necessary safety measures in the vicinity of the receiver sites, including fencing, barricades, and safety personnel.

Lifeguard towers would need to be relocated during notch fill construction activities if any are located within an active construction zone. Temporary relocation would not impair the ability of lifeguards to ensure public safety since only a small portion of the beach would be closed to the public during construction activities. The towers would be replaced after notch fill construction has been completed, and prior to reopening the beach for recreational use. Therefore, the potential impacts would be less than significant.

Alternative EN-1A

Summary of Potential Impacts for Alternative EN-1A

During beach replenishment operations, safety measures would be implemented in the vicinity of the receiver beaches, including fencing, barricades, and flag personnel, as necessary. Access for emergency personnel to the beach and to the water would be maintained. Therefore, Alternative EN-1A would not create a health hazard or potential health hazard nor expose people to potential health hazards. Under Alternative EN-1A, potential impacts to public safety under the low and high sea level rise scenarios would be less than significant.

Mitigation Measures for Alternatives EN-1A

No mitigation would be required as no significant impacts have been identified.

Alternative EN-1B

Summary of Potential Impacts for Alternative EN-1B

Construction activities for Alternative EN-1B would be similar to Alternative EN-1A except the volume of beach fill material is reduced. Public safety requirements for Alternative EN-1B would be the same as Alternative EN-1A. Therefore, implementation of Alternative EN-1B would not result in any significant public safety impacts.

Mitigation Measures for Alternatives EN-1B

No mitigation would be required as no significant impacts have been identified.

<u>Alternative EN-2A</u>

Summary of Potential Impacts for Alternative EN-2A

Construction activities for Alternative EN-2A would be similar to Alternative EN-1A construction activities except the renourishment cycle is extended to ten rather than five years and notch fill construction is added as an additional project element. Public safety requirements for Alternative EN-1B would be the same as Alternative EN-1A. Therefore, implementation of Alternative EN-1B would not result in any significant public safety impacts.

Mitigation Measures for Alternatives EN-2A

No mitigation would be required as no significant impacts have been identified.

<u>Alternative EN-2B</u>

Summary of Potential Impacts for Alternative EN-2B

Construction activities for Alternative EN-2B would be similar to Alternative EN-1A except that the volume of beach fill material is reduced resulting in a correspondingly shorter duration of project construction activities. In addition, Alternative EN-2B includes construction of notch fills. Public safety requirements for Alternative EN-2B would be the same as Alternative EN-1A. Therefore, no public safety impacts would be significant with implementation of Alternative EN-2B.

Mitigation Measures for Alternatives EN-2B

No mitigation would be required as no significant impacts have been identified.

5.13.3 Solana Beach

<u>Borrow Sites</u>

During dredge operations, the potential for a vessel to collide with a dredge or support vessel would be extremely remote as the dredge would be equipped with markings and lights in accordance with established U.S. Coast Guard regulations. The location and operational schedule of the dredge would be published in the U.S. Coast Guard “Local Notice of Mariners” to inform local boaters of the presence and location of the dredge. A hopper dredge would travel at relatively slow speeds (approximately 1.7 knots) during actual dredging operations. The travel speed would also be slow (approximately 5 knots) during the transport of sand from borrow sites (SO-5 and SO-6) to the receiver sites. A cutterhead dredge would be considerably more stationary since the slurried sand would be transported to the beach via a fixed pipeline.

To maintain vessel safety, a 300-ft-radius buffer area would be established around the mono buoy in offshore waters, to allow proper anchoring and pump line operation. To ensure that no vessels would enter this restricted zone, the anchoring area would be included in the “Notice to

Mariners". All pump lines used during beach replenishment efforts, including both floating and submerged, would be clearly marked as "navigational hazards". There would be a short-term and localized increase in vessel traffic in the area associated with project construction with a limited distance of travel to set and remove the pump line. Accordingly, there would not be any potentially significant impacts to public safety as a result of implementation of this alternative. Therefore, Alternatives would not create navigation hazards or result in unsafe conditions for vessel traffic.

Borrow sites have been tested for the suitability of the dredge materials to be placed on the receiver beaches. Although not anticipated, the possibility exists that unforeseen wastes and materials could be dredged from the offshore borrow sites from past illegal dumping activities. In the event that hazardous or otherwise dangerous materials are found in the dredge material, dredging and sand placement activities would immediately stop. An evaluation would be made to determine the extent of the contamination and most appropriate treatment of the site.

<u>Receiver Sites</u>

During the implementation of Alternatives, under both low and high sea level rise scenarios, approximately 200 ft of the receiver site would be inaccessible to the public around the discharge pipeline and berms.

At the Solana Beach receiver site, there are lifeguard towers located within the proposed receiver site: one at Fletcher Cove, a Junior Lifeguard tower at 350 S. Sierra Avenue, one at the base of the Seascape Sur access point, and one at the base of the Del Mar Shores Terrace access point at 825 S. Sierra Avenue. There is a permanent tower at Tide Park located on the access stairs above but not on the Solana Beach receiver site. All of the towers are annually placed on the beach the weekend before Memorial Day and removed the weekend after Labor Day (Solana Beach 2012). Coordination with the City of Solana Beach would occur to temporarily relocate towers during summertime construction. However, temporary relocation would not impair the ability of lifeguards to ensure public safety since this portion of the beach would be closed to the public during construction activities. The towers would be replaced after sand placement, before the beach is reopened for public recreational uses. As long-term beach safety would be improved from the creation of a wider beach, no significant impacts to public safety of lifeguard stations would occur from project implementation.

<u>Alternative SB-1A</u>

Summary of Potential Impacts for Alternative SB-1A

Impacts and conclusions for Alternative SB-1A would be similar to that presented for Alternative EN-1A. During beach replenishment operations, safety measures would be implemented in the vicinity of the receiver beaches, including fencing, barricades, and flag personnel, as necessary. Access for emergency personnel to the beach and to the water would be maintained. Therefore, Alternative SB-1A would not create a health hazard or potential health hazard nor expose people to potential health hazards. Under Alternative SB-1A, potential impacts to public safety under the low and high sea level rise scenarios would be less than significant.

Mitigation Measures for Alternatives SB-1A

No mitigation would be required as no significant impacts have been identified.

Alternative SB-1B

Summary of Potential Impacts for Alternative SB-1B

Construction activities for Alternative SB-1B would be similar to Alternative SB-1A except the volume of beach fill material is reduced. Public safety requirements for Alternative SB-1B would be the same as Alternative SB-1A. Therefore, implementation of this alternative would not result in any significant public safety impacts.

Mitigation Measures for Alternatives SB-1B

No mitigation would be required as no significant impacts have been identified.

Alternative SB-1C

Summary of Potential Impacts for Alternative SB-1C

Construction activities for Alternative SB-1C would be similar to Alternative SB-1A except the volume of beach fill material is reduced. Public safety requirements for Alternative SB-1C would be the same as Alternative SB-1A. Therefore, implementation of this alternative would not result in any significant public safety impacts.

Mitigation Measures for Alternative SB-1C

No mitigation would be required as no significant impacts have been identified.

Alternative SB-2A

Summary of Potential Impacts for Alternative SB-2A

Construction activities for Alternative SB-2A would be similar to Alternative SB-1A except the volume of beach fill material is reduced resulting in a correspondingly shorter duration of project construction activities. In addition, Alternative SB-2A includes construction of notch fills. Public safety requirements for Alternative SB-2A would be the same as Alternative SB-1A. Therefore, no significant public safety impacts associated with implementation of Alternative SB-2A would occur.

Mitigation Measures for Alternative SB-2A

No mitigation would be required as no significant impacts have been identified.

Alternative SB-2B

Summary of Potential Impacts for Alternative SB-2B

Construction activities for Alternative SB-2B would be similar to Alternative SB-1A except the volume of beach fill material is reduced resulting in a correspondingly shorter duration of project construction activities. In addition, Alternative SB-2B includes construction of notch fills. Public safety requirements for Alternative SB-2B would be the same as Alternative SB-1A. Therefore, no impacts would be significant with implementation of Alternative SB-2B.

Mitigation Measures for Alternative SB-2B

No mitigation would be required as no significant impacts have been identified.

5.13.4 No Action Alternative

Under No Action Alternative, there would be no dredging or comprehensive shoreline protection program implemented by the USACE or the Cities between 2015 and 2065. The SANDAG Regional Shoreline Preservation Strategy (1993) identified a need for 30 million cy of sand to be replenished in the littoral cells in San Diego County. Therefore, it is likely that there would be a likely worsening of threats to public safety due to continued bluff failures given the lack of local and regional sediment supply and future predictions of sea level rise of greater than 4 ft by the end of this century.

Coastal bluffs and beaches would continue to erode unabated in the future, which could increase the potential for some loss of recreational uses and public access to beaches. There also would be the potential for some increase in the threat to park facilities, public infrastructure, public access ways, and other bluff top structures. Existing notch fills, plugs, and seawalls would require maintenance and repair during the 50 yr timeframe of 2015-2065. In addition, under the No Action Alternative it is assumed that current trends of piecemeal seawall construction would continue along unprotected segments of the shoreline. There would also continue to be a significant risk to commercial facilities, State Parks, public parking lots and Highway 101 along low-lying areas in Cardiff from storm-generated flooding associated with the lack of sand supply. Implementation of the No Action Alternative would therefore result in significant, adverse and unavoidable impacts to health and safety as the shoreline continues to erode and coastal bluffs collapse onto the public beach below.

5.13.5 Potential Effects of Mitigation Reef

There would be a short-term (maximum 34 days) and localized increase in vessel traffic in the area associated with the construction with a limited distance of travel to place the mitigation reef. The mitigation reef would be entirely submerged at sufficient depth (approximately 30 to 40 ft below MLLW) to avoid potential hazards to boating and public safety. To maintain vessel safety, a 300-ft –radius buffer area would be established around the barge in offshore waters. Therefore, this activity would not create navigation hazards or result in unsafe conditions for vessel traffic. In addition, public access for swimmers and boaters would be restricted during construction, where applicable. Closing the area to the public would prevent any potential unsafe conditions for the public associated with the presence and operation of construction equipment used to place the mitigation reef. This would ensure that the construction activity would not create a health hazard or potential health hazard nor expose people to potential health hazards. Therefore, the impact to public safety would be less than significant.

5.14 <u>Public Utilities</u>

This section addresses public utilities that could be affected by implementation of the proposed action. The season of construction has no bearing on the impact analysis.

5.14.1 Impact Significance Criteria

Significant impacts to public utilities would occur if any of the alternatives result in:

- Substantial and long term interruption of utility service;
- Substantial alteration to existing public utilities; and/or
- An increased need for additional capacity of existing facilities, including water, sewer, stormwater drainage, solid waste, natural gas, electric power, and telephone service

Because an increase in service demand would not occur with the proposed action, this analysis focuses on displacement or disruption of services and utilities.

5.14.2 Encinitas

Borrow Sites

Dredging of the SO-6 sand borrow site would involve dredging to 20 ft below the existing seafloor elevations of -19 to -27 ft mean lower low water (MLLW) over an area approximately 0.94 acres. The SO-5 sand borrow site would be dredged to 20 ft below the existing seafloor elevations of -35 to -60 ft MLLW over an area approximately 2.07 acres. The MB-1 sand borrow site would be dredged to 20 ft below the existing seafloor elevations of -18 to -24 ft MLLW over an area approximately 2.07 acres. Borrow site SO-6 is approximately 670 ft south of the existing San Elijo Outfall, which consists of a substantial pipeline with protective rip-rap surrounding it. The dredging of borrow site SO-6 would avoid the outfall. No other public utilities or structures are located near any of the borrow sites. Therefore, no impacts to public utilities would result from implementation of dredging activities.

Receiver Sites

At the Encinitas receiver site, a 36-in, a 60-in, and three 48-in storm drainpipes are located at the end of B Street at Moonlight State Beach. The invert elevations of these storm drain outlets are approximately 8 ft above MLLW. Low drainage flow typically seeps under any sand or cobble that has accrued over the outlet at these locations. During heavy drainage discharge, the flow creates its own path to the ocean. Nonetheless, sand placed at the receiver sites near the storm drain pipes would be excavated to allow proper drainage.

Public access stairways are located within the vicinity of the proposed receiver site. Covering the bottom portions of the stairways with sand would tend to stabilize the stairway structures. Beach access would not be affected by implementation of Alternatives.

Lifeguard towers located at B and C Streets are not moved during the winter season. Sand would be placed as close to the base of the towers as possible and would provide beneficial impacts to the towers through stabilization and reduced erosion. Any portion of proposed fill higher than the viewing platform would be removed to preserve line-of-sight views for lifeguards. As such no long term interruption to these lifeguard services would occur. Therefore, implementation of Alternatives would not result in a substantial or long term interruption of utility service.

Implementation of the proposed project would increase beach, which would be beneficial for beach goers and increase the capacity of the beach to serve visitors. However, it is not expected that the increase in visitors would result in an increased need for additional capacity of existing facilities, including water, sewer, stormwater drainage, solid waste, natural gas, electric power, or telephone service.

Renourishment activities would be similar to initial placement activities. The only difference would be the shorter duration of the construction activities. Therefore, no impacts to public utilities associated with renourishment would occur.

Alternative EN-1A

Summary of Potential Impacts for Alternative EN-1A

Public utilities located in or near the sand placement locations would be avoided and coordination with local utility companies would occur. No significant impact to public utilities would be due to the anticipated protection of the bluff and resultant reduction in loss of property. Recreational areas would be enhanced. Alternative EN-1A would not result in a substantial and long term interruption of utility service; substantial alteration to existing public utilities; nor an increased need for additional capacity of existing facilities. Therefore, there would be less than significant impacts to public utilities under the low sea level rise scenario.

Mitigation Measures for Alternatives EN-1A

No mitigation would be required as no significant impacts have been identified.

Alternative EN-1B

Summary of Potential Impacts for Alternative EN-1B

Public utilities located in or near the sand placement locations would be avoided and coordination with local utility companies would occur. No significant impact to public utilities would be due to the anticipated protection of the bluff and resultant reduction in loss of property. Recreational areas would be enhanced. Alternative EN-1B would not result in a substantial and long term interruption of utility service; substantial alteration to existing public utilities; nor an increased need for additional capacity of existing facilities. Therefore, there would be less than significant impacts to public utilities under the low sea level rise scenario.

Mitigation Measures for Alternatives EN-1B

No mitigation would be required as no significant impacts have been identified.

Alternative EN-2A

Summary of Potential Impacts for Alternative EN-2A

Under the low sea level rise scenario, public utilities located in or near the sand placement locations would be avoided and coordination with local utility companies would occur. No significant impact to public utilities would be due to the anticipated protection of the bluff and resultant reduction in loss of property. Recreational areas would be enhanced. Alternative EN-2A would not result in a substantial and long term interruption of utility service; substantial alteration to existing public utilities; nor an increased need for additional capacity of existing facilities. Therefore, there would be less than significant impacts to public utilities under the low sea level rise scenario.

Mitigation Measures for Alternatives EN-2A

No mitigation would be required as no significant impacts have been identified.

<u>Alternative EN-2B</u>

Summary of Potential Impacts for Alternative EN-2B

Public utilities located in or near the sand placement locations would be avoided and coordination with local utility companies would occur. No significant impact to public utilities would be due to the anticipated protection of the bluff and resultant reduction in loss of property. Recreational areas would be enhanced. Therefore, Alternative EN-2B would not result in a substantial and long term interruption of utility service; substantial alteration to existing public utilities; nor an increased need for additional capacity of existing facilities. Therefore, there would be less than significant impacts to public utilities under the low sea level rise scenario.

Mitigation Measures for Alternatives EN-2B

No mitigation would be required as no significant impacts have been identified.

5.14.3 Solana Beach

<u>Borrow Sites</u>

Dredging of the SO-6 sand borrow site would involve dredging to 20 ft below the existing seafloor elevations of -19 to -27 ft mean lower low water (MLLW) over an area approximately 0.94 acres. The SO-5 sand borrow site would be dredged to 20 ft below the existing seafloor elevations of -35 to -60 ft MLLW over an area approximately 2.07 acres. The MB-1 sand borrow site would be dredged to 20 ft below the existing seafloor elevations of -18 to -24 ft MLLW over an area approximately 2.07 acres. Borrow site SO-6 is approximately 670 ft south of the existing San Elijo Outfall, which consists of a substantial pipeline with protective rip-rap surrounding it. The dredging of borrow site SO-6 would avoid the outfall. No other public utilities or structures are located near any of the borrow sites. Therefore, no impacts to public utilities would result from implementation of dredging activities.

<u>Receiver Sites</u>

At the Solana Beach receiver site, a 60-in energy dissipater storm drainpipe is located at the west end of Plaza Street. Another smaller storm drain outlet is located at Seascape Surf, to the south of Fletcher Cove. This storm drain emerges from the bluff face at approximately 9 to 10 ft above MSL. A small storm drain is also located at Tide Park. None of the drainpipes are directly on the beach. Storm drains would be avoided during alternative construction activities.

The public and private access ramp and stairs at Fletcher Cove, Seascape Shores, Seascape Surf, and Del Mar Shores Beach Park are located within the vicinity of the proposed receiver site. The increase in beach width would not alter, or require alteration of, the existing access ramps and stairs.

No public utilities, other than the storm drains and stairways described above, existing within the footprint of the receiver site. Therefore, implementation of Alternatives would not result in substantial alteration toe existing public utilities.

If sand placement occurs during the summer months when the four temporary lifeguard towers at Fletcher Cove, at 350 S. Sierra Avenue, at Seascape Surf, and at Del Mar Shores Terrace 825 S. Sierra Avenue are located on the beach, they would be temporarily relocated until construction is completed based on the coordination with the City of Solana Beach. Therefore, no adverse impact to lifeguard towers would occur. Therefore, implementation of Alternatives would not result in a substantial or long term interruption of utility service.

Implementation of the proposed project would increase beach, which would be beneficial for beach goers and increase the capacity of the beach to serve visitors. However, it is not expected that the increase in visitors would result in an increased need for additional capacity of existing facilities, including water, sewer, stormwater drainage, solid waste, natural gas, electric power, or telephone service.

Renourishment construction activities would be similar to initial placement construction activities. The only difference would be the shorter duration of the construction activities. Therefore, no impacts to public utilities associated with renourishment would occur.

<u>Alternative SB-1A</u>

Summary of Potential Impacts for Alternative SB-1A

Public utilities located in or near the sand placement locations would be avoided and coordination with local utility companies would occur. No significant impact to public utilities would be due to the anticipated protection of the bluff and resultant reduction in loss of property. Recreational areas would be enhanced. Alternative SB-1A would not result in a substantial and long term interruption of utility service; substantial alteration to existing public utilities; nor an increased need for additional capacity of existing facilities. Therefore, there would be less than significant impacts to public utilities under the low sea level rise scenario.

Mitigation Measures for Alternatives SB-1A

No mitigation would be required as no significant impacts have been identified.

<u>Alternative SB-1B</u>

Summary of Potential Impacts for Alternative SB-1B

Public utilities located in or near the sand placement locations would be avoided and coordination with local utility companies would occur. No significant impact to public utilities would be due to the anticipated protection of the bluff and resultant reduction in loss of property. Recreational areas would be enhanced. Alternative SB-1B would not result in a substantial and long term interruption of utility service; substantial alteration to existing public utilities; nor an increased need for additional capacity of existing facilities. Therefore, there would be less than significant impacts to public utilities under the low sea level rise scenario.

Mitigation Measures for Alternatives SB-1B

No mitigation would be required as no significant impacts have been identified.

Alternative SB-2B

Summary of Potential Impacts for Alternative SB-2B

Public utilities located in or near the sand placement locations would be avoided and coordination with local utility companies would occur. No significant impact to public utilities would be due to the anticipated protection of the bluff and resultant reduction in loss of property. Recreational areas would be enhanced. Therefore, Alternative SB-2B would not result in a substantial and long term interruption of utility service; substantial alteration to existing public utilities; nor an increased need for additional capacity of existing facilities. Therefore, there would be less than significant impacts to public utilities under the low sea level rise scenario.

Mitigation Measures for Alternative SB-2B

No mitigation would be required as no significant impacts have been identified.

Alternative SB-1C

Summary of Potential Impacts for Alternative SB-1C

Public utilities located in or near the sand placement locations would be avoided and coordination with local utility companies would occur. No significant impact to public utilities would be due to the anticipated protection of the bluff and resultant reduction in loss of property. Recreational areas would be enhanced. Alternative SB-1C would not result in a substantial and long term interruption of utility service; substantial alteration to existing public utilities; nor an increased need for additional capacity of existing facilities. Therefore, there would be less than significant impacts to public utilities under the low sea level rise scenario.

Mitigation Measures for Alternative SB-1C

No mitigation would be required as no significant impacts have been identified.

Alternative SB-2A

Summary of Potential Impacts for Alternative SB-2A

Public utilities located in or near the sand placement locations would be avoided and coordination with local utility companies would occur. No significant impact to public utilities would be due to the anticipated protection of the bluff and resultant reduction in loss of property. Recreational areas would be enhanced. Alternative SB-2A would not result in a substantial and long term interruption of utility service; substantial alteration to existing public utilities; nor an increased need for additional capacity of existing facilities. Therefore, there would be less than significant impacts to public utilities under the low sea level rise scenario.

Mitigation Measures for Alternative SB-2A

No mitigation would be required as no significant impacts have been identified.

5.14.4 No Action Alternative

No dredging or beach replenishment activities would occur under the No Action Alternative. The beneficial effect of stabilizing structures such as stairways would not occur under this alternative. Impacts to public utilities may result as a result of loss of bluff property and erosion around facilities such as stairways and storm drains.

5.14.5 Potential Effects of Mitigation Reef

There are no public utilities or structures on or near the mitigation reef construction area. The proposed construction of mitigation reef would not result in substantial and long term interruption of utility service or substantial alteration to existing public utilities.

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6 CUMULATIVE PROJECT IMPACTS

CEQA Guidelines require a discussion of significant environmental impacts that would result from project related actions in combination with "closely related past, present, and probable future projects" located in the immediate vicinity (CEQA Guidelines, § 15130 [b][1][A]). These cumulative impacts are defined as "two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts" (CEQA Guidelines, § 15355).

The discussion of cumulative impacts is further guided by the CEQA Guidelines in §§ 15130(a) and (b), which state:

- An EIR shall not discuss impacts which do not result in part from the project evaluated in the EIR.
- When the cumulative effect of the project's incremental contribution and the effect of other projects is not significant, the EIR shall briefly indicate why and not discuss it further.
- An EIR may identify a significant cumulative effect, but determine that a project's contribution is less than cumulatively considerable and less than significant. That conclusion could result if the project is required to implement or fund its fair share of a mitigation measure designed to alleviate the cumulative impact.
- The discussion of cumulative impacts shall reflect the possibility of occurrence and severity of the impacts and focus on cumulative impact to which the identified other projects could contribute.

Federal regulations implementing NEPA (40 C.F.R. §§ 1500-1508) require that the cumulative impacts of a proposed action be assessed. NEPA defines a cumulative impact as an "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions" (40 C.F.R. § 1508.7).

In general, effects of a particular action or group of actions would be considered cumulative impacts under the following conditions:

- Effects of several actions occur in a common location;
- Effects are not localized (i.e., can contribute to effects of an action in a different location);
- Effects on a particular resource are similar in nature (i.e., affects the same specific element of a resource); and
- Effects are long-term (short-term impacts tend to dissipate over time and cease to contribute to cumulative impacts).

6.1 <u>Description of Cumulative Projects</u>

The cumulative projects considered in the following analyses generally considered those projects in the Oceanside Littoral Cell as the Region of Influence (ROI). Specifically, the ROI is defined as from Batiquitos Lagoon in the north to Torrey Pines in the south, and from the shoreline to the back beach. The ROI also includes an area of approximately 300 ft around each borrow site. ROI is based on the coastal processes, however, if the ROI is different for a resource, it is noted as such in the appropriate section.

The ROI is Oceanside Littoral Cell and the tentatively recommended plans are within that cell. The entire littoral cell goes from Oceanside south to Torrey Pines and would be sufficient for all noise impacts to remain in the ROI.

There is a long history of beach replenishment projects in the San Diego region, primarily involving projects placing sand from both the large- and small-scale maintenance dredging of harbors and lagoons onto nearby beaches.

RBSP I, implemented in 2001, placed over 2 million cy of dredged sand at 12 receiving locations, several sites being within the current project study area. RBSP II, which is scheduled to occur in 2012, would place between 1.7 and 2.7 million cy on up to 11 receiver sites, including locations within the current project study area.

Additional substantial beach nourishment efforts include nearby lagoon restoration projects. Continued maintenance dredging occurs at Batiquitos Lagoon as a result of the Batiquitos Lagoon Enhancement Project completed in 1997, with approximately 165,000 cy of dredged materials placed on City of Carlsbad and City of Encinitas beaches in fall 2011 through spring 2012. Agua Hedionda Lagoon is dredged every other year, with the most recent maintenance dredging occurring in April 2011; sand is typically placed both north of the north jetties and south of the north jetties on the beach near the Lagoon. Smaller replenishment actions have resulted from opportunistic projects from upland coastal development, such as the Pacific Station and Scripps Memorial Hospital projects in Encinitas. Sand placed at specific locations as a result of these activities disperses throughout the littoral system over time, eventually becoming so dispersed as to be unmeasurable in any single location.

A total of 2.5 million cy of sand was placed on regional beaches between 2001 and 2009, Including the 2 million cy of sand placed on regional beaches as a result of RBSP I. (Coastal Frontiers 2010). These numbers do not include the routine “bypass” placement volumes where sand is removed from north San Diego County lagoons and placed on nearby beaches. Since 2001, the bypass volume has averaged over 197,000 cy/year from Agua Hedionda; 251,000 cy/year from Oceanside Harbor; and 22,000 cy/year from San Elijo Lagoon. The Oceanside littoral cell ROI has, therefore, been subject to sand inputs on a relatively recent and frequent basis. Projected volumes of sand inputs up to 2017 (including RBSP II) would not substantially exceed historic volumes. Data collected before and after RBSP I have shown that the nearshore biological environment of the regional coastline continues to function well.

Sand bypassing operations, in the form of lagoon and harbor dredging, return sand that becomes trapped in these features to the Oceanside Littoral Cell. Sand bypassing plays an important role in maintaining the distribution of sediment within the littoral system and does not appear to substantially increase the quantity of sand in the overall system.

The projects included in this cumulative impact assessment are listed in **Table 6.1-1**. The table identifies the project name, the location, a brief description, and the anticipated schedule for implementation. Cumulative projects considered in this analysis consist of ongoing or proposed projects near to the receiver sites. There are no proposed actions adjacent to the borrow sites.

Pursuant to NEPA, the assessment of cumulative impacts must take into consideration all “reasonably foreseeable future actions.” The included projects have been drawn from a list of projects that are on file with local jurisdictions and/or the Office of Planning and Research (OPR). Relevant projects that have not yet been filed with the OPR may also be included in this list for the purposes of full disclosure, although there may not be adequate information at this time to determine their potential cumulative contribution, if any.

Approved opportunistic sand nourishment programs under SCOUP have also been identified in the list, although the total authorized volumes have not yet been placed at each approved receiver site, nor are they likely. Numerous coastal projects are identified in this list for purposes of disclosure, including several projects that are known in concept but are still very much in the planning stages. Programmatic policy documents (i.e., Coastal Regional Sediment Management Plan, Shoreline Preservation Strategy) are not included in the cumulative project list, as those are considered strategic planning documents that do not necessarily provide authority for implementation and generally do not identify specific projects. An environmental document was not prepared for the Preservation Strategy and an environmental document for the Sediment Management Plan has not yet been initiated.

Cumulatively considerable projects included within **Table 6.1-1** are generally those initiated or completed within the past 5 years or possibly planned over the next 5 years (up to 2017). It is assumed that sand from projects occurring before this time period have become too dispersed to provide reliable information on potential impacts; therefore, they are not included in this analysis. Any projects potentially under consideration beyond the next 5 years are considered too speculative to be included in evaluations. This is not intended to be an exhaustive list of all past beach nourishment and related maintenance projects but rather a fair and appropriate presentation of relevant projects as called for under CEQA and NEPA.

1 **Table 6.1-1 List of Cumulative Projects**

Project Name	General Location / Jurisdiction	Project Type	Description	Project Status/Schedule
REGIONAL/MULTIPLE JURISDICTIONS				
RBSP II	Oceanside, Carlsbad, Encinitas, Solana Beach, Del Mar, San Diego, Imperial Beach	Sand Nourishment	This project replenished 1.5 million cy of clean beach-quality sand on up to 8 receiver sites in the San Diego region: Oceanside, South Carlsbad North, South Carlsbad South, Batiquitos, Moonlight Beach, Cardiff, Solana Beach, and Imperial Beach. Sand dredged from three offshore borrow sites.	Constructed September to December of 2012.
One Paseo Project (SCOUP)	Carlsbad, Encinitas and Solana Beach	Opportunistic Sand Nourishment Program	The project involves 300,000 cy of beach sand compatible material to be hauled to the beach in one or more SCOUP participating cities.	In the EIR Process. 2013-2015
OCEANSIDE				
Oceanside Harbor Maintenance Dredging	Oceanside	Maintenance Dredging/Sand Placement	Oceanside Harbor is dredged annually by the USACE to maintain sufficient depth for boat traffic. Dredged material is typically disposed of by placing it on Oceanside beaches south of Tyson Street. The average amount of material placed on the beach is 175,000 cy. The most recent activity (spring 2010) placed an estimated 268,000 cy of sand between the San Luis Rey River and the Oceanside Pier.	Ongoing; annually in spring.
Sand Compatibility & Opportunistic Use Program (SCOUP)	Oceanside	Opportunistic Sand Nourishment	Implementation of a sand replenishment program to allow for the processing of multiple beach replenishment projects over a 5-year period. The project allows the annual placement of up to 150,000 cy of opportunistic sand along the beach at the 5,000-ft receiver site, located south of Forster Street.	Approved for period 2008–2013. To date, no material has been placed at this site under this program. No material has been identified in the near term due to economic conditions. Under the current authorization, only 20,000 cy could be placed annually in the first 2 years. Given permit expiration date in 2013, it is unlikely that more than 20,000 cy total would be placed under this program.

Project Name	General Location / Jurisdiction	Project Type	Description	Project Status/Schedule
Buena Vista Lagoon Weir Replacement Project	Oceanside	Maintenance	The City of Oceanside has proposed to replace the existing weir at the mouth of Buena Vista Lagoon, located at the border of Oceanside and Carlsbad. The project would replace the existing 50-ft-long weir with an 80- by 10-ft weir. The new weir design would decrease beach erosion downstream and increase flows through the mouth of the lagoon during storm events while maintaining the freshwater characteristic of the lagoon.	Design and plans completed; construction not started. Construction date undermined.
CARLSBAD				
Carlsbad Energy Center Project	Carlsbad	Development	Carlsbad Energy Center LLC proposes to develop a natural-gas-fired generating facility on a 23-acre site in the City of Carlsbad adjacent to Agua Hedionda Lagoon. The project would be a 558-megawatt (MW) gross combined-cycle generating facility with two units (one natural-gas-fired combustion turbine and one steam turbine unit) on the approximately 23-acre Carlsbad project site.	California Energy Commission approved certification on May 31, 2012.
Carlsbad Seawater Desalination Plant	Carlsbad	Development	Poseidon Resources (Channelside) LLC (Poseidon) will construct a collocated 50-million-gallon-per-day seawater desalination plant on the Encina Power Station site to produce potable water from seawater.	Permits approved; construction anticipated in 2012-2013.
Agua Hedionda Lagoon Maintenance Dredging	Carlsbad	Maintenance Dredging/Sand Placement	This lagoon has undergone maintenance dredging since 1955; in that period, over 5.9 mcy may have been removed. This dredged material has been placed on adjacent beaches in Carlsbad. The last maintenance dredging of the outer lagoon was completed in April 2011 and resulted in the removal of 299,000 cy of sand. This sand was placed on adjacent beaches (ref. CDP #6-06-61). Typical dredge volumes anticipated in 2011 are approximately 500,000 cy. Sand is placed	Dredging scheduled for December 2012

Project Name	General Location / Jurisdiction	Project Type	Description	Project Status/Schedule
			north of the north jetty and south of the north (intake) jetties on the beach near the Lagoon	
Batiquitos Lagoon Maintenance Dredging	Carlsbad	Maintenance Dredging/Sand Placement	As a result of the Batiquitos Lagoon Enhancement Project completed in 1997, continued dredging and sand placement occur approximately every 2 years to maintain the lagoon (last performed in 2006). Maintenance dredging is designed to remove sand from flood shoals drawn into the lagoon by tidal action and redistribute it to nearshore areas of adjacent beaches. Whether sand placement will occur nearshore or on the beach is yet to be determined. Dredging and sand placement have occurred periodically over the last 10 years, yielding approximately 110,000 cy of dredged materials, which have historically been placed on local beaches north and south of the inlet channel. Approximately 117,000 cy was placed on City of Carlsbad and Encinitas beaches in fall 2011 through spring 2012.	Completed in March 2012.
Opportunistic Beach Fill Program (SCOUP)	Carlsbad	Opportunistic Sand Nourishment Program	Implementation of a sand replenishment program to allow for the processing of multiple beach replenishment projects over a 5-year period. This project would allow for the placement of up to 150,000 cy per year of opportunistic beach fill along the Encinitas Beach portion of South Carlsbad State Beach, with an initial maximum fill of 50,000 cy. To date, no material has been placed on this site under this program. Permits for the program expired in 2011; however, Carlsbad is pursuing an extension to the program. If extended, approximately 30,000 cy may be placed.	Approved for period 2006–2011. For purposes of this analysis, assume up to 30,000 cy of sand placement between 2012 and 2017.

ENCINITAS				
Opportunistic Beach Fill Program (SCOUP)	Encinitas	Opportunistic Sand Nourishment Program	For Encinitas, this program authorizes the deposition of sand adjacent to Batiquitos Beach and Moonlight Beach at an annual maximum of 120,000 cy and 150,000 cy, respectively. To date, limited material has been placed.	Approved for period 2010–2015.
Moonlight Beach Sand Replenishment	Encinitas	Annual Sand Nourishment	The City of Encinitas imports sand annually to Moonlight Beach to protect public resources that also serves to augment the naturally occurring sand at the beach. This program imports approximately 1,000 cy of sand in the spring from inland sand-borrow areas for placement on the upland portion of the beach. Sand is trucked in, placed in an area above the mean high tide line, and spread across the back beach. This project has been occurring annually in May since 2000.	Approved; occurs annually in May.
Scripps Memorial Hospital – Parking Lot Removal	Encinitas	Development/ Opportunistic Sand Nourishment Project	Approximately 5,000 cy of sand was dispersed at inter-tidal portions of Moonlight Beach from this upland development project, which consisted of the construction of a multistory parking garage at Scripps Memorial Hospital. This sand placement project was authorized under the City's SCOUP program.	Completed March 2010.
Pacific Station	Encinitas	Development/ Opportunistic Sand Nourishment Project	Approximately 37,000 cy of sand was placed on Batiquitos Beach as part of the construction of a mixed-use development at 687 South Coast Highway 101, in downtown Encinitas. Export material was generated from a two-story underground parking garage.	Completed 2009.
San Elijo Lagoon Mouth Opening	Encinitas	Maintenance Dredging/Sand Placement	This project excavates sediment from the mouth of the San Elijo Lagoon to maintain the opening and places the cobble and sand	Occurs at least once annually.

			material south of the mouth on Cardiff Beach. Opening occurs twice annually on an as-needed basis. An average of 20,000 cy is bypassed from the lagoon to the beach to the south per event.	
Encinitas Resorts Hotel	Encinitas	Development/ Opportunistic Sand Nourishment Project	This project placed material excavated from a hotel project near the beach in Leucadia.	Completed 2009.
San Elijo Lagoon Restoration Project (SELRP)	Encinitas	Lagoon Restoration	The proposed project would restore the lagoon via major infrastructure changes (e.g., railroad tracks, Coast Highway 101, and I-5 bridge) and includes dredging and vegetation restoration. The proposed project may also include relocation of the existing lagoon inlet to enhance tidal influence under some of the alternatives. If excess dredged material is available and suitable, then it could be placed on the beach and/or in the nearshore zone.	Slated for public review of the EIR/EIS at the end of 2012, with certification scheduled for July 2013. Construction anticipated in 2015.
SOLANA BEACH				
Opportunistic Beach Fill Program (SCOUP)	Solana Beach	Opportunistic Sand Nourishment Program	For Solana Beach, this program authorizes the deposition of sand at Fletcher Cove at an annual maximum of 150,000 cy. To date, no materials have been placed under the SCOUP program. No placement is currently planned for the near term.	Permits remain valid for a 5 year period ending 2013-2014.
Fletcher Cove Reef Project	Solana Beach	Coastal Storm Damage Reduction	The USACE and the City of Solana Beach are working together to develop the conceptual engineering design for a multipurpose offshore submerged reef located near Fletcher Cove. The primary goal of the reef would be to retain sand to create a wider beach and improve the efficacy of beach nourishment projects.	Conceptual engineering and design completed; Phase II engineering design and environmental review anticipated to begin in 2013-2014.
Fletcher Cove Community Center	Solana Beach	Development	This project includes full refurbishment, accessibility improvements and landscape	Construction completed in March 2012.

			renovation to the existing community center located on a 1-acre site above Fletcher Cove Park.	
DEL MAR				
San Dieguito Wetland Restoration	Del Mar	Restoration	The San Dieguito Wetland Restoration Project involved the development, design, and ultimate implementation of a comprehensive restoration plan for approximately 440 acres in the western San Dieguito River Valley.	Deemed complete in November of 2011.
San Dieguito Wetland Restoration Maintenance Dredging	Del Mar	Maintenance Dredging/Sand Placement	The San Dieguito Wetland Restoration included the alteration of the streambed of the San Dieguito River, tributary to the San Dieguito Lagoon, by opening the mouth of the river to allow for tidal flow. Project activity included initial dredging and subsequent monitoring and maintenance dredging (SAA #1600-2006-0347-R5). An Approximately 80,000 cy of sand was dredged from the lagoon and river mouth and placed on the beach areas immediately to the north and south of the inlet.	Sand Placement and Dredging are completed. (Ranger Brian Ward, 2012)

6.2 Analysis of Cumulative Projects

6.2.1 Geology and Topography

The beaches within the project study area have been eroding over time, and the coastal bluffs have been suffering from impacts related to wave action and storm surge. Implementation of the Coastal Storm Damage Reduction Project would provide a beneficial impact, and would contribute both by itself and cumulatively with other replenishment projects to the reduction of erosion at the receiver locations and the protection of coastal bluffs. There are no expected substantial adverse impacts to geology or topography associated with the Coastal Storm Damage Reduction Project, which is also not expected to contribute to cumulatively significant adverse impacts under any alternative.

6.2.2 Oceanographic and Coastal Processes

The impacts of beach nourishment to oceanographic and coastal processes from sand placement under the proposed action would incrementally add to the cumulative impacts of other dredging projects that discharge sand to the beaches in northern San Diego County. The sand deposited on the neighboring beaches from other small dredging projects would provide additional sand to the littoral cell in the vicinity of the project area. This total volume of sand could increase the potential to adversely impact oceanographic and littoral processes, including nearshore wave characteristics, tides and currents, nearshore sediment transport, and shoreline erosion. However, these dredging projects are undertaken in order to redistribute sand that has been temporarily withheld from the littoral cell and trapped in such locations as within Oceanside Harbor or the coastal lagoons. The dredging and subsequent beach placement of sand from the smaller dredging projects can be considered as a cyclic redistribution of sand within the littoral cell. A main goal of the project is to reduce the impacts of erosion on the beaches and coastal cliff faces, and the implementation of any project alternative is expected to achieve that goal to varying degrees. The RBSP II and San Elijo Lagoon Restoration Project in combination with the proposed project represent considerable increases in sediment to the Oceanside littoral cell. The RBSP II project would be completed several years prior to initiation of the proposed project. The potential for the San Elijo Lagoon Restoration Project to result in dredged material suitable for placement on nearby beaches is not quantified at this time but any suitable material could be used as a source for the Coastal Storm Damage Reduction Project, rather than an additional volume of material entering the system. Because of the temporal differences in implementation of these projects and that suitable San Elijo Lagoon Restoration Project dredged material would be used for the proposed project rather than implementing additional material into the littoral cell, the projects in combination would not be expected to substantially adversely affect oceanographic and coastal process.

The Coastal Storm Damage Reduction Project is not expected to cause a significant adverse impact to oceanography or coastal processes under any alternative, and is also not expected to contribute to cumulatively significant adverse impacts to oceanographic and coastal processes under any alternative.

6.2.3 Water and Sediment Quality

The project impacts to water and sediment quality would incrementally add to the cumulative impacts of other dredging projects that discharge sand to the beaches in northern San Diego

County. Cumulatively considered, these projects could potentially increase turbidity in the study area and contribute to a decrease in water quality.

Both dredging and sand placement operations associated with the proposed project would generate turbidity plumes that would eventually disperse as a result of particle settling, and natural mixing and dilution processes. The spatial extent of the plumes would be limited in size due to the sandy nature of the sediment and would not persist once construction operations are complete. The project also incorporates the use of training dikes, as much as possible, during sand placement at the receiver sites to promote settlement of sediment on the beach and to lower the amount of suspended sediment within return waters subject to wave action. Because the turbidity plumes would be localized at both the borrow and receiver sites, the combined actions of dredging and sand placement operations would not result in overlapping turbidity plumes. Turbidity is not anticipated to span from one receiver site to another since adjacent receiver sites served by the same borrow site would be constructed at different times and turbidity would dissipate quickly when hydraulic pumping of sand to a receiver site concludes.

Potential cumulative impacts may occur if more than one project involving placement of sand occurs simultaneously or immediately before or after the proposed action in the same vicinity. Such potential projects may include harbor or lagoon maintenance, lagoon restoration, or coastal storm damage reduction projects.

The Coastal Storm Damage Reduction Project, similar to other projects identified in **Table 6.1-1** involving discharges to waters of the United States, would be implemented in accordance with RWQCB water quality certifications, which require compliance with all applicable water quality standards, limitations, and restrictions as specified in the California Ocean Plan and San Diego’s Basin Plan. Because the project would result in short-term localized turbidity that has a low potential for overlapping with turbidity resulting from other projects, and any overlap that would occur would also be short term, no significant long-term cumulative impacts to water resources are anticipated.

6.2.4 Biological Resources

The proposed project, in combination with other beach nourishment and bypass projects listed in **Table 6.1-1**, would be expected to result in cumulative changes to biological resources. Beaches naturally undergo seasonal accretion and erosion associated with changes in wave climate. Generally, sand is transported to offshore bars during the winter and to the beach in summer. Sandy beaches within the region have undergone retreat over many years associated with reduced sediment delivery to the coastline from a variety of factors, including watershed development, flood control projects, dams, and construction of harbors. Where projects would increase sandy beach habitat there would be short-term gains for species that utilize that habitat. If sediment moves offshore in substantial excess quantities and for a substantial duration as compared to typical conditions, then sensitive reef habitat could experience adverse impacts. Of the listed cumulative projects, only those involving beach nourishment or associated with the ocean environment have the potential to incrementally contribute to cumulative impacts to nearshore and offshore biological resources. Projects involving land-based capital improvements or development or demolition would not directly affect those biological resources and are not discussed further.

Future types of projects may involve placement of sand in the shorezone, including sand from lagoon restoration projects, opportunistic beach fill programs (e.g., SCOUP projects), coastal storm damage reduction projects, harbor dredging projects, and bypassed sand from lagoon and harbor maintenance dredging projects. SCOUP quantities are considered relatively minor for this cumulative analysis due to the low volumes likely to be placed and the restriction on placing sand within recently nourished sites. While new sand to the system is the primary concern for determining cumulative impacts, this analysis conservatively considers all sand placement in the shorezone. Potential cumulative effects are described below in greater detail by project type, habitat, and sensitive species.

Cumulative Impacts in Combination with Future Maintenance and Opportunistic Beach Fill Projects

Sandy Beach Habitat

Generally, sandy beach habitat was enhanced by RBSP I and subsequent lagoon maintenance programs by providing wider beaches that maintained a persistent sand depth across seasons. Such conditions were beneficial to invertebrates that live within the sandy sediment, shorebirds that feed on the invertebrates and rest on beaches, and grunion that spawn on sandy beach habitat. Results of surveys conducted at several receiver sites and adjacent beaches within 4 years of RBSP I and in 2009 at proposed RBSP II receiver sites indicated that no long-term significant impacts to sandy beach habitat or resources occurred after RBSP I.

The Coastal Storm Damage Reduction Project, in combination with past projects, and future maintenance and opportunistic beach nourishment projects, has the potential to extend the duration of beach width and shorezone volume performance benefits. However, recovery of sandy beach invertebrates after disturbance could be delayed if additional beach nourishment from another project occurred in the same location and same year as the Coastal Storm Damage Reduction Project, although there is a low potential for cumulative impact from repetitive disturbance since the Coastal Storm Damage Reduction Project and routine lagoon maintenance do not share the same receiver site and any opportunistic program contributes a relatively low volume of sediment in a relatively small area.

The Coastal Storm Damage Reduction Project includes protective measures, as described in Section 5.4, to ensure no significant impacts to grunion occur, and overall, the Coastal Storm Damage Reduction Project in combination with past and future maintenance and opportunistic programs, likely would contribute to beneficial cumulative effects by enhancing beach width and increasing sandy beach habitat persistence. Therefore, cumulative impacts on sandy beach habitat are expected to be less than significant.

Soft-Bottom Subtidal Habitat

None of the proposed future maintenance or opportunistic beach fill programs involve offshore borrow site dredging. Therefore, the cumulative effects of the Coastal Storm Damage Reduction Project in combination with future maintenance and opportunistic programs would not be cumulatively significant over the long term.

Nearshore Sensitive Hard-Bottom and Vegetated Habitats

Sand placement on beaches has the potential to result in impacts to sensitive nearshore habitats, including hard-bottom and vegetated habitats, from turbidity during construction and sedimentation after construction. Monitoring conducted for 4 years after implementation of

RBSP I found no significant effects to nearshore reefs or kelp beds attributed to the project. Sand cover increase was noted at several nearshore reefs and kelp bed stations, but was mainly attributed to natural variability or potential contributions from other sources (e.g., maintenance, restoration projects). Of the 33 stations that were monitored, only three were identified as possible areas where increased sedimentation may have resulted from RBSP I in combination with other projects, and only at one of these stations (NC-SS-3) was a decline reported in surfgrass at the end of the monitoring period. The overall conclusion of the monitoring was that no long-term impacts were observed from RBSP I. However, the potential for significant cumulative impacts was acknowledged as a possibility with the placement of large volumes of sand (similar to or exceeding the sand volumes of RBSP I) in proximity to sensitive resources.

Kelp bed mapping conducted over the past two decades indicates that canopies have responded similarly on regional and larger Bight-wide scales in response to temperature and nutrient conditions associated with broader scale oceanographic characteristics of El Niño and La Niña periods. All kelp beds in San Diego County, including those located in the vicinity of RBSP I receiver sites, displayed substantial growth in 2007–2008, reaching bed canopy sizes in 2008 that were the largest recorded in the past decade. Therefore, no significant cumulative effects occurred to kelp bed habitat with implementation of RBSP I in combination with harbor and lagoon maintenance or opportunistic beach nourishment projects. Similarly, no significant cumulative impacts to kelp would be anticipated with implementation of the Coastal Storm Damage Reduction Project.

As noted above, sand movement from receiver sites has the potential for significant cumulative impacts to sensitive nearshore habitat areas where multiple projects, in combination, place large volumes of sand on the beaches or directly in the nearshore. There is tremendous uncertainty associated with predicting long-term indirect impacts from the cumulative addition of sand volumes from multiple natural and/or man made sources to the dynamic ocean system, which displays a high degree of natural variability in wave climate and other oceanographic conditions, all of which have the potential to affect nearshore habitats and resources. However, the Coastal Storm Damage Reduction Project includes protective measures such as adaptive management and monitoring, as described in Section 5.4, to account for potential cumulative impacts associated with other beach nourishment activities (e.g., opportunistic programs, lagoon maintenance).

The Encinitas receiver site is located downcoast of a beach where sand is placed during maintenance of Batiquitos Lagoon, and the Solana Beach receiver site is located between San Elijo and San Dieguito Lagoons, which are also maintained on a regular basis. Modeling predictions of sand level increases in the vicinity of reefs offshore and downcoast of the Encinitas receiver site indicate there would be less than significant effects on reef habitat, although significant impacts were predicted at Solana Beach, as a result of the Coastal Storm Damage Reduction Project. The modeling predictions take into account sand level changes measured at profiles near the lagoons before and after RBSP I, which reflect past placement of dredged material from the various lagoons. Monitoring will be conducted prior to and following implementation of the Coastal Storm Damage Reduction Project to determine if impacts have occurred, and if monitoring indicates a significant impact, mitigation will be implemented. However, as noted above, the Coastal Storm Damage Reduction Project includes protective measures such as adaptive management and monitoring, as described in Section 5.4, to account for potential cumulative impacts associated with other beach nourishment activities. Therefore, the Coastal Storm Damage Reduction Project is not anticipated to contribute considerably to sedimentation on sensitive marine habitats beyond those predicted at Solana Beach, and cumulative effects associated with the project would be less than significant.

Threatened and Endangered Species

Endangered least tern and threatened snowy plover have the potential to be affected by beach nourishment projects. The primary concern to least tern is the potential for effects of turbidity on nearshore foraging habitat and time away from nest sites. Critical habitat for snowy plover occurs on beaches in the project area; the species forages on certain local beaches and nests at many of the same locations as least terns in the county.

The restoration of Batiquitos Lagoon created new nesting habitat that resulted in beneficial effects for both least terns and snowy plovers, and monitoring of turbidity plumes and bird foraging in the vicinity of the borrow and receiver site offshore of the Batiquitos Lagoon nest sites during implementation of RBSP I found no evidence of effects on least tern foraging behavior. In addition, nest sites at Batiquitos Lagoon have continued to substantially contribute to the reproductive success of least terns and snowy plovers in the county since implementation of RBSP I. Therefore, there is no indication of significant cumulative effects of RBSP I in combination with other past projects on either species. The project resulted in enhanced sandy beach habitat in the vicinity of the Batiquitos Lagoon, and beach nourishment has had, and would continue to have, some beneficial effects for that species.

The Coastal Storm Damage Reduction Project receiver sites are located more than 1 mile from least tern nesting sites and would not be expected to affect foraging of the species based on the localized nature of turbidity plumes expected during construction (see Section 5.3), and therefore would not result in significant impacts to the species. The Encinitas receiver site is located approximately 1.3 miles from snowy plover critical habitat located adjacent to Batiquitos Lagoon. This species nests at Batiquitos Lagoon, and has been observed to forage at the beach in the vicinity of the Batiquitos receiver site. No construction would occur within designated or proposed critical habitat. In addition, protective measures would be used to avoid and minimize effects to least terns and snowy plovers during construction of the Coastal Storm Damage Reduction Project. Therefore, construction impacts of the Coastal Storm Damage Reduction Project would be localized and less than significant on a cumulative basis.

<u>Cumulative Impacts in Combination with the RBSP II and San Elijo Lagoon Restoration Project</u>

The RBSP II and the San Elijo Lagoon Restoration Project have the potential to place large volumes of sand on beaches in the project area, including overlapping footprints with the proposed Coastal Storm Damage Reduction Project receiver sites. The RBSP II is anticipated to be completed in 2012, and the San Elijo Lagoon Restoration Project is scheduled to start in 2013. As the Coastal Storm Damage Reduction Project is not anticipated to begin earlier than 2015, the potential for adverse cumulative effects is reduced. In addition, the potential for the San Elijo Lagoon Restoration Project to result in dredged material suitable for placement on nearby beaches is not quantified at this time but any suitable material could be used as a source for the Coastal Storm Damage Reduction Project, rather than an additional volume of material entering the system. There is uncertainty however whether there would be the potential for cumulative effects for the Coastal Storm Damage Reduction Project in combination with either or both of those projects over the 5-year period subject to this cumulative assessment. All of the projects would likely contribute to an overall benefit associated with maintaining or increasing shorezone volume gains in the near term to help counteract coastal storm damage reduction concerns. Because the Coastal Storm Damage Reduction Project would not be implemented in the same year as these two projects, no significant cumulative construction effects would result to sandy beach habitat, grunion, least terns, snowy plovers, etc.

A primary concern is the potential for cumulative effects on sensitive nearshore resources (reefs, kelp beds) associated with large volumes of sand input in proximity to sensitive habitats. Monitoring results from RBSP I and modeling predictions for RBSP II suggest that sand-level increases from RBSP II would have less than significant effects on sensitive habitats and resources, and modeling predictions for the Coastal Storm Damage Reduction Project indicate sand level increases in the vicinity of reefs offshore and downcoast of the Encinitas receiver site would be less than significant on reef habitat, although significant impacts were predicted at Solana Beach. The modeling predictions take into account sand level changes measured on profiles near the lagoons before and after RBSP I. As noted above, the Coastal Storm Damage Reduction Project includes protective measures such as adaptive management and monitoring, as described in Section 5.4, to account for potential cumulative impacts associated with other beach nourishment activities. This, plus the amount of time between implementation of the Coastal Storm Damage Reduction Project and the RBSP II and San Elijo Lagoon Restoration Project suggests that the potential for cumulative effects would be reduced. Therefore, the Coastal Storm Damage Reduction Project is not anticipated to contribute considerably to sedimentation on sensitive marine habitats beyond those predicted at Solana Beach, and cumulative effects would be less than significant.

Soft-Bottom Subtidal Habitat

There could be the potential for cumulative disturbance levels to the soft-bottom subtidal habitat from offshore dredging to produce the sand supply for RBSP II and the Coastal Storm Damage Reduction Project as the location of the dredge sites for these two projects are the same. RBSP II minimized the potential for significant cumulative effects by shifting borrow site locations relative to RBSP I. Further, in the 10+ years since RBSP I dredging, the borrow site seems to be similar in fish and benthic usage as before dredging. Although the dredging amount would be substantially greater, dredging would occur periodically over a 50-year project life span, which would allow some time for natural recovery. The intermittent dredging would allow for varying degrees of recovery within the borrow site; however, given the relatively small area of impact (i.e., less than 2 percent of the inner shelf) and the opportunistic life style of the organisms, cumulative impacts would be less than significant.

Cumulative Impacts in Combination with Other Ocean-Related Projects (Retention Reef and Revetments)

The USACE and the City of Solana Beach are working together to develop the conceptual engineering design for a multipurpose offshore submerged reef located near Fletcher Cove. The primary goal of the reef would be to retain sand to create a wider beach and improve the efficacy of beach nourishment projects. While hybrid alternatives include construction of shotcrete notch fills in addition to nourishment, the Coastal Storm Damage Reduction Project does not involve construction of reefs or sea walls. If mitigation were required to offset significant, long term impacts to nearshore reefs, the construction of reef habitat would be required. Potential mitigation locations have been identified offshore of Fletcher Cove (see Section 5.4), and while there is a possibility that the projects overlap any impacts to offshore soft-bottom habitats would not be considered significant, and the creation of an artificial reef whether as mitigation to create functional habitat or to serve other purposes would not result in a significant cumulative impact.

Conclusion

Overall, the Coastal Storm Damage Reduction Project plus other beach nourishment projects would cumulatively enhance sandy beach habitat to the benefit of numerous species. The potential for cumulative impacts to sensitive nearshore habitat areas beyond those predicted at Solana Beach is anticipated to be less than significant based on project model predictions, with verification by construction monitoring and implementation of adaptive management. Therefore, there would be no cumulative significant impacts associated with the Coastal Storm Damage Reduction Project.

6.2.5 Air Quality

Cumulative projects include local construction as well as general growth within the project area. However, as with most development, the greatest source of emissions is from mobile sources, which travel well outside the local area. Therefore, from an air quality standpoint, the cumulative analysis would extend beyond any local projects and when wind patterns are considered, would cover an even larger area. Accordingly, the cumulative analysis for the project's air quality must be generic by nature and the study area is the Federally-defined air quality basin. The project area is out of attainment for ozone and PM_{10}. Construction and operation of cumulative projects would further degrade the local air quality. The greatest cumulative impact on the quality of regional air basin would be the incremental addition of pollutants mainly from increased traffic due to residential, commercial, and industrial development, and the use of heavy equipment and trucks associated with the construction of these projects.

As the project area is out of attainment for the ozone and PM_{10} standards, projects that are significant on a daily basis are also considered as significant on a cumulative basis. However, the Coastal Storm Damage Reduction Project air quality assessment concludes that the there would be no significant adverse impacts associated with any alternative. Further, Coastal Storm Damage Reduction Project activities that create air emissions would be temporary and short-term in duration. Therefore, implementation of the Coastal Storm Damage Reduction Project would not result in, or considerably contribute to, a cumulatively significant adverse impact to air quality.

USACE has concluded that the cumulative impacts of projects, including local construction as well as general growth, from current project and forecasted (i.e., future) actions in the proximity of the tentatively recommended project will be highly localized and will not significantly affect the quality of the existing natural or built environments.

6.2.6 Greenhouse Gases

A single project is unlikely to have a significant impact on global climate change. However, the cumulative effects of various human activities involving emissions of GHGs have been clearly linked to quantifiable changes in the composition of the atmosphere, which in turn have been shown to be the main cause of global climate change. Therefore, the analysis of the incremental environmental effects of GHG emissions from the project has been addressed as a cumulative impact analysis because, although it is extremely unlikely that a single project would contribute significantly to climate change, cumulative emissions from many projects could affect global

GHG concentrations and the climate system. Section 5.6 provides a complete analysis of GHG emissions for the alternative scenarios for the Coastal Storm Damage Reduction Project. The GHG emissions projected from nourishment with implementation of the proposed project are considered small and are well below the adopted levels that are considered substantial at both the federal and state levels. Therefore, implementation of the Coastal Storm Damage Reduction Project would not result in, or considerably contribute to, a cumulatively significant adverse impact to GHG.

6.2.7 Aesthetics

Cumulative visual impacts are dependent on the scenic quality of the region and the type of proposed project. The coastal region of San Diego County is generally considered highly scenic. Sand placement activities and other reasonably foreseeable nourishment projects along the proposed receiver beach sites and adjacent areas would result in short-term visual impacts that would cease at the end of construction activities. The Coastal Storm Damage Reduction Project is considered to have a longer-term beneficial visual impact, as it would widen beaches currently affected by erosion. The Project does not have any permanent visual elements aside from the sand placement and notch-fill areas (under Alternatives EN-2A and SB-2A and EN-2B and SB-2B). Because the additional sand would supplement existing sand it would not result in an adverse change to the aesthetics of the shoreline in Encinitas or Solana Beach. Also for those alternatives that include notch fill, the practice of notch filling is undertaken in a manner to reduce visual alteration of the bluffs, matching color and contouring of the existing bluffs. As a result the long term changes that would result from the project would be visible in the immediate vicinity and would not substantially change the character or integrity of any valued view or aesthetic resource. Therefore, the proposed project would not contribute to a cumulative aesthetics impact. Due to the short-term nature of the more visible construction activities, any overlap between other ongoing or proposed projects in the study area would be minimal and temporary. Therefore, no significant adverse impacts to aesthetics are anticipated under any alternative.

6.2.8 Cultural Resources

As is documented in section 5.8 Cultural Resources, there is the potential for discovery of sensitive cultural resources during dredging operations at the borrow sites (Significant Impact CR-1). With appropriate mitigation (Mitigation Measure CR-1) involving archaeological monitoring, the Project is not expected to result in a significant adverse impact to cultural resources under any alternative. The Project is not expected to adversely impact any cultural resources onshore during sand placement activities. The Project and the RBSP II Project are the only projects that would have a potential effect to underwater archaeological sites, as the other cumulative projects do not involve offshore dredging at this depth or in the same location. Both projects identify the potential impact and require mitigation monitoring to address discovery of cultural resources during dredging activities. The Coastal Storm Damage Reduction Project itself and RBSP II would not result in cumulatively considerable adverse impacts to cultural resources following implementation of mitigation measures, and no significant adverse cumulative impacts are expected.

6.2.9 Noise

The Coastal Storm Damage Reduction Project would generate noise during construction at offshore borrow site and onshore receiver site. The noise generated offshore would not substantially contribute to adverse noise impacts because of the distance from receptors. With the exception of RBSP II, the other projects listed in Table 6.1-1 do not include offshore operations in the vicinity that could contribute to cumulative noise impacts. Because RBSP II is planned to commence in summer 2012 and be completed prior to initiation of the Coastal Storm Damage Reduction Project the construction schedules and thus the offshore noise generators would not occur concurrently. The proposed project and each of the projects listed in Table 6.1-1 would result in noise at onshore locations that could in combination increase noise levels at sensitive receptors if the construction of projects occurred concurrently. As discussed the schedule for the proposed project, RBSP II, and San Elijo Lagoon Restoration Project would not overlap. In addition, the potential for the San Elijo Lagoon Restoration Project to result in dredged material suitable for placement on nearby beaches is not quantified at this time but any suitable material could be used as a source for the Coastal Storm Damage Reduction Project, rather than undertaking additional construction activities along the receiver sites. The other listed project as are located sufficiently far and are of short-duration in any one area such that their noise is not expected to measurably add to the project-related noise. Under all alternatives, mitigation measures for nighttime construction would be implemented that will reduce noise impacts to less than significant.

Cumulative impacts over the short-term are not expected to be significant because the other projects considered in the cumulative assessment are not located in the same immediate vicinity and/or are not likely to be constructed concurrently with the Coastal Storm Damage Reduction Project. Listed cumulative projects are expected to result in similar short-term and temporary noise increases during construction, but not contribute any permanent or long-term increase in noise. Furthermore, all construction would be subject to the requirements specified under the applicable Municipal Code. With the implementation of appropriate mitigation measures, no long-term, permanent significant cumulative noise impacts are expected under any alternative.

6.2.10 Socioeconomics

The Coastal Storm Damage Reduction Project and other similar sand placement projects would result in long-term beneficial impacts to socioeconomics in the local area and region under all alternatives. The beaches in the study area are a major attraction for tourists, and improvements to those beaches will in turn provide a better setting for recreation and tourism. The direct economic impact of the Project is expected to be minor, though beneficial, in terms of jobs.

As discussed in the socioeconomic affects assessment section, temporary impacts to fishermen, both commercial and sport, may occur due to restrictions on fishing areas during Project activities. However, these impacts would be short-term, localized, and reversible, and therefore are not considered significantly adverse. Other projects in the cumulative assessment are also generally short-term.

Short-term and localized impacts to recreational activities, such as surfing or diving, may occur as a result of the Project, as well as other cumulatively considered projects. Over the long-term, the Project is expected to have beneficial impacts to recreation, tourism, and associated socioeconomic considerations. Therefore, implementation of the Coastal Storm Damage Reduction Project would not result in, or considerably contribute to, a cumulatively significant adverse impact to socioeconomics under any alternative.

6.2.11 Transportation

As discussed in Section 5.11, no long-term traffic impacts would occur because only a minor temporary (construction-related) increase in vehicular activity to the receiver sites is anticipated. Because either the timing is not concurrent or distance is sufficiently far between the proposed project and cumulative projects listed in Table 6.1-1 that impacts to surface streets would not be substantial. Cumulative impacts would not be significant when considering the other reasonably foreseeable projects, since few (if any) projects would require the use of the same routes for construction vehicles at the same time of the proposed project construction activities and would not generate substantial traffic. Therefore, implementation of the Coastal Storm Damage Reduction Project would not result in, or considerably contribute to, a cumulatively significant adverse impact to traffic under any alternative.

6.2.12 Land Use

As discussed in Section 5.12, beach replenishment activities associated with the proposed project would be compatible with existing designated land uses. No inconsistencies with federal, state, or local land use plans have been identified and land use plans encourage beach nourishment. . . Under all alternatives, the project would not cause significant adverse impacts to land use. The cumulatively considered future projects would also be compatible with existing and future land use plans. Combined with the beneficial impacts to land use that would occur with implementation of the proposed action, no cumulatively significant adverse impacts to land use would occur under any alternative.

6.2.13 Recreation

Recreational activities at a specific receiver site and dredging site would be temporarily restricted during project construction for all alternatives. Because of physical constraints such as staging areas and beach access, it is not feasible other replenishment activities or other reasonably foreseeable projects in the same vicinity would occur concurrently. As a result all beaches would continue to be capable of serving beach goers daily, with only relatively small portions of any given beach restricted due to sand placement activities. As beach closure would only occur on a short-term basis, and nearby beaches would not be expected to close at the same time, recreational opportunities could continue and no substantial adverse cumulative impacts to recreation would occur.

Over the long-term, beach replenishment activities are designed to increase and enhance recreational opportunities at beaches for both residents and tourists. Implementation of this action and other listed beach nourishment projects would increase the width and quality of the proposed receiver beaches, increasing the value of beach recreational activities for both the local and regional tourist industry. Therefore, implementation of the Coastal Storm Damage Reduction Project would not result in, or considerably contribute to, a cumulatively significant adverse impact to recreation under any alternative. Implementation of this project would contribute to a cumulative benefit to the recreational value of San Diego regional beaches.

6.2.14 Public Safety

Appropriate public safety measures such as onshore and offshore closure to public access, onshore barricades, and safety personnel as necessary would be taken for the proposed project. Other beach nourishment projects would institute the same type of buffer zones and barricades. These safety measures would only be used on a short-term basis for the length of individual beach replenishment activities. Some seasonal lifeguard towers may need to be temporarily relocated during replenishment activities. However, these impacts would not be significant because no beach usage would occur in areas of active construction. No cumulative impacts are expected to occur along the length of the pipeline since the pipe would be buried or spanned by access ramps at critical public and lifeguard access points. To maintain vessel safety, an approximate 300-ft-radius buffer area would be established around the mono buoy in offshore waters to allow proper anchoring and pump line operation. The location and schedule of the dredge and the offshore restricted zone would be published in the U.S. Coast Guard Local Notice to Mariners. Considering the implementation of these and other reasonable public safety measures at the Project site and would be required for all other projects listed in Table 6.1-1, no adverse cumulative impacts to public safety would occur.

6.2.15 Public Utilities

Regional demand for existing utility services such as water, sewer, gas and electric, solid waste, and wastewater would not be incrementally increased by implementation of the proposed project. Short-term cumulative interruption of services would be avoided by project design and monitoring efforts. It is not anticipated that any long-term disruption impacts would occur. Generally, the proposed project and listed cumulative projects would not result in new construction with substantial increase in demand for utilities. Therefore, implementation of the Coastal Storm Damage Reduction Project would not result in, or considerably contribute to, a cumulatively significant adverse impact to public utilities under any alternative.

7 EFFECTS FOUND NOT TO BE SIGNIFICANT

Issues that were found to be less than significant without the need for mitigation measures included in this Integrated Report included geology and topography, oceanographic and coastal processes, water and sediment quality, air quality, greenhouse gases, aesthetics, socioeconomics, transportation, land use, recreation, public safety, and public utilities. Issues that were found to be significant and require mitigation measures to reduce impacts below a level of significance included biological resources, noise, and cultural resources. The analysis determined that the proposed action would not have a long-term significant effect on these elements and the analyses of these issues are detailed in this document in Section 5.0. Although no long-term significant impacts are expected, a monitoring plan would be implemented during construction and post-construction to verify no significant impacts occur.

In other instances, consequences of the beach nourishment were found to be beneficial, such as the positive effect of enhanced local recreational opportunities for both residents and tourists, enhanced visual appeal of broadened beaches, as well as increased protection of public property and infrastructure.

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8 UNAVOIDABLE SIGNIFICANT IMPACTS

This Integrated Report considered the potential impacts of the proposed alternatives, in addition to the No Action Alternative, according to several resource categories: geology and topography, oceanographic and coastal processes, water and sediment quality, biological resources, air quality, greenhouse gases, aesthetics, cultural resources, noise, socioeconomics, transportation, land use, recreation, public safety, and public utilities. Significant impacts have been identified for cultural resources for borrow sites (there is the potential for discovery of significant cultural resources during dredging activities) and biological resources for Solana Beach (sand introduced into the system would indirectly impact marine biological resources as a result of burial or degradation of sensitive habitats and resources). Mitigation measures will be implemented to reduce impacts to below significance. Significant unavoidable impacts to biological resources may occur to marine biological resources (quality or quantity of benthic habitat EFH and HAPCs); however, since it will take at least two years to identify impacts, some temporal loss of habitat is unavoidable. If mitigation were required based on results of the post-construction monitoring, rocky reef and surfgrass mitigation shall each be conducted at a 2:1 functional equivalent. Additionally, if impacts were to occur, future beach fills would be modified to avoid future impacts.

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9 TENTATIVELY RECOMMENDED PLAN

9.1 Environmentally Superior Plan (CEQA)

Table 9.1-1 and **Table 9.1-2** show the comparison of the potential environmental impacts associated with each of the project's alternatives. These alternatives represent a diversity of approaches to the project objectives. Alternatives EN-3 and SB-3, the No Action Alternative would not meet the project need or objective. While the significance level of each alternative as presented below is comparable to one another, the amount or severity of a specific impact is varied amongst the alternatives as evaluated in Section 5.

Table 9.1-3 and and **Table 9.1-4** highlight the benefits of each of the alternatives as well as the potential mitigation needed for the alternatives in Solana Beach (Segment 2).

Impacts associated with the Encinitas (Segment 1) alternatives have been evaluated for all resource topics and were determined to be less than significant for all resources except cultural resources (discovery). Mitigation is proposed for the impacts identified under each alternative and the severity of these impacts is directly relative to the size of the proposed beach and associated number of days for construction, with the greatest potential for impacts to occur associated with Alternative EN-1A and EN-2A, and reduced severity of potential impacts associated with Alternative EN-1B and EN-2B.

Impacts associated with the Solana Beach (Segment 2) alternatives have been evaluated for all resource topics and determined to be less than significant for all resources except biological resources and cultural resources (discovery). Mitigation is proposed for the impacts identified under each alternative and the severity of these impacts is directly relative to the size of the proposed beach and associated number of days for construction, with the greatest potential for impacts to occur associated with Alternative SB-1A and SB-2A, and reduced severity of potential impacts associated with Alternative SB-1C and SB-2B.

Based on the analysis presented in the tables below as well as in section 5, Alternatives EN-1B and SB-1C are considered the Environmentally Superior Plans.

Table 9.1-1 Potential Impacts in Encinitas

Alternative	Biological Resources	Cultural Resources
Encinitas		
EN-1A: Beach Nourishment (100 ft; 5-yr cycle)	Less than significant	**Significant** The sensitivity of prehistoric resources within each borrow site may vary laterally based on the occurrence of submerged landforms, and vertically, based on the types of sediments revealed by the vibracore sample. While the sensitivity of contexts around the borrow sites is generally assessed as low, there is the potential for discovery and/or loss of sensitive cultural resources during dredging activities. A monitoring program will be implemented to avoid potential impacts associated with discovery of resources.
EN-1B: Beach Nourishment (50 ft; 5-yr cycle) and EN-2A: Hybrid (100 ft; 10-yr cycle) and EN-2B: Hybrid (50 ft; 5-yr cycle)	Less than significant	**Significant** Monitoring will be similar to EN-1A. Consequences are similar to EN-1A, however, since the volume of material to be dredged under these alternatives is reduced, the potential for discovery and impact to prehistoric resources is incrementally reduced.
EN-3: No Action	Less than significant	Less than significant

Table 9.1-2 Potential Impacts in Solana Beach

Alternative	Biological Resources	Cultural Resources
Solana Beach		
SB-1A: Beach Nourishment (200/300 ft; 13/14-yr cycle)	**Significant** Sand introduced into the system would indirectly impact up to 8.4 acres of marine biological resources (benthic habitat) as a result of burial or degradation of sensitive habitats and resources, under the low sea level rise scenario. Mitigation in the form of a 16.8-acre artificial reef would be required.	**Significant** The sensitivity of prehistoric resources within each borrow site may vary laterally based on the occurrence of submerged landforms, and vertically, based on the types of sediments revealed by the vibracore sample. While the sensitivity of contexts around the borrow sites are generally assessed as low, there is the potential for discovery and/or loss of sensitive cultural resources during dredging activities. A monitoring program will be implemented to avoid potential impacts associated with discovery of resources.
SB-1B: Beach Nourishment (150 ft; 10-yr cycle) and SB-2A: Hybrid (150 ft; 10-yr cycle)	**Significant** Sand introduced into the system would indirectly impact up to 6.8 acres of marine biological resources (benthic habitat) as a result of burial or degradation of sensitive habitats and resources, under the low sea level rise scenario. Mitigation in the form of a 13.6-acre artificial reef would be required.	**Significant** Consequences are similar to SB-1A, however, since the volume of material to be dredged under these alternatives is reduced, the potential for discovery and impact to prehistoric resources is incrementally reduced. A monitoring program will be implemented to avoid potential impacts associated with discovery of resources.
SB-1C: Beach Nourishment (100 ft; 10-yr cycle) and SB-2B: Hybrid (100 ft; 10-yr cycle)	**Significant** Sand introduced into the system would indirectly impact up to 1.6 acres of marine biological resources (benthic habitat) as a result of burial or degradation of sensitive habitats and resources, under the low sea level rise scenario. Mitigation in the form of a 3.2-acre artificial reef would be required.	**Significant** Consequences are similar to SB-1A, however, since the volume of material to be dredged under these alternatives is reduced, the potential for discovery and impact to prehistoric resources is incrementally reduced. A monitoring program will be implemented to avoid potential impacts associated with discovery of resources.
SB-3: No Action	Less than significant	Less than significant

Table 9.1-3 Summary of Final Array of Encinitas Alternatives

Encinitas (EN)	Alternative EN -1A: Beach Nourishment (100 ft; 5-yr cycle)	Alternative EN -1B: Beach Nourishment (50 ft; 5-yr cycle)	Alternative EN-2A: Hybrid (100 ft; 10-yr cycle)	Alternative EN-2B: Hybrid (50 ft; 5-yr cycle)
Initial Placement Volume (cy)	680,000	340,000	680,000	340,000
Re-Nourishment Volume (cy)	280,000	220,000	280,000	220,000
Re-Nourishment Cycle	5-years	5-years	5-years	5-years
Total Placement Volume (cy) (50 Years)	3,200,000	2,320,000	3,200,000	2,320,000
Added Beach MSL Width (ft)	100	50	100	50
Total Project Costs	$98.9M	$55.6M	$98.9M	$55.6M
Average Annual Costs	$2.3M	$1.8M	$2.3M	$1.8M
Average Annual Benefits	$3.5M	$2.0M	$3.5M	$2.0M
Net Average Annual Benefits	$1.20M	$0.17M	$1.20M	$0.17M
Benefit to Cost Ratio	1.53	1.09	1.53	1.09
Residual Risk	32%	62%	32%	62%

Table 9.1-4 Summary of Final Array of Solana Beach Alternatives

Solana Beach (SB)	Alternative SB -1A: Beach Nourishment (200 ft; 13-yr cycle)	Alternative SB -1B: Beach Nourishment (150 ft; 10-yr cycle)	Alternative SB-1C: Beach Nourishment (100 ft; 10-yr cycle)	Alternative SB-2A: Hybrid (150 ft; 10-yr cycle)	Alternative SB-2B: Hybrid (100 ft; 10-yr cycle)
Initial Placement Volume (cy)	960,000	700,000	440,000	700,000	440,000
Re-Nourishment Volume (cy)	420,000	290,000	260,000	290,000	260,000
Re-Nourishment Cycle	13-years	10-years	10-years	10-years	10-years
Total Placement Volume (cy) (50 Years)	2,210,000	1,860,000	1,470,000	1,860,000	1,470,000
Added Beach MSL Width (ft)	200	150	100	150	100
Total Project Costs	$65.8M	$61.3M	$47.2M	$62.8M	$48.7M
Average Annual Costs	$1.9M	$1.7M	$1.2M	$1.8M	$1.3M
Average Annual Benefits	$2.9M	$2.3M	$1.5M	$2.4M	$1.7M
Net Average Annual Benefits	$0.86M	$0.51M	$0.29M	$0.52M	$0.37M
Benefit to Cost Ratio	1.43	1.28	1.23	1.28	1.28
Residual Risk	45%	56%	72%	55%	70%
Potential Mitigation (acres)	16.4	13.6	3.2	13.6	3.2

9.2 Tentatively Recommended Plan

The tentatively recommended plan is composed of the alternatives that have been identified as the NED plans for Segment 1 (Encinitas - EN-1A) and for Segment 2 (Solana Beach - SB-1A). Alternatives EN-1A and SB-1A involve sand nourishment on the study area beaches as the method of reducing coastal storm damages.

EN-1A has an initial dredged volume of 820,000 cy (890,000 cy under high SLR) that extends the base year beach width at mean-sea level approximately 100 ft. Nourishments would occur every 5 years and require dredging 340,000 cy of material (400,000 to 480,000 cy under high SLR). Net annual benefits are expected to be $1.44 million annually ($3.22 million under high SLR). Details of this alternative are described in section 3.4.1.

SB-1A has an initial dredged volume of 1,170,000 cy (2,070,000 cy under high SLR) that extends the base year beach width at mean-sea level approximately 200 ft (300 ft under high SLR). Nourishments would occur every 13 years (14 years under high SLR) and require dredging 500,000 cy of material (1-1.1 mcy under high SLR). Net annual benefits are expected to be $1.11 million annually ($1.67 million under high SLR). Details of this alternative are described in section 3.4.5.

9.2.1 Detailed Cost Estimate

An economics and engineering analysis was performed on the tentatively recommended plan. This required analysis incorporates qualitative and quantitative cost and schedule uncertainties associated with the project to determine a project contingency and, subsequently, the Total Project Cost. The Total Project cost is used for Appropriations because it includes inflation through the mid-point of construction. The Project First Cost at current price levels is used for requesting project Authorization. The detailed analysis is fully described and presented in Appendix F and follows guidance ETL 1110-2-573.

The project first cost includes a contingency of 29% greater than the model's estimate. The total project first cost estimated for the tentatively recommended plan is presented in **Table 9.2-1.**

Table 9.2-1 Total Project First Cost Estimate for Tentatively Recommended Plan (EN-1A and SB-1A)(OCT 2014 Price Level) (Rounded)

DESCRIPTION	ESTIMATED COST	CONTINGENCY	ESTIMATED COST INCLUDING CONTINGENCY
LANDS & DAMAGES	$36,000	$5,000	$41,000
MITIGATION	$2,387,000	$1,073,000	$4,533,000
BEACH REPLENISHMENT	$18,035,000	$5,573,000	$23,608,000
MONITORING	$3,911,000	$1,761,000	$5,672,000
PLANNING, ENG, & DESIGN	$2,471,000	$371,000	$2,842,000
CONSTRUCTION MANAGEMENT	$2,619,000	$393,000	$3,012,000
TOTAL FIRST PROJECT COSTS (EN-1A AND SB-1A)	**$29,459,000**	**$9,176,000**	**$38,635,000**

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10 ENVIRONMENTAL COMPLIANCE AND COMMITMENTS

10.1 Compliance with Applicable Regulatory Statutes and Permit Requirements

Federal and state environmental requirements considered in the preparation of this Integrated Report are briefly reviewed in the following subsections. Applicable local regulations are presented in Section 4 of this document, as appropriate.

10.1.1 Federal Environmental Regulations

National Environmental Policy Act of 1969 (42 U.S.C 4321 et seq.)

This EIS has been prepared in accordance with the requirements of NEPA (et seq) and the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] 1500-1508), as well as USACE's NEPA regulations at 33 C.F.R. part 230 (also ER 200-2-2).. NEPA requires that agencies of the Federal Government shall implement an environmental impact analysis program in order to evaluate "major federal actions significantly affecting the quality of the human environment." A "major federal action" may include projects financed, assisted, conducted, regulated, or approved by a federal agency. NEPA regulations are followed in the preparation of this EIS.

Coastal Zone Management Act of 1972 (16 U.S.C. 1451 et seq.) and California Coastal Act of 1976

The Coastal Zone Management Act (CZMA) preserves, protects, develops, and, where possible, restores or enhances the Nation's coastal zone resources for this and succeeding generations. This Integrated Report will act as the Coastal Consistency Determination (CCD) to the CCC, in satisfaction of CZMA requirements, Section 106(d), to certify consistency to the maximum extent practicable with an approved State Coastal Zone Management Plan. In addition to Coastal Act policies, the local ordinances of the cities of Encinitas and Solana Beach are included in this Integrated Report and in the analysis of environmental resources. This Integrated Report serves as the coordination with the CCC and this Integrated Report will serve as the CCD, and the USACE will submit this Integrated Report to the CCC for their review. The USACE has determined, based on the evaluation of potential impacts in this Integrated Report, that the project is consistent to the maximum extent practicable with the CZMA. The USACE will obtain concurrence from the CCC prior to construction.

Clean Water Act (33 U.S.C. §1251 et seq.)

The Clean Water Act (CWA) governs discharge of dredge or fill materials into the waters of the United States and it governs pollution control and water quality of waterways throughout the U.S. Its intent, in part, is to restore and maintain the biological integrity of the nation's waters. The goals and standards of the CWA are enforced through permit provisions. Sections 404 and 401 of the CWA pertain directly to the proposed project. Section 404 outlines the permit program required for filling the nation's waterways.

The USACE does not issue itself a permit for civil works projects, but must perform an equivalent evaluation of the project impacts on waters of the US, or seek an exemption from Congress. Therefore, a Section 404(b)(1) evaluation is prepared and included in this Integrated Report as Appendix D. Section 404(b)(1) evaluates project related impacts to the waters of the

U.S. and provides appropriate mitigation measures to minimize impacts. Section 230.10(a)(2) of the 404(b)(1) guidelines states that “an alternative is practicable if it is available and capable of being done after taking into consideration costs, existing technology and logistics in light of overall project purposes. Impacts to waters of the United States related to initial construction activities and future renourishment are identified in this Integrated Report. Mitigation measures for initial construction activities and future renourishment for the life of the project are included in this Integrated Report. The Cities of Solana Beach and Encinitas must follow all the environmental commitments identified in this Integrated Report where applicable. The USACE will continue to coordinate with the Regional Water Quality Control Board (RWQCB) throughout the CWA of 1977 process and construction activities. Coordination with the California State Water Resources Control Board (SWRCB) was performed during preparation of this Integrated Report. USACE has determined that full compliance with CWA Section 404 is met and thus may invoke, if needed, CWA 404(r), once the project is authorized by Congress.

Rivers and Harbors Act (33 U.S.C. 403)

Section 10 of the Rivers and Harbors Act prohibits the unauthorized obstruction or alteration of any navigable waters of the United States, and authorizes the USACE to regulate all activities that affect the course, capacity, or coordination of waters of the U.S. Navigable waters of the U.S. are defined in 33 CFR Part 329 as those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. USACE has complied with River and Harbors Act in the development of this Integrated Report.

Fish and Wildlife Coordination Act (16 U.S.C 661 et seq)

This Act requires Federal agencies to coordinate with the USFWS and local State agencies when any stream or body of water is proposed to be impounded, diverted, or otherwise modified. The intent is to give fish and wildlife conservation equal consideration with other purposes of water resources development projects. Coordination under the Fish and Wildlife Coordination Act is ongoing. In response to the requirements of this Act, USACE is coordinating with the U.S. Fish and Wildlife Service (USFWS) and the California Department of Fish and Game (CDFG) during the initial and current stages of planning. The USACE has coordinated extensively with the USFWS, National Oceanographic and Atmospheric Administration (NOAA) Fisheries (formerly NMFS), and CDFG in the development of the proposed alternatives, environmental commitments, and potential mitigation measures. USACE and will continue to coordinate with NOAA Fisheries throughout the NEPA process. The USFWS is in the process of revising the Coordination Act Report for this project (Appendix J).

Endangered Species Act (16 U.S.C. 1531 et seq)

The Endangered Species Act of 1973 (ESA) protects endangered and threatened species by prohibiting Federal actions that would jeopardize the continued existence of such species or result in the destruction or adverse modification of habitat of such species. USACE requested a species list of Federal endangered and threatened species from the USFWS on July 10, 2003, however, USFWS did not respond to the request. However, the USFWS responded to the NOI, stating that Federal endangered and threatened species were in the vicinity of the project area, and that development of this Integrated Report has considered the impacts of this project to Federal endangered and threatened species (Subsection 5.4). Additional and more recent ongoing coordination with respect to Federal endangered and threatened species has occurred with both USFWS and NOAA Fisheries in the development of this Integrated Report. Federally endangered or threatened species that inhabit the project area are listed and discussed in and **Table 4.5-10**.

The Corps has determined that the project would not affect any listed species or designated critical habitat.

<u>Magnuson-Stevens Fishery Management and Conservation Act (16 U.S.C 1801 et seq.)</u>

Federal agencies must consult with NOAA Fisheries on actions that may adversely affect Essential Fish Habitat (EFH). EFH is defined as those “waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” NOAA Fisheries encourages streamlining the consultation process using review procedures under NEPA, Fish and Wildlife Coordination Act, CWA, and/or FESA provided that documents meet requirements for EFH assessments under Section 600.920(g). EFH assessments must include (1) a description of the proposed action, (2) an analysis of effects, including cumulative effects, (3) the Federal agency’s views regarding the effects of the action on EFH, and (4) proposed mitigation, if applicable. Description and evaluation of EFH for the coastal zone is included in this Integrated Report in Subsection 5.4.

<u>Marine Mammal Protection Act (16 U.S.C. § 1361 et seq)</u>

The Marine Mammal Protection Act (MMPA) protects marine mammals and establishes a marine mammal commission to regulate such protection. The requirements of this Act were considered in the evaluation of environmental consequences of the alternatives The MMPA was considered and evaluated in the development of this Integrated Report in Subsection 5.4.

<u>Migratory Bird Treaty Act (MBTA) (16 USC 703-711)</u>

The Migratory Bird Treaty Act (1916), agreed upon between the United States and Canada; the Convention for the Protection of Migratory Birds and Animals (1936), agreed upon between the United States and Mexico; and subsequent amendments to these Acts, collectively referred to as the MBTA, provide legal protection for almost all breeding bird species occurring in the United States. These Acts restrict the killing, taking, collecting, and selling or purchasing of native bird species or their parts, nests, or eggs. Certain game bird species are allowed to be hunted for specific periods determined by federal and state governments. The intent of the Act is to eliminate any commercial market for migratory birds, feathers, or bird parts, especially for eagles and other birds of prey. The proposed action complies with this Act in that no occupied nests will be destroyed and the action will not disrupt migratory patterns. The MBTA was considered and evaluated in the development of this Integrated Report in Subsection 5.4.

<u>Executive Order 11990</u>

This Order requires that governmental agencies, in carrying out their responsibilities, provide leadership and “take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.” This Order was considered in the development of alternatives. The action will have no permanent adverse effect on wetlands.

Executive Order 11991

This Order is related to protection and enhancement of environmental quality. Section 1 of this Order directs the CEQ to issue guidelines to Federal agencies for implementing procedural provisions of NEPA (1969). The guidelines recommend early EIS preparation and preparation of impact statements that are concise, clear, and supported by evidence that agencies have made the necessary analyses. These guidelines (ER 200-2-2, 33 CFR 230 March 1988) were followed in the preparation of this Integrated Report.

National Historic Preservation Act (16 U.S.C. § 479)

Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, established the National Register of Historic Places (NRHP), which is a master list of historic properties of national, state, and local significance. Under Section 106, agencies are required to consider the effects of their actions on properties that may be eligible for or are listed in the NRHP. The NRHP established the Advisory Council on Historic Preservation (ACHP) to comment on federally licensed, funded, or executed undertakings affecting National Register properties. Regulations of the ACHP (36 C.F.R. part § 800) provide guidance for Federal agencies to meet Section 106 requirements. This process involves consultation with the State Historic Preservation Officer (SHPO), the ACHP, and other interested parties, including Native American Tribes, as warranted. The USACE consulted with SHPO regarding this project on July 13, 2005 and reconsultation will occur during Preconstruction, Engineering and Design.

Clean Air Act (42 U.S.C. §7401 et seq)

The Clean Air Act (CAA) regulates emissions of air pollutants to protect the nation's air quality. The CAA is applicable to permits and planning procedures related to the disposal of dredged materials onshore and in open waters within 3 miles (mi) of the nearest shoreline. Section 118 of the CAA (42 U.S.C. § 7418) requires all Federal agencies engaged in activities that may result in the discharge of air pollutants to comply with Federal and State laws, and interstate and local requirements regarding control and abatement of air pollution. Section 176(c) requires all Federal projects to conform to U.S. Environmental Protection Agency- (USEPA) approved or promulgated State Implementation Plans (SIPs). This Act was considered in the evaluation of consequences of the alternatives. CAA Conformity Analysis is addressed for this action (Subsection 5.5).

Executive Order 12898

This Executive Order requires that the EIS/EIR analyze the impacts of federal actions on minority and low-income populations and provides opportunities for input on the EIS/EIR by affected communities (Subsection 5.9). During EIS/EIR scoping, all interested members of the public, including minority communities and low-income populations, were invited to participate in the environmental process for this action. The alternatives developed for this Integrated Report were based on a set of criteria that did not discriminate on the basis of race, color, or national origin. The proposed action would not have an impact on minority communities or low income populations and therefore it is in compliance with this Order.

Executive Order 13045

This Order addresses "Environmental Health and Safety Risks to Children." This Order is designed to focus Federal attention on actions that affect human health and safety conditions that may disproportionately affect children. Consistent with Executive Order 13045, the project would not disproportionately impact children in the region of influence.

Federal Water Project Recreation Act (16 U.S.C. 460l-12 – 460l-22, 662)

This Act requires that any Federal water project must give full consideration to opportunities afforded by the project for outdoor recreation and fish and wildlife enhancement. The proposed action would provide opportunity for recreational activities by development of beach, including recreational use areas, which would be primarily passive in nature.

10.1.2 State Environmental Regulations

California Environmental Quality Act (Public Resources Code, Sections 21000-21177)

This Act requires that state and local agencies consider environmental consequences and project alternatives before a decision is made to implement a project requiring state or local government approval, financing, or participation by the State of California. In addition, CEQA requires the identification of ways to avoid or reduce environmental degradation or prevent environmental damage by requiring implementation of feasible alternatives or mitigation measures. This Integrated Report was prepared in accordance with this regulation.

California Coastal Act of 1976, as amended

The Act specifies basic goals for coastal conservation and development related to protection, enhancement and restoration of coastal resources, giving priority to "coastal-dependent" uses and maximizing public access to California residents and visitors. The Act defines the "coastal zone" of California, which generally extends 3.0 mi out to sea and inland generally 1,000 yard (yd). It may be extended further inland in certain circumstances. It is also less than 1,000 yd wide in some urban areas. Each city and county in California, which, is on the coast must prepare a Local Coastal Program (LCP) for all areas within the coastal zone. The LCP includes Land Use Plans (LUPs), zoning ordinance amendments and map changes to reflect the Coastal Act and LCP goals and policies at the local level. See discussion of required federal coordination of the CZMA with the California Coastal Act above.

Porter-Cologne Water Quality Control Act of 1969 (California Water Code §§ 13000-13999.10)

This Act mandates that activities that may affect waters of the State shall be regulated to attain the highest quality. The RWQCB provides regulations for a "nondegradation policy" that are especially protective of waters with high quality. This Act was considered in the evaluation of consequences of the alternatives.

California State Lands Commission

The California State Lands Commission (CSLC) has regulatory authority to administer, sell, lease or dispose of the public lands owned by the state or under its control, including not only school lands but tidelands, submerged lands, swamp and overflowed lands, and beds of navigable rivers and lakes (California Public Resources Code Section 6216). The CSLC created the California Coastal Sanctuary, which includes all state waters subject to tidal influence such as the study area. California Public Resources Code Section 6303 requires that a Lease Agreement for Utilization of Sovereign Lands be issued prior to initiation of any project that occurs on state-owned lands.

<u>California Endangered Species Act (Cal. Fish and Game Code §§ 2050-2116)</u>

The California Endangered Species Act (CESA) parallels FESA. As a responsible agency, the CDFG has regulatory authority over state-listed endangered and threatened species. Since the proposed project may affect species that are listed as threatened or endangered under both the state and federal Endangered Species Acts and, since the project is subject to CEQA review and federal review pursuant to NEPA, the CDFG shall participate to the greatest extent practicable in the federal endangered species consultation. The state legislature encourages cooperative and simultaneous findings between state and federal agencies. Further, the General Counsel for the CDFG has issued a memorandum to CDFG regional managers and division chiefs clarifying the CESA consultation process wherein, if a federal BO has been prepared for a species, the CDFG must use this BO in lieu of its own findings unless it is inconsistent with CESA. CDFG Code Section 2095 authorizes participation in federal consultation and adoption of a federal BO. By adopting the federal BO, the CDFG need not issue a taking permit per Section 2081 of the state Code. If the BO is consistent with CESA, the CDFG will complete a 2095 form in finalizing the adoption of the BO. If the federal BO is found to be inconsistent with CESA, the CDFG will issue its own BO per Section 2090 of the state Code and may issue a 2081 take permit with conditions of approval. The proposed project would comply with this Act.

10.1.3 Local Environmental Regulations

<u>San Diego Air Pollution Control District</u>

The Encinitas and Solana Beach Coastal Storm Damage Reduction Study is located within the San Diego Air Basin (SDAB). Emissions that would result from the construction and operation of the project are subject to the rules and regulations of the County of San Diego Air Pollution Control District (SDAPCD). Rules and regulations of this agency are designed to achieve defined air quality standards that are protective of public health. To that purpose they limit the emissions and the permissible impacts of emissions from projects, and specify emission controls and control technologies for each type of emitting source in order to ultimately achieve the air quality standards.

<u>City of Encinitas (City of Encinitas General Plan, as amended)</u>

The Plan consists of an integrated and internally-consistent set of goals, policies and standards that address a number of issue areas which include land use, circulation, housing, noise, safety, recreation, conservation and open space. These issues are discussed in the seven elements, which correspond with State requirements. These elements include Land Use, Housing, Circulation, Public Safety, Resource Management (Open Space and Conservation), Recreation, and Noise. The Encinitas General Plan identified issues and opportunities relative to planning decisions within the City. Regarding beaches, the plan states, “the beach areas are losing sand depth each year and sand replenishment programs are needed to provide for their restoration.”

City of Encinitas (Encinitas Municipal Code, Zoning)

The City of Encinitas municipal code includes regulations for Coastal Development Permits (30C80), which are applicable to proposed developments along the shoreline including notch fills and seawalls. Issuance of Coastal Development Permits is a discretionary action by the City and may be appealed to the CCC.

City of Solana Beach (City of Solana Beach General Plan, as amended)

The Plan consists of an integrated and internally-consistent set of goals, policies and standards that address a number of issue areas which include land use, circulation, housing, noise, safety, recreation, conservation and open space. These issues are discussed in the seven elements, which correspond with State requirements. These elements include Land Use, Housing, Circulation, Public Safety, Resource Management (Open Space and Conservation), Recreation, and Noise. The City of Solana Beach draft Local Coastal Program (LCP) Land Use Plan (LUP) was approved by the CCC on March 7, 2012. The LUP for the Solana Beach LCP recognizes the importance of a sandy beach, and includes a number of policies that specifically encourage beach sand replenishment and sand retention strategies to establish a wide sandy beach in the city. The LUP has an overarching land use policy that addresses beach replenishment and sand retention.

City of Solana Beach (Solana Beach Municipal Code, Title 17 Zoning)

Solana Beach Municipal Code Chapter 17.62 requires a discretionary City Use Permit for infilling basal notches and sea caves. The CCC also requires this same measure. The City of Solana Beach does not require a separate discretionary permit for beach sand projects and defers to the CCC in their permit process.

10.2 Commitments

The following table (**Table 10.2-1**) lists the actions committed to be undertaken by the USACE for the proposed action to ensure environmental impacts are reduced to the extent possible. These actions may be part of design of the project as may be best management practices or specific features to reduce environmental impacts; they may be monitoring activities to alert the USACE and the contractor to potential environmental impacts; and they may be mitigation measures to compensate for actual impacts to the environment.

1 **Table 10.2-1 Summary of Design Features/Monitoring Commitments**

Design Features	Purpose	Timing	Implementation Responsibility
Topography, Geology, and Geography			
Use of concrete for notch fill material	Mimic natural erosive processes	During notch fill	Construction contractor
Oceanographic Characteristics and Coastal Processes			
Use of concrete for notch fill material	Mimic natural erosive processes	During notch fill	Construction contractor
Water and Sediment Quality			
Construct "L"-shaped berms at all receiver sites	Anchor sand placement operations and reduce nearshore turbidity	During beach fill	Construction contractor
Maintenance for land-based vehicles will occur in staging area away from beach and sensitive areas	Avoid minimal contamination from leaks, if any	During beach nourishment/notch fill	Construction contractor
Use proper BMPs during vehicle fueling	Avoid petroleum spills	During beach nourishment/notch fill	Construction contractor
Generate plan for hazardous spill prevention and containment	Ensure minimal contamination from fuel leaks, if any	During operation of equipment on the beach or in the water	Construction contractor
Biological Resources			
Design borrow sites to maintain adequate distance from artificial reefs, kelp, and other features	Avoid direct impacts to artificial reefs and kelp	Final engineering and during construction	Engineering contractor and construction contractor
Construct second transverse berm to begin a new cell if grunion spawning or eggs are encountered during construction	Section of beach with grunion would be avoided and bypassed	If grunion spawning or eggs are encountered	Construction contractor, in coordination with USACE
No construction shall be performed within 1,400 ft of any sensitive bird species that have clear line of site to the construction area during breeding and nesting season; no beach construction within 790 ft of any sensitive bird species during the breeding and nesting season	Minimize impacts to sensitive wildlife of noise emissions	During beach nourishment/notch fill	Construction contractor
Air Quality			
Use of BMPs to reduce air quality impacts such as the use of BACT and/or BART for the dredge	To reduce air emissions	During all construction activities	Construction contractor
Construction equipment will be properly maintained and tuned	To reduce air emissions	During beach nourishment/notch fill	Construction contractor
Aesthetics			
Notch fill material will be colorized and textured to match the existing bluff face	Improve aesthetics of erodible concrete.	During notch fill	Construction contractor
Cultural Resources			
Cultural Resource Surveys	Avoid/Minimize impacts to	Preconstruction,	USACE

Design Features	Purpose	Timing	Implementation Responsibility
	resources.	Engineering and Design Phase	
A plan for unanticipated discoveries will be provided to the construction contractor	To prepare for unanticipated discoveries	During excavation	USACE
Noise			
Construction equipment shall be fitted with mufflers, air intake silencers, and engine shrouds; stationary noise sources will be located far from residential receptor locations	Minimize noise emissions	During beach nourishment/ notch fill	Construction contractor
A noise variance shall be obtained for work done after 7 pm from the City of Encinitas and the City of Solana Beach	Public notification and approval	Prior to the commencement of any work	Construction contractor
In Solana Beach, no beach construction shall be performed within 1,400 ft of any sensitive bird species that have a clear line of sight to the construction area during the breeding and nesting season; and no beach construction shall be performed within 790 ft of any sensitive bird species during the breeding and nesting season	Minimize impacts to sensitive wildlife of noise emissions	During beach nourishment/notch fill	Construction contractor
Socioeconomics			
Coordination with commercial fishermen; establishment of offshore transit corridors in consultation with a commercial fishermen representative; issue Notice to Mariners	Avoid gear conflicts and provide for compensation if loss occurs	Before and during dredging operations	Coast Guard (via construction contractor) and USACE
Recreation			
Communicate with local jurisdictions to avoid recreational events	Avoid disruption of established recreational events.	During beach nourishment/notch fill	Construction contractor
Public Safety			
Avoid placing fill material near storm drain outlets	Continue proper drainage	During beach nourishment/notch fill activities	Construction contractor, in coordination with City Engineer
Generate plan for hazardous spill prevention and containment	Ensure minimal contamination from fuel leaks, if any	During operation of equipment on the beach or in the water	Construction contractor
Issue Notice to Mariners and maintain 500-ft buffer around active dredge equipment	Warn boaters/fishermen of dredging activities to ensure avoidance	Before and during dredging activities	Coast Guard (via construction contractor)
Generate safety plan to restrict public access at receiver and notch fill sites and maintain 150-ft buffer around construction areas	Public safety during construction	During beach nourishment/notch fill activities	Construction contractor, in coordination with local lifeguards

Design Features	Purpose	Timing	Implementation Responsibility
Relocation of temporary lifeguard towers	Public safety during construction	During beach nourishment activities/notch fill	Construction contractor, in coordination with local lifeguards
Sand placement to avoid blocking line-of-sight at permanent lifeguard towers	Public safety during construction	During beach nourishment activities	Construction contractor, in coordination with local lifeguards
Monitoring Commitments			
Cultural resources: Observation by a qualified archaeological monitor during sediment removal	To identify existing cultural resources and avoid potential impacts	During excavation	USACE
Water and Sediment Quality: Monitor turbidity levels	To avoid turbidity impacts to fish and aquatic species	During dredging operations and beach fill activities	
Biology: Conduct nearshore underwater surveys	Establish baseline data for comparison purposes and determine if any natural/biological resources/habitats have been adversely impacted by the project	Prior to construction and after construction	Qualified biologist
Biology: Monitor weekly for grunion spawning in construction area, establish buffer extending 100 ft shoreward of high tide line and 100 ft upcoast and downcoast (total 200 ft), until eggs hatch (minimum of one lunar month) and surveys show no subsequent spawning	Avoid grunion eggs and protect until hatched	April through September and per CDFG annual pamphlet *Expected Grunion Runs*.	Qualified biologist
Public Safety: Generate safety plan to restrict public access at receiver and notch fill sites and maintain 150-ft buffer around construction areas	Public safety during construction	During beach nourishment/notch fill activities	Construction contractor, in coordination with local lifeguards
Post-Project Mitigation Measures (If Necessary)			
Biology: Restoration or creation of like habitat at a functional equivalent (assumed to be 2:1 for the purposes of evaluation) to be determined with the responsible resource agencies according to the long-term significant impacts, if any, to marine resources	Mitigate for significant, long-term Impacts, if any, to sensitive marine resources caused by sediment placement or transport	Subsequent to resource agency review of monitoring reports and determination that significant impact had occurred	Qualified biologist

11 OTHER NEPA/CEQA REQUIRED ANALYSES

This section addresses other topics required by CEQA and NEPA in this Integrated Report. These include the relationship between local short-term uses of the environmental and long-term productivity (NEPA); the identification of any irreversible and irretrievable commitments of resources (NEPA and CEQA); an analysis of growth-inducing impacts (CEQA); a discussion of energy requirements and conservation potential of alternatives and mitigation measures (CEQA); a discussion of Executive Order 13045 (Environmental Health and Safety Risk to Children, 62 Fed. Reg. 19885 (1997)); and a discussion of issue related to Executive Order 12898 (Environmental Justice, 59 Fed. Reg. 7629 (1994)).

11.1 Relationship Between Short-Term Uses of the Environmental and Maintenance and Enhancement of Long-Term Productivity

The CEQ under NEPA Regulations (40 CFR Part 1500 et seq.) require that an EIS discuss issues related to environmental sustainability. The discussion relates to environmental consequences, including consideration of "the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (42 USC Section 4332[C][iv]).

The objective of the proposed project is to provide a beach sand nourishment project in the Cities of Encinitas and Solana Beach eroding beaches by dredging material from offshore borrow sites and placing sand directly onshore. This action would widen existing beaches in order to reduce erosion potential and increase protection of existing structures, as well as increase recreation opportunities for long-term use. Disposal of beach-compatible dredged material on identified receiver sites would support the USACE plan; policies contained in the Encinitas and Solana Beach General Plans; and the project objectives.

Implementation of the proposed action or any alternative would not result in any environmental impacts that would significantly narrow the range of beneficial uses of the environment or pose long-term risks to health, safety, or the general welfare of the public communities surrounding the receiver sites. Rather, the project would provide for future beneficial beach resources (e.g., recreational activities, sandy shoreline habitat).

11.2 Irreversible and Irretrievable Commitment of Resources

Section 15126(c) of the CEQA Guidelines requires an EIR to address any significant irreversible environmental changes and irretrievable commitment of resources that may occur as a result of alternative implementation. Resources which are irreversibly or irretrievably committed to a project are those that are typically used on a long-term or permanent basis; however, some are considered short-term resources that cannot be recovered and are thus considered irretrievable. This includes use of nonrenewable resources (e.g., fuel, wood, or other natural or cultural resources), the commitment of future generations to similar uses, and irreversible damage, which can result from environmental accidents associated with the project. Irreversible changes associated with all of the alternatives include the use of building materials, nonrenewable energy sources, and labor required to operate trucks, machinery, and other equipment. The unavoidable destruction of natural resources which limit the range of potential uses of that particular environment would also be considered an irreversible or irretrievable commitment of resources.

The proposed beach nourishment activities in the cities of Encinitas and Solana Beach would result in the placement of dredged beach fill material. The project is necessary to increase protection of existing beaches, which not only provide recreational opportunities for residents, but also contribute to the regional tourist industry. The action would result in consumption of nonrenewable energy sources and labor required to operate dredges, trucks, pumping equipment, grading equipment, and any other necessary machinery associated with beach nourishment and notch fill. Beach nourishment activities in subsequent years would require the use of resources periodically. Long-term continuation of sand nourishment projects would require periodic labor and nonrenewable energy sources. These commitments of resources could have otherwise been applied to projects other than the proposed action. However, the proposed action would not result in the use of a substantial amount of resources and would be short term and periodic in nature. Additionally, no natural resources would be permanently destroyed and beach nourishment would be considered beneficial to the region.

11.3 Growth Inducing Impacts

Under CEQA Guidelines Section 15126.2(d), an EIR must discuss the ways in which the proposed action and alternatives could foster economic or population growth or the construction of additional housing, either directly or indirectly, in the area of population growth or the construction of additional housing, either directly or indirectly, in the area surrounding the proposed action. Analysis of growth-inducing effects includes those characteristics of the action that may encourage and facilitate activities that, either individually or cumulatively, would affect the environment. Population increases, for example, may impose new burdens on existing community service facilities. Similarly, improvement of access routes may encourage growth in previously undeveloped areas. Growth may be considered beneficial, adverse, or of no significance environmentally, depending on its actual impacts to the environmental resources present.

The proposed action would result in a temporary increase in beach area and sand cover at each of the receiver sites. A benefit of the proposed action would be enhancement or continuation of the recreational usage of each of the receiver sites. It must be emphasized, however, that such localized recreational benefits would be temporary (a maximum lifespan of the renourishment is approximately 5 years), although the dispersed sand may continue to cycle in the littoral system past that time. For use in evaluating the growth-inducing impact of the proposed action, it is assumed that the level of beach use at each site would remain near current levels or increase slightly. The resulting temporary recreational benefits derived from the additional beach area would not be expected to increase the demand for public services and utilities, nor create a need for additional recreational facilities above current projections. The proposed action would not involve any new development or add any new people to the local population. The proposed action would have no growth-inducing impacts.

11.4 Energy Requirements and Conservation Potential of Alternatives and Mitigation Measures

Under Appendix F of the CEQA Guidelines, EIRs are required to include a discussion of the potential energy impacts of proposed actions, with particular emphasis on avoiding or reducing inefficient, wasteful, and unnecessary consumption of energy. Potential energy considerations include energy consuming equipment and processes for construction, operation, and/or removal of the action, energy requirements by fuel type for each project stage, energy conservation and design features, energy costs and supplies, and transportation use requirements (e.g., estimated daily trips by mode).

The proposed action would implement several mitigation measures that would reduce inefficient, wasteful, and unnecessary consumption of energy. The energy requirements for the proposed construction activity would be confined to fuel for the dredge, labor transportation, and other construction equipment. Examples of mitigation measures include use of a diesel oxidation catalytic converter for the dredge and the use of newer, lower-emitting trucks to transport construction workers as well as equipment and material to and from construction sites, such as the use of "low-sulfur diesel for construction equipment and diesel particulate filters for diesel equipment and trucks." The use of alternative clean fuel, such as electric or compressed natural gas-powered construction equipment with oxidation catalysts instead of gasoline- or diesel-powered engines, is also recommended. However, where diesel equipment has to be used because there are no practical alternatives, it is recommended the construction contractor use low-sulfur diesel. In addition, the proposed action does not involve the trucking of materials, which would decrease the use of trucking equipment typically associated with a beach nourishment project. The minimal use of pieces of construction equipment and implementation of the mitigation measures recommended would allow impacts to energy to be less than significant.

11.5 Protection of Children from Environmental Health Risks and Safety Risks

On April 21, 1997, President Clinton signed Executive Order 13045, Protection of Children From Environmental Health Risks and Safety Risks (62 Fed. Reg. 19885 (1997)). The policy of the Executive Order states that:

> A growing body of scientific knowledge demonstrates that children may suffer disproportionately from environmental health risks and safety risks. These risks arise because: children's neurological, immunological, digestive, and other bodily systems are still developing; children eat more food, drink more fluids, and breath more air in proportion to their body weights than adults; children's size and weight may diminish their protection from standard safety features; and children's behavior patterns may make them more susceptible to accidents because they are less able to protect themselves. Therefore, to the extent permitted by law and appropriate, and consistent with the agency's mission, each Federal agency;
>
> (a) shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children; and
>
> (b) ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.

To assess the potential for impacts to disproportionately accrue to children, it is important to document those land uses surrounding the proposed project sites (i.e., receiver sites) that are likely to contain a higher proportion of children throughout the course of a day. For the purposes of this analysis, children are considered those individuals who are under 18 years of age and the sensitive land uses identified include schools, parks, and daycare centers within 0.25 mile and 0.5 mile from the proposed action sites. It is considered that health and safety risks to children, if they were to occur as part of the proposed action, would occur within these buffer zones. The list below presents the child-focused land uses near the proposed receiver sites for all alternatives combined. Existing land use maps were used to identify these land uses. Schools and parks are relatively well documented on such maps. Daycare centers vary in size and can include in-home daycare providers, stand-alone institutional centers, or larger centers associated with another facility such as a church or larger school. Larger facilities or those associated with other facilities are typically more commonly documented on land use maps. Smaller facilities may not be included in mapping, but these are not necessarily dedicated child-focused land uses and are more similar in nature to residences than schools with respect to the number of children present on-site.

11.5.1 Encinitas

- Montessori Children's House
- Pacific View Elementary School
- Paul Ecke Central Elementary School
- Saint John School
- Drum Circles for Kids
- PRODIGY Kids Performing Arts
- Julian Charter School
- Oasis Community School
- Head Start Center
- Leucadia Roadside Park
- Moonlight Beach Park
- Encinitas Viewpoint Park

11.5.2 Solana Beach

- Child Development Center North City West School
- American Family Martial Arts
- Hanna Fenichel Center
- Fusion Learning Center/Fusion Academy
- Fletcher Cove Beach Park

Despite the number of child-focused land uses within 0.25 and 0.5 mile of the proposed action sites, there would be no disproportionate impacts to children during implementation of the proposed sand replenishment. No significant impacts would occur and there is no indication that any impacts would disproportionately accrue to children. Areas of nourishment would be restricted during implementation for safety reasons and no long-term health and safety effects would occur after the beach areas are reopened for public use. In summary, no disproportionate impacts to environmental health risks and/or safety risks to children are likely to occur with implementation of the proposed action.

12 PUBLIC INVOLVEMENT AND AGENCY COORDINATION

12.1 Agency Coordination

The USACE is the lead agency for NEPA, and the Cities of Encinitas and Solana Beach are the lead/responsible agencies for CEQA. This Integrated Report is prepared as a joint document. The implementation or construction phase of the proposed action will be cost-shared with the non-federal sponsors, the City of Encinitas and the City of Solana Beach. Therefore, this document is prepared in compliance with NEPA and CEQA regulations.

The proposed action was coordinated with the concerned resource agencies during preparation of the Draft EIS/EIR to ensure that the proposed action complies with the requirements of the applicable laws and regulations. Pursuant to specific legislative mandates and to assist in the preparation of this document, formal and information coordination has been initiated with various agencies. A large part of the coordination was done relative to NEPA requirements for public involvement and interagency coordination during the Feasibility Study. Additional coordination was done with resource agencies as part of the Coordination Act Report process. A summary of coordination is provided in the following sections.

12.1.1 Cities of Encinitas and Solana Beach

The Feasibility Study is a cooperative effort between the USACE and the Cities of Encinitas and Solana Beach, which are the non-Federal co-sponsors of the study. The study was coordinated with Federal and State resource agencies including the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), and National Marine Fisheries Service (NMFS).

Other agencies and institutions coordinated with during the Feasibility Study included the California Department of Boating and Waterways, County of San Diego Department of Parks and Recreation, California Coastal Conservancy, Southern California Coastal Water Research Project, Southern California Wetlands Recovery Project, and University of California San Diego.

Feasibility studies require formal public meetings at the Pubic Workshop and Scoping Meeting and Draft Feasibility Report milestones, and formal internal or interagency meetings at the baseline studies, alternatives analysis and feasibility review conference milestones. An initial Public Workshop was held on October 3, 2001 to solicit public input on the Feasibility Study scope. Numerous meetings have been held since November 2001 with the agencies mentioned above during the feasibility phase. This coordination will continue through the remainder of the Feasibility phase.

Upon completion of the Draft Integrated Report the document will be circulated to appropriate State and Federal agencies, interested organizations, and individuals. Comments received on the draft will be addressed and revisions will be made in accordance with Federal and State law.

Documentation relative to interagency coordination is attached as Appendix A.

12.1.2 U.S. Fish and Wildlife Service (USFWS)

Coordination with USFWS has been on-going. The USACE met with resources agencies, including USFWS, on April 11, 2006; December 11, 2006; January 10, 2008; May 19, 2009; and

October 20, 2011 to discuss the proposed project and alternatives. The USACE will continue to coordinate with USFWS throughout the NEPA process and construction activities.

A USFWS Planning Aid Report and Coordination Act Report will help to document existing conditions, determine impacts of alternatives on fish and wildlife resources, recommend types and amounts of mitigation for habitat losses, and recognize opportunities for environmental restoration. The USACE will coordinate with USFWS and supervise the interagency contract as part of its environmental impact studies task. If necessary, Section 7 consultation pursuant to the FESA will be initiated. A BA will be prepared by the USACE and a BO will be prepared by USFWS and/or NMFS.

12.1.3 U.S. Army Corps of Engineers, Regulatory Branch (USACE)

The proposed project has been coordinated with the USACE Regulatory Branch, which is responsible for issuing the Section 404 permit for dredging. Coordination with USACE Regulatory Branch is on-going. The USACE does not issue itself a 404 permit, but must comply with the CWA. The USACE will complete a 404(b)(1) analysis to ensure project compliance with the CWA.

12.1.4 U.S. Environmental Protection Agency (USEPA)

The USACE will continue to coordinate with the USEPA throughout the NEPA process and construction activities.

12.1.5 National Marine Fisheries Services (NMFS)

The USACE met with resource agencies, including NMFS, on April 11, 2006; December 11, 2006; January 10, 2008; May 19, 2009; and October 20, 2011 to discuss the proposed project and alternatives. The USACE will continue to coordinate with NMFS throughout the NEPA process and construction activities.

12.1.6 California Coastal Commission (CCC)

The USACE will continue coordinating with CCC throughout the NEPA process and construction activities. The USACE is preparing a Coastal Consistent Determination (CCD) in accordance with Federal Coastal Zone Management Act (CZMA), 16 U.S.C. §1455(d), and regulations at 15 C.F.R. §930 et seq. It is the responsibility of the USACE to determine if a proposed federal activity affects the coastal use of resources in a manner that is not consistent with the California Coastal Management Plan (CCMP) that California has adopted and implemented.

12.1.7 California State Lands Commission (CSLC)

The USACE will continue coordinating with the CSLC throughout the NEPA process and construction activities.

12.1.8 California Department of Fish and Game (CDFG)

The USACE met with resource agencies, including CDFG, on April 11, 2006; December 11, 2006; January 10, 2008; May 19, 2009; October 20, 2011; and January 30, 2012 to discuss the proposed project and alternatives. The USACE will continue to coordinate with CDFG throughout the CEQA process and construction activities. Also, the USACE will coordinate with

CDFG relative to California listed species and Species of Special Concern. The CDFG may participate in a Federal Section 7 consultation, if initiated, and has the option to adopt the Federal BO or to prepare its own BO. Depending on the results of the BO, a Section 2081 take permit may be required for the project. The non-federal sponsors would be responsible for applying for a Section 2081 take permit, as well as a 1601 Streambed Alternation Agreement, if required.

12.1.9 California State Historic Preservation Officer (SHPO) / Advisory Council on Historic Preservation

Under Section 106 of the NHPA, initial SHPO coordination was undertaken on July 15, 2005 and initial Tribal coordination was undertaken on September 11, 2003. The USACE coordinates with the SHPO regarding defining the APE for the project, and consults with SHPO, the ACHP, and other interested parties, including Native American Tribes to determine ways to reduce impacts from the project, as warranted. Renewed coordination with SHPO and Tribal coordination was been initiated in April 2012.

12.1.10 Regional Water Quality Control Board (RWQCB)

The USACE met with resource agencies, including RWQCB, on October 20, 2011 to discuss the proposed project and alternatives. To satisfy requirements of the Federal Clean Water Act (CWA), the USACE would submit this Draft EIS/EIR and appropriate technical documentation to the San Diego RWQCB, tasked with implementing the CWA within the region, for their review for CWA Section 401 certification, pursuant to 33 CFG 336.1(a)(1). Upon review of the submittal, the RWQCB would evaluate if issuance of a 401-water quality certification is appropriate. The USACE will continue to coordinate with the RWQCB throughout the CWA process and construction activities.

12.1.11 Other Agencies/Public Interest Groups

In addition to the above, the USACE will continue coordination efforts with various agencies to minimize impacts to fishing activities and marine resources that may result from placement of beach fill.

12.2 <u>Public Involvement</u>

Public involvement is a process by which interested and affected individuals, organizations, agencies, and government entities are consulted and included in the decision-making process of a planning effort. In providing public service, the Federal role in water resources planning is to respond to what the public perceives as problems and opportunities and to formulate and select alternative plans that reflect public preferences. In addition, the National Environmental Policy Act (PL 91-190), among other Federal laws and regulations, mandate public involvement. Federal planning policies, USACE practice, and regulations have consistently required and encouraged this practice. All this must occur, however, with the awareness that the USACE cannot relinquish its legislated decision-making responsibility.

Public participation through the NEPA/CEQA review process is through both a formal public scoping period and a public and agency review period. To announce the start of the report scoping, a public notice was issued to local residents, Federal, State, and Local agencies, and interested groups. The recipients were invited to provide input to the study, including the scoping of environmental issues that should be addressed throughout the study. The Notice of

Intent (NOI) was published in the Federal Register. The Notice of Preparation (NOP) was distributed with the NOI and has been approved by the lead CEQA agencies, Cities of Encinitas and Solana Beach, on April 18, 2012. The notice also announced a public scoping meeting, where the public were given the opportunity to comment. A copy of the NOI and NOP, the distribution list and copies of all letters received in response to the NOP are provided in Appendix A. Section 1.4 of this document provides a summary of the comments received in response to the NOP.

A 60-day public review of the Draft EIS/EIR is scheduled for 28 December, 2012 through ___ 26 February, 2013.

When the EIS/EIR is considered for certification by the USACE Board there will be a public hearing on the document. Individual jurisdictions will likely have public meetings and utilize the certified EIS/EIR for local discretionary actions such as issuing coastal permits or noise variances.

13 IMPLEMENTATION OF THE TENTATIVELY RECOMMENDED PLAN

13.1 General

This chapter presents the Federal and non-Federal responsibilities for implementing the tentatively recommended plan. This includes Federal and non-Federal project cost sharing requirements and the division of responsibilities between the Federal government and the Non-Federal Sponsors, the City of Encinitas and the City of Solana Beach. It also lists the steps toward project approval, and a schedule of the major milestones for the design and construction of the tentatively recommended plan.

13.2 Cost Apportionment for the Tentatively Recommended Plan

Cost sharing for initial construction of the tentatively recommended plan would be consistent with that specified in Section 103(c)(5) of WRDA 86 as amended by WRDA 96 (generally 65 percent Federal and 35 percent non-Federal). Cost sharing for periodic nourishment (continuing construction) would be consistent with Section 103(d) of WRDA 86 as amended by Section 215 of WRDA 99, which requires that such costs be shared 50 percent Federal and 50 percent non-Federal. The final division of specific responsibilities will be formalized in the project partnership agreement (PPA).

These general cost shares apply for developed public or private shores where there is adequate public access and use. For public non-Federal shores, such as a park, the cost sharing for initial construction and each renourishment is 50/50 and for private non-developed shores the cost sharing is 100 percent non-Federal. Federal shores are cost shared 100 percent Federal.

The study area consists mostly of developed public or private shores and will be therefore subject to the general cost sharing of 65% Federal, 35% non-Federal for the initial project and 50/50 for each renourishment. The only parks that exist within the two Segments that provide recreational facilities are Moonlight Beach (Segment 1) and Fletcher Cove (Segment 2). The portion of the project that protects these areas will be subject to 50% Federal, 50% non-Federal initial and renourishment cost sharing.

Six privately owned vacant lots currently exist in Segments 1 and 2. The portion of the Federal project that would protect privately owned vacant lots would be cost shared 100% non-Federal. It is assumed that these lots will be developed prior to project construction. Therefore, cost sharing for the portion of the project protecting these areas will be subject to the general cost sharing. If, upon execution of a Project Partnership Agreement (PPA), these lands are still undeveloped, project cost sharing will be modified to reflect 100% non-Federal cost sharing for those portions. **Table 13.2-1** displays the study area land use in terms of shoreline length.

As detailed in **Section 1.8**, the study is requesting an ASA-CW policy waiver for the issue related to the ¼ mile limit on access points to ensure cost-share apportionment will not be adjusted.

Table 13.2-1 Study Area Land Use

Land Type	Length
Developed public or private shores	14,000 ft
Public Park	1,000 ft
Total Project Length	**15,000 ft**

Table 13.2-2 and **Table 13.2-3**, below, display the currently assumed Federal cost sharing for initial construction and each renourishment respectively.

Table 13.2-2 Federal Cost Share: Initial Construction

Land Type	Fraction	Percent Federal Share	Weighted Federal Share
Developed public or private shores	.93	0.65	0.60
Public park	.07	0.5	0.04
Total Federal cost share initial construction			**0.64**

Table 13.2-3 Federal Cost Share: Renourishment

Land Type	Fraction	Percent Federal Share	Weighted Federal Share
Developed public or private shores	.93	0.5	0.46
Public park	.07	0.5	0.04
Total Federal cost share renourishment			**0.50**

Based on these calculations, cost sharing for the project will be as follows:

- Initial construction costs, including sunk costs, are cost shared at 64% Federal and 36% non-Federal.
- Costs for project performance monitoring in support of continuing construction, used to refine plans for the beach renourishment, are cost shared at 50% Federal and 50% non-Federal.
- Total beach renourishment costs are cost shared at 50% Federal and 50% non-Federal.

Table 13.2-4 indicates that the project first costs at October 2014 Price Levels are $38,635,000 of which non-Federal costs total $17,481,000 and Federal costs total $21,154,000.

Table 13.2-4 Federal and Non-Federal Initial Costs of the Tentatively Recommended Plan (OCT 2014 Price Levels)

		Non-Federal		Federal	
	Total Cost	**%**	**Cost**	**%**	**Cost**
Cash	$38,635,000		$17,481,000		$21,154,000
Real Estate (LERRDs)	$0		$0		
Cost Share: First Costs	$38,635,000	45	$17,481,000	55	$21,154,000
Cost Share: Continuing Construction	$138,486,000	50	$69,243,000	50	$69,243,000

Finally, **Table 13.2-5** illustrates the fully funded apportionment for Total Project Cost. It shows that the total project cost is $177,121,000 of which $94,620,000 (54%) is non-Federal and $82,501,000 (46%) is Federal.

Table 13.2-5 Federal and Non-Federal Cost Apportionment for the Total Project Cost Estimate

Item	**Total Project Cost**	**Non-Federal Cost**	**Federal Cost**
Initial Construction			
Cash	$38,635,000	$17,481,000	$21,154,000
Non-Federal LERRD's	$0	$0	$0
Total Initial Cost	$38,635,000	$17,481,000	$21,154,000
Total Continuing Construction Cost	$138,486,000	$77,139,000	$61,347,000
Total Project Cost	$177,121,000	$94,620,000	$82,501,000
Percentage Share		54	46

13.3 <u>Division of Plan Responsibilities</u>

The Federal Government and the Cities of Encinitas and Solana Beach are responsible for implementation of the tentatively recommended plan, including the sharing of costs and maintenance. In addition, certain responsibilities are required by each party in accordance with Federal law.

13.3.1 Federal Responsibilities

Responsibilities of the Federal Government for implementation of the tentatively recommended plan include:

a) Sharing a percentage of the costs for Preconstruction, Engineering and Design (PED), including preparation of the Plans and Specifications, which is cost shared at the same percentage that applies to construction of the project.

b) Sharing a percentage of construction costs for the project.

c) Administering contracts for construction and supervision of the project after authorization funding, and receipt of non-Federal assurances.

13.3.2 Non-Federal Responsibilities

Federal law requires that a local non-Federal sponsors provide and guarantee certain local cooperation items to ensure equitable participation in a project and to ensure continual maintenance and public receipt of the intended benefits. The particulars of the tentatively recommended plan were carefully reviewed and a set of applicable project partnering items established to include cost sharing of the Project as prescribed in the above paragraphs. The local non-Federal sponsors will:

a. Provide 35 percent of initial project costs assigned to hurricane and storm damage reduction, plus 50 percent of initial project costs assigned to protecting public park lands, plus 100 percent of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits; and 50 percent of periodic nourishment costs assigned to hurricane and storm damage reduction, plus 100 percent of periodic nourishment costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits and as further specified below:

   (1) Enter into an agreement that provides, prior to construction, 25 percent of design costs;
   (2) Provide, during the first year of construction, any additional funds needed to cover the non-federal share of design costs;
   (3) Provide all lands, easements, and rights-of-way, and perform or ensure the performance of any relocations determined by the Federal Government to be necessary for the initial construction, periodic nourishment, operation, and maintenance of the project;
   (4) Provide, during construction, any additional amounts as are necessary to make their total contribution equal to 35 percent of initial project costs assigned to hurricane and storm damage reduction, plus 50 percent of initial project costs assigned to protecting public park lands, plus 100 percent of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits; and 50 percent of periodic nourishment costs assigned to hurricane and storm damage reduction, plus 100 percent of periodic nourishment costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits;

b. For so long as the project remains authorized, operate, maintain, repair, rehabilitate, and replace the project, or functional portion of the project, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

c. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Sponsors, now or hereafter, owns or controls for access to the project for the purpose of inspecting, operating, maintaining, repairing, replacing, rehabilitating, or completing the project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Federal Government shall relieve the Non-Federal Sponsors of responsibility to meet the Non-Federal Sponsor's obligations, or to preclude the Federal Government from pursuing any other remedy at law or equity to ensure faithful performance;

d. Hold and save the United States free from all damages arising from the initial construction, periodic nourishment, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the United States or its contractors;

e. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR) Section 33.20;

f. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended, 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for the initial construction, periodic nourishment, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the Non-Federal Sponsors – the City of Encinitas and the City of Solana Beach with prior specific written direction, in which case the Non-Federal Sponsors – the City of Encinitas and the City of Solana Beach shall perform such investigations in accordance with such written direction;

g. Assume, as between the Federal government and the Non-Federal Sponsors – the City of Encinitas and the City of Solana Beach, complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the initial construction, periodic nourishment, operation, or maintenance of the project;

h. Agree, as between the Federal government and the Non-Federal Sponsors – the City of Encinitas and the City of Solana Beach, that the Non-Federal Sponsor - the City of Encinitas and the City of Solana Beach shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, and repair the project in a manner that will not cause liability to arise under CERCLA;

i. If applicable, comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for the initial construction, periodic nourishment, operation, and maintenance of the project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

j. Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal preparation and implementation of floodplain management plans; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)).";

k. Provide the non-Federal share of that portion of the costs of data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project, in accordance with the cost sharing provisions of the agreement;

l. Participate in and comply with applicable Federal floodplain management and flood insurance programs;

m. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized;

n. Prescribe and enforce regulations to prevent obstruction of or encroachment on the project that would reduce the level of protection it affords or that would hinder future periodic nourishment and/or the operation and maintenance of the project;

o. Not less than once each year, inform affected interests of the extent of protection afforded by the project;

p. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the floodplain, and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the project;

q. For so long as the project remains authorized, the Non-Federal Sponsors – the City of Encinintas and the City of Solana Beach shall ensure continued conditions of public ownership and use of the shore upon which the amount of Federal participation is based;

r. Provide and maintain necessary access roads, parking areas, and other public use facilities, open and available to all on equal terms;

s. Recognize and support the requirements of Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsors – the City of Encinitas and the City of Solana Beach has entered into a written agreement to furnish its required cooperation for the project or separable element; and

t. At least twice annually and after storm events, perform surveillance of the beach to determine losses of nourishment material from the project design section and provide the results of such surveillance to the Corps of Engineers.

u. Comply with Section 402 of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 701b-12), which requires the non-Federal sponsor to participate in and comply with applicable Federal floodplain management and flood insurance programs, prepare a floodplain management plan within one year after the date of signing the project partnership agreement, and implement the plan no later than one year after project construction is complete.

13.4 Non-Federal Sponsors Financial Capability

The non-Federal cost share is the obligation in its entirety, with no specification on the contribution by individual parties, of both the City of Encinitas and the City of Solana Beach. A potential source for this non-Federal share for the Cities is the State of California, California Department of Boating and Waterways through the Beach Nourishment Program. The Beach Nourishment Program is funded through annual appropriations and enables the State to fund up to 85% of the local share.

13.5 Project Partnership Agreement

Prior to advertisement for the Construction Contract, a Project Partnership Agreement (PPA) will be required to be signed by the Federal Government and the City of Encinitas and City of Solana Beach, requiring formal assurances of local cooperation from the Cities. This agreement will be prepared and negotiated during the Plans and Specifications Phase.

13.6 Approval and Implementation

The necessary reviews and activities leading to approval and implementation of the tentatively recommended plan are listed below:

a. Environmental Impact Statement Filing - the FEIS will be circulated to State and Federal Agencies as directed by HQUSACE for the 30-Day State and Agency review. The District will concurrently distribute the FEIS to parties not included on the HQUSACE mailing list. The District will then file the decision document and FEIS together with the proposed report of the Chief of Engineers with EPA.

b. Chief of Engineers Approval - Chief of Engineer signs the report signifying approval of the project recommendation and submits the following to ASA (CW): the Chief of Engineers Report, the FEIS, and the unsigned ROD.

c. ASA (CW) Approval - The Assistant Secretary of the Army for Civil Works will review the documents to determine the level of administration support for the Chief of Engineers recommendation. The ASA (CW) will formally submit the report to the Office of Management and Budget (OMB). OMB will review the recommendation to determine its relationship to the program of the President. OMB may clear the release of the report to Congress.

d. Project requires congressional approval for construction.

e. Funds could be provided, when appropriated in the budget, for preconstruction, engineering and design (PED), upon issuance of the Division Commander's public notice announcing the completion of the final report and pending project authorization for construction.

f. Surveys, model studies, and detailed engineering and design for PED studies will be accomplished first and then plans and specifications will be completed, upon receipt of funds.

Construction would be performed with Federal and non-Federal funds, once the construction project was advertised and awarded.

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14 RECOMMENDATION

I recommend that the selected plan for storm damage risk reduction along the shoreline within the corporate boundaries of the City of Encinitas and City of Solana Beach as described in this report be authorized as a Federal project; with such modifications thereof as in the discretion of the Commander, HQUSACE, may be advisable. The tentatively recommended plan is estimated to have an initial total cost of $45,900,000 (October 2012 price levels). Of this cost, 64%, or $29,400,000 will be the responsibility of the Federal Government and, 36%, or $16,500,000 will be the responsibility of the City of Encinitas and City of Solana Beach, combined.

The tentatively recommended plan further includes periodic nourishment at 5 year intervals within the 50- year project lifetime for a total of nine periodic renourishment episodes, project beach monitoring for periodic nourishment planning, environmental monitoring, and mitigation plans for the City of Encinitas and 10 year intervals within the 50- year project lifetime for a total of three periodic renourishment episodes, project beach monitoring for periodic nourishment planning, environmental monitoring, and mitigation plans for the City of Solana Beach if required as described in this document. The tentatively recommended plan is estimated to have a total continuing construction cost of $121,000,000 (October 2012 price levels). Of this cost, 50% or $60,500,000 will be the responsibility of the Federal Government and 50% or $60,500,000 will be the responsibility of the City of Encinitas and City of Solana Beach.

This recommendation is made with the provision that before implementation, the City of Encinitas and City of Solana Beach will, in addition to the general requirements of law for this type of project, agree to the following requirements:

a. Provide 35 percent of initial project costs assigned to hurricane and storm damage reduction, plus 50 percent of initial project costs assigned to protecting public park lands, plus 100 percent of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits; and 50 percent of periodic nourishment costs assigned to hurricane and storm damage reduction, plus 100 percent of periodic nourishment costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits and as further specified below:

(1) Enter into an agreement that provides, prior to construction, 25 percent of design costs;

(2) Provide, during the first year of construction, any additional funds needed to cover the non-federal share of design costs;

(3) Provide all lands, easements, and rights-of-way, and perform or ensure the performance of any relocations determined by the Federal Government to be necessary for the initial construction, periodic nourishment, operation, and maintenance of the project;

(4) Provide, during construction, any additional amounts as are necessary to make their total contribution equal to 35 percent of initial project costs assigned to hurricane and storm damage reduction, plus 50 percent of initial project costs assigned to protecting public park lands, plus 100 percent of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits; and 50 percent of periodic nourishment costs assigned to hurricane and storm damage

reduction, plus 100 percent of periodic nourishment costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits;

b. For so long as the project remains authorized, operate, maintain, repair, rehabilitate, and replace the project, or functional portion of the project, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

c. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Sponsors – the City of Encinitas and the City of Solana Beach, now or hereafter, owns or controls for access to the project for the purpose of inspecting, operating, maintaining, repairing, replacing, rehabilitating, or completing the project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Federal Government shall relieve the Non-Federal Sponsors – the City of Encinitas and the City of Solana Beach of responsibility to meet the Non-Federal Sponsors's obligations, or to preclude the Federal Government from pursuing any other remedy at law or equity to ensure faithful performance;

d. Hold and save the United States free from all damages arising from the initial construction, periodic nourishment, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the United States or its contractors;

e. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR) Section 33.20;

f. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended, 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for the initial construction, periodic nourishment, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the Non-Federal Sponsors - the City of Encinitas and the City of Solana Beach with prior specific written direction, in which case the Non-Federal Sponsors shall perform such investigations in accordance with such written direction;

g. Assume, as between the Federal Government and the Non-Federal Sponsors – the City of Encinitas and the City of Solana Beach, complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the initial construction, periodic nourishment, operation, or maintenance of the project;

h. Agree, as between the Federal Government and the Non-Federal Sponsors – the City of Encinitas and the City of Solana Beach, that the Non-Federal Sponsors shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, and repair the project in a manner that will not cause liability to arise under CERCLA;

i. If applicable, comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for the initial construction, periodic nourishment, operation, and maintenance of the project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

j. Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal preparation and implementation of floodplain management plans; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)).";

k. Provide the non-Federal share of that portion of the costs of data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project, in accordance with the cost sharing provisions of the agreement;

l. Participate in and comply with applicable Federal floodplain management and flood insurance programs;

m. Do not use Federal funds to meet the non-Federal sponsors's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

n. Prescribe and enforce regulations to prevent obstruction of or encroachment on the project that would reduce the level of protection it affords or that would hinder future periodic nourishment and/or the operation and maintenance of the project;

o. Not less than once each year, inform affected interests of the extent of protection afforded by the project;

p. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the floodplain, and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the project;

q. For so long as the project remains authorized, the Non-Federal Sponsors – the City of Encinintas and the City of Solana Beach shall ensure continued conditions of public ownership and use of the shore upon which the amount of Federal participation is based;

r. Provide and maintain necessary access roads, parking areas, and other public use facilities, open and available to all on equal terms;

s. Recognize and support the requirements of Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsors - the City of Encinitas and the City of Solana Beach has entered into a written agreement to furnish its required cooperation for the project or separable element; and

t. At least twice annually and after storm events, perform surveillance of the beach to determine losses of nourishment material from the project design section and provide the results of such surveillance to the Federal Government.

u. Comply with Section 402 of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 701b-12), which requires the non-Federal sponsor to participate in and comply with applicable Federal floodplain management and flood insurance programs, prepare a floodplain management plan within one year after the date of signing the project partnership agreement, and implement the plan no later than one year after project construction is complete.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the non-federal sponsors, the States, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

R. Mark Toy, P.E.
Colonel, US Army
District Engineer
Los Angeles District

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16 LIST OF ACRONYMS AND ABBREVIATIONS

24/7	24 hours a day/7 days a week
AB-411	Assembly Bill 411
ac	acre(s)
ACHP	Federal Advisory Council on Historic Preservation
ACOE	U.S. Army Corps of Engineers, Los Angeles District
A.D.	After Christ, of the Christian era
a.m.	Ante meridiem, before noon
AMSL	Above Mean Sea Level
ANSI	American National Standards Institute
APE	Area of Potential Effects
ARB	Air Resources Board
BA	Biological Assessment
BACT	Best Available Control Technology
BART	Best Available Retrofit Technology
B.C.	Before Christ, before the Christian era
BMPs	Best Management Practices
BO	Biological Opinion
BP	Before present
CAA	Clean Air Act
CAAA	Clean Air Act Amendments of 1990
CAAQS	California Ambient Air Quality Standards
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CCAA	California Clean Air Act
CCAT	California Climate Action Team
CCC	California Coastal Commission
CCD	Coastal Consistency Determination
CCSTWS	Coast of California Storm and Tidal Waves Study
CCSTWS-SD	Coast of California Storm and Tidal Waves Study for the San Diego County Region
CDFG	California Department of Fish and Game
ºC	degrees Celsius
CEC	California Energy Commission
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act of 1970
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CFU	colony forming units
CH_4	methane
CHMIRS	California Hazardous Material Incident Report System
CHRIS	California Historical Resources Information System
CNDDB	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	CO_2-equivalency
The Corps	U.S. Army Corps of Engineers, Los Angeles District
CNPS	California Native Plant Society
CSC	California Species of Special Concern

CSLC	California State Lands Commission
CWA	Clean Water Act of 1977
cy	cubic yard(s)
CZMA	Coastal Zone Management Act
dBA	decibels
DDT	dichlorodiphenyltrichloroethane
dGPS	Differential Global Positioning System
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EN	Encinitas
ENSO	El Niño Southern Oscillation
EPA	U.S. Environmental Protection Agency
ER	Engineer Regulation
ER-L	Effects Range-Low
ER-M	Effects Range-Median
ERNS	Emergency Response Notification System
ºF	degrees Fahrenheit
FC	Federal candidate species for listing
FE	Federal-listed, endangered species
FESA	Federal Endangered Species Act of 1973
FIP	Federal Implementation Plan
FMP	Fishery Management Plan
FPE	Federally proposed for listing as endangered species
FT	Federal-listed, threatened species
ft	ft/foot
ft/sec	ft/foot per second
ft^2	square ft
FY	fiscal year
GHG	greenhouse gas
GIS	Geographic Information System
gpd	gallons per day
HAPC	Habitat Areas of Particular Concern
HFC	hydrofluorocarbon
hp	horsepower
HSL	High Sea Level Rise
HTRW	hazardous, toxic, or radioactive waste
I-5	Interstate 5 Freeway
IEC	International Electrotechnical Commission
in	inch(es)
IPCC	Intergovernmental Panel on Climate Change
JPA	Joint Powers Authority
kg	kilograms
km	kilometer(s)
km^2	square kilometer(s)
km^3	cubic kilometer(s)
lbs	pounds
kHz	kilohertz
LCFS	Low Carbon Fuel Standard

LCP	Local Coastal Program
L_{dn}	Day-night average noise level
L_{eq}	Average equivalent noise level
LOS	Level of Service
LSL	Low Sea Level Rise
LUP	Land Use Plan
LUSTs	Leaking Underground Storage Tanks
m	meter(s)
m^2	square meter(s)
m^3	cubic meter(s)
MACT	Maximum Available Control Technology
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MBTA	Migratory Bird Treaty Act
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MGD	million gallons per day
MHHW	mean higher high water
MHTL	mean high tide line
MHW	mean high water
mi	mile(s)
mi^2	square mile(s)
mL	milliliter(s)
MLW	mean low water
MLLW	mean lower low water
MLPA	Marine Life Protection Act
mm	millimeter(s)
MMPA	Marine Mammal Protection Act of 1972
MMT	million metric tons
MPA	marine protected areas
MPN	most probable number
MSL	Mean Sea Level
MT	metric tons
MTL	Mean Tide Level
NAAQS	National Ambient Air Quality Standards
NAS	National Academy of Science
NAVD	North American Vertical Datum
NED	National Economic Development
NEPA	National Environmental Policy Act of 1969
NFMP	Nearshore Fishery Management Plan
NGVD	National Geodetic Vertical Datum; equivalent to +2.72 ft MLLW in the study area
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOAA	National Oceanographic and Atmospheric Administration
NOI	Notice of Intent
NOP	Notice of Preparation
NOx	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NTU	Nephelometric Turbidity Unit(s)
N_2O	nitrous oxide

NWR	National Wildlife Refuge
OHP	Office of Historic Preservation
OPC	Ocean Protection Council
OPR	California Office of Planning and Research
OSHA	Occupational Safety and Health Administration
O_3	Ozone
PADI	Professional Association of Diving Instructors
PAHs	polycyclic aromatic hydrocarbons
Pb	lead
PCBs	polychlorinated biphenyls
PFC	perfluorocarbons
p.m.	Post meridiem, after noon
PM_{10}	particulate matter equal to or less than 10 microns in size
$PM_{2.5}$	fine particulate matter equal to or less than 2.5 microns in size
pphm	parts per hundred million
ppm	parts per million
ppt	parts per thousand
PRC	Public Resources Code
RAQS	Regional Air Quality Strategies
RBMP	Regional Beach Monitoring Program
RBSP I	San Diego Regional Beach Sand Project I
RBSP II	San Diego Regional Beach Sand Project II
REC-1	Contact Water Recreation Standards
ROD	Record of Decision
ROG	reactive organic gases
RTP	Regional Transportation Plan
RWQCB	Regional Water Quality Control Board
SANDAG	San Diego Association of Governments
SB	Solana Beach
SCAQMD	South Coast Air Quality Management District
SCB	Southern California Bight
SCUBA	Self Contained Underwater Breathing Apparatus
SDAB	San Diego Air Basin
SDAPCD	County of San Diego Air Pollution Control District
SDUPD	San Diego Unified Port District
SE	State-listed, endangered species
SF_6	sulfur hexafluoride
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SDNR	San Diego Northern Railway
SLERP	San Elijo Lagoon Restoration Project
SLR	Sea Level Rise
SMCA	State Marine Conservation Area
SO_2	sulfur dioxide
SOx	oxides of sulfur
SPCC	Spill Prevention Control and Countermeasure Plan
SQUIRT	Screening Quick Reference Table
SRF	Self Realization Fellowship
ST	State-listed, threatened species
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	California State Water Resources Control Board

TAC	Toxic Air Contaminant
TDS	total dissolved solids
TFIC	Transportation Forecast Information Center
TOC	total organic carbon
TSP	total suspended particulates
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers, Los Angeles District
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VOCs	volatile organic compounds
WDRs	Waste Discharge Requirements
WOP	without project
yd	yard(s)
yd^2	square yard(s)
yd^3	cubic yard(s)
yd^3/ft	cubic yard(s) per foot
YMCA	Young Men’s Christian Association
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
%	percent
%o	parts per thousand

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