6.0  

SEDIMENT MANAGEMENT APPROACH FOR VARIOUS CATEGORIES OF SEDIMENT SOURCES

This section presents specific considerations and recommendations for regional sediment management using a variety of probable sediment sources. Each type of source - upland, lagoons and harbors, and offshore - lends itself to a different management approach in terms of transport methods, receiver site(s), quantities, and placement design. Possible management approaches for each sediment source type are described below.

Various types of sand placement sites are referred to in this section of the Plan. For clarity, definitions of the range of sand placement sites are:

Onshore – Sand placed on the dry beach, as a berm, between the elevations of 0 and +12 feet MLLW and sand placed in the high-tide surf zone by earthmoving equipment from the dry beach onshore. Sand placed onshore as a beach berm is typically “optimum” sand. The high-tide surf zone is accessible at lower tides, but becomes inundated at higher tides. Surf zone placement is useful for less-than-optimum sands due to the winnowing effect of waves and currents and broad dispersal of fine-grained particles.

Nearshore – Sand placed on the seabed in water depths between -5 and -30 feet MLLW. Nearshore placement is suitable for any type of sediment, except that the USEPA prohibits placement of sediment with greater than 50% fines. Nearshore placement provides for flexibility in nourishment activities if placement volumes are greater than can be accommodated onshore due to environmental constraints, or if the sediment quality is less-than-optimum.

6.1 Upland Sediment

Materials from upland areas generally possess a different quality than material from an aquatic environment. As described in the SCOUP program (Moffatt & Nichol 2006), upland materials may include a range of sediment characteristics from optimum sands with a relatively low percentage of fines (0 to 15 percent) to less-than-optimum sands with a relatively high percentage of fines (between 15 and 45 percent). Materials from reservoirs, rivers, or debris basins may be poorly sorted, containing a broad range and mix of grain sizes. In contrast, materials from dry (e.g., geologic deposits) upland areas can be more homogeneous in gradation due to soil-forming processes or historic depositional stratigraphy. However, upland materials (dry upland areas and water bodies/courses) may possess a higher portion of less-than-optimum sands than materials from streambeds, lagoons, harbors, and the ocean. This is due to the higher energy conditions of active waterways that tend to winnow fine-grained particles out of depositional areas.
6.1.1 Availability and Timing

Dry upland material is nearly constantly available due to ongoing development and maintenance projects, and site-specific sources tend to out-number wet upland sources. Dry upland sources are typically smaller in quantity than wet upland sources, but can have a larger areal extent and may be more available in the dry season.

The timing of opportunistic beach fill projects has thus far emphasized placement in the fall, winter, and early spring seasons. Summer placement has been discouraged, although limited summer placement is acceptable in some instances. Timing is intended to avoid sensitive bird nesting and breeding seasons, and potential impacts to habitat and recreation from increased turbidity. Similar environmental windows are likely to be required for different types of fill, with the exception of ocean sediment (containing fewer fines), which can be placed in the nearshore during summer if monitoring occurs to verify low turbidity levels and lack of impacts.

6.1.2 Transportation

Upland material is typically transported by truck to the discharge site. Other modes of transport are possible, including train, conveyor belt, or hydraulic pipeline (from lakes) through suitable terrain. However, innovative measures such as sluicing material from reservoirs through river valleys are not commonly considered as feasible due to logistical and practical difficulties, such as permitting restrictions for working in sensitive riparian habitats. Rail car transport is feasible, and some of the proposed Coastal RSM Plan sites possess attributes for future rail delivery, such as proximity to the rail line, but most receiver sites do not presently possess a rail access point. It may be possible to retrofit certain receiver sites with infrastructure to receive material by rail. These are not yet called out in this report, as further studies are needed to identify suitable sites in light of the future double-tracking plans by the North County Transit District. Therefore, for this Coastal RSM Plan, most or all opportunistic sand is assumed to be trucked to the beach.

6.1.3 Receiver Sites

Beach receiver sites suitable for upland material all require surf zone placement sites. Surf zone placement sites are considered to be onshore placement. Sites are designated as potential receivers of upland beach fill material if they are readily accessible from a major transportation route, have easy access to the beach, and in some instances are located relatively far from residential land uses to minimize disturbances and potential issues with public safety and truck circulation.
Logistics

San Diego County is characterized by several regional transportation routes that are parallel to the coast, providing north to south access (e.g., I-5 and Highway 101) that are principal routes to the potential upland receiver sites. Also, several major east-to-west access routes extend from inland to the coast (Highways 905 to Imperial Beach, I-8 to Ocean Beach, 52 to La Jolla, 56 to Torrey Pines, and 76 and 78 to Oceanside). Several smaller east-to-west access corridors between these larger ones provide supplemental access to the coast from inland.

Receiver sites for upland sand should be positioned near the location of regional east-to-west access routes to benefit from inland material. A number of receiver sites have been identified as appropriate specifically for opportunistic sand. These sites also possess the attributes considered in the SCOUP report (Moffatt & Nichol 2006) such as needing sand, being relatively distant from residential land uses, possessing construction access ramps, and other criteria considered in that document. If possible, receiver sites for upland sand should also be in the vicinity of stockpile areas that provide for screening, processing, storage, and optional handling of the material. Otherwise, it is assumed that the material is processed prior to delivery to the coast at the source location.

North and Central County

Logistics associated with potential upland beach fill projects for North San Diego County are briefly described herein. They are based on existing and proposed opportunistic beach fill programs at Oceanside, Carlsbad, Encinitas, and Solana Beach.

Regional transport routes relative to beach locations are shown in Figure 26 and also listed below.

- Highways 76 and 78 in the north;
- Via De La Valle, Palomar Airport Road, La Costa Avenue, and Manchester Drive in central North County; and
- Highways 56 and 58 as options in the southern North County.

Potential upland receiver sites, transport routes to those locations, and access considerations include:

- South Oceanside, from Highways 76 and 78 (an existing rail spur exists near Oceanside Boulevard for the future option of rail delivery, two truck ramps exist, and a stockpile site is identified at El Corazon);
- South Carlsbad State Beach (north), from Palomar Airport Road (the site needs a temporary ramp as is planned by the City for each project, and no stockpile site is available);
- Batiquitos Beach in Encinitas, from La Costa Avenue (the site possesses existing at-grade access, but no stockpile site is available; however it is in proximity to Saxony Detention Basin, identified by Encinitas as a stockpile site);
- Moonlight Beach, from Encinitas Boulevard (the site possesses existing at-grade access, and a stockpile site exists at Saxony Detention basin);
Figure 26 – Regional Transport Routes in San Diego County
Cardiff State Beach, from Manchester Avenue (the site needs a ramp and possesses no stockpile site);
Fletcher Cove, from Via De La Valle (the site possesses an existing ramp but no stockpile site); and
Torrey Pines State Beach, from Highways 56 and 52 (the site needs a ramp and possesses no stockpile site).

North and Central County receiver sites are shown in more detail in Figures 27 and 28. Using existing and proposed opportunistic beach fill programs as guidelines (and to be consistent with the approach used to formulate these programs), each site is designated to receive a maximum quantity of 150,000 cubic yards of material annually, except for the Batiquitos Beach in Encinitas site which is limited to 120,000 cy/yr due to the sensitivity of being adjacent to Batiquitos Lagoon.

South Central and South County

Potential upland beach fill project logistics for South Central and South San Diego County are mainly based on proposed programs at Coronado and Imperial Beach with Ocean Beach as an additional site. Specific transport routes are:

- Interstate 8;
- Highway 70 (Coronado Bridge);
- Palm Avenue (Main Street in Imperial Beach);
- Imperial Beach Boulevard;
- Highway 905; and
- Monument Road.

Potential upland receiver sites, transport routes to those locations and access considerations include:

- Ocean Beach in San Diego, from Interstate 8 (a new concrete ramp exists but may require protection of some type, and a stockpile site exists at the adjacent Dog Beach);
- Coronado Beach, from Highway 70, local streets, and the North Island Naval Air Station (at-grade beach access exists, but no stockpile sites are available);
- Imperial Beach, from Palm Avenue, Imperial Beach Boulevard, and Highway 905 (two truck ramps exist, but no stockpile sites are available); and
- Border Field State Park beach, from Monument Road and from Tijuana Estuary debris basins (at-grade access exists over state property but is constrained by a small bridge that needs to be temporarily spanned for truck deliveries).

South Central and South County receiver sites are shown in more detail in Figures 29 and 30. Coronado is designated to receive a maximum quantity of 100,000 cubic yards of material annually, and Imperial Beach and the Border Field State Park beach are limited to 75,000 cubic yards per year each, due to the sensitivity of being adjacent to the Tijuana Estuary. These quantity limits are taken from proposed opportunistic beach fill programs at Coronado and Imperial Beach, respectively.
Figure 27 – North County Upland Sediment Receiver Sites
Figure 28 – Central County Upland Sediment Receiver Sites
Figure 29 – South Central County Upland Sediment Receiver Sites
Figure 30 – South County Upland Sediment Receiver Sites
6.1.4
Habitat Considerations

Placement of optimum sediments onshore generally is not constrained from the perspective of sand compatibility. However, frequency or timing of placement and volume and duration of projects are important considerations for minimizing potential adverse effects to sensitive biota and habitats including:

- Sandy beach invertebrates;
- California grunion;
- California least tern;
- Western snowy plover; and
- Nearshore reefs and kelp beds.

Construction activities have the potential to adversely impact the invertebrate community from burial or spreading of fill material with earth-moving equipment. Invertebrates seasonally recruit to beaches and have a peak productivity period in spring and summer, and lower abundance during fall and winter, associated with offshore sand migration. Sand placement during the low season minimizes interference with natural seasonal recruitment and development of the sandy beach invertebrate community, which provides forage base for fishes and shorebirds.

If construction activities are considered during the period of grunion runs, then beaches should be assessed for habitat suitability, and if suitable, monitored prior to and during placement activities to ensure that grunion eggs are not damaged or buried during construction. Monitoring should take place even if no grunion are expected to arrive as beaches change over the course of a season. However, monitoring would not be necessary if habitat is not suitable for spawning (e.g., insufficient beach width, rocky, shallow sand depths).

When opportunistic placements are conducted more than once a year, avoidance of repetitive placement of sand in the same location is recommended to speed invertebrate recovery rates. Successive placements should be separated by a protective distance interval (e.g., 150 feet) and not require vehicle disturbance of previous placement locations (e.g., placement started farthest from the beach access location and successive placements made closer to the access location) (Moffatt & Nichol 2006).

Generally, sediment placement during September 30 through February 28 minimizes potential effects to the biota and avoids sensitive use periods of protected species such as California grunion, California least tern, and western snowy plover. One exception concerns wintering concentrations of snowy plover. Although several potential wintering areas have been identified in San Diego County (USFWS unpublished data), available winter survey data indicates that actual use differs among sites and years. Pre-project coordination with resource and regulatory agencies is mandatory for receiver sites located within identified snowy plover wintering areas. Coordination should include review of recent winter survey data, as available, and identification of whether additional mitigation measures (e.g., construction monitoring) may be warranted.
For projects occurring between March 1 and September 30, pre-construction survey assessment or coordination with resource and regulatory agencies will be necessary consistent with RGP 67 (USACE 2006) and the SCOUP (Moffatt & Nichol 2006) to ensure no adverse impacts to sensitive resources.

- During the California grunion spawning season (March 1-August 31), habitat suitability to support spawning success must be assessed. If suitable, construction monitoring will be required to ensure no adverse impacts to the species. Grunion monitoring during construction may be waived if habitat is unsuitable (e.g., extensive cobble cover, insufficient sand thickness, narrow beach width with substantial wave exposure across tides).

- If a receiver site is located within 1,500 feet (500 yards) of snowy plover nesting areas, sand placement would be restricted during the breeding season (March 1 through September 30) unless otherwise coordinated in advance with the USFWS and USACE.

- If a receiver site is located within 3,000 feet (1,000 yards) of a California least tern breeding colony, sand placement would be restricted during the breeding season (April 1 through August 30) unless otherwise coordinated in advance with the USFWS and USACE.

Discharge of less-than optimum sands should be confined to less-sensitive areas due to turbidity and sedimentation concerns. Discharge near the mouths of active streams during the winter season would most closely approximate natural conditions. Discharge near sensitive reef and vegetated habitats or near nesting sites of California least tern during the breeding season is not recommended. Frequency, volume, and discharge rate should be controlled to minimize the potential for adverse or cumulative impacts to beach and nearshore hard or soft-bottom communities. Initial projects should involve small volumes (e.g., < 25,000 cubic yards). Sediment testing before and after discharge is recommended to verify that beach and nearshore sand characteristics in the vicinity of the receiver site are not significantly altered by placement of less-than optimum sand. Volume and frequency may be adaptively refined in subsequent placements based on monitoring results.

A study is being conducted at the Tijuana Estuary to document the fate and transport of upland sediment containing up to 49 percent fines. Approximately 44,000 cubic yards total of material is planned for delivery to the beach by truck from a nearby debris basin, and approximately 24,000 cubic yards of the material was placed in at the beach in 2008. The USGS monitored the turbidity and pattern of sedimentation in 2008, and may monitor future phases. The remaining material may be placed in 2009. The objective is to provide information for possible reconsideration of the 80/20 (sand/fines) rule-of-thumb presently employed by the USEPA and USACE for project approvals. Results of monitoring are still pending. If the study results indicate that sediment with more than 20% fines can be used for beach nourishment without significant adverse effects, then the viability of upland sand sources (as well as wetland restoration) for improving the region’s sand deficit may be enhanced. However, as of the writing of this Plan, completion of the project has been put on hold.
6.1.5 Placement Designs and Restrictions

Upland sand placement options are described fully in the SCOUP document (Moffatt & Nichol 2006) and in the technical and environmental documentation for each local agency’s opportunistic beach fill program under the SCOUP process (EDAW 2006 and 2008; Moffatt & Nichol 2000c). Carlsbad possesses a separate opportunistic beach fill program from the SCOUP programs. Cities participating in the SCOUP programs are:

- SCOUP I
  - Oceanside.
- SCOUP II
  - Encinitas;
  - Solana Beach;
  - Coronado; and
  - Imperial Beach.

Placement options are defined in the first portion of Section 6.0. Options consist of onshore placement as a berm on the high, dry beach if the material is optimum sand. Alternatively, the material could be placed at the surf-line in a low-tide dike or mound if the material is less-than-optimum sand. Nearshore placement is less desirable because it requires hydraulic pumping, which results in the need for additional material handling and higher costs.

Material placement is restricted over time and space to reduce trucking impacts, and to minimize environmental impacts. Delivery of all materials by truck is controlled to reduce the number of truck trips on roadways to an acceptable level within each City (Moffatt & Nichol 2000c, EDAW 2006 and 2008). Less-than-optimum sands are placed at the beach at a specified rate over time to minimize turbidity and potential impacts to invertebrates.

6.1.6 Stockpiling

Regional or subregional stockpile sites could increase the flexibility of opportunistic beach fill operations. Flexibility is needed to provide temporary staging if the following conditions occur:

- Suppliers cannot fund transport to the coast;
- The materials need to be processed prior to delivery to the coast; and/or
- The quantity exceeds the allowable placement volume, and it would need to be placed either at a later date or at a different location.

Project economics tend to be more favorable for delivering material to the coast if the source is relatively close to receiver sites or the quantities of material to be transported are large. Sources may be far enough from the coast to render transport economically infeasible. In addition, quantities from specific projects may be so small as to render the project incapable of funding.
transport to the coast. In these instances, stockpile sites could serve as “deposit” locations for suppliers intending to contribute their material to a future opportunistic beach fill project.

Any material placed at a designated regional or local stockpile must be chemically clean before arrival and preferably already processed (screened of boulders/rocks, debris, trash, vegetation, and any other material incompatible with beach fill). The stockpile site may be a suitable location to perform processing operations if sufficient space is available.

Two stockpile sites are currently designated as part of proposed opportunistic beach fill programs in San Diego County - the El Corazon site in Oceanside and Saxony Detention Basin in Encinitas. These sites would supplement sediment management activities at multiple opportunistic beach fill receiver sites at South Oceanside (El Corazon), and Batiquitos Beach and Moonlight Beach (Saxony Basin). Other stockpile sites should be considered for use in sediment management activities elsewhere in the County. Candidate stockpile sites should be on public land if possible to avoid the cost of leasing the land from private landowners. Figure 31 shows example stockpile locations within the region, which includes:

- Undeveloped lots in Otay Mesa;
- Vacant lots near the intersection of Seaworld Drive and Friars Road in San Diego;
- Miramar landfill;
- The Highway 56 corridor; and
- The Tijuana Estuary stockpile site.

![Figure 31- Examples of Potential Stockpile Locations](image-url)
Theoretically, stockpiled material could be managed by account so that contributors could be credited for their contribution and potentially given some form of offset or incentive to make the donation attractive. Multiple sources of materials at a given stockpile site should be kept physically separate and somehow labeled with signage or markings to identify the source and donor. All stockpile areas would have to conform to Water Board requirements for storm water and erosion control. Costs to truck the stockpiled material to the coast could periodically be funded by the state or others.

6.2 Lagoon Restoration, and Lagoon and Harbor Maintenance

Sediment deposits in lagoons and harbors require periodic or regular removal. Examples are described below.

- **Maintenance Dredging Material**

  Harbors and coastal lagoons open to the ocean are repositories for sand transported in by overwash and flood-tide currents. Streams and rivers do not appreciably contribute sediment to downstream areas (the coast, harbors and lagoons) in this region due to damming for flood control and water conservation. Consequently, sand delivered to harbors or open lagoons from the coast is lost to the littoral zone until it is either flushed or mechanically moved to the beach and/or nearshore. The term used herein for sediment management from these sources is maintenance dredging, and it is a critical component of the coastal sediment budget.

  Littoral sand that collects in lagoons and harbors generally is well-sorted and of fairly uniform grain size. The sediment usually possesses a higher percentage of sand and lower percentage of fines than upland sand. This material generally represents optimum sand for renourishment. The median grain size diameter may be relatively fine. Therefore, sediment removed from restored lagoons and existing harbors close to the active littoral zone is typically of high quality for beach nourishment. The higher energy level of the littoral environment, even if protected, leads to deposition of the relatively larger and heavier sediment such as sand (compared to fine-grained silts and clays). As such, this material tends to be clean of contaminants because they do not adhere as well to sand grains as they do to silts and clays. This conclusion applies to the outer harbor areas where sand from the ocean has deposited. Inner harbors that receive siltation from surrounding upland areas may possess a higher percentage of fine-grained sediment, and the sediment may be contaminated.

- **Wetland Restoration Material**

  Sediment that deposits in protected and low energy aquatic environments, such as closed (or not yet restored) lagoons, represents new sediment that can be added to the littoral zone to offset losses to the region. Sediment from wetland restoration projects will be relatively poorly-sorted. The quieter conditions of a closed lagoon lead to a depositional environment for all sizes of sediments, including sand from periodic coastal influxes and fines from the upland watershed. This material represents a mix of optimum and less-than-optimum sand in stratigraphic layers. Therefore, sediment removed from a lagoon
during restoration may consist of alternating layers of sandy sediment and finer sediments. This material can therefore potentially possess contaminants in the finer-grained layers contributed from the watershed.

6.2.1 Availability and Timing

**Maintenance Dredging Material**

Maintenance-dredged material is typically available on a recurring basis such as annually or bi-annually. These sources and their respective actual and projected quantities are shown in Table 8. The quantities vary, but total up to approximately 700,000 cubic yards for the region. They are more predictable in amount and frequency than other sources because they are delivered by a fairly constant process of wave- and tidal-driven currents. Maintenance dredging is typically done in the fall or spring to avoid the high beach use season and winter storms, respectively.

<table>
<thead>
<tr>
<th>Location</th>
<th>Annual Quantity (Cubic Yards)</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Oceanside Harbor</td>
<td>222,000</td>
<td>Harbor maintenance dredging</td>
</tr>
<tr>
<td>2. Del Mar Boat Basin</td>
<td>2,500</td>
<td>Dredging of boat launch ramp at inner Oceanside Harbor for larger vessel access</td>
</tr>
<tr>
<td>3. Agua Hedionda Lagoon</td>
<td>300,000</td>
<td>Lagoon maintenance dredging</td>
</tr>
<tr>
<td>4. Batiquitos Lagoon</td>
<td>25,000</td>
<td>Lagoon maintenance dredging</td>
</tr>
<tr>
<td>5. San Elijo Lagoon</td>
<td>25,900</td>
<td>Lagoon mouth opening</td>
</tr>
<tr>
<td>6. San Dieguito Lagoon</td>
<td>16,000</td>
<td>Projected lagoon mouth maintenance (not opened yet as of this writing)</td>
</tr>
<tr>
<td>7. Mission Bay entrance channel</td>
<td>Undetermined, but estimated to be relatively small (10,000 assumed)</td>
<td>Possible future channel maintenance dredging</td>
</tr>
<tr>
<td>8. Lower San Diego River (mouth area in Ocean Beach)</td>
<td>Undetermined, but estimated to be relatively small (10,000 assumed)</td>
<td>Possible lower river flood control maintenance or habitat restoration of Famosa Slough</td>
</tr>
<tr>
<td>9. San Diego Bay</td>
<td>100,000 (estimated)</td>
<td>Harbor maintenance dredging</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>701,400</strong></td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

Sources: Coastal Frontiers Corporation (2007) for 1, 3 and 5; Southern California Edison for 2 and 6; State Department of Fish & Game for 4; Moffatt & Nichol for 7, 8, and 9.
**Wetland Restoration Material**

Material from lagoon restoration is available on an infrequent basis (decade or longer periods). Sand volumes vary widely, from 60,000 cubic yards (to be removed from the San Dieguito Lagoon mouth as the last restoration stage) to 1.5 million cubic yards dredged from Batiquitos Lagoon for restoration in 1995 (Table 9). They are less predictable in volume and frequency than maintenance dredging projects. Restoration work is typically done in the fall and winter to avoid affecting sensitive nesting birds in spring and summer.

<table>
<thead>
<tr>
<th>Location</th>
<th>Periodic Quantity (Cubic Yards)</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Buena Vista Lagoon</td>
<td>800,000</td>
<td>Future lagoon restoration</td>
</tr>
<tr>
<td>2. Batiquitos Lagoon</td>
<td>1,500,000</td>
<td>Lagoon restoration in 1995</td>
</tr>
<tr>
<td>3. San Elijo Lagoon</td>
<td>500,000</td>
<td>Future lagoon restoration</td>
</tr>
<tr>
<td>4. San Dieguito Lagoon</td>
<td>60,000</td>
<td>Future channel restoration</td>
</tr>
<tr>
<td>5. Los Peñasquitos Lagoon</td>
<td>Quantity undetermined</td>
<td>Future lagoon restoration</td>
</tr>
<tr>
<td>6. San Diego Bay</td>
<td>Quantity undetermined</td>
<td>Future restoration</td>
</tr>
<tr>
<td>7. Tijuana Estuary</td>
<td>600,000</td>
<td>Future restoration</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>3,160,000</strong></td>
<td></td>
</tr>
</tbody>
</table>

Sources: Everest International Consultants for 1; Moffatt & Nichol for 2; San Elijo Lagoon Conservancy for 3; Southern California Edison for 4; Nordby Biological for 7. No estimates are yet available for items 5 and 6.

6.2.2

**Transportation**

Material generated in an aqueous environment is dredged and discharged by slurry line because it is already in water. Compared to truck trips, this mode of transport is unobtrusive and has less of an impact on the surrounding environment. It is an efficient and inexpensive way to convey sediment, while being relative unnoticeable.

6.2.3

**Receiver Sites with Proportional Placement**

An important consideration regarding placement of dredged material from maintenance and restoration activities is the placement location along the coast within the littoral zone. Presently, most projects place material as close to the dredge site as possible to minimize costs. The placement location relative to the deposition location is typically “downcoast” or wherever there is a demonstrated need. However, some projects actually place the material “upcoast” relative to the dredge site for various reasons including political ones, and at times because of a misunderstanding of the net longshore transport direction.
An objective of coastal regional sediment management should be to retain sand within the littoral zone for as long a time period as possible before it is potentially lost to the littoral cell. Therefore, more study of sand transport direction is needed in the vicinity of each inlet/entrance channel to identify site-specific littoral transport patterns. Net longshore sediment transport in the North County San Diego region is generally to the south at a rate of between 100,000 to 250,000 cubic yards per year (with significant variation) (USACE 1991). Sediment placement from many projects anticipates southward transport and results in the majority of placement occurring downcoast, south of the maintenance or restoration location.

However, studies for the City of Encinitas show that longshore transport direction in the vicinity of the San Elijo Lagoon mouth are northward up to 80% of the time in summer, and 40% of the time in winter, with the average being 45% north and 55% south over the year (Coastal Environments 2001). As such, sand placement from restoration at that lagoon could be done proportional to the net transport direction at the time of construction. This approach mainly applies to North County San Diego, as the South County area possesses only one lagoon entrance (Tijuana Estuary) toward the southern end of the littoral cell.

Another consideration should be the existence of lagoon-subcells identified by SIO researchers (O’Reilly 2008). As described in Section 3.0 of this Plan, work by O’Reilly indicates that North County San Diego is broken up into a series of lagoon subcells along the coast where longshore sediment transport is interrupted and deflected offshore at the lagoon locations. Sand placement near lagoons should be done considering implications of these observations on ultimate sand losses to the offshore zone from the littoral zone. Initial indications are that sediment dredged from lagoons should be placed downcoast approximately one-half mile or more from the lagoon to remain outside of the influence of these theoretical lagoon subcells.

This Coastal RSM Plan recommends placing material so as to maximize its lifespan within the active littoral zone. Based on available information, this plan generally recommends placing less than half of the sand from lagoons upcoast and more than half of it downcoast to minimize return to lagoons or harbors. Also, providing as much distance as possible between the placement sites and source lagoons or harbors will reduce return flows. Figures 32 through 36 show the San Diego County maintenance dredging operations. Proportional sand placement scenarios are offered in Table 10 as Coastal RSM Plan maintenance dredging receiver sites to optimize coastal regional sediment management. Several new nearshore sites are included to increase flexibility in operations and to reduce potential cumulative impacts of several projects occurring simultaneously. Existing or historical operations performed consistent with these recommendations are noted in Table 10 as “existing” or “historical,” and new recommendations are noted as “new.”
Table 10 - Proportional Placement of Sediment from Local Dredge Projects

<table>
<thead>
<tr>
<th>Dredge Location</th>
<th>Annual Quantity (Cubic Yards)</th>
<th>Placement Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance Dredging/Excavation Projects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oceanside Harbor</td>
<td>222,000</td>
<td>Onshore 100% south of Tyson St (existing); alternatively Oceanside nearshore for less than optimum sand (new)</td>
</tr>
<tr>
<td>Del Mar Boat Basin</td>
<td>2,500</td>
<td>Onshore 100% at South Oceanside (new)</td>
</tr>
<tr>
<td>Agua Hedionda Lagoon</td>
<td>300,000</td>
<td>Onshore 60% south of entrance, 40% north of entrance (new)</td>
</tr>
<tr>
<td>Batiquitos Lagoon</td>
<td>25,000</td>
<td>Onshore with 60% south of entrance, 40% north of entrance (new); alternatively nearshore for less than optimum sand (new)</td>
</tr>
<tr>
<td>San Elijo Lagoon</td>
<td>25,900</td>
<td>Onshore 100% south of entrance (existing); alternatively nearshore for less than optimum sand (new)</td>
</tr>
<tr>
<td>San Dieguito Lagoon</td>
<td>16,000</td>
<td>Onshore 60% south of entrance, 40% north of entrance (new)</td>
</tr>
<tr>
<td>Mission Bay entrance channel</td>
<td>Undetermined, but estimated to be relatively small (10,000 assumed)</td>
<td>Onshore 100% north of entrance (historical)</td>
</tr>
<tr>
<td>Lower San Diego River (mouth area in Ocean Beach)</td>
<td>Undetermined, but estimated to be relatively small (10,000 assumed)</td>
<td>Onshore 100% south of entrance (new)</td>
</tr>
<tr>
<td>San Diego Bay</td>
<td>100,000</td>
<td>Onshore 100% south of entrance at Coronado and Imperial Beach (historical); alternatively nearshore at either Coronado or Imperial Beach for less than optimum sand (new)</td>
</tr>
<tr>
<td>Future Wetlands Restoration Dredging Projects – Placement Location recommendations are all new</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buena Vista Lagoon</td>
<td>800,000</td>
<td>North Carlsbad onshore for optimum sand; Oceanside nearshore for less than optimum sand</td>
</tr>
<tr>
<td>San Elijo Lagoon</td>
<td>800,000</td>
<td>Onshore 45% north of entrance, 55% south of entrance; Cardiff nearshore for less than optimum sand</td>
</tr>
<tr>
<td>San Dieguito Lagoon</td>
<td>60,000</td>
<td>Onshore 60% south of entrance, 40% north of entrance; Del Mar nearshore for less than optimum sand</td>
</tr>
<tr>
<td>Los Peñasquitos Lagoon</td>
<td>Quantity undetermined</td>
<td>Onshore 60% south of entrance, 40% north of entrance; Torrey Pines nearshore for less than optimum sand</td>
</tr>
<tr>
<td>Tijuana Estuary (Phase 1 Project, per Chris Nordby 2008)</td>
<td>600,000</td>
<td>Onshore 60% north of entrance at Imperial Beach, 40% south of the Estuary mouth; and nearshore Imperial Beach for less than optimum sand</td>
</tr>
</tbody>
</table>
Figure 32 – Maintenance Dredging and Wetland Restoration (North County)
Figure 33 – Maintenance Dredging and Wetland Restoration (North Central County)
Figure 34 – Maintenance Dredging and Wetland Restoration (Central County)
Figure 35 – Maintenance Dredging and Wetland Restoration (South Central County)
Figure 36 – Maintenance Dredging and Wetland Restoration (South County)
Several new receiver sites are identified for lagoon and harbor maintenance dredging that are located in the nearshore zone off the beach. These new nearshore receiver sites are off the following beach areas:

- South Oceanside;
- Batiquitos Lagoon;
- Cardiff State Beach;
- San Dieguito;
- Torrey Pines State Beach;
- Mission Beach;
- Coronado; and
- Imperial Beach (two sites, each located on opposite sides of the pier).

6.2.4 Habitat Considerations

Excessive sedimentation reduces habitat quality within lagoon and harbor habitats and is controlled with periodic maintenance dredging or excavation. Habitat restoration may be required when sedimentation alters tidal exchange and/or substantially degrades habitat functions. Proportional placement may minimize impacts to biota by decreasing the frequency of sediment management activities. A decrease in sedimentation rates within lagoons has the potential to reduce the frequency of maintenance dredging. Similarly, a reduction in dredge frequency has the potential to reduce the frequency of placement of suitable dredged materials on beach sites adjacent to lagoons. Habitat considerations associated with onshore placement of optimum and less-than-optimum sands are described in Section 6.1.

Nearshore receiver sites are located over sandy subtidal habitats relatively close to lagoons and harbors to increase flexibility of beneficial reuse of suitable source materials from maintenance dredging. The inclusion of nearshore sites also may improve lagoon maintenance schedules by providing nearby sites to receive less than optimum sediments. Sediment grain size characteristics of less than optimum sediments are within the range of grain sizes on the lower beach profile and can be used for nourishment. These sediments are required to be free of contamination to ensure compatibility with beneficial use objectives. Similar to onshore placement, primary impact considerations with use of nearshore sites include sediment compatibility and recovery rates of benthic invertebrates, avoidance of sensitive hard bottom and vegetated habitat areas, and minimizing adverse turbidity and sedimentation effects on sensitive habitats and biota.

Because receiver sites must be located relatively close to be a cost-effective for use during lagoon restoration or lagoon and harbor maintenance, an important habitat consideration is the potential for sediment migration after placement to alter sedimentation rates, inlet shoaling, and/or frequency of maintenance requirements and disturbance of sensitive estuarine habitat and biota. Consequently, location and distance of receiver sites relative to prevailing current direction as well as placement volumes are important factors related to habitat considerations.
Limited information is available regarding locations of soft-bottom sensitive aquatic resource areas. Potential occurrence of Pismo clam beds and effects on essential fish habitat would require assessment. Pre-project surveys to document existing conditions, and coordination with commercial fishermen to better understand local uses of the area, may be necessary to minimize potential adverse effects and to reduce conflicts with use of nearshore sites. While locations of hard bottom nearshore habitats are relatively well known in the region, less information is available on habitat quality. Field assessment of habitat quality of hard-bottom areas, if present in the vicinity, may be necessary to finalize the design and/or to support environmental review and permitting of some nearshore sites.

### 6.2.5 Receiver Sites Without Proportional Placement

The existing sediment placement scenario as part of maintenance dredging operations is referred to as being non-proportional to the net longshore sediment transport rate. Existing dredging operations do not necessarily place sand in the locations where it will move downcoast away from the inlet/entrance channel. This sediment placement practice is the default scenario that can continue to be used if proportional placement poses unforeseen complications, such as costs, to the sediment discharger. Existing sand placement is shown in Table 11 with proposed nearshore placement sites (labeled “new”) to provide flexibility for lagoon and harbor maintenance.

<table>
<thead>
<tr>
<th>Dredge Location</th>
<th>Annual Quantity (Cubic Yards)</th>
<th>Placement Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance Dredging/Excavation Projects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oceanside Harbor</td>
<td>222,000</td>
<td>Onshore 100% south of Tyson St (existing); alternatively Oceanside nearshore for less than optimum sand (new)</td>
</tr>
<tr>
<td>Del Mar Boat Basin</td>
<td>2,500</td>
<td>Onshore 100% at South Oceanside (new)</td>
</tr>
<tr>
<td>Agua Hedionda Lagoon</td>
<td>300,000</td>
<td>Onshore 40% south of entrance, 60% north of entrance</td>
</tr>
<tr>
<td>Batiquitos Lagoon</td>
<td>25,000</td>
<td>Onshore with 50% south of entrance, 50% north of entrance; alternatively nearshore for less than optimum sand (new)</td>
</tr>
<tr>
<td>San Elijo Lagoon</td>
<td>25,900</td>
<td>Onshore 100% south of entrance; alternatively nearshore for less than optimum sand (new)</td>
</tr>
</tbody>
</table>
### Dredge Location

<table>
<thead>
<tr>
<th>Dredge Location</th>
<th>Annual Quantity (Cubic Yards)</th>
<th>Placement Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mission Bay entrance channel</td>
<td>Undetermined, but estimated to be relatively small (&gt; 10,000)</td>
<td>Onshore 100% north of entrance</td>
</tr>
<tr>
<td>Lower San Diego River (mouth area in Ocean Beach)</td>
<td>Undetermined, but estimated to be relatively small (&gt; 10,000)</td>
<td>Onshore 100% south of entrance</td>
</tr>
<tr>
<td>San Diego Bay</td>
<td>100,000</td>
<td>Onshore 100% south of entrance at Imperial Beach; alternatively nearshore at either Coronado or Imperial Beach for less than optimum sand (new)</td>
</tr>
<tr>
<td>Tijuana Estuary/Goat Canyon Debris Basins</td>
<td>50,000</td>
<td>In surfzone 100% north of site</td>
</tr>
</tbody>
</table>

### Future Wetlands Restoration Dredging Projects

<table>
<thead>
<tr>
<th>Future Wetlands Restoration Dredging Projects</th>
<th>Annual Quantity (Cubic Yards)</th>
<th>Placement Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buena Vista Lagoon</td>
<td>800,000</td>
<td>North Carlsbad onshore for optimum sand (new); Oceanside nearshore for less than optimum sand (new)</td>
</tr>
<tr>
<td>San Elijo Lagoon</td>
<td>800,000</td>
<td>Onshore 45% north of entrance, 55% south of entrance; Cardiff nearshore for less than optimum sand (new)</td>
</tr>
<tr>
<td>San Dieguito Lagoon</td>
<td>60,000</td>
<td>Onshore 60% south of entrance, 40% north of entrance; Del Mar nearshore for less than optimum sand (new)</td>
</tr>
<tr>
<td>Los Peñasquitos Lagoon</td>
<td>Quantity undetermined</td>
<td>Onshore 60% south of entrance, 40% north of entrance; Torrey Pines nearshore for less than optimum sand (new)</td>
</tr>
<tr>
<td>Tijuana Estuary (Phase 1)</td>
<td>600,000</td>
<td>Onshore 60% north of entrance (Imperial Beach - new), 40% south of entrance (new); and nearshore Imperial Beach for less than optimum sand (new)</td>
</tr>
</tbody>
</table>
6.2.6
Habitat Considerations

Environmental effects associated with non-proportional placement would be similar to existing sediment management activities. However, the inclusion of nearshore sites may improve lagoon maintenance schedules by increasing flexibility for beneficial reuse of maintenance materials. Habitat considerations associated with placement of optimum and less-than-optimum sediments were described in Sections 6.1 and 6.2.4.

6.2.7
Placement Designs

The main types of material placement consist of:

- Onshore if it is optimum sand from maintenance dredging or restoration;
- Nearshore if it is less-than-optimum sand anticipated from wetland restoration and with large enough quantities to make it cost-effective (100,000 cubic yards or more); and
- Surf-zone dike if the material is less-than-optimum sand and the volumes are too small to make nearshore placement cost effective.

Each placement mode is described in greater detail in the SCOUP report (Moffatt & Nichol 2006). Onshore placement is used to create a level beach berm created over the high and dry area of the existing beach that then slopes seaward at a certain point toward the water. It can also include surf zone placement along the low water line using earthmoving equipment to create a low dike or mound that is subsequently reworked and redistributed naturally by tides and waves. Nearshore placement is deposition in depths of approximately between 5 and 30 feet of water in a mound by hydraulic means.

6.3 Offshore Sediment

Sediment deposits in the offshore and outside of the active littoral cell can consist of relic depositional layers of drowned river valleys or cross-shore losses that occurred during severe storms. This material has been lost from the littoral cell and will remain sequestered unless it is removed and replaced within the littoral zone. These deposits represent a potentially large supply of new sediment from outside the littoral cell available for nourishment.

The term used herein for sediment management from these sources is dredging from offshore. It has become a critical component of the coastal sediment budget for the San Diego region since SANDAG utilized this type of material for RBSP I (Sea Surveyor 1999; Noble Consultants 2000). SANDAG plans to use offshore sands as the primary source for their RBSP II in 2011 or 2012. Research of sand deposits offshore of San Diego County has continued since RBSP I by various groups, and additional potential sources have been identified (Coastal Conservancy and SANDAG 2008; Hogarth, et al. 2007). SANDAG conducted new offshore investigations in late 2008. The USACE plans to use the same or similar offshore sources as SANDAG for any projects they may conduct in North and South County as well.
Littoral sand that deposits in the relatively quiet areas farther from shore can be well-sorted and has a fairly uniform grain size. The material tends to deposit in stratigraphic layers that vary in properties, but large sand lenses are typically present at or near the surface of the seafloor. Existing data indicate that offshore sediment deposits possess a higher percentage of sand and lower percentage of fines than upland sand (Alpine 2008). This material represents optimum sands and is of high quality for beach nourishment. It varies from being relatively fine in median grain size (at site TP-1 offshore of Torrey Pines State Beach) to being fairly coarse (at site MB-1 off Mission Beach). Additionally, the sandy layers tend to be clean of contaminants since contaminants do not adhere well to sand grains.

6.3.1
Availability and Timing

Sand from offshore is continually available without temporal restrictions, but the relatively high costs of offshore dredging are a constraint that reduces project frequency. Large-scale projects that use sand from offshore are typically performed every five to ten years, depending on funding availability. For example, SANDAG’s RBSP I occurred in 2001 and RBSP II may occur in 2011 or 2012.

There are many potential source locations for offshore sand in the San Diego region. SANDAG previously investigated the sites labeled as SO in North County, MB off Mission Beach, and SS off Silver Strand for RBSP I. SANDAG then extended the areas of interest around those sites, and investigated the new sites off Camp Pendleton (labeled as SM-1), Torrey Pines (TP-1), and Zuniga Shoal (ZS-1) for RBSP II. Sand quantities available from offshore sites can be huge, such as approximately 60 million cubic yards estimated to exist off Mission Beach at MB-1, and can be smaller, such as the more limited amount estimated to exist off Cardiff Beach at SO-6.

Projects using offshore sand may be constrained by weather when scheduled during fall to spring, and may extend through summer to capitalize on quiet ocean conditions for dredging and beach filling. Schedules may be restricted or additional construction monitoring required between March and the end of September depending on proximity to nesting areas of California least tern or snowy plover, and to maintain recreational uses.

Both SANDAG and the USACE envision performing large projects in the next ten years or less, and their efforts need to be coordinated to prevent significant cumulative impacts to essential fish habitat. SANDAG proposes placement of 2.1 million cubic yards of sand in 2011 or 2012. The USACE anticipates placement of a total of 950,000 cubic yards of sand at Encinitas/Solana Beach, a similar quantity of sand with retention measures at Oceanside, and 1.5 million cubic yards of sand at Imperial Beach. Dates for the USACE projects are uncertain due to federal budget uncertainties. It may be necessary for SANDAG to perform their work while this Coastal RSM Plan process continues, and for monitoring data from RBSP II to inform any future USACE efforts. The USACE can consider both the SANDAG monitoring results, the latest sand placement operations of other projects, and quantity targets of this Coastal RSM Plan to optimize their project quantities for region-wide benefits.
6.3.2 Transportation

Material dredged from offshore is transported to the littoral zone either by dredge discharge line to the nearshore or beach, or bottom dumped from scows or barges in the nearshore. No other transport mode is cost-effective for this scenario.

6.3.3 Receiver Sites for Offshore Sand

Sites within the San Diego region designated in this Coastal RSM Plan for receiving offshore sand are the onshore sites utilized in RBSP I, plus some additional nearshore sites. The RBSP I site boundaries are referenced in this document. It should be noted, however, that SANDAG intends to review and possibly modify the boundaries at some sites to improve performance or further minimize potential environmental effects based on monitoring results or more recent information.

SANDAG may also consider increasing placement quantities to increase their project effects and cost-efficiency. New nearshore sites are intended to lend flexibility and are located in areas where sensitive aquatic resource constraints are either absent or less extensive. The nearshore sites may also allow for reduced potential cumulative impacts from multiple placements. These nearshore sites can receive larger quantities of sand than onshore sites. Figures 37 through 39 show the following examples of potential receiver sites for offshore sand:

1. South Oceanside Beach onshore;
2. South Oceanside nearshore;
3. North Carlsbad Beach onshore;
4. South Carlsbad State Beach, onshore (north and south);
5. Batiquitos Beach (Encinitas) onshore;
6. Leucadia Beach onshore;
7. Moonlight Beach onshore;
8. Cardiff State Beach onshore;
9. Fletcher Cove onshore;
10. Del Mar onshore;
11. Torrey Pines State Beach onshore;
12. Mission Beach onshore;
13. Mission Beach nearshore;
14. Coronado Beach onshore;
15. Coronado Beach nearshore;
16. Imperial Beach onshore; and
17. Imperial Beach nearshore (south of pier).

Some of these sites are also positioned as “feeder” beaches to the rest of the region. Feeder beaches are those located upcoast of areas in need of nourishment that provide sand delivered by prevailing currents. Examples are South Oceanside Beach feeding North County beaches and Imperial Beach feeding South County beaches. South Oceanside Beach serves as a feeder beach...
Figure 37 – Offshore Sediment Receiver Sites (North County)
Figure 38 – Offshore Sediment Receiver Sites (Central County)
Figure 39 – Offshore Sediment Receiver Sites (South County)
to North County because longshore sediment transport is north to south and it is located at the northern end of the southern Oceanside littoral subcell. This is why both onshore and nearshore placement sites at South Oceanside that can accommodate large quantities of material are recommended. Similarly, the Imperial Beach placement site consists of both onshore and nearshore placement areas to accommodate large quantities of sediment that could then feed the coast to the north, as the net longshore drift is south to north at that location.

6.3.4 Habitat Considerations

Previously used beach receiver sites are recommended for use of offshore sediment sources due to the success of RBSP I at minimizing impacts. RBSP I demonstrated success of multiple placement locations increasing beach width within the region and minimizing environmental effects associated with large volume placements in localized areas (Coastal Frontiers 2004, AMEC 2005). RBSP I also varied the volume placed at individual sites according to environmental constraint considerations. Generally, larger volumes were placed at less constrained sites than receiver sites near sensitive resource areas. The inclusion of nearshore sites has the potential to increase flexibility and/or volume of sand placement in certain shoreline areas of the region that are less environmentally constrained.

Sufficient sediment is a limiting factor associated with seasonal development of the invertebrate community and functional use of the beach for spawning by grunion and foraging, resting, and/or nesting by shorebirds. When beaches are erosive, these habitat functions may be delayed until sufficient sediment has seasonally accreted to the beach. Beach nourishment has been shown to extend habitat suitability across seasons and/or enhance habitat functions in areas with pre-project erosive beach conditions (Melvin et al. 2001; CZR 2003, SAIC 2006).

Borrow site dredging includes habitat removal, damage, and disturbance of biota from operation of the dredge equipment and vessel anchoring. Other impacts are associated with sediment resuspension and turbidity. Primary issues of concern include the potential for habitat modification, recovery rates of benthic fauna at the site, and proximity of dredging to sensitive resources. Habitat considerations associated with borrow site dredging include:

- Excavation depths and potential to alter sediment characteristics, hydrodynamics (e.g., wave transmission and effects to surfing), water quality, and/or recovery rates;
- Proximity to sensitive aquatic habitats (e.g., reefs, kelp beds);
- Proximity to spawning grounds or fishing areas; and
- Proximity to primary foraging locations of the California least tern during its breeding season.

Borrow site design may vary due to site conditions. However, reviews indicate that deep holes may result in altered water quality, such as decreased dissolved oxygen and increased hydrogen sulfide concentrations (NRC 1995). Recovery of the benthic community after borrow site dredging may be facilitated by shallow dredging over a larger area rather than creation of deep pits covering a limited area, dredging shifting sands rather than more stable bottoms, retaining
similar surface sediment type, and leaving undisturbed areas within the larger dredged area (Thompson, 1973; Hurme and Pullen, 1988; Jutte, 2002; Diaz, et al. 2004; SAIC, in review). Generally, relatively shallow pits minimize the potential to change hydrodynamics and promote recovery rates of benthic invertebrate forage base for secondary consumers (e.g., fish). Incorporating undredged refuge areas in the design of borrow site use may also speed recovery of the invertebrate forage base.

Potential turbidity or sedimentation are primary considerations in proximity to sensitive resources. Placement of offshore sands generally involves larger volumes than with opportunistic sand projects. Therefore, project duration may be an important consideration when sites are located near environmentally constrained areas. Placement of offshore sediments at nearshore sites is not recommended near sensitive habitats and should be limited to less environmentally constrained locations.

Limited information is available on nursery or spawning areas of commercial and recreation fishery species. Similar to nearshore sites, pre-project surveys to document existing conditions, and coordination with commercial fishermen to better understand local uses of the area, may be necessary to minimize potential adverse effects and to reduce conflicts with use of offshore borrow sites.

### 6.4 Bypassing of Offshore Sand from Marine Corps Base Camp Pendleton

Oceanside Harbor jetty is a large and effective sand retention structure in the San Diego region. The Oceanside harbor jetty system was first installed by the military during World War II, and expanded in the 1960s for the civilian boat harbor. Although not intended, the effect of the upcoast (north) jetty was to retain a wide sandy fillet against the jetty. To the present, this fillet has extended farther upcoast as deposition continued. Now, the fillet extends several miles north into MCB Camp Pendleton (DBW/SANDAG 1994).

An estimate of the volume of sand existing in the fillet north of the Harbor is 3 million cubic yards (DBW/SANDAG 1994). Sand in the fillet is expected to be of very high quality as it has been transported longshore in the surf zone. The sand gradation is expected to be very coarse nearest the foot of the north jetty (upcoast side), and remain fairly coarse along the length of the fillet in the upcoast direction (Seymour, Personal Communication, June 2008). The sand should be clean of contaminants but this would need to be verified as the fillet is near a military base that could be a source of munitions or other contaminants.

This material would have been transported south into the southern portion of the Oceanside littoral cell had the jetty not retained it. Therefore, it represents an anthropogenic sediment sink that is also a large-scale source of new sediment for nourishment. Sand bypassing from this fillet represents one if not the most potentially productive contributions to the coastal sediment budget for the San Diego region. This material is accessible because it is in fairly shallow water within the littoral zone. SANDAG investigated an area partially within, and just offshore and upcoast, of this source in late 2008 for RBSP II and found it suitable for nourishment.
6.4.1
Availability and Timing

Sediment from this nearshore source could be removed by dredge and transported around the Harbor downcoast to replenish the southern littoral cell. A large volume is available in this area, but constraints on acquiring the material could be placed by MCB Camp Pendleton. Initial discussions between SANDAG and MCB Camp Pendleton officials have identified possibilities for bypassing the sediment. MCB Camp Pendleton personnel have initially indicated that their operational restrictions need to be considered, and that the dredge site should be located just north of the Santa Margarita River mouth. SANDAG will continue coordinating with MCB Camp Pendleton as their RBSP II project and sediment management activities move forward.

Dredging in the nearshore zone is typically undesirable because it can “rob” sediment from downcoast locations. However, in this instance there is no downcoast site as the north harbor jetty is a littoral barrier. No negative downcoast impact will occur from bypassing this fillet sediment around the Harbor. Sediment bypassing of the jetty would keep sediments in the nearshore on the downcoast side of the Harbor. Therefore, bypassing of this nearshore sediment could result in positive downcoast effects, including reduction of shoaling at Del Mar boat basin and Oceanside Harbor. This sediment bypassing would result in a bathymetric depression that should backfill rather quickly due to the relatively high southward littoral transport rates estimated for this reach of coast (USACE 1990 and 1991). Thus, this sediment bypassing could create a “sand trap” that could be regularly mined for high quality sand to nourish beaches downcoast of Oceanside Harbor.

Sediment bypassing of the Harbor could be performed at whatever frequency is needed and is economical to the region. This Coastal RSM Plan assumes it could occur every five to ten years depending on the availability of funding (similar to offshore dredging). This sediment bypassing concept is shown in Figure 40. This activity should occur from late spring through summer when there are likely to be quiet ocean conditions for dredging and beach filling. This project would need turbidity controls in place because this is also the nesting season for endangered coastal birds. However, the turbidity caused by this project should be fairly low because of the anticipated larger sediment grain size.

6.4.2
Transportation

Sediment bypassed from the harbor would be transported by dredge discharge line to the beach or nearshore, or bottom dumped from scows or barges in the nearshore. Other cost-effective transport modes do not exist. The USACE previously installed and operated a stationary sand bypass system in the early 1990s, but discontinued it due to low productivity and high costs (Moffatt & Nichol 1995). The bypassing method presented in this CRSM Plan is entirely different from the previous method employed by the USACE and should be more economical and effective.
Figure 40 – Oceanside Nearshore Sediment Bypassing Concept

6.4.3 Receiver Sites

Receiver sites that could receive sediment from a nearshore sand trap off MCB Camp Pendleton and serve as feeder beaches would be those closest in proximity to the trap to reduce transport costs, and located at the upcoast end of the southern Oceanside Littoral subcell in order to increase benefits and residence time of the bypassed sediment through the southern littoral subcell. These sites include:

- South Oceanside Beach onshore; and
- South Oceanside Beach nearshore.
6.4.4 Timing of Nourishment

Sediment bypassing can be done as-needed to supplement nourishment from other sources. If insufficient sediment is placed over a year from opportunistic projects to meet annual goals, then the deficit could be made up by bypassing as an alternative to offshore dredging. The bypassing option may pose advantages over typical ocean dredging in that the sediment is shallower, optimum, and relatively close to the nearest receiver site.

Sediment bypassing could also be potentially used to even-out rates of nourishment to modest volumes over longer time periods, as compared to spikes of high volumes over short times that would occur during large offshore dredging projects. The timing of bypassing could specifically be managed to occur during windows of relatively low nourishment rates from other sources (i.e., plan for it to occur between larger SANDAG RBSP projects and other nourishment efforts such as those under consideration by the USACE).

6.4.5 Habitat Considerations

Dredging of nearshore sediment has the potential to disturb or degrade the subtidal habitat depending on the dredging frequency and its potential to alter local hydrodynamics within the excavated area. Potential occurrence of Pismo clam beds and effects on essential fish habitat would require assessment. Proximity to least tern and snowy plover nesting areas on the beach just north of the Oceanside jetty may constrain the timing of bypassing operations depending on the potential for disturbance (e.g., noise or turbidity). Habitat considerations associated with placement of sands were further described in Section 6.1.

6.5 All Sources or a Combination of Sources

The alternatives described previously in this report are based on the target nourishment occurring throughout the region from upland opportunistic sand sources, coastal maintenance or restoration, or sand from offshore dredging, to bracket the range of actions for costing and impact assessment. The most probable scenario will be that a number of sources will be used concurrently over time, rather than exclusive use of one type of source. For example, nourishment from upland sources could occur during time periods when lagoon and harbor maintenance dredging is also occurring. Therefore, coordination of nourishment activities may be needed to apply sediment to the region more evenly over time and space to maximize natural sediment retention and environmental sensitivity in the region, and minimize cumulative impacts (as opposed to periodic spikes leading to higher sand loss rates and potentially significant cumulative impacts).
6.5.1 Receiver Sites

Receiver sites for all possible sediment sources are shown in Table 12 and in Figures 41 through 45. The figures show:

- Proposed RSM sites for sand nourishment shown as yellow polygons;
- Lagoon restoration and lagoon/harbor maintenance sites recommended for proportional placement of sand shown as green polygons; and
- An area off South Oceanside nearshore that is moderately restricted due to rocky seabed conditions.

The entire network of placement sites constitutes the Coastal RSM Plan for San Diego County. Proposed RSM placement sites (solid yellow and green polygons on Figures 42-46) include both existing sediment placement sites used for previous projects and proposed new sites that would add flexibility to RSM efforts. Upland and offshore sand would be placed within yellow polygons. Sand from new lagoon restoration would be placed within solid green polygons. Existing lagoon and harbor maintenance receiver sites are shown as dashed green polygons on Figures 42-46 and are not changed from present use (unless indicated). These sites represent locations where proportional placement of sand should be considered to reduce the return of sand to lagoons and harbors after maintenance dredging. Certain sites may serve as both new nearshore RSM sites and new proportional placement sites, such as off the San Dieguito River and off Torrey Pines State Beach and are therefore colored as solid green. Several sites have multiple uses, such as receiving harbor or lagoon sediment, and offshore or upland sediment. These sites are shown by the yellow box overlaid by the dashed green box and include South Oceanside Beach, North Carlsbad State Beach, Torrey Pines State Beach, and Border Field State Park beach.

A total of 27 possible placement sites (some with multiple placement footprints) are incorporated into this Coastal RSM Plan to enable the greatest flexibility in sediment management. The majority of the sites have been used previously for sediment placement and some footprints have been enlarged to accommodate more sediment. Seven new sites are nearshore placement sites (off South Oceanside outside of a previous USACE placement area, off Batiquitos, off Cardiff State Beach, off San Dieguito Lagoon, off Torrey Pines State Beach, off Mission Beach, and off Coronado). The suite of receiver sites are proposed to maximize environmental sensitivity of long-term sediment placement within the region by spreading the placed sediment volume over more numerous and larger areas to reduce cumulative impacts (i.e., burial of sensitive resources, turbidity near bird nesting/foraging areas).

Modifications to some onshore sand placement sites may occur as part of the ongoing RBSP II planning effort. Certain cities have indicated a desire for either more or less sediment and for placement at slightly different locations other than those included in RBSP I. Therefore, some of the placement locations currently shown may change slightly in future adaptations to the Coastal RSM Plan.
Table 12 – Coastal RSM Plan Receiver Sites for All Sediment Sources

<table>
<thead>
<tr>
<th>Site ID Number</th>
<th>Receiver Sites (New Sites and Changes to Existing Ones are Indicated)</th>
<th>Probable Source(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>South Oceanside Beach onshore (extended farther northward)</td>
<td>Harbor maintenance, upland, offshore and bypassing, Buena Vista Lagoon maintenance</td>
</tr>
<tr>
<td>2.</td>
<td>South Oceanside nearshore (new site over a majority of its area)</td>
<td>Harbor maintenance, Buena Vista Lagoon restoration, bypassing, offshore</td>
</tr>
<tr>
<td>3.</td>
<td>North Carlsbad State Beach onshore</td>
<td>Offshore, Buena Vista Lagoon restoration and maintenance</td>
</tr>
<tr>
<td>4.</td>
<td>Agua Hedionda onshore (north, central, and south footprint sites)</td>
<td>Agua Hedionda Lagoon maintenance</td>
</tr>
<tr>
<td>5.</td>
<td>South Carlsbad State Beach onshore (north and south)</td>
<td>Offshore and upland</td>
</tr>
<tr>
<td>6.</td>
<td>Batiquitos Lagoon Beach in Carlsbad onshore (north and south)</td>
<td>Offshore, Batiquitos Lagoon maintenance</td>
</tr>
<tr>
<td>7.</td>
<td>Batiquitos nearshore (new site)</td>
<td>Batiquitos Lagoon maintenance</td>
</tr>
<tr>
<td>8.</td>
<td>Batiquitos Beach in Encinitas onshore</td>
<td>Offshore, upland</td>
</tr>
<tr>
<td>9.</td>
<td>Leucadia Beach onshore</td>
<td>Offshore</td>
</tr>
<tr>
<td>10.</td>
<td>Moonlight Beach onshore</td>
<td>Offshore, upland</td>
</tr>
<tr>
<td>11.</td>
<td>Cardiff State Beach onshore</td>
<td>Offshore, upland, San Elijo Lagoon restoration and maintenance</td>
</tr>
<tr>
<td>12.</td>
<td>Cardiff nearshore (new site)</td>
<td>San Elijo Lagoon restoration</td>
</tr>
<tr>
<td>13.</td>
<td>Fletcher Cove onshore</td>
<td>Offshore, upland</td>
</tr>
<tr>
<td>14.</td>
<td>San Dieguito Lagoon nearshore (new site)</td>
<td>San Dieguito Lagoon ocean channel restoration</td>
</tr>
<tr>
<td>15.</td>
<td>San Dieguito Lagoon onshore (new sites north and south of the mouth)</td>
<td>San Dieguito Lagoon maintenance</td>
</tr>
<tr>
<td>16.</td>
<td>Del Mar onshore</td>
<td>Offshore</td>
</tr>
<tr>
<td>17.</td>
<td>Torrey Pines State Beach onshore</td>
<td>Offshore, upland, Los Peñasquitos Lagoon restoration and maintenance</td>
</tr>
<tr>
<td>18.</td>
<td>Torrey Pines State Beach nearshore (new site)</td>
<td>Los Peñasquitos Lagoon restoration</td>
</tr>
<tr>
<td>19.</td>
<td>Mission Beach onshore</td>
<td>Offshore</td>
</tr>
<tr>
<td>20.</td>
<td>Mission Beach nearshore (new site)</td>
<td>Mission Bay maintenance, offshore</td>
</tr>
<tr>
<td>21.</td>
<td>Ocean Beach onshore (new site)</td>
<td>Upland</td>
</tr>
<tr>
<td>22.</td>
<td>Coronado Beach onshore</td>
<td>Upland, offshore</td>
</tr>
<tr>
<td>23.</td>
<td>Coronado Beach nearshore</td>
<td>San Diego Bay maintenance, Offshore</td>
</tr>
<tr>
<td>24.</td>
<td>Imperial Beach onshore</td>
<td>Offshore, upland</td>
</tr>
<tr>
<td>25.</td>
<td>Imperial Beach nearshore north</td>
<td>San Diego Bay maintenance, offshore</td>
</tr>
<tr>
<td>26.</td>
<td>Imperial Beach nearshore south (enlarged from USACE site)</td>
<td>San Diego Bay maintenance, Tijuana Estuary restoration, offshore</td>
</tr>
<tr>
<td>27.</td>
<td>Border Field State Park onshore</td>
<td>Upland – debris basins</td>
</tr>
</tbody>
</table>
Figure 41 – North County Regional Receiver Sites
Figure 42 – North Central County Regional Receiver Sites
Figure 43 – Central County Regional Receiver Sites
Figure 44 – South Central County Regional Receiver Sites
Figure 45 – South County Regional Receiver Sites
6.5.2  
Timing of Nourishment

Nourishment should be coordinated to eliminate large sediment pulses and associated resource impacts, and reduce potential large-scale losses from storms. Sediment applied to the region evenly over time and space, as opposed to periodic spikes, may maximize natural sediment retention and environmental sensitivity in the region and minimize cumulative impacts. In contrast, periodic spikes of high sediment input may result in higher sediment loss rates during storms and potentially significant cumulative impacts.

The timing of less frequent and larger projects by SANDAG and the USACE should be planned to occur during windows of lower nourishment rates (i.e., occur “around” maintenance actions and opportunistic beach fill efforts) to achieve a consistent rate of 1 million cubic yards of sand added to the region annually, and dispersed as broadly as possible during placement to benefit the greatest area of all three littoral cells.

The timing of projects also is an important consideration to adaptive management of the Plan. Magnitude and frequency of disturbance are important cumulative impact considerations. However, factors such as sediment volume and disturbance frequency will vary among placement sites depending on local uses and site specific conditions. Monitoring will be conducted to support refinement of the regional sediment management strategy, including timing and frequency of nourishment activities. Monitoring of both physical and biological parameters is recommended to support decisions for optimizing performance of sediment management projects while ensuring that environmental protection objectives are met.

6.5.3  
Habitat Considerations

Habitat considerations associated with coordinated sediment management activities involving a variety of sand sources include those previously described for different project elements (Sections 6.1.4, 6.2.4, 6.2.6, 6.3.4, and 6.4.5). Foremost considerations include avoidance and minimization of potential adverse effects to sensitive habitats and resources during project implementation. Various strategies may be considered to avoid or minimize negative impacts, including restrictions on volumes, frequency, timing, or placement location relative to proximity to sensitive resource constraints.

Other important considerations are pertinent to minimizing potential adverse cumulative impacts. Sand placement strategies that maximize early season placement and avoidance of repetitive placement at the same beach locations within the same year would facilitate invertebrate recovery rates and protection of the forage base for fishes and shorebirds. Borrow site use also may be designed to facilitate recovery and protection of the benthic forage base by incorporating un-dredged refuge areas within the site boundaries and avoiding creation of deep pits. Pre-project surveys and coordination with commercial fishermen to better understand nearshore resources and uses may be effective for minimizing potential adverse cumulative impacts and reducing conflicts.
Enhancing functional quality of beaches in erosive areas and providing more persistent quality habitats for biota are important objectives of the sediment management strategy. Sediment placement that contributes to more persistent sediment across seasons has the potential to improve habitat quality for California grunion spawning, invertebrate forage base for shorebirds, and quality of critical habitat and wintering areas for threatened snowy plover.