

### 3.3 OCEANOGRAPHY/COASTAL PROCESSES

Beaches are dynamic and conditions vary based on the onshore/offshore movement of sand both seasonally and annually. Sand also moves alongshore within a generally defined stretch of coastline referred to as a littoral cell (which encompasses the onshore and nearshore coastal areas). When structures are built, beach conditions are modified, or hydraulic modifications are made along the coast, the movement of sand can be affected within the littoral zone. Coastal processes address currents, flows, and transport cycles within the littoral zone and function independently from lagoon hydrologic processes, with the exception of the localized effect around the lagoon mouth. Coastal processes and lagoon hydrology are therefore addressed separately in this EIR. This section describes existing environmental conditions related to coastal processes in the coastal area both surrounding Buena Vista Lagoon (e.g., at the lagoon/ocean interface) and the areas identified for materials disposal/reuse.

This section is based largely on information from the *Buena Vista Lagoon Enhancement Project Shoreline Report* (Everest 2014a), the *Buena Vista Lagoon Enhancement Project Tidal Inlet Stability Memo* (Everest 2014f), and the *Buena Vista Lagoon Enhancement Project Tidal Inlet Maintenance Program Memo* (Everest 2014e). *The Coastal Regional Sediment Management Plan* (SANDAG 2009) and *Coast of California Storm and Tidal Wave Study, San Diego Region* (Corps 1991) also provide data on coastal conditions, including waves, the sediment budget, and longshore sediment transport data (Corps 1990; 1991). Other studies include a study of littoral cells and sand budgets in California (Patsch and Griggs 2006; 2007). Information from the 2012 RBSP EA/Final EIR is also discussed, as appropriate. Coastal processes, while dynamic, are better understood through longer-term studies that account for annual and seasonal variability (e.g., differences in currents, wave action, and sand transport that can occur between less storm and/or El Niño years for example). Therefore, studies that predate the NOP issuance remain relevant to this analysis and provide a valid baseline for the EIR.

Beneficial use of dredged sediment is a principle put forth by EPA and enforced by the Corps. EPA's National Dredging Team recognizes dredged material as a valuable resource that can be used in environmentally beneficial ways (EPA 2013). Thus, instead of simply disposing of sediment in the least costly manner, regulatory agencies strongly encourage beneficial use where feasible. The CCC and SANDAG also encourage the beneficial use of sediment for beach and nearshore placement whenever feasible (SANDAG 2009). Only beneficial uses constituting beach and nearshore nourishment are described within this section because those uses have the potential to affect shoreline conditions and littoral processes, as discussed above. The offshore disposal site, LA-5, is outside of the littoral zone and therefore not influenced by coastal processes. This section addresses inlet conditions where the lagoon meets the ocean, as well as anticipated consequences of the placement of sand at the three sites within the littoral zone: the Oceanside beach and nearshore placement site, and the beach at North Carlsbad.

Section 3.2 Hydrology and Section 3.4 Water and Aquatic Sediment Quality address circulation and tidal dynamics within the lagoon and tidal exchange between the lagoon and ocean and lagoon and Buena Vista Creek in the context of hydrology and water quality, respectively. Section 3.4 also addresses water quality within the ocean as it relates to placement of disposal/reuse materials. Section 3.5 Biological Resources addresses potential biological impacts associated with the dispersion of sand placed as part of materials disposal/reuse. Long-term sea level rise and potential extreme events associated with climate change are discussed in Section 3.12 Global Climate Change and Greenhouse Gas Emissions, and Sea Level Rise of this document.

### **3.3.1 EXISTING CONDITIONS**

Buena Vista Lagoon and the proposed littoral zone nourishment sites are located within the Oceanside Littoral Cell, with the exception of LA-5, which is located approximately 30 miles south, 6 miles offshore of the Mission Bay Littoral Cell. The following discussion describes the coastal processes and coastal geomorphology within the Oceanside Littoral Cell, as well as site-specific conditions at Buena Vista Lagoon and the proposed materials placement sites. LA-5 is outside of the littoral cell and is not influenced by coastal processes; it is not addressed in this section.

#### Regulatory Setting

A full description of the regulatory setting for this document can be found in Appendix B. The following laws, regulations, policies, and plans are applicable to this resource area:

- Coastal Zone Management Act
- Marine Protection, Research, and Sanctuaries Act
- California Coastal Act

#### **Coastal Geomorphology**

The project study area extends from the City of Oceanside south to the northern end of the City of Carlsbad, within San Diego County. The coastal processes in this section encompass the littoral zone, which extends from the shoreline to outside the surf zone, as described below. Shorelines in this area are characterized by sandy beaches backed by riprap and bluffs that vary in width, and sand cover, both seasonally and annually. The nearshore area of the littoral zone is characterized by sandy bottom in north Oceanside, to reefs interspersed with sandy bottom farther south into North Carlsbad. The southern half of the Oceanside Littoral Cell stretches from Oceanside to La Jolla and includes the shorelines of the Cities of Oceanside, Carlsbad, Encinitas,

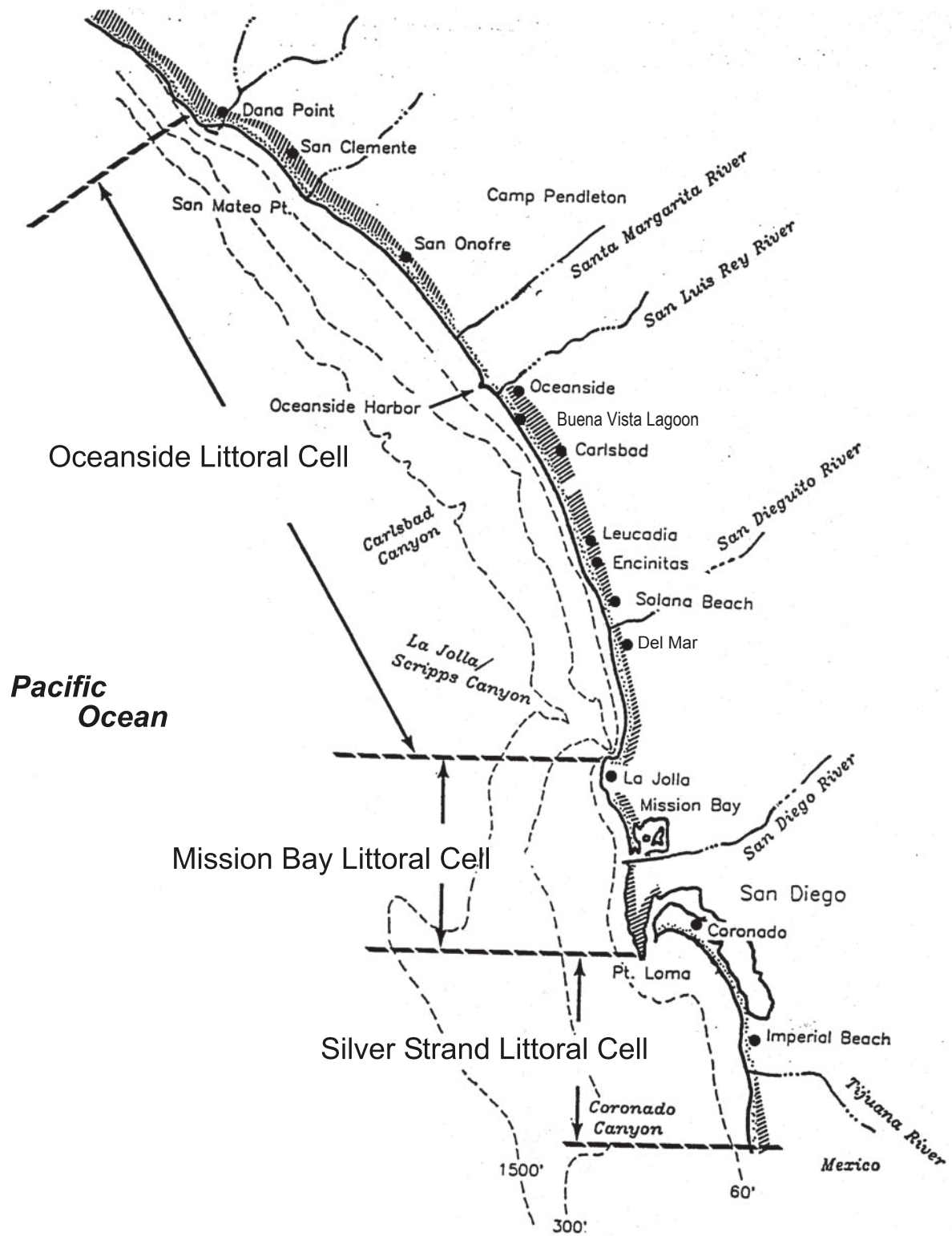
Solana Beach, Del Mar, and La Jolla, and encompasses the project study area. The littoral cells located in San Diego County are illustrated in Figure 3.3-1.

A littoral cell is a stretch of coast bounded by physical features (e.g., submarine canyons, coastal headlands, harbors, etc.) where sediment enters, moves along, and leaves the coast. In general, littoral cells do not naturally transport or receive littoral sediment to or from another cell in either the “upcoast” or “downcoast” direction (Corps 1991). A sediment cycle within the cell exists that can include erosion of highland terrain, fluvial transport to the shoreline, and littoral transport along the shoreline. Sediment sources to a cell are beaches, rivers, bluffs, offshore deposits, bypassing, and artificial nourishment. Sediment sinks (how sediment is lost from the cell) include submarine canyons, offshore deeper-water areas, inland lagoons, and harbors. Sediment can also be lost from the littoral system through storm events or wave energy that draws sand past the depth of closure, the offshore depth beyond which sediment will not cycle back into the nearshore zone. Therefore, once drawn past this point, the sediment is effectively removed from the nearshore sand cycle. The sediment budget of a cell is either in balance with stable beaches, in a surplus with growing beaches, or in a deficit with narrowing beaches. The portion of the Oceanside Littoral Cell encompassing the project study area is in a deficit of nearly 55,000 cubic yards per year (cy/yr), as evidenced by widespread beach retreat since the early 1980s (DBW/SANDAG 1994) into the present. This is due to reductions in historic sand sources from rivers and bluff erosion that are not balanced out by sand nourishment (Patsch and Griggs 2006, 2007).

Bounded on one side by the landward limit of the beach and extending seaward beyond the area of breaking waves, the seaward edge of an active littoral cell is defined as its depth of closure. Substantial quantities of sand from coastal littoral cells do not usually travel outside of this depth and into the deeper ocean, except during severe coastal storm wave events, although other sediment sinks can result in an overall loss of sediment from the cell over time. Coastal processes are not strongly influenced by changes outside of this depth of closure.

Typically, in the San Diego region, greater sand movement from the shallow portion of the beach profile to the deeper portion of the profile within the littoral zone occurs in the winter due to large storms and waves, followed by a period of sand gain to the shallow portion of the beach profile during the summer’s more gentle conditions and surf. As a result, the exposed portion of the beach is generally wider in the summer and narrower in the winter. These combined seasonal processes, including both winter and summer sand shifts, compose a complete cross-shore sedimentation cycle. Longshore sand transport occurs continually and also varies seasonally.

Net sediment transport within the Oceanside Littoral Cell occurs to the south (Corps 1991), with minor seasonal reversals in the dominant sediment transport direction that can extend over longer

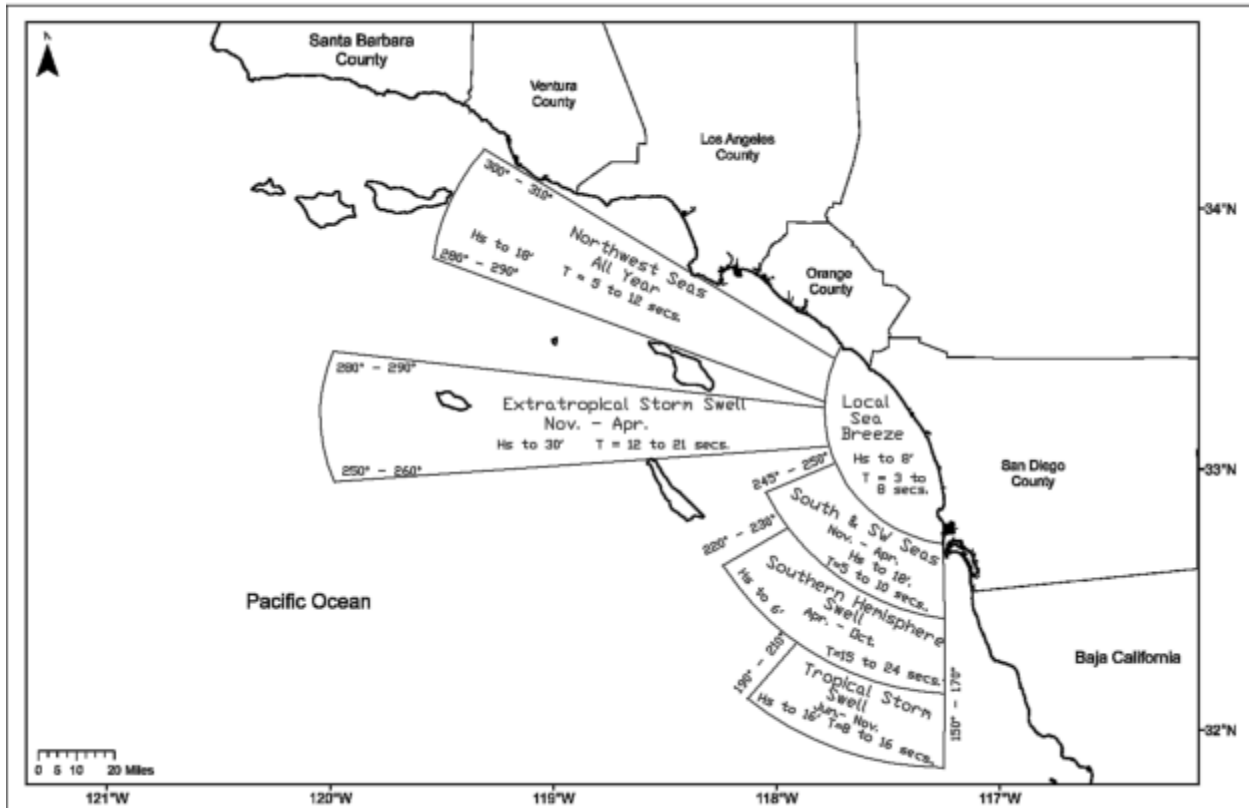


Source: Moffatt & Nichol Engineers



**Figure 3.3-1**  
Littoral Cells in the San Diego Region

periods of years. Winter and spring seasons are typically dominated by northern hemisphere swells that generate currents and sediment transport to the south. Summer and fall seasons are typically dominated by southern hemisphere swells that generate currents and sediment transport to the north. The wave exposure window at Buena Vista Lagoon is shown in Figure 3.3-2. This winter/spring condition is typified by higher energy waves than summer/fall conditions and so the southern transport tends to be the dominant process over the long term.



**Figure 3.3-2. Wave Exposure Window of Buena Vista Lagoon**

Site-specific conditions in the vicinity of Buena Vista Lagoon reflect the predominant southern transport of beach sand, and sand from Oceanside generally is distributed south over time toward Carlsbad (Everest 2014a). Other site-specific conditions relate to the separation of the lagoon from tidal exchange with the ocean by a weir. Because there is no active ocean inlet at the lagoon, a beach berm accumulates across the inlet and creates a continuous beach fronting the lagoon. This weir, as well as the existence of residences extending along the west side of the Weir Basin, protects the interior of the lagoon from intensive wave action during some storm events, although the weir is overtopped during larger storm events and high tide conditions.

### **Buena Vista Lagoon Study Area**

Buena Vista Lagoon is effectively separated from the ocean and coastal processes by the weir present across the inlet channel. There can be limited tidal exchange with the lagoon during high tide and/or storm conditions, but this occurs infrequently. Longshore transport of sand within a littoral cell results in a “river of sand” moving parallel to the shoreline. As this “river” crosses river and lagoon mouths that are open to tidal action, the cross-current action of an outgoing or incoming tide deflects material from its parallel movement. This leads to sand bar formation either out into deeper water (ebb bar) or into the water body itself (flood shoal). Because the inlet of Buena Vista Lagoon is not open to the ocean, sand is not entrained into the lagoon, but a sand berm in front of the weir accumulates in various times throughout the year as sand is carried along the coast in the littoral cell. This berm can develop to elevations that exceed the weir and creates an even stronger separation between the lagoon and ocean. No ebb bar currently exists in the nearshore off Buena Vista Lagoon because there is no active tidal inlet at the lagoon.

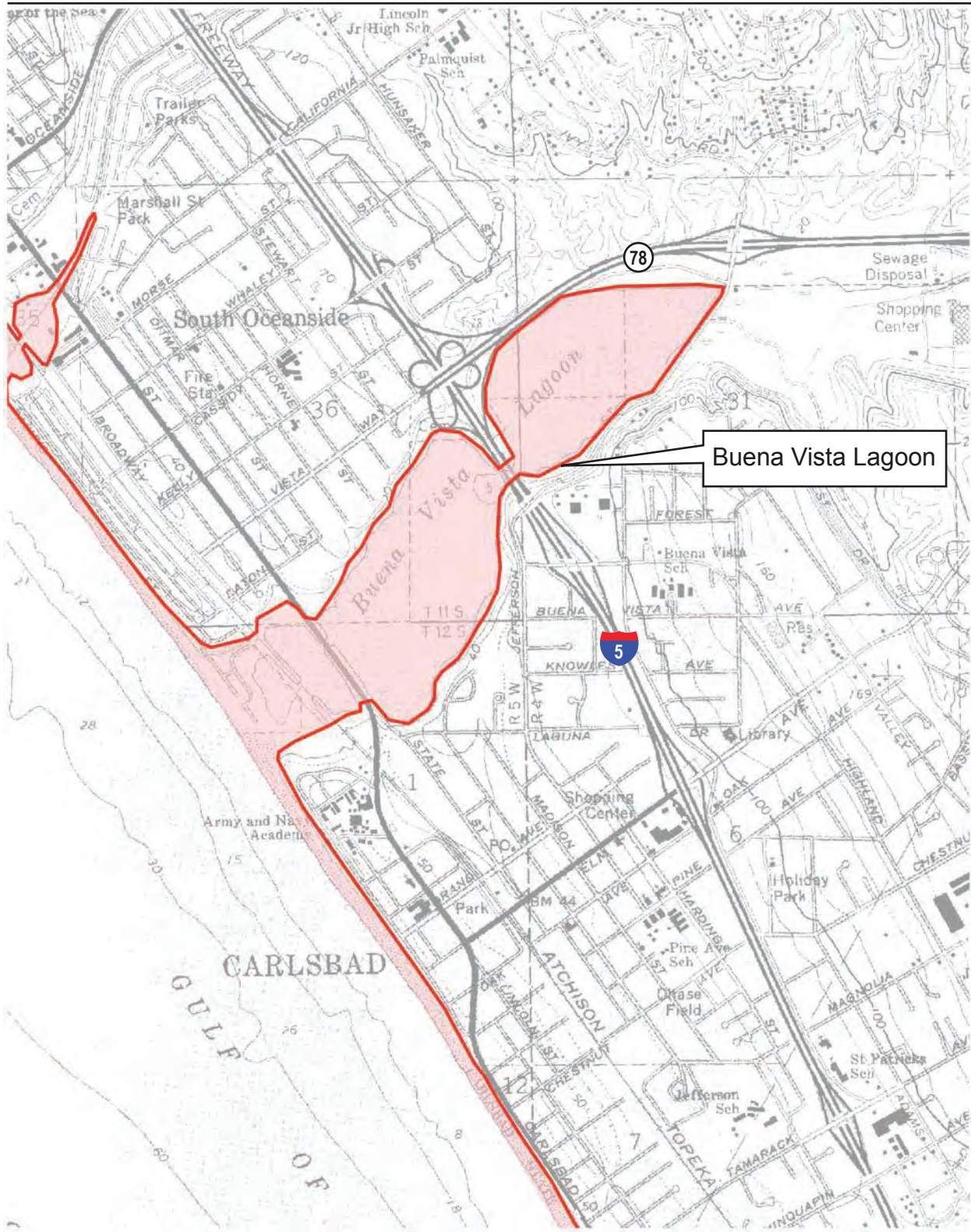
#### Inundation Conditions

Inundation can be caused by seiche, tsunami, or mudflow. The interior of the lagoon and structures along its perimeter are currently protected from high wave energy along the beaches during some coastal storm wave events by the presence of the weir and the relatively narrow inlet channel. Seiche and mudflow are conditions that are internal to the lagoon, and are addressed in Section 3.2. Tsunami is a condition that is influenced by coastal processes, and is addressed in this section.

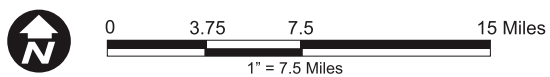
Tsunamis are large ocean waves caused by sudden displacement of water that results from an underwater earthquake, landslide, or volcanic eruption. These tidal phenomena affect low-lying areas along the coastline. The lagoon is currently mapped within the tsunami inundation area by the California Emergency Management Agency (2009), which also encompasses the St. Malo community west of the lagoon. The tsunami inundation area in the vicinity of the project is shown in Figure 3.3-3.

### **Materials Disposal/Reuse Study Area**

This section addresses coastal processes and inundation, focusing on the littoral cell in which the majority of sand is cycled through the onshore and nearshore zone. As previously discussed, LA-5 is outside of the littoral cell and is not influenced by coastal processes. Inundation and effects from tsunami would not be substantially affected by materials placement. Because placement volumes are relatively low-profile compared to tsunami conditions and are anticipated



Source: California Emergency Management Agency 2009



**Figure 3.3-3**  
**Tsunami Inundation Area in Project Vicinity**

to distribute throughout the littoral cell over time, there would not be potential for those types of impacts; therefore tsunamis are not addressed in this section.

#### Littoral Zone Nourishment

Coastal processes that drive beach conditions within the southern portion of the Oceanside Littoral Cell are generally common to the proposed Oceanside nearshore and onshore sand placement site, as well as the North Carlsbad onshore placement site. Oceanside and North Carlsbad onshore placement sites vary in width seasonally and annually, and beaches encompassing both placement sites are backed by roads and/or houses with riprap for storm protection during narrow beach conditions. Some areas in the southern portion of the North Carlsbad site are backed by bluffs. The Oceanside beach encompassing that onshore placement site in particular has areas where the beach is completely inundated during high tide, and water extends up to the riprap on the back beach. The nearshore Oceanside placement site is primarily characterized by a sandy bottom over which sand bars develop seasonally and annually. Oceanside beaches are consistently nourished in the existing condition as part of the Oceanside Harbor maintenance.

#### Coastal Lagoons/Wetlands

Within the Oceanside littoral cell, sand moving alongshore can become trapped behind coastal structures and inlets, leaving less sand downcoast for transport, and potentially create a flood shoal that can close coastal water body inlets, with adverse impacts to the systems they support (e.g., coastal lagoons and estuaries or river mouths). Regular maintenance at structures and lagoons minimizes water body closure/constriction at ocean interfaces and replenishes downcoast beaches by bypassing sand beyond lagoon inlets, helping maintain tidal exchange and function of coastal water body functions. A series of lagoon inlets exist along the San Diego County coast. Agua Hedionda is the closest lagoon inlet south of the placement site in North Carlsbad. The 2012 RBSP EA/Final EIR estimated potential additional sand could accumulate in Agua Hedionda Lagoon as a result of disposal of sand at both the North Carlsbad placement site and a South Carlsbad disposal site; the additional sand proposed for disposal was determined not to increase maintenance needs at Agua Hedionda (SANDAG 2011). Placement of dredged materials at the South Carlsbad site is not proposed for inclusion in the Enhancement Project, and no additional sand beyond that analyzed in the RBSP EA/Final EIR is currently proposed for placement at the North Carlsbad site. Therefore, the placement of materials at the North Carlsbad site in connection with the Enhancement Project is not anticipated to create additional maintenance needs at Agua Hedionda. No other lagoons exist close enough to Buena Vista Lagoon to be affected by the proposed sand placement volumes at the Oceanside nearshore or onshore sites. Maintenance needs associated with the Saltwater and Hybrid Alternatives have



taken into account potential placement of material at the Oceanside sites upcoast of the proposed lagoon inlet.

### 3.3.2 SIGNIFICANCE CRITERIA

A significant impact to coastal processes would occur if implementation of the Enhancement Project would result in any of the following:

- A. Disrupt the littoral system through substantial modification of beach or nearshore bottom topography or an increase in maintenance requirements for other lagoons; or
- B. Increase risks of damage to coastal structures, focused on inundation by tsunami.

The CEQA thresholds of significance for coastal processes were derived from a combination of thresholds listed in Appendix G of the CEQA Guidelines and thresholds used in environmental analyses for similar coastal enhancement projects. Appendix G sample questions are not specific enough to distinguish potential effects to the littoral system, which is unique to coastal projects.

### 3.3.3 IMPACT ANALYSIS

#### Lagoon Enhancement—Inlet Modification

The proposed Enhancement Project could affect coastal processes through modification of the currently closed inlet. This discussion focuses on inlet modifications proposed under each alternative and the potential for impacts to the littoral process and inundation by tsunami; Section 3.2 Hydrology discusses hydrological modifications within the interior of the lagoon, and the potential for impacts to tidal exchange and influences within the lagoon.

#### *Freshwater Alternative*

The Freshwater Alternative would not modify the existing inlet configuration except to widen the channel and install an 80-foot-wide weir in place of the current 50-foot weir. The lagoon would remain effectively separated from the littoral coastal processes with no changes to beach or nearshore topography. Replacement of the weir with a wider weir would increase the amount of storm flows able to exit the lagoon during storm events, but storm waves would continue to exceed the height of the weir during high tide events. No increased risks of damage to coastal structures would result. **No disruption of the littoral system resulting in topography change or increased lagoon maintenance requirements, and no increases of risk to coastal structures would occur; therefore, no significant impacts would result from the Freshwater Alternative (Criteria A and B).**

### *Saltwater Alternative*

The Saltwater Alternative would open the inlet of Buena Vista Lagoon to tidal exchange and would result in a tidal prism of 8.7 million cubic feet (Everest 2014f). The introduction of a tidal inlet would modify the interaction of the lagoon with coastal processes in the immediate vicinity of the inlet. The inlet would create an interruption in the longshore transport of sand in the southerly direction through the littoral cell and would draw sand into the inlet and create a flood shoal. The beach berm would be breached through enhancement activities and the inlet would be maintained as an open lagoon mouth through maintenance as discussed in Chapter 2. Inlet maintenance would ensure sand entrained in the lagoon, including in the flood shoal, is returned to the littoral system and no long-term disruption of the littoral system would occur.

Additionally, creation of a tidal inlet at Buena Vista Lagoon would result in the development of an ebb bar in the nearshore zone off the lagoon. The ebb bar would contain approximately 30,000 cy and would measure approximately 2.5 feet in thickness. The bar would extend 1,700 feet along the coast and would be located approximately 500 feet offshore, with a width of 250 feet. The ebb bar would gradually develop over approximately 8 years before reaching its equilibrium volume. Development of the ebb bar would not likely change the bathymetry of the bottom substantially enough to modify wave patterns, water currents, or sand transport pattern within the littoral system (Everest 2014b). Coastal sediment transport systems operate on a large scale and are dominated by wave climate and sediment supply, and the relatively small ebb bar form created off Buena Vista Lagoon would not be large enough to modify large-scale coastal currents and sediment transport. The creation of the ebb bar could result in a slightly wider beach on either side of the Buena Vista Lagoon inlet but would not disrupt the littoral processes of sand transport within the littoral zone. **Impacts due to disruption of the littoral system resulting in a change in topography or increase lagoon maintenance requirements would be less than significant (Criterion A).**

After removal of the weir, ocean waves would propagate through the new tidal inlet and into the lagoon. This process would occur typically at higher tides and/or during high wave events. The inlet would be relatively narrow at 100 feet wide, constraining wave action within the lagoon. Inlet conditions would reduce incoming wave energy by blocking a portion of incident wave energy at the inlet mouth, and waves would begin to fan-out as they enter the lagoon basins, which results in loss of energy from their original ocean condition. In the event of tsunamis, additional areas of inundation are not anticipated to occur. The existing weir limits tidal exchange between the lagoon and ocean, but waves currently overtop the weir during storm events and/or high tide conditions. With an open inlet condition, additional low-energy wave action could enter the lagoon but differences during tsunami or other extreme storm events would not be substantial. Tsunami inundation mapping currently encompasses the lagoon and the

St. Malo community to the west, and this mapping would not be anticipated to change. No increased risk of inundation of coastal structures due to tsunami would result from project implementation. **Impacts with respect to risks of damage to coastal structures would be less than significant (Criterion B).**

### *Hybrid Alternative*

Similar to the Saltwater Alternative, the Hybrid Alternative (Options A and B) would open the inlet of Buena Vista Lagoon to tidal exchange. The tidal prism associated with the Hybrid Alternative would be slightly smaller than the Saltwater Alternative at 7.9 million cubic feet (Everest 2014f), but the introduction of a tidal inlet would modify the interaction of the lagoon with coastal processes in the immediate vicinity of the inlet. The beach berm would be breached through enhancement activities and a flood shoal would develop. Inlet maintenance would ensure sand entrained in the lagoon, including the flood shoal, is returned to the littoral system and no disruption of the littoral system would occur.

An ebb bar would also develop with creation of a tidal inlet under the Hybrid Alternative. The ebb bar would be similar in size and location to the Saltwater Alternative, and would contain approximately 30,000 cy, measure approximately 2.5 feet in thickness, and extend 1,700 feet along the coast approximately 500 feet offshore. Development of the ebb bar would not likely change the bathymetry of the bottom substantially enough to modify wave patterns, water currents, or sand transport pattern (Everest 2014b). Because coastal sediment transport systems operate on a large scale and are dominated by wave climate and sediment supply, the relatively small ebb bar would not modify large-scale coastal currents and sediment transport. The creation of the ebb bar could result in a slightly wider beach on either side of the inlet, but would not disrupt the littoral processes of sand transport within the littoral zone. **Impacts due to disruption of the littoral system resulting in topography change or increased lagoon maintenance requirements would be less than significant (Criterion A).**

Ocean waves would propagate through the new tidal inlet and into the lagoon, similar to the Saltwater Alternative. This process would occur typically at higher tides and/or during high wave events. Inlet conditions would reduce incoming wave energy by blocking a portion of incident wave energy at the inlet mouth, and waves would begin to fan-out as they enter the lagoon basins. With an open inlet condition, additional low-energy wave action could enter the lagoon but differences during tsunami or other extreme storm events would not be substantial. Tsunami inundation mapping currently encompasses the lagoon and the St. Malo community to the west, and this mapping would not be anticipated to change. No increased risk of inundation of coastal structures from tsunami would result from project implementation. **Impacts with respect to risks of damage to coastal structures would be less than significant (Criterion B).**

### *No Project Alternative*

No changes to the existing weir at the mouth of Buena Vista Lagoon would be made under the No Project Alternative. The lagoon would continue to be mapped within the tsunami inundation area, and **no impacts due to disruption of the littoral system resulting in topography change or increased lagoon maintenance requirements, or increased risks of damage to coastal structures due to tsunami would occur (Criteria A and B).**

### **Materials Disposal/Reuse**

#### Littoral Zone Nourishment

Lagoon enhancement activities would generate sediment that would need to be disposed of or beneficially reused in the littoral zone. Beneficial use options include beach nourishment and nearshore nourishment, with volumes available for placement within the littoral zone dependent on the construction approach used (e.g., overdredge pit or disposal of fines at LA-5) and the grain size of the sediment removed from the site. Up to 421,000 cy could be placed on the beach disposal site in Oceanside, and up to 580,000 cy could be placed in the nearshore disposal site off Oceanside. The North Carlsbad beach placement site could receive up to 225,000 cy. This analysis evaluates these maximum volumes for potential placement, although the volumes are conservative for any one site, since 833,000 cy is the largest volume of material anticipated to be generated by any of the Enhancement Project alternatives. Selection of the beach and nearshore nourishment sites were based on previously permitted and/or utilized nourishment sites near the Buena Vista Lagoon, as identified in Table 3.3-1. These previous projects were the Navy Homeporting project in 1997, Corps Dredge Disposal project of 1997–1998, 2001 RBSP, and 2012 RBSP.

**Table 3.3-1  
Previously Permitted Volumes at Proposed Placement Sites**

Project	Date	Location		
		Oceanside Beach (cy)	Oceanside Nearshore (cy)	North Carlsbad (cy)
Corps Dredge Disposal	1997–1998	-	533,000	533,000
Navy Homeporting	Permitted 1996	-	1,900,000	-
2001 RBSP	Permitted 2000	420,000	-	225,000
2012 RBSP	Permitted 2011	420,000	-	225,000

cy = cubic yards

Shorelines typically widen after beach and nearshore nourishment. Changes to the beach from potential placement of the maximum potential volume of material at each of the sites were estimated from the relevant previous project analyses, as shown in Table 3.3-2. Potential changes

due to nearshore placement are discussed below as well. Estimates of expected changes to shorelines and profiles can be useful to assess changes to beach width, littoral processes, and risk of damage to coastal structures.

**Table 3.3-2  
2001 RBSP Beach Widths Over Time at Oceanside and North Carlsbad Sites**

2001 RBSP Beach Placement Site	Constructed Beach Width (feet)	Post-Project Beach Widths (in feet)				
		1 Year	2 Years	3 Years	4 Years	5 Years
Oceanside	200	55	40	40	40	40
North Carlsbad	135	40	40	35	35	35

Source: Coastal Frontiers 2010

Beaches encompassing both the onshore Oceanside and North Carlsbad placement sites would be noticeably larger after nourishment. As time passes, sand placed at these beaches would gradually become distributed and extend laterally along the coast. Beaches between the placement sites would become wider, particularly between sites in proximity such as Oceanside and Carlsbad. This widening would add material to the littoral system but would not change transport patterns or erosion rates of sand on those beaches. Beach width at Carlsbad would also increase during periodic inlet maintenance for the Saltwater and Hybrid Alternatives, although the 27,000 cy anticipated to be removed during each maintenance event would not create a substantially larger beach. Once it is placed, sand would migrate cross-shore as well as along the shore, and sometimes accumulate in the nearshore as additional sand volume or sand bars. This accumulation may affect localized wave characteristics temporarily (e.g., surfing), as described in Section 3.1, Land Use/Recreation, and in the Surfing Change Assessment Report (Everest 2014b), but would not change the underlying littoral processes that drive sand transport, including regional wave patterns and currents. While short-term benefits to beaches would occur with materials placement in the littoral zone, no long-term benefits to coastal processes would occur.

During previous materials placement at the Oceanside nearshore placement site, some indications of beach widening were seen in Oceanside after nearshore nourishment, although these were generally smaller than the natural variability and essentially unnoticeable within 3 years after placement. The beach directly adjacent to the placement site did widen up to 100 feet after the largest of the nearshore nourishments (315,000 cy in January to May of 1998), but this widening is similar to the natural widening occurring in a typical summer. Also, it was found that the total nearshore nourishment yielded profile changes that generally were within the noise (e.g., natural variation) of the profile data. From the limited data available, the changes to profiles and shorelines from the nearshore Corps Dredge Disposal appear negligible when

compared to background natural variability. While it is likely that the shoreline did widen due to the nourishment, the change in width was relatively small in comparison to the natural variability and was likely distributed over a long length of beach.

Because smaller to equal volumes are proposed for placement under the Enhancement Project alternatives, less discernible changes to the coastline would be anticipated. **No significant impacts due to disruption of the littoral system resulting in topography change or lagoon maintenance requirements would occur (Criterion A).**

No new permanent coastal structures would be constructed as part of materials placement on area beaches, and the addition of sand in the littoral zone would temporarily provide additional protection to existing coastal structures on the beach, as well as bluffs that support coastal structures under some storm events and high tide conditions. **No significant impact would result with respect to risks of damage to coastal structures (Criterion B).**

#### *No Project Alternative*

No materials would be dredged or excavated that would need to be disposed of or used for littoral cell nourishment under the No Project Alternative. The shoreline and littoral system would remain unaffected by sand placement that could occur under the Enhancement Project alternatives. No disruption of the littoral system or increase in risks of damage to coastal structures would occur and **no impacts would result from the No Project Alternative (Criteria A and B).**

#### **3.3.4 MITIGATION MEASURES**

No significant impacts to coastal processes have been identified; therefore, no mitigation measures are required.