

**LITERATURE SEARCH AND REVIEW OF SELECTED TOPICS RELATED TO
COASTAL PROCESSES, FEATURES, AND ISSUES IN CALIFORNIA**

**Prepared for the
California Coastal Sediment Management Workgroup**

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OVERVIEW OF ASSIGNMENT

INTRODUCTION

In 2004, the California Coastal Sediment Management Workgroup (CSMW) requested that the California Geological Survey (CGS) conduct research and prepare brief summaries of literature on various topics and geographic locations related to physical properties of sediment management along the coast of California. The CSMW, a consortium of state and federal agencies, is charged with preparing the Coastal Sediment Management Master Plan, a dynamic document that will guide the future coordination of local, regional, state, and federal approaches to coastal sediment management in California. The goal of the plan is to manage regionally, from a natural-systems approach, rather than locally, from a site-specific approach.

As prepared and prioritized by Cliff Davenport, the state's project manager for the CSMW, this research was divided into seven tasks, which are listed below. The tasks were distributed among three staff geologists of the CGS. Because of the interest of the CSMW in completing this research quickly so that other phases of the Master Plan could move forward, the assignment was limited to a few months for research and preparation of results. Correspondingly, the research on the seven tasks was neither intensive nor comprehensive. Nonetheless, the results of the research should provide foundations for follow-up detailed research and direction for the CSMW Master Plan.

The results of this literature search are symptomatic of what the CSMW Master Plan will attempt to resolve, namely, that the studies and reports related to coastal activities have historically been done largely from a local, project-by-project approach. There is abundant information and documentation, but much of it has been accomplished and presented in piecemeal, isolated (rather than integrated) fashion.

There are many hundreds of published and unpublished technical reports and documents pertinent to the topics addressed in the seven tasks of this assignment. Many of those listed in the attached bibliographies were not reviewed. Nonetheless, they are presented here as examples of the literature as well as what we interpreted to be potentially the most important sources of information on the respective topics. We have not attempted to cull all pertinent data and information from these many reports. Rather, the bibliographies are presented as starting points for future detailed research on each of the topics as needed.

We researched literature and information for this project from the following sources:

- Standard hard-copy reports and maps
- Visits to libraries
- On-line search engines (e.g., GEOREF, ASCE, USACE, NTIS, AGU, Google)
- Web sites (e.g., NOAA, USGS, CERES)
- Personal interviews and correspondence

At the end of this overview are lists of selected Web sites for information on marine and coastal topics. We used some of these regularly to aid our research. Regarding search engines, we found many instances where journal articles were missed by on-line searches.

Within the main body of this report, we have broken each task into two sections: results and bibliography. For some of the tasks, we have included recommendations for continued related work to assist the Master Plan. For the tasks that are geographically oriented, we have divided the bibliographies into two sections. The first lists general references that the reader may want to use for related background or further education. The second lists references that apply directly to the coast of California. Several of the tasks include accompanying tables (Tables 1-5), which are included here as separate Excel spreadsheet files. Some of the tables have blank columns for latitude and longitude, which will allow the data in the tables to be georeferenced in GIS format. Values for latitude and longitude were not determined during this assignment.

Finally, we greatly appreciate the information and assistance provided by many individuals, particularly those at the California Coastal Commission, California Geological Survey Library, California Department of Boating and Waterways, California State Lands Commission, Orange County Public Facilities and Resources Department, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Geological Survey, U.S. Minerals Management Service, and several academic institutions. We especially thank Melanie Coyne for sharing insights on her table of beach-nourishment projects in California.

SUMMARIES BY TASK

The following sections list the seven tasks and briefly summarize findings for each of them:

Task 1 - Compile available and known beach nourishment needs along the entire California coast (locations, reasons, severity of need, and consequences); identify critical beaches that would benefit most from beach nourishment and compile a list of known erosion hot spots.

Erosion along the coast of California manifests itself through two types of processes: natural and man-induced. The former is expected because of the dynamic geology of the state. The latter has resulted from many coastal and inland modifications that have disrupted or exacerbated the natural processes. Coastal erosion in the state affects beaches, cliffs/bluffs, and steep mountain slopes adjacent to the ocean; overall, the first two are of most concern.

The severity of erosion can be viewed from a purely geologic perspective or a cultural perspective. From a cultural perspective, many factors affect the need for intervention to reduce or halt erosion. They fall into the categories of public safety and economic/recreation. These are largely driven in California by the disparate distribution of population and associated development along the coast. The two segments of the coastline with the greatest need for intervention to protect the public from erosion are from the Santa Barbara area to the border with Mexico and from the San Francisco Bay region to the Monterey area.

There appears to be no consistent definition of the term “erosion hot spot.” Although the National Research Council has defined it in one of its technical publications, how the term is used can depend on context and need.

Literature on coastal erosion in California covers from statewide to the local site-specific level. Some reports are published and widely available; others are more obscure and require more effort to locate and obtain. The documentation of locations and features of erosion are probably greater for cliffs and bluffs than for beaches.

An up-to-date, systematic, detailed inventory of rates and locations of erosion along the entire coast is warranted. A database for cliff/bluff erosion is in preparation, but one for beach erosion remains to be developed.

Task 2 - Gather studies that investigate the transport and depositional fate of fine-grained materials associated with natural and anthropogenic turbidity plumes; focus on what’s currently known about the densities and duration of “natural” turbidity plumes, and similar information on plumes associated with beach nourishment or other sediment management activities.

“Turbidity” as related to marine/coastal environments falls into two main categories, natural and anthropogenic. If the subcategory of turbidity currents is excluded from the natural category, then the volume of research and literature for the anthropogenic category by far exceeds that for the natural category.

Natural turbidity plumes in the marine environment generally fall into one of three categories: 1) classical turbidity currents, which transport sediment from the shelf slope to the deep abyssal environment, 2) hypopycnal (surface) and hyperpycnal (bottom-flowing) turbidity plumes at river mouths, and 3) storm-related turbidity plumes.

The primary sources of anthropogenic, open-water turbidity are channel-maintenance dredging, disposal of dredged material, beach replenishment, mining of aggregate by dredge, and coastal construction activities. Many studies have been conducted by the U.S. Army Corps of Engineers (USACE) on maintenance dredging and disposal activities in enclosed waters such as estuaries and embayments, locations where the presence of a high fine-sediment fraction is conducive to elevated turbidity. Studies have demonstrated that most dredge-induced turbidity plumes are localized, spreading

less than a thousand meters from their source; the plumes are short-lived, dissipating to ambient water quality within several hours after dredging is completed. In many cases, suspended-sediment concentrations are less than those generated by commercial shipping operations or during severe storms. In some infrequent cases involving high fine-sediment content and strong tidal or riverine currents, surface plumes can be visible for distances of many kilometers.

Considerably less research has been conducted in unprotected marine waters where most of the literature has focused on the effect of turbidity on specific marine species and biosystems or on the transport dynamics of coarse sand, rather than on the temporal or spatial characteristics of re-suspension of fine sediment.

Few attempts have been made to quantify turbidity conditions during beach-nourishment activities. Nonetheless, it is generally agreed that turbidity that results from placement of sand on the beach face is even more localized and transitory than that during offshore or enclosed-water operations. In some studies, elevated turbidity was rarely observed outside the surf zone and was not discernable from normal turbidity caused by waves in the surf zone. In another study, elevated turbidity was limited to a narrow swath in the swash zone in the immediate vicinity of the operation. These results are largely attributable to the use of nourishment material that is low in clay and silt and resembles as closely as possible the indigenous beach sand.

Recent efforts have concentrated on modeling to predict suspended-sediment behavior. Most notable of these are the USACE PLUme MEasurement System (PLUMES) model, which documents the movement of sediment plumes using sediment concentrations and three-dimensional fluid velocity data; the Short-Term FATE (STFATE) model which evaluates the short-term behavior of surface discharges in open water; the Long Term FATE (LTFATE) model designed to assess the long-term fate of seabed accumulations of disposed material; and more recently, the Suspended Sediment FATE (SSFATE) numerical modeling system, which allows the running of multiple simulations to determine those scenarios with the least potential for adverse environmental impact.

Task 3 - Compile known and available information on: the types and grain size distribution of sands that have been used for nourishment projects along the important California beaches; observed end results of nourishment projects; the basis for limitation placed on the percentage of allowable finer grained materials in nourishment projects. Include any information gathered on existing grain size distributions at those important beaches.

Beach nourishment began in the early 1900s in California and has since encompassed hundreds of episodes at dozens of beaches along the coast. Most of the projects have been in southern California from Santa Barbara County to the Mexico border.

Data and information on the physical character of sediment (fill and native materials) involved in these projects range from sparse to well documented. This range results

largely from the purpose and time period of the individual projects; those designed as purely nourishment (rather than disposal) projects and that are relatively recent tend to have more data and information. Sources of data include academic studies as well as site-specific reports prepared by government agencies and private consultants.

To date, the overall results of beach nourishment in California have been mixed. Regarding documentation of results, it appears that early projects were either not monitored or monitoring was more qualitative in nature; documentation of results in the literature has been spotty. Rigorous quantitative monitoring (e.g., beach profiling, fill-volume measurements) of fill performance has become more routine in the last 10-20 years.

Various parameters can affect the performance of beach fills. There is some question as to the importance of the continued use of grain-size comparisons between fill and native materials as measures of beach performance.

Task 4 - Compile available information which identifies the presence of fine-grained “mud belts”, potential sand source areas, and sandy and rocky bottom habitats in the offshore vicinity of potential beach nourishment locations.

Because of its diverse and dynamic setting along an active plate margin, the seafloor off California is underlain by a complex distribution of geologic materials. Areas of mud, sand, and bedrock are interspersed, with sand prevalent along most of the coast at shallow depths.

The available data and information on the locations and character of these materials ranges from very sparse to highly detailed. There are a few statewide compilations of offshore geology. These were prepared from many historic observations, geophysical surveys, and samples collected by numerous institutions, both public and private. At the regional and local level along the coast, many academic and government groups have conducted studies of seafloor materials. The density and scale of coverage of these studies vary from place to place depending on funding and purpose. The most-detailed studies have been done in the San Francisco-Monterey Bay region and along the Southern California Bight from Santa Barbara County to the Mexico border.

Volumes of sand deposits using hypothetical thicknesses have been estimated for sand deposits along the entire coast of the state. Many sand deposits have been studied locally along the coast of southern California through direct sampling and vibracoring. Such deposits have served and could continue to serve as sources of sand for beach-nourishment projects nearby.

Task 5 - Research any studies assessing the 80/20 coarse-to-fines “rule-of-thumb” ratio used by various regulatory agencies to determine whether potential source sands are compatible with a given beach. Identify the origin of the rule-of-

thumb and nourishment projects where variances from the rule of thumb were allowed, including the basis for each variance.

There is a common misperception that beach-nourishment operations must conform to an 80/20 coarse-to-fines ratio, which prohibits the use of material containing more than 20% fines (silt and clay). This arises from the U.S. Corps of Engineers' (USACE) and U.S. Environmental Protection Agency's (EPA) use of this arbitrary cut-off for applying testing exclusions to marine disposal projects regulated under the Marine Protection, Research, and Sanctuaries Act (MPRSA). Beach nourishment is considered a fill activity and thus jointly regulated by the USACE and EPA under the under Section 404 of the Clean Water Act (CWA), which imposes no specific limits on sediment grain size. Instead, the 404(b)(1) guidelines require site-specific determinations that dredged material be demonstrably compatible with the receiving beach. Compatibility of dredged material is determined through a tiered testing protocol outlined in the Inland Testing Manual of the USACE and EPA.

It is necessary to proceed through the tiers only until enough information is obtained to make factual determinations. Tier-one testing evaluates the compatibility of grain-size distribution. If there is a reason to believe that the dredged material might contain contaminants, which are commonly adsorbed to the fine-clay fraction, then a second, and possibly third, tier of testing is required to identify potential adverse chemical and biological impacts. In California, to preclude second- and third-tier chemical and biologic testing, the USACE generally requires that the overall percentage of silt and clay in the dredged material be no more than 10% higher than that of the finest beach sample. Sediments containing more than this can be approved for beach nourishment provided that the additional testing demonstrates they pose no adverse environmental or health effects.

In recent years, there have been some beach nourishment projects in California that have been approved to use dredged material with greater than 20% fines, but only after complying with the 404(b)(1) guidelines and Inland Testing Manual protocols.

We were unable to determine why the values of 80% and 20% were originally selected.

Task 6 - Compile known information on debris-basin locations, contacts, volumes, and cleanout frequencies. Focus efforts outside of Ventura and Los Angeles Counties, since debris basins in those counties are already included within the SMP GIS.

We contacted officials in San Diego, Orange, San Luis Obispo, and Monterey counties to collect information on debris basins. Of these, only Orange County has debris basins, which are classified by local officials as retarding basins to trap fines and slow runoff during storms.

We did not collect information from Santa Barbara, Ventura, Los Angeles, San Bernardino, and Riverside counties because these were documented in detail in a study published in 2002.

Task 7 - Document known information (i.e., case studies, etc.) regarding the natural seasonal movement of sand from the beach to nearshore and back.

Numerous morphological studies of beach profiles and the hydrologic and hydraulic conditions that form them have demonstrated the phenomenon of seasonal cross-shore (onshore-offshore) transport of beach sediments on wave-dominated beaches. Seasonal beach erosion and accretion are natural mechanisms that allow the beach profile to adjust itself to the prevailing wave forces in order to effectively dissipate wave energy.

In winter, California's beaches are subjected to pounding by tall, high-energy short-wavelength "storm waves" generated by local storms. Beaches respond by reducing their overall slope through erosion of the beach face and berm and the transport and redeposition of the sand in an offshore bar. This shifts the breaker zone farther offshore and produces a "winter" beach profile. At this point, the surf zone is at its widest and the breaker heights greatest. In summer, low, long-wavelength "swell waves", generated by distant storms, reverse this process by eroding and redelivering the sand stored in the offshore bar to the beach face and berm (summer profile). Decreasing wave energy also causes beaches to narrow and steepen. The critical wave conditions that govern the shift between summer and winter profiles are largely a function of critical wave steepness (ratio of wave height to wavelength). Storm waves have high steepness values, while long swell waves have low steepness values. Up until the late 1990s, it appeared that no study had yet identified critical wave-steepness values that would dictate when a summer profile would revert to a winter profile and vice versa.

While the complete cycle between fully developed seasonal profiles is uncommon, southern California beaches are examples that generally experience the full sequence.

SELECTED WEB SITES FOR INFORMATION ON MARINE AND COASTAL TOPICS

Presented here are lists of Web sites that contain pertinent information and avenues for additional research on the seven tasks.

Web sites for marine and coastal data:

<http://www.ngdc.noaa.gov/mgg/mggd.html> (repository for marine geophysical and geologic data – NOAA National Geophysical Data Center – free)

<http://www.nodc.noaa.gov/> (site for ocean data – NOAA National Oceanographic Data Center – free)

<http://ceres.ca.gov/ocean/> (site for ocean and coastal data and information – California Environmental Resources Evaluation System – free)

http://www.netlobby.com/beachapprops05_table.htm (proposed 2005 funding for beach nourishment projects in California)

<http://www.ngdc.noaa.gov/mgg/geology/mmdb.html> (database for marine minerals - NOAA National Geophysical Data Center – free)

<http://geopubs.wr.usgs.gov/dds>, IN REVIEW (a Web-based GIS project that covers the central California coast from Cape Mendocino to Point Conception – U.S. Geological Survey: contact Mimi D'lorio at mmdiorio@usgs.gov)

Web sites for bibliographic references for marine and coastal studies:

<http://webspirs.silverplatter.com/cgi-bin/login.cgi> (GEOREF database - highlights geologic studies - American Geological Institute – subscription service for CGS, not free)

<http://www.spn.usace.army.mil/library.html> (listing of holdings for technical library - U.S. Army Corps of Engineers – free)

<http://www.lib.noaa.gov/> (list of library holdings and NOAA publications – NOAA Central Library – free)

<http://www.csc.noaa.gov/> (list of library holdings and publications of Coastal Services Center – NOAA Coastal Services Center – free)

<http://www.ntis.gov/search/index.asp?loc=3-0-0> (list of miscellaneous publications since 1990 – National Technical Information Service – free search, but charge for download of document)

<http://grc.ntis.gov/daypass.htm> (list of miscellaneous publications since 1964 – National Technical Information Service - \$15 per day charge plus download costs)

<http://www.pubs.asce.org/chrhome2.html> (list of journal articles since 1970 – American Society of Civil Engineers – free)

<http://www.mms.gov/library/> (list of publications – U.S. Minerals Management Service – free – many publications on-line, but appear to be limited to fairly recent) plus
<http://www.mms.gov/itd/pacpubs.htm>

<http://scilib.ucsd.edu/sio/> (information and services – Scripps Institution of Oceanography Library – free and cost?)

<http://www.coastalconservancy.ca.gov/Publications/pubs.htm> (list of agency publications some of which are about California beaches and wetlands) Also on CCC Web site are two pages for “Southern California Wetlands Recovery Project” and “Southern California Wetlands information Station”

<http://gis.ca.gov/catalog/BrowseRecord.epi?id=1532> (catalog of publications held by CDBW related to coastal hazards – California Department of Boating and Waterways – free)

Miscellaneous Papers on Beach Erosion, Nourishment, and Performance

<http://www.coastal.ca.gov/pgd/pgd-mon.html> (main text)

<http://www.coastal.ca.gov/web/pgd/pgd-mon2.html> (appendix)

http://resources.ca.gov/ocean/html/chapt_5c.html

<http://bigfoot.wes.army.mil/6720.html> (Orange County 1998)

<http://ceres.ca.gov/ceres/calweb/coastal/beaches.html> (General discussion of California beaches)

<http://cdip.ucsd.edu/SCBPS/Torrey/homepage.shtml#top> (Torrey Pines Beach nourishment project)

http://www.eurekaalert.org/pub_releases/2000-12/UoCS-Hrrl-1612100.php (UCSC studies on coastal erosion related to storms)

<http://www4.nationalacademies.org/onpi/oped.nsf/0/25D22ABB0CCB005F852566750073B95C?OpenDocument> (General on eroding beaches)

http://www.beacon.dst.ca.us/goleta_beach_restoration.htm (Goleta Beach restoration project)

RESULTS FROM CSMW TASK 1

(Coastal Erosion – Needs for Beach Nourishment)

TASK 1 – Compile available and known beach nourishment needs along the entire California coast (locations, reasons, severity of need, and consequences); identify critical beaches that would benefit most from beach nourishment and compile a list of known erosion hot spots.

BACKGROUND

The issues of coastal erosion and beach replenishment/nourishment are commonly related. Coastal erosion manifests itself through two processes: natural and man-induced. An important challenge is our capability to separate the two for a given geographic location or episode. Beach replenishment or nourishment has increasingly become a preferred method of reducing or halting erosion along coastlines throughout the world. The reasons can range from purely economic (e.g., recreation; tourism) to public safety (e.g., collapse of cliffs above occupied beaches; destruction of houses and businesses).

One of the first steps to manage sediment along a regional coastline is to identify the physical locations and rates of erosion from a geologic perspective only, regardless of cultural conditions and influences. After this identification is complete, a next step would be to then overlay the cultural conditions and influences. These could include such variables as population, development, jurisdiction (public, private), economics, safety, and anticipated future conditions, among others. These variables could be weighted and then combined in a quantitative fashion to rank “severity of need” for intervention with beach replenishment/nourishment.

An issue related to severity of need is that of “erosion hot spots.” Erosion hot spots can be defined from a scientific perspective (high erosion rates with no “value” assigned) or from a cultural perspective (erosion is causing economic or safety hardships even though actual amount of erosion may not be severe compared to other locations). The National Research Council (1995) defined an “erosion hot spot” as one or more areas along a beach project that will erode more rapidly than their neighbors and more rapidly than predicted using accepted methodologies. Indeed, the definition of an erosion hot spot can be different depending on one’s purpose and interests. Is it based on purely geologic variables such as measured erosion rates? Is it based on economic losses? Is it based on jurisdictional location (public land or private property)?

The “benefit” of beach replenishment/nourishment is also an important part of ranking locations along a coastline for intervention. If considering economic benefits (tourism, recreation), King’s study (California Department of Boating and Waterways and State Coastal Commission, 2002, Part 1, Chapter 3) provides an example of a monetary

benefit/cost approach to ranking. If considering public safety benefits (which do not as easily lend themselves to monetary benefit/cost analysis), the approach would have to consider human exposure at sites (e.g., potential injuries or fatalities from collapse of cliffs or structures because of erosion).

EROSION ALONG THE COAST OF CALIFORNIA

Because of its dynamic geologic setting, the coast of California is subject to the natural processes of erosion along its entire length. Uplift of the coastal land mass by geologic forces in combination with rising sea level since the last ice age have created a complex interplay of erosion and deposition of sediment that varies from place to place. This coastal environment differs substantially from the more passive environments of the U.S. Atlantic and Gulf Coasts.

With the advent of man's intense settlement and development of the state since the 1800s, this natural condition has been significantly modified: the rate of erosion has been exacerbated in many places by the construction of inland dams and artificial channeling of rivers (which block or hinder movement of sediment to the ocean) and of coastal structures such as harbors, jetties, and seawalls/revetments.

Whether natural or man-induced, erosion along the coast of California affects beaches; cliffs and bluffs associated with terraces; and steep mountain slopes that front the ocean. The first two categories of features are by far the most important to humans because they are the sites where many people live, work, and pursue recreation. The coastline from the Oregon border to Point Conception is characterized generally by short, narrow beaches and rocky shorelines; the segment from Carmel to San Simeon is notably rugged. The coastline from Point Conception to the Mexico border is generally more subdued with longer, wider beaches, and bluffs and terraces interspersed with alluvial plains.

The significance of erosion along the coast largely correlates with the location of population centers. Population is relatively sparse north of the San Francisco Bay region. From the San Francisco Bay region to Monterey, population and development are much higher. The segment from the Monterey area to the San Simeon region is sparsely populated. Farther south, there is a cluster of population centers and associated development in the Morro Bay-San Luis Obispo region. The most intensively populated and developed part of the coast is from the Santa Barbara area to the Mexico border. Correspondingly, concerns and complaints about erosion are greatest along this part. To the north, concerns about erosion are less overall, with most expressed in the San Francisco Bay and Monterey Bay regions.

Statewide Documentation of Erosion

Documentation and interpretation of erosion along the entire coast of California are summarized in inventories published by the U.S. Army Corps of Engineers

and Dames and Moore (1971), Habel and Armstrong (1977), and Griggs and Savoy (1985). Each of these reports provides observations and interpretations of erosion plotted on base maps for the entire length of the coastline. Each has an advantage of observation at different periods of time, which can be important because of changes in coastal development. These reports represent relatively consistent “baseline” views of the coastline of the state.

Our research did not reveal a detailed systematic statewide survey of erosion done subsequently to the inventory of Griggs and Savoy (1985). In the last few years, however, two reports (Noble Consultants, 2000; California Department of Boating and Waterways and State Coastal Commission, 2002) have documented the locations of several dozen sites of critical erosion that are threatening the economic/recreational well-being and/or public safety of citizens along the coast of California. These sites include both beach and cliff/bluff erosion and are briefly summarized in Table 1. This list is not comprehensive, but it does give an idea of the distribution of erosion problems based on a cultural perspective.

Currently, the California Coastal Commission is developing a database of cliff and bluff erosion rates and locations of armoring along the entire state coastline. The database, which is being prepared by Jennifer Dare (jdare@coastal.ca.gov), a National Oceanographic and Atmospheric Administration (NOAA) Fellow with the Commission, is being designed in a GIS format. One of the main sources of data being researched for data on erosion rates is the large collection of consultant reports in the files of the Commission. As of April 2004, detailed research and population of the database was underway for San Diego County, which is serving as a template for the project. When completed, this GIS layer will be a valuable source of information for incorporation into the statewide Coastal Sediment Management Master Plan.

Concerning erosion of beaches in California, there is relatively poor understanding of both this phenomenon and the character of sediment budgets along the coast (Griggs and others, 2003). To improve understanding of these phenomena, Gary Griggs at the University of California, Santa Cruz, is researching beach erosion and sediment budgets along selected segments of the coast of California (Gary Griggs, personal communication, 2003).

Regional and Local Documentation of Erosion

Coastal managers and researchers have increasingly recognized the importance of studying and managing the coast of California from a regional and statewide approach, with focus on natural (system) boundaries rather than jurisdictional boundaries. Correspondingly, relatively recent reports reflect this perspective. Among the most noteworthy are those associated with the Coast of California Storm and Tidal Wave Study prepared by the U.S. Army Corps of Engineers (e.g., 1991, 1993, 2002). The first two installments of this study cover the San Diego and Orange County coastlines. In particular, the 1991 report for San Diego County identified the coastal segments from Oceanside to La Jolla and from Imperial Beach to the border with Mexico as locations of

“critical erosion.” Another important study is that of Flick (1994), which is a detailed atlas of erosion along the coast from Dana Point in southernmost Orange County through all of San Diego County to the Mexico border.

Historically, academic researchers have studied some topical issues related to coastal erosion as exemplified by some of the references included in the accompanying bibliography. More recently, local government, as exemplified by the San Diego Association of Governments (SANDAG) and the Beach Erosion Authority for Central Operations and Nourishment (BEACON) in Santa Barbara and Ventura Counties, have embraced the concept of regional management of sediment and correspondingly prepared reports that identify locations of erosion and strategies to manage them (Noble Consultants, 1989; San Diego Association of Governments, 1993).

At the local, or project, level, numerous published and unpublished reports and information are available that document beach and cliff/bluff erosion along the coast of California. The three main sources of this literature are the U.S. Army Corps of Engineers (some are readily available; others are difficult to obtain), private-consultant reports (the California Coastal Commission has a large holding related to permit applications), and academic/professional journals (generally readily available at university libraries where coastal and marine studies are emphasized). Examples from each group are in the accompanying bibliography.

Compilation of Information from Reports

Because of the short length of the present study, detailed research and compilation of information from the wide array of literature and files on coastal erosion was beyond the scope of this study. Not only must the information be located, it must be evaluated for its timeliness; commonly, present conditions are not the same as when the information was gathered and reported for the individual studies.

The importance of compiling the available information on statewide beach and cliff/bluff erosion from the sources described above into a GIS format cannot be overestimated. The integration of the observations and interpretations, particularly those of the three state inventories published between 1971 and 1985, can significantly aid a modern systematic compilation and evaluation of erosion along any segment of the coast of California. The systematic compilation for cliff/bluff-erosion locations and rates is already underway through Jennifer Dare’s project. The systematic, detailed compilation for beach-erosion locations and rates remains to be accomplished.

NEED FOR BEACH NOURISHMENT

Coastal managers and researchers of the coast of California are increasingly looking to replenishment/nourishment as a way to maintain the size of beaches and to protect the landforms and associated development behind the beaches. The progressive diminishment of beaches along the coast, particularly in southern California, can

negatively affect recreation and tourism as well as lead to hazardous cliff/bluff failure and flooding that affects public safety.

The need for replenishment/nourishment at any particular beach in the state depends on many variables as described previously. To establish a list of beaches requires evaluation and weighting of these variables. As one approach, Coyne (2000) presented a GIS-based decision-support tool for identifying potential sites of beach nourishment, with examples focused on southern California. Also, the “need” of many beaches in California has been met by a history of successive nourishment episodes (e.g., Surfside/Sunset). These beaches are either on a prescribed schedule of nourishment or may be irregularly nourished because they depend on receiving fill from sources that are defined as “opportunistic” (e.g., harbor dredging or channel maintenance, which must dispose of the excavated material). Need can also be “performance-dependent.” In other words, timeliness of the next nourishment episode can depend on how well the fill from the previous episode has performed according to design specifications.

For the coast of California, Table 1 lists selected beaches identified in previous reports as having a critical need for replenishment/nourishment. Also listed are the potential consequences if there is no intervention. Nearly all sites are in southern California, from Point Conception to the Mexico border. The main reason for this geographic bias is the distribution and density of coastal population and development. This list is not necessarily comprehensive, but represents sites evaluated and selected by consulting specialists and government officials in recent years. To prepare a comprehensive list would require research and evaluation of many published and unpublished reports and documents on all individual beaches along the coast. Furthermore, we believe at this point in development of the Master Plan that severity of need cannot be rigorously established for individual sites along the coast of California until a protocol for ranking is established. Consequently, we have not made judgments on severity of need for the sites listed in Table 1.

RECOMMENDATIONS

- For the CSMW Master Plan, prepare a clear definition of the term “erosion hot spot.”
- For the CSMW Master Plan, prepare a set of criteria to clearly define and rank needs for beach nourishment according to severity. To identify and rank based on economic effects, a benefit/cost analysis could be one approach. To identify and rank based on public health and safety will require other criteria such as previous fatalities or injuries.
- As part of CSMW Master Plan, annually maintain a GIS-based list of beach-nourishment needs, perhaps categorized by littoral cell.

- Digitize and attribute in GIS-format the data and interpretations from the following reports to establish baselines to aid interpretation of beach erosion and needs for nourishment. This process should be coordinated with the current project of Jennifer Dare at the California Coastal Commission.

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CSMW TASK ONE

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RESULTS FROM CSMW TASK 2

(Natural and Anthropogenic Turbidity)

TASK 2 – Gather studies that investigate the transport and depositional fate of fine-grained materials associated with natural and anthropogenic turbidity plumes; focus on what’s currently known about the densities and duration of “natural” turbidity plumes, and similar information on plumes associated with beach nourishment or other sediment management activities.

BACKGROUND

The issue of “turbidity” related to marine/coastal environments falls into two main categories, natural and anthropogenic. If the subcategory of turbidity currents is excluded from the natural category, then the volume of research and literature for the anthropogenic category by far exceeds that for the natural category. Our research revealed little information for turbidity in the nearshore environment caused by the artificial placement of sand on beaches.

NATURAL TURBIDITY

Natural turbidity plumes in the marine environment generally fall into one of three distinct categories: 1) classical turbidity currents, which transport sediment from the shelf slope to the deep abyssal environment, 2) hypopycnal and hyperpycnal turbidity plumes at river mouths, and 3) storm-related turbidity plumes.

Classical turbidity currents are submarine phenomena that are responsible for transporting the majority of sediment to the oceanic basins. Usually triggered by earthquakes and slumping of oversteepened delta fronts or submarine canyon walls, bottom sediment is re-suspended increasing the density of the nearby water, which then flows down the continental slope, entraining more sediment as it goes. When it encounters a decrease in slope, its velocity slows allowing the suspended particles to settle. Since a large portion of the world’s petroleum reserves occur in these mixed clastic deposits (turbidites), voluminous research and literature exist. Therefore, turbidity currents and turbidites are excluded from this literature search.

When sediment-laden river water enters the ocean, it can generate a “hypopycnal” plume (overflowing surface plume) or “hyperpycnal” plume (bottom-flowing plume). Hypopycnal plumes are more common since river outflows are typically fresh and warm relative to the ocean. Hyperpycnal plumes occur when the density of sediment-laden river water exceeds that of the ambient seawater and descends to the sea floor as a result of the excessive sediment load (Mulder and Syvitski, 1995; Parsons and others,

2001). Hyperpycnal plumes are predominantly seasonal and require unusually high sediment concentrations exceeding 40 kg m^3 .

Smaller-scale storm-related turbidity plumes can also be generated by storm-wave re-suspension of either fine seafloor sediments in shallow marine environments or sediments along a wave-dominated beach or other shoreface.

ANTHROPOGENIC TURBIDITY

The primary sources of anthropogenic open-water turbidity are channel-maintenance dredging, disposal of dredged material, beach replenishment, aggregate mining, and coastal construction activities. The main environmental effects of increased turbidity levels from these operations are a reduction in penetration of light into the water column and suspended-sediment impacts on filter-feeding organisms and fish. Most studies have focused on maintenance dredging and disposal activities in enclosed waters such as estuaries, embayments, and navigational channels where there is a high percentage of fine-grained sediment (often 75% or more), which results in larger dispersion plumes than similar activities in offshore waters. Hitchcock and others (1999) cite numerous dredge-related plume studies from around the world in their report on benthic and surface plumes prepared for the U.S. Minerals Management Service. However, the largest inventory of research and literature on dredge-induced turbidity, was produced by the U.S. Army Corps of Engineers (USACE) through its Dredging Research Program (DRP), Dredged Material Research Program (DMRP), and Dredging Operations and Environmental Research Program (DOER) administered through the U.S. Army Engineer Research and Development Center (ERDC) and its predecessor, the U.S. Army Engineer Waterways Experiment Station in Vicksburg, Mississippi.

Considerably less research has been conducted in unprotected offshore waters. Most of the available literature regarding suspended-sediment studies in the swash, surf, and nearshore zones has dealt with either the effect of turbidity on specific marine species and biosystems or on coarse-sand transport dynamics. This focus is largely because offshore disturbances generally produce fewer turbidity-related impacts since offshore sands tend to be coarser, cleaner, and have been winnowed of most clay and silt. In California and many other parts of the world, sands in high-energy offshore areas commonly contain less than 5 percent clay and silt (Nielsen, 1997). This is one reason beach-nourishment projects favor offshore borrow sites. The offshore hydrodynamic environment also favors prompt plume dispersion. Additionally, offshore organisms are more adapted to higher-energy natural sediment transport processes, which can create turbidity under normal conditions (storms, waves, etc).

Dredge and Material-Disposal Turbidity

Turbidity from marine dredging and disposal arises from disturbance of bottom sediments (benthic plumes), overflow of surplus or screened sediment mixtures from the surface dredge (surface plumes), and open-water disposal of dredged sediments (surface and benthic plumes). Generally overflow from spillways, screening, and open-

water disposal generates a far greater quantity of suspended material and larger plumes than bottom disturbances (Herbich and Brahme, 1991; LaSalle and others, 1991; Herbich, 2000).

Turbidity is generally not an issue when dredging deposits of clean offshore sands with little fine-grained material. Studies also suggest that dredge-induced turbidity is of little concern in areas with high natural background levels of turbidity, such as at the mouth of estuaries, or in high-energy areas close to eroding coastlines since ecosystems are well-adapted to naturally high loads of suspended sediment caused by tides and wave action.

The majority of studies and monitoring efforts of dredge-induced turbidity has demonstrated that turbidity plumes are, more often than not, localized, spreading less than a thousand meters from their sources and dissipating to ambient water quality within several hours after dredging is completed (Schubel and others, 1978; Byrnes and others, 2003, LaSalle and others, 1991; McClellan and others, 1989; Pennekamp and Quaak, 1990). These results are characteristic of both offshore operations and those in enclosed waters.

Numerous observations and models by the USACE support the conclusion that dredge plumes are localized and of short duration. In one model of a turbid plume of re-suspended sediment generated by an operating hopper dredge in 90 meters of water in San Francisco Bay, a benthic plume extended 700-730 meters downcurrent from the dredge. In the immediate vicinity of the dredge, an overspill surface plume merged into the lower plume, becoming a single plume about 300 meters behind the dredge.

Infrequently, surface plumes can be visible for distances of many kilometers. In these cases, plumes are usually associated with enclosed waters with high fine-sediment content and strong tidal or riverine currents, which carry the plume marineward. In an instance of peak spring tidal velocities of 1.75 m/s, H.R. Wallingford reported that very fine sand could be carried up to 11 km from a dredging site (Hitchcock and others, 1999). Another extreme case was reported by Hitchcock and others (1999) wherein detailed monitoring associated with construction of the Storebaelt Link Bridge in Denmark detected suspended sediment up to 35 km from the source.

Measurements around properly operated dredges show that elevated levels of suspended bottom sediments can be confined to several hundred meters from the cutterhead location and dissipate exponentially towards the surface with little turbidity actually reaching surface waters (Herbich and Brahme, 1991; LaSalle and others, 1991; Herbich, 2000). In many cases, the suspended sediment concentrations are no greater than those generated by commercial shipping operations or during severe storms. Storms, floods, and large tides can increase suspended sediments over much larger areas and for longer periods than dredging operations, which makes it very difficult to distinguish between dredging-induced turbidity and that generated by marine natural processes or normal navigation activities (Pennekamp and others, 1996).

Both surface and benthic plumes are usually associated with marine disposal of dredged material (open-water pipeline discharges or hopper dredge releases). Upon release, the fines can behave either as a density current (dynamic plume), or mix with the water increasing turbidity throughout the water column (passive plume). In passive plumes, concentrations are generally low and sediment falls at the settling velocity of the single particles. In dynamic plumes, the bulk density of sediment-water mixture, relative to the ambient water, determines the rate of fall.

A dense, sediment-laden dynamic plume descends rapidly through the water column as a well-defined jet of high-density fluid, entraining ambient seawater as it falls. At the same time, a passive plume arises from turbidity-induced entrainment of sediment along the perimeter of the dynamic plume. It has been estimated that 95-99 percent of most discharged sediment loads descend to the bottom within 30 meters of the point of discharge with only the remaining few percent being stripped from the outside of the dynamic plume (Schubel and others, 1978; Neal and others, 1978).

In extremely strong current velocities and/or in deep water, where the bottom may be thousands of feet down, a descending dynamic plume may entrain so much water that it mixes entirely with the surrounding water and loses its integrity, thus becoming a passive plume. When this occurs, sediment concentrations become relatively low and fine particles usually stay in the water column for several hours, but may remain for as much as several days before settling out. The settling zone of the passive plume can cover several kilometers resulting in no significant bottom buildup.

Passive plumes will move away from the point of discharge by three separate mechanisms, all of which are a function of hydrodynamics and particle size and shape: advection by tidal currents; diffusion by turbulence; and settling. The fine particles in a plume are advected by the current and also undergo settling. Coarser sediments will be transported a lesser distance away from the point of discharge. Non-cohesive sediments, or those greater than sand size (>2mm) are generally considered to fall to the seabed immediately (Hitchcock and others, 1999). As the current velocity increases, advection becomes relatively more important in spreading the suspended sediment. Concentrations rapidly decrease with increasing distance downstream or downcurrent from the discharge point and laterally away from the plume center line due to settling and horizontal dispersion of the suspended solids (Bernard, 1978). Barnard (1978) presents a plot showing the relationship of suspended-solids concentrations along the plume centerline and distance down-current from several open-water pipeline disposal operations.

The duration of turbidity in water is largely based on the fall velocity of the sediment particles. Fall velocity depends on size, shape, and density of the particles as well as the fluid density, viscosity, and several other parameters. When a particle falls through water, it accelerates until it reaches its fall velocity, or the terminal velocity that a particle reaches when the retarding drag force on the particle just equals the downward gravitational force. While low concentrations of silt and clay (with diameters <0.03 mm) settle very slowly and cause more persistent plumes, under certain conditions, clay

particles may collide to form aggregates or flocs with diameters of 0.1 to 2.0 mm. The formation of flocs increases settling velocity, which results in a more rapid decrease in suspended-sediment concentration with distance from the source (Barnard, 1978).

When a dynamic plume impacts the seafloor, it causes a horizontal, radially-spreading bottom surge outward across the seabed as a density underflow plume until its velocity and turbulence are sufficiently reduced to permit deposition. The greater the thickness and solids content of the layer, the greater the density flow effect. Generally, these underflow plumes originate as turbulent flows, characterized by chaotic motions and a billowing head just behind the leading edge and decay with deceleration to laminar underflow after spreading a short distance (Thevenot and others, 1992). Since turbulent underflows generally entrain ambient water, they grow vertically and tend to have lower concentrations than laminar underflows (Teeter, 2000a). The sediments ultimately form a low-gradient circular or elliptical fluid mud mound consisting of high-density (nonflowing) mud overlain by a surface layer of low-density (flowing) fluid mud (Barnard, 1978). Depending on the volume of material, these mounds can measure several feet thick (Holliday, 1978).

Tides also affect plume dispersion with plumes extending landward and seaward during the incoming flood tides and the outgoing ebb tides, respectively (Barnard, 1978).

Beach-Nourishment Turbidity

Suspended-sediment related issues are often a concern during beach-nourishment activities and afterward, while the new beach responds to the prevailing wave regime. Surprisingly, few attempts have been made to actually monitor and quantify turbidity conditions. Most of the literature regarding suspended sediments in the swash, surf, and nearshore environments addresses sand-transport dynamics and faunal effects rather than the distribution of re-suspended fine sediments. However, based on observations and the available studies, it is generally agreed that turbidity resulting from placement of sand on the beach face in beach nourishment and other sediment management projects is even more localized and transitory than offshore or enclosed-water operations. This is largely attributable to the use of nourishment material that is low in clay and silt and resembles as closely as possible the indigenous beach sand.

Generally, beach-nourishment projects on high-energy beaches quickly equilibrate with the current wave regime. Finer sediments are promptly winnowed from the nourishment material, causing only a short period of elevated turbidity. Parr and others (1978) noted that the silt and clay fractions were quickly winnowed from the nourishment material placed on Imperial Beach, California, and that after four months, the grain-size distribution of the nourishment fill was comparable to the indigenous beach sand.

In another study of beach nourishment on North Carolina beaches during 2001 and 2002, it was concluded that plumes caused by sand placement and de-watering on the beach face were small, short-lived, and did not create large increases in turbidity over background conditions (Versar, Inc., 2004). Sampling conducted immediately following

nourishment and again one year later, demonstrated that turbidity generated by the pipeline discharge hugged the shoreline following the long-shore currents. While elevated turbidity spikes were associated with the discharge pipe itself, in most cases the plumes were not discernable from turbidity created by breaking waves in the surf zone a few hundred meters away or turbidity when dredging operations were temporarily shut down. Elevated suspended-sediment loads outside of the surf zone were rarely observed. Increases in turbidity detected during the second year of sampling were attributed to storm events and high surf conditions.

Perhaps one of the more definitive studies was conducted by the USACE between 1997 and 1999. During this period, the Corps completed one of the largest beach-nourishment projects on record, placing 19.39 million cubic meters of sand (<10% silt and clay) on 47 km of high-energy New Jersey beaches. Detailed sampling revealed little evidence of short-term elevated turbidity in the nearshore environment. Elevated turbidity was limited to a narrow swath (less than 500 m) in the swash zone in the immediate vicinity of the operation with a lateral extent on the order of several hundred meters. While discharge effluents ranged as high as 1048 g/l, observed concentrations decayed rapidly with dispersal through the surf zone to concentrations between <10mg/l to 34 mg/l, which are levels that many of the indigenous fish and invertebrate species experience in estuaries or during storm-induced turbidity (Burlas and others, 2001).

Post-storm monitoring of the swash, surf, and nearshore zones after hurricanes Dennis and Floyd in 1999 indicated that beach sediments at both recently filled and undisturbed beaches were equally susceptible to re-suspension. Suspended-sediment concentrations were generally comparable to slightly higher in the swash, surf, and near shore zones adjacent to the newly restored beaches as compared to undisturbed reference beaches. Only in a few samples from the swash zone of the nourished beach were suspended solids concentrations markedly elevated (Burlas and others, 2001).

DIFFICULTIES IN PLUME-PREDICTION AND MODELING

While many turbidity plumes have been qualitatively described both during and after dredging and beach-nourishment activities, it is difficult to ascribe the results of many studies in more than a general way. Few quantitative studies of short- and long-term plume behavior have been conducted. As a result, development of an accurate and universally applicable model of turbidity induced by dredging, beach nourishment, or other activities associated with largely cohesive sediments is considered nearly impossible (Pennekamp and others, 1996). This is largely because plumes, driven by tidal, wave, and current forces, can change dynamically over large spatial scales (both horizontally and vertically) and short time scales. Data collected at points in time at fixed locations are generally insufficient to rigorously assess the potential dispersion of suspended sediments. The development of widely applicable models is also hindered by the large number of parameters involved and the complications introduced by the dynamic temporal and spatial nature of plumes. Suspended-sediment dispersion is controlled by both operational parameters (dredge type and technique, method of

overboard returns, speed) and the interaction of environmental parameters and physical properties. Water properties include depth, temperature, viscosity, stratification, and salinity; sediment properties include background levels of suspended solids, material composition, density, size, particle size distribution (individual grains or flocs), and solids concentration of the slurry; hydrodynamic forces include currents, waves, turbulence, all of which cause horizontal and vertical mixing; and other influences include buoyancy (entrapped air or gas), initial momentum on entering the water body, etc. The behavior and characteristics of a turbidity plume can only be evaluated if the complex interactions between the parts are taken into consideration.

Barnard (1978) offered one of the earlier methods of prediction of turbidity plumes from open-water sediment disposal activities requiring only six input parameters including dredge size, water depth, current velocity, sediment diameter or settling velocity, diffusion velocity, and the "age" of the plume to determine the worst case dimensions of the plume.

More recently, the USACE developed models and software in an effort to evaluate several aspects of suspended sediment behavior. The Dredging Research Program developed the PLUme MEasurement System (PLUMES) model (Kraus and Thevenot, 1992), which utilized commercially available broad-band acoustic Doppler current profiling equipment to measure sediment concentration and three dimensional (3-D) fluid velocity at dredging sites and to document the actual movement of sediment plumes.

The Dredging Research Program also developed the Short-Term FATE (STFATE) model (Johnson and others, 1993; Johnson and Fong 1993) as one module of the Automated Dredging and Disposal Alternatives Management System (ADDAMS) (Schroeder and Palermo, 1990). The STFATE software evaluates the short-term behavior of dredged material discharges in open water during and immediately after a surface discharge. The model was primarily designed to model disposed hazardous material mounds on the seafloor, but it can also be used to predict what portion of the discharge is dispersed as a passive plume. The model output includes a time history of the descent and collapse phases of the discharge and suspended-sediment concentrations for various particle-size ranges as a function of depth and time. At the conclusion of the model simulation, the thickness of the deposited material on the bottom is given.

The STFATE model was followed by development of the Long Term FATE (LTFATE) model (Scheffner and others, 1995). LTFATE modeling software was designed to assess the long-term fate and stability of dredged material disposal sites with an emphasis on seabed accumulations of disposed material.

More recently, the USACE, in conjunction with Applied Science Associates (ASA), developed the Suspended Sediment FATE (SSFATE) numerical modeling system to model suspended sediment plume behavior from dredging operations (Johnson and others, 2000). The software allows the running of multiple simulations in a short period of time so that alternative scenarios can be evaluated to determine those with the least

potential for adverse environmental impact. The program evaluates sediment sources resulting from the operation of cutterhead, hopper, or clamshell dredges and differentiates the relative contribution of each type of suspended sediments to the water from bottom re-suspension and surface discharges. While this application is available to USACE staff, ASA has retained the distribution and marketing rights for non-USACE users. The model is currently undergoing upgrading following field testing, after which ASA intends to market the application.

Our research of the literature did not reveal reliability or success of these models as determined by any field-testing.

RECOMMENDATIONS

- Follow up on the field testing and potential availability of the updated SSFATE model.

CSMW TASK TWO

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RESULTS FROM CSMW TASK 3

(Beach Nourishment Projects – Performance and Sediment Characteristics)

TASK 3 – Compile known and available information on: the types and grain size distribution of sands that have been used for nourishment projects along the important California beaches; observed end results of nourishment projects; the basis for limitation placed on the percentage of allowable finer grained materials in nourishment projects. Include any information gathered on existing grain size distributions at those important beaches.

BACKGROUND

There are many variables that affect the success or failure of beach replenishment/nourishment projects. One of the main criteria for defining the “success” of such projects is the longevity of the “fill,” or borrow material, placed during individual episodes of nourishment. For example, given a volume of fill emplaced in a beach system, managers and engineers want to know what percentage of that fill is retained in the littoral cell after a given period of time. How a fill performs with time is a function of the interaction of several conditions and properties. Some of these include local wave and current conditions; technique and location of fill placement; and the reliability of the monitoring method. The interactions will determine if a fill remains in the system longer or shorter than expected.

One property of interest in the performance of fills is the physical compatibility between the fill material and the “native” material of the beach where the fill is to be placed. “Compatibility” refers to the degree of similarity of the two materials and includes the size, type (mineralogy), color, density, and shape of the component sediment grains. Typically, size is the most commonly evaluated in trying to match a fill material with a native material mainly because of its potential mechanical performance within the dynamics of the beach environment. Grain type and color can locally be important because of aesthetic or health/safety concerns. A textbook on beach nourishment and protection published by the National Research Council (1995) presents a brief discussion of sand compatibility; various papers are cited that discuss the pros and cons of continued use of grain-size comparisons between fill and native materials as measures of beach performance. Also, the Coastal Engineering Manual (U.S. Army Corps of Engineers, 2002) has sections on beach-fill design and performance.

There are three main concerns with grain size. First, if the percentage of fines (clay- and silt-sized grains) in the fill is too high, a correspondingly larger volume of fill material must be emplaced in the beach system to allow for loss of the fines with time caused by winnowing action of the waves. Second, too high of a percentage of fines in a beach sand is recreationally undesirable – there may be clumping of the material, for example.

Third, fines can harbor or attract contaminants, which may be hazardous to humans and sea life; placement of a contaminated material on a beach system can be detrimental.

Beach Replenishment/Nourishment in California

Beach replenishment/nourishment began in California at least as early as 1919 (Coyne, 2000). Several hundred episodes of replenishment and periodic nourishment have occurred at several dozen beach systems along the coast. Most of these have been in southern California, particularly in the Santa Barbara and Ventura areas, and along the coastlines of Santa Monica Bay, Orange County, and San Diego County.

Currently (2004), there is reportedly only one beach replenishment/nourishment project currently underway in the San Francisco District of the U.S. Army Corps of Engineers, which extends from the Oregon border to just north of the San Luis Obispo-Monterey County line. This project consists of disposal of dredge material at Ocean Beach in San Francisco. In the Los Angeles District, which covers the remainder of the coast to the Mexico border, there are many on-going projects. Some are related to harbor maintenance: those at Santa Barbara, Ventura, Channel Islands, and Oceanside are done annually, while those at Morro Bay, Playa del Rey, and Mission Beach are done infrequently. As an example unrelated to disposal of dredged material, nourishment was recently accomplished at Goleta in Santa Barbara County.

Tracking the history and performance of these projects and individual episodes of replenishment/nourishment is a challenge largely because of the inconsistent documentation and because the information is commonly in unpublished files or reports. Through sponsorship of the California Coastal Commission and California Department of Boating and Waterways, Melanie Coyne, a National Oceanographic and Atmospheric Administration (NOAA) Fellow, researched and compiled the most comprehensive list of beach nourishment projects along the coast of California (Coyne, 2000). Presented here in modified form as Table 2, this list covered projects up to the year 2000. Also included here as Table 3 is Coyne's list of references that she consulted to compile the data and information. As an update to the list since 2000, we have added the individual replenishment/nourishment episodes of the SANDAG Regional Beach Sand Project as documented by Coastal Frontiers Corporation (2004).

Historically, most of the replenishment/nourishment activities in California have been pursued as local, rather than regional, projects. They have been dominantly "opportunistic" projects, meaning that beach restoration was not the primary purpose of the placement of fill. Rather, the beach systems were the receiving (disposal) sites for dredged material from other primary activities such as harbor construction or channel maintenance. Only in recent years has the number of "deterministic" projects become more common. In these projects, beach restoration through replenishment and nourishment is the primary purpose. The recently instituted Regional Beach Sand Project of the San Diego Association of Governments (SANDAG) is the first regional deterministic beach-nourishment program on the Pacific Coast of the United States.

CHARACTER OF FILL MATERIAL AND NATIVE MATERIAL

Data and information on the physical character of sediment involved in beach replenishment/nourishment projects along the coast of California range from sparse to well-documented. One of the main influences on documentation is whether a project is deterministic or opportunistic. Deterministic projects generally have greater testing of materials because of regulatory or economic considerations and requirements; the fill materials are commonly taken for a fee from virgin sources, which have unknown or poorly known characteristics. In contrast, testing is commonly less rigorous in opportunistic projects, particularly if a source for the fill material has been used previously and there are few or no reported problems of compatibility with the native material. The receiver beaches are generally very close to the sources of fill (e.g., bypassing operations) because of the desire to minimize transportation costs. Consequently, the fill material may be very similar in character to what would have been deposited naturally at the receiver beach.

Another factor that affects documentation of the physical character of sediment is the age of the projects. Older projects were under less regulation and thus may not have the quantity and quality of test data like those of modern projects.

Types of information reported for replenishment/nourishment projects can include size, type, color, density, and shape of the component grains. Grain size is by far the most dominant characteristic analyzed and reported; results are typically presented as percentage distribution of sizes within each sediment sample based on sieve analysis. In some reports, the percentage composition by mineral type is presented.

Regarding the character of native material on beaches, many pure- and applied-research studies have been conducted at several sites along the coast of California. Some of these studies are published and thus readily available (e.g., Hutton, 1959; Trask, 1952). Other sources include more-obscure or less-easily obtained reports (e.g., Straughan, 1981; reports of the Hydraulic Engineering Laboratory at the University of California, Berkeley). As a group, this category of studies is neither systematic nor consistent in content and presentation because of differences in researchers' purposes and interests. Nonetheless, they can provide background and baseline information, particularly at beaches that have not yet been replenished.

Regarding the character of both fill materials and native materials, much data and information are also available in geotechnical reports prepared for specific replenishment/nourishment projects. For example, data on grain characteristics are commonly presented in documents, such as environmental impact reports, submitted to the California Coastal Commission as part of its permit process. Also, the U.S. Army Corps of Engineers conducts detailed sampling and analyses of sediments, which are presented in its geotechnical reports (e.g., U.S. Army Corps of Engineers, 1989; 1995; 2002b). Some of its reports are readily available, while others are not; some reside in

the project files of the geotechnical branches of both the Los Angeles and San Francisco District offices, while others are at archive centers in Laguna Niguel (Los Angeles District) and San Bruno (San Francisco District).

The character of fill material and, to a much lesser extent, native material at some of the replenishment/nourishment projects in California is summarized in Table 2 (modified from Coyne, 2000) under the column heading of “dredge/fill characteristics.” These entries were extracted from research of a few hundred reports. Most are qualitative descriptions rather than quantitative data.

It is worth noting that at many southern California beaches (Santa Barbara County to the Mexico border) there is probably not much truly pristine, “native” material still present. Episodes of nourishment have diluted the original natural character of the beaches, particularly where nourishment has taken place frequently over many decades. Also, because of the inherent variability in the physical nature of natural sediments, it is difficult to generalize or define representative grain characteristics for individual beaches and fill material.

To prepare a comprehensive list of grain characteristics of fill material and native material will require systematic, detailed research of published literature as well as unpublished reports and files in agencies such as the U.S. Army Corps of Engineers and the California Coastal Commission, among others.

RESULTS OF BEACH REPLENISHMENT/NOURISHMENT IN CALIFORNIA

Of paramount importance in a replenishment/nourishment project is how well the emplace material performs compared to the engineering specifications of the project. To make reliable comparisons requires the use of systematic, quantitative monitoring of the performance of beach fills. Unfortunately, it was not until about 10-20 years ago that monitoring became more routine (Leonard and others, 1989; Komar, 1997). Up to the end of the 1980s, performance data for projects on the Pacific Coast of the U.S. were less prevalent than for those for the Atlantic Coast (Leonard and others, 1989). Since then, agencies in California have been taking more coordinated, regional approaches to protecting beaches. Part of this process has been institution of monitoring programs. One example is the Regional Beach Monitoring Program of the San Diego Association of Governments (SANDAG), which began in the middle 1990s (Coastal Frontiers Corporation, 2004). Associated with this project is the Southern California Beach Processes Study (Guza and others, 2002) at Torrey Pines State Beach, which is attempting to improve understanding of how and where a recent beach fill there is being transported by waves and currents. What is learned here could be applied to design and maintenance of replenishment/nourishment projects else where along the coast of California.

Historically, written documentation of the results of beach replenishment/nourishment projects along the coast of California has been inconsistent. Commonly, results have

been reported from a site-specific perspective, with an emphasis on qualitative rather than quantitative observation and measurement. Examples are presented in Cahill (1989), Clayton (1989), Leonard and others (1989), Leidersdorf and others (1993, 1994), Mesa (1996), California Department of Boating and Waterways and State Coastal Conservancy (2002), U.S. Army Corps of Engineers (2002b), and Coastal Frontiers Corporation (2004). Important overview papers for results and performance in California include those by Hall (1952), Shaw (1980), Herron (1987), Clayton (1989), and Leonard and others (1989).

The performance of beach fills at various sites in the state is briefly summarized in Table 2 (modified from Coyne, 2000) under the column heading “duration of fill.” Similar to the entries in the table for “fill characteristics” described earlier, the reported results are largely qualitative descriptions rather than quantitative measurements. Many cells in this column are blank, either because monitoring was not conducted or because the research did not discover pertinent documents with recorded results.

To date, the overall results of beach nourishment in California have been mixed. As a current example of performance and monitoring of beach fills, Coastal Frontiers Corporation (2004) recently reported results of monitoring of a major nourishment program in San Diego County. In this program, administered by the San Diego Association of Governments, twelve beaches received nourishment in 2001. During the 2003 monitoring year, the performance of the individual fills at the twelve beaches reportedly varied considerably; at some beaches, previous gains in shorezone volumes persisted, while at others, the gains were short-lived.

Despite the spotty record of documented results of replenishment/nourishment projects in California, Leonard and others (1989) attempted to determine the overall success of various projects as of the late 1980s. As part of this determination, they also evaluated how five physical parameters might influence the success of fill episodes as measured by longevity, or “durability,” of the emplaced fills. Some of their major conclusions for Pacific Coast beaches (nearly all are evidently in southern California) were:

- Longevity of fills at Pacific Coast beaches has overall been higher than those at Atlantic Coast and Gulf Coast beaches.
- Of those beaches measured, 48% were successfully maintained, 15% were not, and 36% were unknown.
- The Pacific Coast management philosophy of nourishment by periodic “maintenance” was advantageous over the Atlantic/Gulf Coast management philosophy of nourishment by “crisis.”
- Project monitoring must be a mandatory part of each replenishment project.

Regarding replenishment parameters:

- **Length:** There was no relationship between longevity of replenished beaches and their lengths.
- **Density:** Pacific Coast beaches had higher cumulative densities of fill than Atlantic Coast and Gulf Coast beaches. For the Pacific Coast, there didn't appear to be a correlation between fill density and fill durability.
- **Grain Size:** The data suggested that grain size was not of particular importance in determining durability.
- **Groins:** These structures have aided stabilization of certain nourished beaches on the Pacific Coast.
- **Storms:** There was a correlation between high erosion rates on nourished beaches of the Pacific Coast and the passage of major storms.

RECOMMENDATIONS

- With some editing and modification, use Coyne's (2000) spreadsheet (Table 2) as a foundation to annually compile data and information on all beach replenishment/nourishment projects along the coast of California. Georeference this table so that it can be incorporated into the GIS of the CSMW Master Plan.
- Determine if the influence of grain-size on fill performance is significant enough to devote CSMW resources to the task of compiling detailed data on grain-size characteristics of fill materials and native materials for beach-nourishment projects along the coast of California.

CSMW TASK THREE

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GENERAL

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RESULTS FROM CSMW TASK 4

(Offshore Materials for Beach Nourishment)

TASK 4 – Compile available information which identifies the presence of fine-grained “mud belts”, potential sand source areas, sandy and rocky bottom habitats in the offshore vicinity of potential beach nourishment locations.

BACKGROUND

The observation and mapping of the geologic materials on the ocean floor can lead to discovery of deposits of sand. Where of acceptable grain characteristics, volume, degree of consolidation, depth of submergence, and distance from shore, such deposits have been and will continue to be sources of material for beach replenishment/nourishment. The most desirable deposits are unconsolidated, have large volumes, are similar in physical character to the material on the receiving beaches, are in shallow water close to the receiving beaches, and are free of contaminants and debris. Also, mining of them would produce minimal environmental disturbance.

Typically, the identification and characterization of submarine geologic materials relies on both direct and indirect observation and measurement. Direct methods include visual observation, via submersible vehicles or cameras, and collection of samples through diving, dredging, or coring. Indirect methods include various geophysical techniques that can characterize the seafloor as well as the material beneath it. These data lead to maps and calculations that determine the locations, areal extents, volumes, and physical properties of the materials at and below the ocean floor. Furthermore, because of economic and technological limitations, the depth of sand deposits below the sea surface is of major interest, which requires reliable bathymetric measurements.

The identification and characterization of materials is also important for understanding and management of benthic habitat for marine organisms. The mapping of such habitats, which has become common in recent years, relies on the same techniques for exploration and characterization of sand deposits. Consequently, submarine geologic mapping and benthic habitat mapping are complementary and in some ways might be considered one and the same.

OVERVIEW OF OFFSHORE GEOLOGY OF CALIFORNIA

The complex geology that makes up onshore coastal California continues offshore beneath the continental shelf. In contrast to the U.S. Atlantic and Gulf Coasts, the shelf off California is notably narrow and irregular, a reflection of the active geologic forces there. It is commonly dissected by submarine canyons and, in some places, is only 1-2

miles wide. In simplified view, offshore California is underlain by diverse types of bedrock covered or surrounded by mantles of unconsolidated sand, mud, and gravel.

Available geologic mapping of offshore California is spotty as to areal coverage and detail. Some areas have been intensively studied and mapped, while others have been covered only by limited reconnaissance. Generally, areas close to shore and near large harbors and population centers have received more attention than those near less-developed parts of the coast.

At the statewide level, there are two sets of published maps that cover the entire offshore length of the state. The first, by Welday and Williams (1975), portrays at a scale of 1:500,000 the surficial geology of the offshore, with the greatest detail limited generally to within five miles of the coastline. The strength of this map is that the authors interpreted geologic bottom-types based on thousands of direct and indirect geologic observations made by various organizations. Especially noteworthy was use by the authors of the many historic observations of bottom type made during a suite of hydrographic surveys by the U.S. Coast and Geodetic Survey. Despite its age, this map is still a valuable aid to studies along many parts of offshore California. The second publication, a collaboration between the California Division of Mines and Geology (CDMG, now the California Geological Survey) and the U.S. Geological Survey, consists of seven map sheets that portray at a scale of 1:250,000 details of local geology among other geologic-related information for the continental margin (see Kennedy and others, 1987). The sheets that cover the offshore north of San Francisco have very little geologic detail, while those south of San Francisco have much greater detail. This distribution mainly reflects the focus, intensity, and availability of offshore study by different institutions. Also, the CDMG-USGS map series does not display the mapping of Welday and Williams (1975), therefore, investigators should consult both sets of maps when studying all or part of offshore California. The digitized version of the CDMG-USGS map series can be downloaded from the Seafloor Mapping Lab Website at California State University, Monterey Bay (<http://seafloor.csumb.edu/>).

In addition to the statewide maps discussed above, the California Geological Survey (CGS) and U.S. Geological Survey have published or are nearing publication of several regional geologic maps at a scale of 1:100,000 that include offshore areas. Some of these have newly compiled offshore geologic data, others do not. A few examples include the following quadrangles, from north to south: Monterey (CGS – published, new offshore data), Long Beach (CGS – in preparation, some new offshore data), and Oceanside (CGS – in preparation, no new offshore data).

Maps of surficial geology along portions of the coast are presented in Howard (1974), but we were unable to obtain and evaluate this report at the time of the CSMW study.

At local levels, various institutions and agencies have conducted detailed ocean floor surveys and mapping. These studies have been mainly in the Monterey Bay-San Francisco area in northern California and at several localities along the Southern California Bight, which extends from Point Conception to the Mexico border and

includes the Channel Islands. In recent years, seafloor mapping in California has focused on benthic habitats. Much of this work has used multibeam mapping systems to produce “backscatter” images that display seafloor properties such as areas of mud and bedrock (e.g., Gardner and Dartnell, 2002). Although generally not termed “geologic” mapping, these activities have collected information on the geologic character of the seafloor through their qualitative descriptions of materials as “sand,” “mud,” and “bedrock.” The U.S. Geological Survey, Moss Landing Marine Laboratory, Seafloor Mapping Lab, and Scripps Institution of Oceanography as well as private companies are some of the groups that have conducted this type of work in California. Examples of benthic habitat mapping for the nearshore zone of San Diego County can be viewed or downloaded on-line at <http://sccoos.ucsd.edu/nearshore/>. The U.S. Geological Survey has published several reports on its offshore mapping in the Monterey Bay-San Francisco and southern California regions. Several are listed in the accompanying bibliography (e.g., Wong and Eittreim, 2001; Gardner and Dartnell, 2002).

DISTRIBUTION OF SEAFLOOR MATERIALS ALONG THE COAST

The geologically active and diverse interior coast of California has profoundly influenced the geologic character of the adjacent seafloor. The high topographic relief, numerous watersheds that drain into the ocean, and the great variety of rock types all have contributed to the many types and complex distribution of materials that make up the coastal seafloor from Oregon to Mexico. This diversity is apparent from the geologic maps of Welday and Williams (1975) and the CDMG-USGS continental margin series.

Documentation of seafloor materials along the coast is available for many local areas. Again, we emphasize that this information was most commonly collected from the Monterey Bay-San Francisco region and the segment of coast from Santa Barbara County to San Diego County. Except for the semi-reconnaissance work of Welday and Williams (1975), there has been no attempt to consistently map in detail the distribution of offshore geologic materials from Oregon to Mexico. This situation is more a result of insufficient resources (funds and time) rather than lack of interest. Correspondingly, the documentation of details has been mostly limited to local projects conducted through government and academic groups and, in some cases, private industry. Government reports and data are generally produced by agencies such as the U.S. Geological Survey, U.S. Army Corps of Engineers, and the National Oceanic and Atmospheric Administration (NOAA). Products from the academic community are typically in the form of theses and dissertations, and papers in technical journals. Studies by private industry typically are prepared as consulting reports to clients (public and private). Examples of some of these categories are presented in the accompanying bibliography.

Mapping of seafloor materials along the California coast has been greatly aided by collection of samples. These include surficial sediment and rock and shallow cores. The U.S. Geological Survey maintains a Website (<http://coastalmap.marine.usgs.gov/regional/contusa/westcoast/usSEABED/>) that catalogs offshore sample sites and associated data as part of a national database; the

data can be viewed on-line through a map server. The U.S. Army Corps of Engineers has data from numerous vibrocore samples taken to assess potential borrow sites for beach replenishment/nourishment. NOAA maintains a Website (<http://www.ngdc.noaa.gov/mgg/mggd.html>) that can be visited to obtain digitized seabottom observations collected during hydrographic surveys conducted between 1851 and 1965 as well as offshore geophysical and geological data. Academic institutions also have bottom sample and core data, some of which have been published. Examples include data collected by the University of Southern California in the Southern California Bight and by the Hydraulic Engineering Laboratory at the University of California, Berkeley, from various coastal localities. Still other data are available in disparate, sometimes obscure, published and unpublished documents.

Together, the technical reports and sets of data portray a pattern of distributed materials that reflect such things as source areas, geologic structure, variations in dynamics of transportation, energy conditions and geomorphology of the depositional areas, and variations of all of these factors with time. For example, deposits of sand are common in the nearshore regions of the state and where rivers have discharged material at their mouths (Welday and Williams, 1975). Mud belts are concentrated farther away from the shoreline or in nearshore areas where the energy of waves and currents are less because of protective coastal settings (e.g., Monterey Bay). Bedrock areas are often nearshore extensions of onshore features or where either relief is positive or current patterns do not favor deposition of sediment. Many of the sand deposits farther offshore are probably paleo-beaches, which originated when the shoreline was much farther west than today; since the last ice age the shoreline has migrated eastward from these locations as sea level has risen.

Finally, the techniques of mapping seafloor materials off the coast of California are evolving. Traditional mapping techniques (e.g., Welday and Williams, 1975) emphasize manual interpretation and drawing of map-unit boundaries based on data from sampling and/or backscattering properties of seafloor materials. Currently, there are attempts to map the boundaries of materials based on image-processing techniques (e.g., classification), which use the same sorts of datasets as the manual approaches. An example is the work in progress by the U.S. Geological Survey on the San Pedro shelf in southern California (Peter Dartnell, U.S. Geological Survey, personal communication, 2003).

POTENTIAL OFFSHORE SOURCES OF SAND

Historically, the sources of sand for beach replenishment/nourishment along the coast of California have predominantly been provided from non-offshore locations (see column labeled "fill source/site" in Table 2; modified from Coyne, 2000). Included among these are inland sources as well as coastline sources, which have been related to such activities as harbor construction and channel maintenance or by-passing and back-passing operations. Interest in and use of offshore sand resources has generally occurred more recently in California.

Largely because of the abundant contributions from inland source areas and the prevailing southward-directed littoral drift along the entire coast, deposits of sand are prevalent in the offshore of California. Welday and Williams (1975) show numerous linear belts of sand that are dominantly fine-grained, with local areas that are medium- to coarse-grained as well. It is important to recognize, however, that these observations are for the seafloor surface only. Evaluation of sand deposits for potential beach replenishment/nourishment must also consider thickness of the deposits, which may or may not be known for any given location along the coast. To address this issue, Martindale and Hess (1979) and Luken and Hess (1979) used assumed thicknesses to calculate estimated volumes of sand and gravel deposits along the entire coast. The deposits they used for calculation were largely taken from the individual bottom-type areas shown on the maps of Welday and Williams (1975) and Howard (1974).

Because of the preponderance of historic beach replenishment/nourishment projects there, nearly all regional and local exploration and evaluation of offshore sand deposits have occurred in southern California from Santa Barbara County to the Mexico border. Also, because of limitations on dredging (cost, technology), most of this work has been done in shallow water close to shore. Some offshore borrow sites are used more than once because the excavations may be re-filled by natural sedimentation. Consequently, virgin borrow areas are not necessarily required for every episode of replenishment/nourishment, which lessens the overall need for their exploration and evaluation.

Various studies have identified many local offshore sand deposits in southern California that could serve as borrow sites for replenishment/nourishment. A list of selected sites is presented in Table 4. This list is not comprehensive, but gives an idea of the distribution and volumes of the deposits. Details of exploration, sampling, and analytical results for the deposits can be found in published and unpublished technical reports. The report by Osborne and others (1983) and many internal reports by the Geotechnical Branches of the U.S. Army Corps of Engineers (e.g., U.S. Army Corps of Engineers, 1989; 1995; 2002) are good examples of detailed study of individual deposits by use of vibracore data.

RECOMMENDATIONS

- Unless already accomplished, digitize and attribute the map of Welday and Williams (1975) for inclusion in the GIS of the CSMW Master Plan. Research files of the California Geological Survey to determine if the original 1:125,000-scale geology worksheets used to prepare the map are still available; these could be used for digitizing. Despite its age, this map is still a valuable statewide reference.
- Unless already accomplished, digitize and attribute the maps of Martindale and Hess (1979) and Luken and Hess (1979) for inclusion in the GIS of the CSMW

Master Plan. Original files for these reports may still be available in archives of the U.S. Geological Survey. This GIS product would be a companion layer to that for the Welday and Williams (1975) map discussed above.

- Unless already accomplished, digitize and attribute the maps associated with detailed studies of local sand deposits for inclusion in the GIS of the CSMW Master Plan. Examples of such reports would be those by Osborne and others (1983) and the U.S. Army Corps of Engineers (1989).

CSMW TASK FOUR

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RESULTS FROM CSMW TASK 5

(80/20 Coarse-to-Fines Rule of Thumb)

TASK 5 - Research any studies assessing the 80/20 coarse-to-fines “rule-of-thumb” ratio used by various regulatory agencies to determine whether potential source sands are compatible with a given beach. Identify the origin of the rule-of-thumb and nourishment projects where variances from the rule of thumb were allowed, including the basis for each variance.

80/20 COARSE-TO-FINES “RULE-OF-THUMB” RATIO

It appears that there is a widespread misperception, within both regulatory agencies and the regulated community, that an 80/20 coarse-to-fines “rule-of-thumb” ratio is an inviolate rule prohibiting the use of dredged material containing more than 20% fines for beach nourishment purposes. In actuality, the 80/20 ratio is merely a consensus view among regional offices of the U.S. Environmental Protection Agency and the Interagency National Dredging Team of what constitutes “predominantly” sand, for the purpose of applying the testing exclusion criteria of the Marine Protection, Research, and Sanctuaries Act (MPRSA or “Ocean Dumping Act”) to the disposition of dredged material (memo from Brian Ross to Laura Johnson, April 2000). Specifics of the exemption are codified in 40 CFR –Part 227, Section 227.13 (b)(1) (U.S. Code of Federal Regulations, 2003a). When the 80/20 ratio is applied under MPRSA, dredged material that is less than 20% silt and finer material (i.e., “composed predominantly of sand”) is deemed environmentally acceptable for ocean dumping or beach replenishment without further chemical or toxicity testing. Nonetheless, grain-size analysis of the dredged material must be done to make this determination. The desire to impose an upper limit of fine sediment content is premised on the fact that silts and clays, as opposed to coarser sediments, commonly contain adsorbed chemical contaminants that may have adverse impacts on marine environments or human health.

The U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (EPA) share regulatory responsibility for all discharges of dredged material in waters of the United States under Section 404 of the Clean Water Act (CWA), and section 103 of the MPRSA. Officials with both agencies agree that the 80/20 ratio is a “rule of thumb” only and that there is no statutory authority for its enforcement nor any known definitive studies or research from which a 20% cut-off was selected. Instead, it represents a national consensus value based on experience that such sediments are unlikely to be contaminated to an extent that would cause environmental damage (Brian Ross, “Beach Nourishment Questions”, e-mail to author, June 7, 2004; Gregory Dombrosky, U.S. Army Corps of Engineers, personal communication, April 9, 2004). More importantly, the MPRSA testing exclusion in no way prohibits the use of material containing more than 20% silt and clay for beach nourishment. To the contrary, both the MPRSA and CWA 404(b)(1) guidelines (40 CFR – Part 230, U.S. Code of Federal

Regulations, 2003b) actually provide the means by which sediments containing a greater percentage of fines can be approved for beach replenishment on a site-specific basis. The EPA and USACE recognize a critical need for beach replenishment and encourage the use of dredged material (which might otherwise be disposed of) for beneficial nourishment projects. Both agencies also recognize that there is significant flexibility in allowing material with higher percentages of fines provided it meets the requirements of the 404(b)(1) guidelines that dredged material be demonstrated to be compatible with the receiving beach (memo from Brian Ross to Laura Johnson, April 2000).

Both the USACE and EPA define dredged material for beach replenishment as “fill” when the basic project purpose is beneficial beach nourishment and the project is determined to be necessary. In this case, regardless of whether the material is specifically dredged from borrow sites or is dredge waste material, it can be regulated under the 404(b)(1) guidelines rather than the MPRSA. This eliminates the need for a lengthy and formal designation as an official ocean disposal site for each and every receiving beach (memo from Brian Ross to Laura Johnson, April 2000). Hence, the guidelines become the primary criteria used by the USACE and EPA in evaluating beach nourishment projects. If no real need for nourishment can be demonstrated or if most of the material will not serve the intended purpose, the activity would be considered disposal (and thus regulated under MPRSA).

The 404(b)(1) guidelines allow for site-specific determinations regarding compatibility of dredged-sediment grain sizes with receiving beaches. Dredge or fill discharges must satisfy the requirements of sec 230.10 of the guidelines which, among other things, mandate that 1) the discharge site must be the least environmentally damaging alternative, 2) discharge will not result in significant degradation of ecosystems based on factual determinations, and 3) that all practicable means must be employed to minimize for adverse environmental impacts.

The Inland Testing Manual (Manual) was prepared by the USACE and EPA as a guidance document for implementing compliance with the 404(b)(1) Guidelines. It sets out the recommended protocols for three levels of tiered testing of dredged materials. It is necessary to proceed through the tiers only until information sufficient to make factual determinations has been obtained. Subpart G of the 404(b)(1) guidelines requires the use of available information to make a preliminary determination whether additional tiered chemical or biological testing of the material is necessary. Tier 1 emphasizes grain-size compatibility and chemical similarity of the dredged material to the receiving beach. If a first-tier analysis demonstrates grain-size compatibility with the receiving beach, dredged material can often be excluded from second- and third-tier chemical or biological testing. Such situations are most likely when the dredged material is composed primarily of sand, gravel and/or inert materials from a high-energy environment, the sediments are from locations far removed from contaminant sources, or the sediments are from pre-industrial age deposits not exposed to modern pollution sources (40 CFR Sec. 230.60(a), U.S. Code of Federal Regulations, 2003b). Additional

testing is based on the concept of “reason to believe.” If there is a reason to believe that contaminants may be present, further evaluation is required.

From a regulatory standpoint, the physical compatibility of dredged material with the beach is the USACE’s primary basis for its decision regarding whether additional tiered chemical or biological testing is necessary. To make this decision, first-tier analysis of the dredged material grain-size distribution must be first be conducted and compared with the grain-size “envelope” of the receiving beach. When the material is determined to have an incompatibly high fine-sediment fraction, the second- and possibly third-tier chemical and biological testing are required to ascertain the degree of contamination in the fine fraction and the natural resources that might be impacted by the discharge or deposition of the fine-sediment fraction. Only then can the EPA and the USACE decide whether a relatively higher percentage of fines can be approved.

The Los Angeles District of the USACE regulates most California beach replenishment projects. In order to approve the use of dredged material for beach nourishment, the District requires the tiered testing approach as described in the Manual. The District’s tier-one testing is designed to determine if the dredged material is composed predominantly of sand, gravel, rock, or any other material greater than silt size and if the dredged material is compatible with the material on the receiving beach. Specific protocols for number and selection of dredge area and receiving beach sample sites, sampling methods, and data analysis methods are described in the District’s “Requirements for Sampling, Testing, and Data Analysis of Dredged Material Guidelines” (U.S. Army Corps of Engineers, undated; copy is available from CGS). To demonstrate compatibility with a given beach, the Los Angeles District requires that the overall percentage of silt and clay (grains less than 0.074 mm) in the dredged material must not exceed that of the finest beach sample by 10 percentage points. When a definitive determination of compatibility cannot be made, or, the dredged material contains a higher percentage of silt and clay, the tiered testing is then required. Satisfactory second- and third-tier test results may provide the USACE with the factual information from which it could approve using dredged material with 20% or more clay and silt for beach nourishment projects.

80/20 COARSE-TO-FINES “RULE-OF-THUMB” RATIO VARIANCES

Since the 80/20 ratio is an unenforceable rule of thumb, and applies to provisions of the MPRSA rather than the CWA, it becomes a futile exercise to identify beach nourishment projects that were permitted under a variance to this rule. While there may be isolated cases where the ratio was used to approve dredged sediment for replenishment, it is clear that most, if not all, projects that were implemented after enactment of the CWA in 1977 and development of the Inland Testing Manual required testing as required under the 404(b)(1) guidelines. Further, since it is agreed that the 80/20 ratio applied to provisions of the MPRSA, it could not have been applied to projects preceding enactment of the MPRSA in 1972.

In fact, in recent years there have been some beach nourishment projects in California that have been allowed to use dredged material with greater than 20% fines, but only after compatibility testing under the 404(b)(1) guidelines. In no case, however, has material exceeding 50% fines been approved. In one case, Santa Cruz Harbor was approved to use a maximum of 3,000 cubic yards per year of inner harbor material with fines ranging between 20-50%. It should be noted that this represents only 1% of the total material (generally 90%+ sand) placed on the beach every year (Brian Ross, "Beach Nourishment Questions", e-mail to author, June 7, 2004).

Since records indicate that perhaps hundreds of site-specific nourishment episodes have been undertaken in California over the years (some as early as the 1920s), it would be a daunting task requiring many hours of research to identify all projects involving the use of sediments containing more than 20% fines. Consequently, it is considered beyond the scope of this project.

RECOMMENDATIONS

- Research the numerous beach-nourishment project files to identify projects that actually used a higher percentage of fines than 20%. Also research any post-nourishment monitoring of these beaches to determine the fate of the fine-sediment fraction and the long-term effects on beach profiles.

CSMW TASK FIVE

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U.S. Code of Federal Regulations, 2003b, Title 40, Chapter 1, Part 230- Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material, revised as of July 1, 2003.

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<http://www.epa.gov/waterscience/itm/ITM/>

RESULTS FROM CSMW TASK 6

(Debris Basins)

TASK 6 – Compile known information on debris-basin locations, contacts, volumes, and cleanout frequencies. Focus efforts outside of Ventura and Los Angeles Counties, since debris basins in those counties are already included within the SMP GIS.

INFORMATION ON DEBRIS BASINS

To identify debris basins in San Diego, Orange, San Luis Obispo, and Monterey counties, the public works departments/flood control districts in each county were contacted. Additionally, the California Department of Transportation was contacted regarding debris basins in San Luis Obispo and Monterey counties. Representatives of the public works departments/flood control districts in San Diego, San Luis Obispo, and Monterey counties stated that those counties do not have debris basins.

Orange County does not have debris basins like those in Los Angeles or Ventura counties that collect coarse material. However, it does have several retarding basins that are intended to slow runoff from storm events and reduce the amount of silt reaching Upper Newport Bay. These retarding basins are usually built by developers and turned over to the County for operation and maintenance. The retarding basins typically trap only silt and fines. Information on seven of these retarding basins is included in Table 5. Information for retarding basins in Orange County was provided by Mr. John Gietzen of the Orange County Public Facilities and Resources Department.

No efforts were made to collect information for Santa Barbara, Ventura, Los Angeles, San Bernardino, or Riverside counties as information on debris basins in these counties is summarized in a report prepared by the California Department of Boating and Waterways and State Coastal Conservancy (2002).

RECOMMENDATIONS

None

CSMW TASK SIX

Bibliography

California Department of Boating and Waterways (CDBW) and State Coastal Conservancy (SCC), 2002, California beach restoration study: Sacramento, California.

RESULTS FROM CSMW TASK 7

(Seasonal Cross-Shore Movement of Sand)

TASK 7 – Document known information (i.e., case studies, etc.) regarding the natural seasonal movement of sand from the beach to nearshore and back.

OVERVIEW

Numerous investigators and authors have documented and described the phenomenon of seasonal cross-shore transport of sand from the beach to nearshore and back again, a process that is particularly common along the coast of California. Most of what is known comes from morphological studies of beach profiles over time and the hydrologic and hydraulic conditions that form them. Little attention has been paid to differentiating between the transport patterns of the various sediment fractions, with the emphasis instead being focused on the effects of bulk coarse sediment transport.

Two types of sediment transport, determined by waves and currents, influence beaches and nearshore environments. “Cross-shore” transport describes the sediment transport perpendicular to the shoreline (onshore-offshore) and is the dominant mechanism by which beaches erode and accrete; it creates distinctly different seasonal beach profiles. “Longshore” transport carries sand parallel to the shoreline.

Excellent recent examples of seasonal cross-shore transport and the resultant change in beach profiles are described in the Regional Beach Monitoring Program Annual Reports of the San Diego Association of Government (Coastal Frontiers Corporation, 2000; 2004). During the 1999 one-year cycle, offshore sediment transport during the winter months resulted in beach transects exhibiting shoreline retreat of from 10 feet to 100 feet at transects on Imperial Beach, La Jolla, and Carlsbad. During the following summer season, the shoreline advanced more than 10 feet at 29 of 33 transects. Advances of more than 100 feet were recorded at locations near the Tijuana River mouth, La Jolla, Torrey Pines, and Carlsbad (Coastal Frontiers Corporation, 2000).

Beaches exist in a constant state of change undergoing both erosion and accretion in an attempt to come to equilibrium with the varying energy of the attacking waves. The beach profile is a natural mechanism that causes waves to break and dissipate their energy, in effect, adjusting itself to the prevailing wave forces. Faced with increasingly larger waves, a beach responds by reducing its overall slope and shifting the breaker zone farther offshore, thereby enhancing the dissipation of the waves before they reach the shore (Komar, 1997). Conversely, as wave energy decreases, beaches narrow and steepen. Average sediment size also impacts beach slope with finer material producing gentler slopes than coarse material. Short (1979) presented a model of beach erosion and accretion showing the various stages of this continuum whose end members are the winter “storm” profile and summer “swell” profile (“dissipative” and “reflective”

profiles of Short, “bar” and “berm” profiles of Komar). Where a beach resides in the spectrum of beach profiles and the speed at which erosion and accretion remove and replace sand are largely a function of changes in wave height, period, and grain size (Short, 1999).

A total understanding of the critical wave conditions that govern the shift between summer and winter profiles is still incomplete. There are many field studies that demonstrate an increasing wave height leads to offshore sand transport and a bar profile, while low wave conditions cause a shoreward return of sand to the beachface and berm. However, no study has identified a critical wave steepness (ratio of wave height to wavelength, described below) that dictates when a summer profile will revert to a winter profile or vice versa (Komar, 1997).

Seasonal cross-sand transport is driven by major differences in the waves impinging on a beach. Waves are classified as either “storm” waves or “swell” waves. Storm waves are generated in the vicinity of a coast by storms and the interaction of strong winds on the ocean surface, while swell waves are generated by distant storms (Johnson, 1956; Silvester and Hsu, 1993). The two types of waves generally coexist simultaneously. Swells, however, can be completely obscured by local storm waves.

One of the most important factors in determining the character of a beach profile and the cross-shore transport of sand is the ratio of wave height to wavelength, or “wave steepness” (Johnson, 1949). Wave steepness is the ratio of deep-water wave height to wavelength, which is related to the wave period. Storm waves have high steepness values while long swell waves have low steepness values. Wave steepness can be increased either by an increase in the wave height or a decrease in the wave period. Physical parameters of the beach (i.e., grain-size distribution, cohesiveness, beach slope) also play an important role. In general, high, steep waves move beach sediments offshore, while low waves of long period (low steepness) move material onshore (USACE, 1989).

The process of winter marineward sand transport can be illustrated by studies of pre- and post-storm event beach profiles. During winter storms, higher wind velocities generate high and steep storm waves that assail the beach, which is largely near equilibrium with the milder summer swell waves. The beach begins to rearrange itself to accommodate the larger waves. Storm “surges” (water pushed toward shore by winds associated with the storm) also raise water levels and expose higher parts of the beach to wave action (USACE, 1989). When the waves break, their excess energy is expended on erosion of the beach. The eroded material is carried offshore in large quantities and deposited on the nearshore bottom in the form of an offshore bar. The bar eventually grows large enough to break the incoming waves farther offshore, forcing the waves to expend their energy farther seaward (USACE, 1989). In simplistic terms, larger storm waves erode the beach berm and redeposit the sand offshore in the form of a bar. Once the bar is fully formed and is breaking the majority of incoming storm waves, the surf zone is at its widest and the breaker heights greatest. It is at this time that the littoral current plus littoral drift are at a maximum (Silvester and Hsu, 1993).

The milder swell waves remobilize the bar sand and sweep this material back from the bar redepositing the sand back onshore and reforming the beach. Littoral current and littoral drift decrease as the bar is removed, and the profile reverts back to the swell-built curve. Also, the surf zone is at its narrowest width. While the sand is stored in the beach berm, the waves can only re-suspend sand on the beach face or a small fraction of the total volume of sand available during a storm profile, and hence, littoral drift becomes negligible (Silvester and Hsu, 1993).

BEACH RESPONSE TO STORM WAVES

When a swell profile beach is subjected to the increasing wave height and decreasing period of storm waves it responds with erosion and offshore transport of sand. The high wind velocities of local storms can produce large waves and a wide spectrum of wave trains of varying period and height (Silvester and Hsu, 1993). Storm waves are steep and powerful, containing more water above the mean sea surface than swell waves. Storm waves break on a beach almost every second, much more frequently than during quiescent times. Erosion first occurs with beach material being placed into suspension by the strong plunging vertical motion of the breaking storm waves. The plunging motion creates sediment suspension and offshore sand transport over the seabed.

The repeated onslaught of storm waves quickly saturates the beach face and raises the water table until it is almost coincident with the beach face itself (Short, 1999). With the beach face saturated, there is nowhere else for the water to go and the downrush becomes almost equal to the uprush dragging much of the sand that was suspended in the breaking waves back down the beach face. Contributing to the downrush return of sand is the flow of excess groundwater back to the sea. At the waterline, it is moving vertically, which causes liquefaction, placing more sand in suspension and causing wave-induced slumping. This phenomenon undermines the toe of the beach face, which progressively retreats landward (Silvester and Hsu, 1993). The disappearance of the berm can happen rather quickly and can be removed in one or two days of unusually heavy erosional activity.

As wave heights increase, the combined action of berm-overwashing, berm-breaching, and strong swash action results in the slumping and collapse of the lower beachface. The sediment removed from the berm and beachface is deposited immediately seaward of the beach face where it begins to form an attached bar (Short, 1999). The increase of storm wave-heights accelerates beach erosion. which drives the beach profile to the fully erosional, winter, beach type and the offshore bar moves seaward, separated from the beach by a broad trough (Short, 1999).

BEACH RESPONSE TO SWELL WAVES

Swell waves are generated from far-away storms and continue to propagate radially outward across the ocean, dissipating their energy over an ever-increasing area. The energy dissipation associated with the radial wave front reduces wave heights to only 5-10% of their original height and increases wave period (Silvester and Hsu, 1993). Along the west coast of North America the largest storm waves and predominant swell travel in an east and southward direction towards the equator.

As swell waves replace storm waves, they dismantle the offshore bar and transport its sand shoreward infilling the trough and building the beach face. Swell waves are refracted at the continental shelf where their path becomes normal to the coast. During their traverse of the nearshore and surf zone, bottom material is suspended, most of it from the offshore bar (Silvester and Hsu, 1993). As each wave breaks and swashes up the beach face, its water percolates into the sand. The infrequent arrival of swell waves (often many seconds) relative to the higher frequency of storm waves allows much of the water to percolate to the water table before making its way back out to sea (Silvester and Hsu, 1993). The resulting downrush is smaller than the uprush and can't carry much of the sediment load back down the beach face, hence, the beach accretes (Silvester and Hsu, 1993).

As wave heights continue to drop, increasing swell-wave dominance continues to move sand shoreward. The bar moves shoreward, and the width of the surf zone decreases. As more sand moves onto the beach, a berm crest develops which is characterized by a slightly landward sloping berm. The accretion of the beach face and berm will continue only so long as there is material available in the offshore bar to be fed into the breaking waves. By this time the bar has moved completely on to the beachface and a relatively deep, barless nearshore zone fronts the beach. In this fully accreted state, a beach will take on a parabolic curve characteristic of a summer swell-beach profile. The slope of the beach face depends on the size of available sediment: fine sand produces gentler slopes than coarse materials.

In nature, the complete erosional/accretional sequence is not common, since waves rarely stay low long enough to achieve the full transition. However, the southern California beaches are considered an example of beaches that generally experience the full sequence (Short, 1999).

IMPACT OF LONGSHORE CURRENTS

On most beaches, cross-shore sand transport is impacted by longshore currents, which are largely responsible for the net erosion of beaches that results in the need for beach replenishment. Wave-induced longshore currents are related to angle of incidence of the breaking wave fronts to the shoreline and become superimposed on the oscillatory nature of wave motion perpendicular to the shore. When a wave breaks at an angle to the shoreline, the longshore current it produces carries in a zigzag pattern some of the

sand suspended by the breaking waves a short distance downshore in a process called littoral drift.

RECOMMENDATIONS

None

CSMW TASK SEVEN

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TABLE 1 - Selected Sites of Important Coastal Erosion in California

SITE	LOCATION	LATITUDE	LONGITUDE	NEED FOR BEACH NOURISHMENT?	CONSEQUENCES OF NO NOURISHMENT	REFERENCE
Crescent City Beach	Crescent City, Del Norte Count			No		Noble Consultants (2000)
Ocean Beach	City of San Francisco, San Francisco County			Yes	Erosion of beach and seacliff by storm waves. Threat to major highway	CDBW and SCC (2002), U.S. Army Corps of Engineers (SF District)
Sharp Park	City of Pacifica, San Mateo Count			No		Noble Consultants (2000)
El Granada State Beach	San Mateo County			No		Noble Consultants (2000)
Cliff Drive (various segments)	Santa Cruz County			?		U.S. Army Corps of Engineers (SF District)
The Hook	City of Santa Cruz, Santa Cruz Count			No		Noble Consultants (2000)
Twin Lakes	City of Santa Cruz, Santa Cruz Count			No		Noble Consultants (2000)
Moss Landing Harbor	Monterey County			?		U.S. Army Corps of Engineers (SF District)
San Simeon State Park	San Luis Obispo County			No		Noble Consultants (2000)
Cayucos	San Luis Obispo County			Yes	Inadequate protection of commercial area from storm waves and coastal flooding.	Noble Consultants (2000)
Price Street Pocket Beach	San Luis Obispo County			Yes	Street threatened by erosion of steep seacliff.	Noble Consultants (2000)
Refugio State Beach	Santa Barbara County			Yes	Current beach inadequate to protect back-beach from storm waves and coastal flooding.	Noble Consultants (2000)
El Capitan State Beach	Santa Barbara County			Yes	Current beach inadequate to protect cliff toe and backlands from storm waves and coastal flooding.	Noble Consultants (2000)
Isla Vista	Santa Barbara County			Yes	Current beach inadequate to support recreation and to protect cliff toe and back-beach from storm waves and coastal flooding.	Noble Consultants (2000)
Goleta Beach County Park	Santa Barbara County			Yes	Beach erosion has caused loss of recreational area and damage to park improvements	Noble Consultants (2000), CDBW and SCC (2002)
Leadbetter Beach	Santa Barbara Count			No		Noble Consultants (2000)
Carpinteria City Beach	Santa Barbara County			Yes	Current beach inadequate to protect back-beach development from storm waves and coastal flooding.	Noble Consultants (2000), CDBW and SCC (2002), U.S. Army Corps of Engineers (LA District)
Carpinteria State Beach	Santa Barbara Count			No		Noble Consultants (2000)

SITE	LOCATION	LATITUDE	LONGITUDE	NEED FOR BEACH NOURISHMENT?	CONSEQUENCES OF NO NOURISHMENT	REFERENCE
La Conchita	Ventura County			Yes	Beach compromised by encroachment of highway, railroad, which limits recreational access.	Noble Consultants (2000)
Hobson County Park Beach	Ventura County			Yes	Beach compromised by encroachment of highway, railroad, which limits recreational access.	Noble Consultants (2000)
Emma Wood County Beach	Ventura County			Yes	Beach compromised by encroachment of highway, railroad, which limits recreational access.	Noble Consultants (2000)
Emma Wood State Beach	Ventura County			No		Noble Consultants (2000)
Surfers Point Park	Ventura County			No		Noble Consultants (2000)
San Buenaventura State Beach	Ventura County			No		Noble Consultants (2000)
Pierpont Beach	Ventura County			Yes	Current beach is chronically narrow, which limits recreational access.	Noble Consultants (2000)
Marina Park	Ventura County			No		Noble Consultants (2000)
Hueneme Beach Mile 24	Ventura County			No		Noble Consultants (2000)
Hueneme Beach Mile 24.5	Ventura County			No		Noble Consultants (2000)
Leo Carrillo State Beach	Los Angeles County			Yes	Current beach inadequate to protect back-beach improvements from erosion by storm waves.	Noble Consultants (2000)
Dan Blocker Beach	Los Angeles County			Yes	Current beach inadequate to protect highway from storm waves and coastal flooding.	Noble Consultants (2000)
Topanga Beach	Los Angeles County			No		Noble Consultants (2000)
Will Rogers State Beach	Los Angeles County			No		Noble Consultants (2000)
Venice Beach	Los Angeles County			No		Noble Consultants (2000)
Dockweiler Beach	Los Angeles County			No		Noble Consultants (2000)
Peninsula Beach	City of Long Beach, Los Angeles County			Yes	Waves erode beach, which is backed by oceanfront homes.	CDBW and SCC (2002), U.S. Army Corps of Engineers (LA District)
Seal Beach Mile 1	Orange County			No		Noble Consultants (2000)
Surfside-Sunset Beach	City of Seal Beach, Orange County			Yes	Erosion of this beach and downshore beaches if not periodically renourished.	CDBW and SCC (2002), U.S. Army Corps of Engineers (LA District)
Huntington Cliffs	City of Huntington Beach, Orange County			Yes	Lack of adequate beach has resulted in erosion of bluff with consequent loss of facilities at park.	CDBW and SCC (2002), U.S. Army Corps of Engineers (LA District)
City of San Clemente Beach	City of San Clemente, Orange County			Yes	Continued reduction in beach width has allowed storm waves to cause damage to public and private development.	CDBW and SCC (2002), U.S. Army Corps of Engineers (LA District)

SITE	LOCATION	LATITUDE	LONGITUDE	NEED FOR BEACH NOURISHMENT?	CONSEQUENCES OF NO NOURISHMENT	REFERENCE
Oceanside	City of Oceanside, San Diego County			Yes	On-going beach and seacliff erosion threatens public and private development as well as public safety.	CDBW and SCC (2002)
Carlsbad State Beach	San Diego County			Yes	Current beach inadequate to protect back-beach improvements from erosion by storm waves.	Noble Consultants (2000)
North Carlsbad	City of Carlsbad, San Diego County			Yes	On-going beach and seacliff erosion threatens public and private development as well as public safety.	CDBW and SCC (2002)
South Carlsbad	City of Carlsbad, San Diego County			Yes	On-going beach and seacliff erosion threatens public and private development as well as public safety.	CDBW and SCC (2002)
Batiquitos	San Diego County			Yes	On-going beach and seacliff erosion threatens public and private development as well as public safety.	CDBW and SCC (2002)
Leucadia State Beach	City of Encinitas, San Diego County			Yes	On-going beach and seacliff erosion threatens public and private development as well as public safety.	CDBW and SCC (2002)
Moonlight State Beach	City of Encinitas, San Diego County			Yes	On-going beach and seacliff erosion threatens public and private development as well as public safety.	CDBW and SCC (2002)
Cardiff State Beach	City of Encinitas, San Diego County			Yes	Narrow beaches allow coastal flooding of roads during storms.	CDBW and SCC (2002)
Encinitas	City of Encinitas, San Diego County			Yes	On-going beach and seacliff erosion threatens public and private development as well as public safety.	U.S. Army Corps of Engineers (LA District)
Solana Beach	City of Solana Beach, San Diego County			Yes	On-going beach and seacliff erosion threatens public and private development as well as public safety.	CDBW and SCC (2002), U.S. Army Corps of Engineers (LA District)

SITE	LOCATION	LATITUDE	LONGITUDE	NEED FOR BEACH NOURISHMENT?	CONSEQUENCES OF NO NOURISHMENT	REFERENCE
Del Mar	City of Del Mar, San Diego County			Yes	On-going beach and seacliff erosion threatens public and private development as well as public safety.	CDBW and SCC (2002)
Torrey Pines State Beach	San Diego County			Yes	On-going beach and seacliff erosion threatens public safety.	CDBW and SCC (2002)
Mission Beach	San Diego County			Yes	On-going beach and bluff erosion and coastal flooding during storms threaten public and private development as well as public safety.	CDBW and SCC (2002)
Coronado	San Diego County			?		U.S. Army Corps of Engineers (LA District)
Imperial Beach	City of Imperial Beach			Yes	Current beach inadequate in places to protect back-beach development from storm waves and coastal flooding.	CDBW and SCC (2002), U.S. Army Corps of Engineers (LA District)

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TABLE 2 - Beach Nourishment Projects in California (modified from Coyne, 2000)											
Site	Cell	City/County	Latitude	Longitude	Database	Date of project	Dredge/Fill Volume (yd ³)	Fill Source/Site	Dredge/Transport Method	Dredge/Fill Characteristics	Activity
Whaler Island	Smith River	Crescent City, Del Norte Co.			FC	1998	70,000	Crescent City Harbor (inner Harbor Basin, entrance channels)	hopper dredge, hydraulic pipeline dredge or clamshell/barge.	sandy/silty	DR, R
Crescent City	Klamath River	Crescent City, Del Norte Co.			TC'89	every few years	3-4,000,000		harbor bypassing		B
Crescent City	Klamath River	Crescent City, Del Norte Co.			TC'91	every few years	-3,500,000				harbor bypassing
Humboldt Bay South Spit (Nearshore Ocean Disposal Site)	Eureka	Humboldt Bay, Humboldt Co.			FC	August to October, 1988	745,000	Humboldt Harbor Bar, Entrance, and North Bay Channels	maintenance and advance maintenance dredging using hopper dredge	expected to be >90% sand	N,DS, DR
Humboldt Bay (Nearshore Ocean Disposal Site)	Eureka	Humboldt Bay, Humboldt Co.			FC	August 1 - October 15, 1989	585,000	Humboldt Harbor Bar, Entrance, North Bay Channel	self-propelled hopper dredge		DS, DR
Doran Beach	Bodega Bay	Bodega Bay, Sonoma County			FC	1980	<80,000	Federal Channel, Bodega Harbor, Bodega Bay	placed above MHHW	mostly sand	DS, DR
Bolinas Bay	Bolinas Bay	Bolinas Bay			TC'91		-65,000				beach erosion control
Ocean Beach	San Francisco	San Francisco, San Francisco			TC'91			San Francisco sewage disposal "box"			upland excavation spoils
Capitola	Santa Cruz	Capitola, Santa Cruz Co.			TC'91	1970	-20,000				beach restoration
Capitola	Santa Cruz	Capitola, Santa Cruz Co.			TC'89	1969-70	2000 truckloads	local quarry sand	terminal groin with small beach fill delivered by truck		N
Capitola	Santa Cruz	Capitola, Santa Cruz Co.			SPCA'76	1970					groin and fill
Seabright Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			TC'89	periodically		Santa Cruz small craft harbor entrance	harbor dredging and beach placement		DR, N
Seabright Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			TC'91						harbor bypassing
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1965	70,000	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1966	34,000	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1967	57,000	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1968	60,500	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1969	79,000	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1970	94,700	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1971	108,300	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1972	90,000	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1973	109,000	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1974	60,000	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1975	91,000	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1976	98,000	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1977	52,000	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1977	147,000	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1978	55,000	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1979	162,000	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1980	190,250	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1981	187,687	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1982	138,188	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1983	154,498	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1984	78,479	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1985	145,237	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1986	207,315	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1987	212,410	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1988	230,351	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1989	214,544	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1990	173,567	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1991	163,250	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			RW'94	1992	160,000	Santa Cruz Harbor			
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			TC'89			Santa Cruz small craft harbor entrance	harbor dredging and beach placement		DR, N
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			TC'91						harbor bypassing
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			FC	October 81; October 82; October 83; October 84; October 85; October 86	230,000	Santa Cruz Yacht Harbor channel	maintenance dredging; transport by suction dredge and pipeline into surf zone		DR, R
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			FC	March/April/ May 1984	130,000	maintenance dredging of Santa Cruz Yacht Harbor	<16" diameter dredge pipeline, in water, discharging onto beach, followed by beach shaping		R, DS, DR
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			FC	12/15/84-2/10/85; 2/11/85-3/28/85; 4/15/85-5/17/85	176,000	Santa Cruz Yacht Harbor	<16" pipeline from E jetty of yacht harbor, then buried in beach w/ shifting discharge points either on beach or in surf zone		R, DS, DR
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			FC	11/22/85-12/22/85 1/6/86 - 2/6/86; 2/10/86 - 3/21/86; 4/7/86 - 5/7/86	230,000	Santa Cruz Yacht Harbor maintenance dredging	<16" diameter dredge pipeline, from E jetty, buried, discharging onto beach at multiple points		DS, DR
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			ACOE'90	1986	197,000	Santa Cruz Harbor	beach fill		DR, DS
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			ACOE'90	1987	212,000	Santa Cruz Harbor	beach fill		DR, DS

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Applicant/Sponsor	Duration of Fill/Performance	Funding	Environmental Effects	Monitoring	Notes	Ref. ID	Permit/FC Ref.	See Also
USACOE						CD-80-98		
					source: Armstrong 1987 sources: Armstrong			
USACOE			Gray Whale (scheduled outside of migration periods); commercial and recreational crab fishing (scheduled after season ends)	COE monitored nearshore site using bathymetric surveys (Aug., Oct. '88, March '89) and Seabed Drifter (Nov. '88)	"disposal of the dredged material directly on the beach was considered impractical due to high costs and unsafe wave conditions in the area." "the designation of a [nearshore site]...is viewed as a "test" to discover whether sand will be retained in the littoral system and provide beach nourishment."	CD-045-88		CD-21-87
USACOE			turbidity, smothering of benthics	planned bathymetric and seabed drifter surveys of site: Aug. 89, post-deposition, Winter, '90, Spring '90; biological: June, Sept. '89, March '90	"preliminary data from bathymetric surveys and seabed drifter releases indicates that the dredge deposited the Nearshore Site (sic) in FY-1988 have dispersed and has remained in the littoral zone."	CD-026-89		CD-5-88; CD-45-88; CD-31-86; CD-18-85; CD-21-87
USACOE						CD-006-80		
	washed away in '82-'83 storms				sources: Armstrong			
city of Capitola	lost 3x '70-'86; present in '86	\$146,100 (inc. groin)			source: Armstrong			
city/CA Parks and Recreation		\$146,000			source: CA Dept of Nav. And Ocean Dev. 1976; Griggs and Savoy '86; Shaw 1980			
city/CA Parks and Recreation		\$146,100			source: CA-DNOD 1977; Griggs and Savoy 1986			
					source: CA-DNOD 1976			
					source: CA-DNOD 1977; Griggs and Savoy 1986 source: Griggs and Savoy 1986			
					source: CA-DNOD 1977; Armstrong 1987			
	leader beach				source: CA Dept of Nav. And Ocean Dev. 1977 (atlas); Armstrong 1987			
USACOE						CD-012-81		
USACOE						CD-046-83		
USACOE						CD-059-84	CDP 3-84-13	CD-12-81, CD-46-83, CDP 3-59-84
						CD-031-85	CDP 3-84-13	CD-59-84; CD-46-83
USACOE		via navigation Project						
USACOE		via navigation Project						

TABLE2TASK3CSMW.xls

Site	Cell	City/County	Latitude	Longitude	Database	Date of project	Dredge/Fill Volume (yd ³)	Fill Source/Site	Dredge/Transport Method	Dredge/Fill Characteristics	Activity
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			ACOE'90	1988	210,000	Santa Cruz Harbor	beach fill		DR, DS
Twin Lakes State Beach	Santa Cruz	Santa Cruz, Santa Cruz Co.			FC	1994	<75,000	San Lorenzo River channels			N, DS, DR
Moss Landing State Beach	Southern Monterey Bay	Monterey Bay, Monterey County			FC	March/April '84	10-20,000	maintenance dredging of Moss Landing Harbor	hydraulic cutterhead dredge with submerged pipeline disposal intertidally (north of Sandholt Pier)	medium sand	R, DS, DR
Moss Landing State Beach	Southern Monterey Bay	Monterey Bay, Monterey County			ACOE'90	1987	29,000	Moss Landing Harbor	beach fill		DR, DS
Morro Bay beaches	Morro Bay	Morro Bay, San Luis Obispo			TC'89	since 1940s	120,000/yr	Morro Bay navigational channel			DR, N
Morro Bay	Morro Bay	Morro Bay, San Luis Obispo			TC'91	1949	822,000				
Morro Bay	Morro Bay	Morro Bay, San Luis Obispo			TC'91	1964	702,000				
Morro Bay	Morro Bay	Morro Bay, San Luis Obispo			TC'91	1968	406,000				
Morro Bay	Morro Bay	Morro Bay, San Luis Obispo			TC'91	1971	190,000				
Morro Bay	Morro Bay	Morro Bay, San Luis Obispo			TC'91	1982					
Morro Bay	Morro Bay	Morro Bay, San Luis Obispo			TC'91	1985					
Morro Bay	Morro Bay	Morro Bay, San Luis Obispo			TC'89	1985	120,000	Morro Bay navigational channel	dredged, then pumped N of harbor entrance		DR, N
Morro Bay	Morro Bay	Morro Bay, San Luis Obispo			TC'91	1987					
Morro Bay	Morro Bay	Morro Bay, San Luis Obispo			ACOE'90	1987	400,000	probably Morro Bay	beach fill		DR, DS
Morro Bay	Morro Bay	Morro Bay, San Luis Obispo			TC'91	1941-1943	1,000,000		0.7 mi long fill		
Morro Bay	Morro Bay	Morro Bay, San Luis Obispo			TC'91	1942-1946	3,071,000				Harbor construction
Morro Bay	Morro Bay	Morro Bay, San Luis Obispo			TC'91	1974?					
Morro Bay	Morro Bay	Morro Bay, San Luis Obispo			TC'89	early 1940's		Morro Bay navigational channel			DR
Morro Bay	Morro Bay	Morro Bay, San Luis Obispo			TC'91	yearly	~120,000				harbor bypassing
Morro Dunes Natural Preserve	Morro Bay	Morro Bay, San Luis Obispo			FC	November '84 to February '85	50,000	Morro Bay entrance channel, Navy Channel, Morro Channel	hydraulic suction dredge, tractor with pipe lift attachment on beach	fine to medium grained, poorly sorted sands, 1-8% fines	R, DS, DR
Morro Dunes Natural Preserve	Morro Bay	Morro Bay, San Luis Obispo			FC	October 1, 1986 - February 15, 1987	350,000	Morro Bay Harbor	pipeline along sand spit to beach disposal site 3 miles S of harbor entrance	predominantly sand	R, DS, DR
Morro Dunes Natural Preserve	Morro Bay	Morro Bay, San Luis Obispo			FC	September '90 to 10/15/90-11/30/90	200,000	Morro Bay Entrance, Navy, Morro Channels and additional embayment near entrance	maintenance dredging by hopper dredge; deposition in no deeper than 40' MLLW (sand spit 8000' S of harbor) (nearshore disposal)	>97% sand	DS, DR
Morro Dunes Natural Preserve	Morro Bay	Morro Bay, San Luis Obispo			FC	August to December 1993	all or fraction of 840,000	Morro Bay Harbor mouth	hopper dredge; disposal by hopper dredge to nearshore no deeper than -40' MLLW (sand spit; 8000' S of harbor)		N, DS
Morro Strand State Beach (South)	Morro Bay	Morro Bay, San Luis Obispo			FC	November '84 to February '85	450,000	Morro Bay entrance channel, Navy Channel, Morro Channel	hydraulic suction dredge, 12-26" diameter pipeline on surface of beach (3.6 mi long)	fine to medium grained, poorly sorted sands, 1-8% fines	R, DS, DR
Morro Strand State Beach (South)	Morro Bay	Morro Bay, San Luis Obispo			FC	September '90 to 10/15/90-11/30/90	200,000	Morro Bay Entrance, Navy, Morro Channels and additional embayment near entrance	maintenance dredging by hopper dredge; deposition in no deeper than 40' MLLW (8000' N of harbor) (nearshore disposal)	>97% sand	DS, DR
Morro Strand State Beach (South)	Morro Bay	Morro Bay, San Luis Obispo			FC	August to December 1993	all or fraction of 840,000	Morro Bay Harbor mouth	hopper dredge; disposal by either hopper dredge or pipeline from hopper dredge to surf zone or nearshore no deeper than -40' MLLW; (8000' N of harbor)		N, DS
Morro Strand State Beach (South)	Morro Bay	Morro Bay, San Luis Obispo			FC	11/1/93 - 3/31/94	600,000	Morro Bay Harbor Entrance, Navy and Morro Channels	either cutterhead hydraulic pipeline dredge with surf zone disposal or hopper/clamshell combination dredge with nearshore disposal		DS, DR
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			TC'89	1935	202,000	Santa Barbara Harbor	first sand-bypassing operation; created offshore ridge: 200' wide, 2000' long, 18' of water, 1000' offshore (nearshore)		B
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			TC'91	1935	202,000		0.4 mi long; deposited in ~20 ft water depth, ~1000 ft offshore		harbor bypassing
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			TC'91	1938	584,000		0.2 mi long; ~500 ft wide		harbor bypassing
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			TC'91	1940	697,700		0.5 mi long		harbor bypassing
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			TC'91	1942	600,110		1.0 mi long		harbor bypassing
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			TC'91	1945	717,773		1.0 mi long		harbor bypassing
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			TC'91	1947	642,977		1.0 mi long		harbor bypassing
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			TC'91	1949	638,152		1.0 mi long		harbor bypassing
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			TC'91	1950-1952	2,476,098				harbor bypassing
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			TC'91	1954-1972 (periodically)					harbor bypassing
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			TC'91	1972	229,333				harbor bypassing
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			Shaw'80	1972	224804	Santa Barbara Harbor	bypassing to downcoast of harbor		
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			Shaw'80	1974	380337	Santa Barbara Harbor	bypassing to downcoast of harbor		
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			TC'91	1974	388,000				harbor bypassing
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			TC'91	1975	50,667				harbor bypassing
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			Shaw'80	1975	49666	Santa Barbara Harbor	bypassing to downcoast of harbor		
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			Shaw'80	1976	394714	Santa Barbara Harbor	bypassing to downcoast of harbor		
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			TC'91	1976	402,667				harbor bypassing
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			Shaw'80	1977	335899	Santa Barbara Harbor	bypassing to downcoast of harbor		
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			TC'91	1977	342,667				harbor bypassing
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			ACOE'90	1986	300,000	Santa Barbara Harbor	beach fill		
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			ACOE'90	1987	225,000	Santa Barbara Harbor	beach fill		
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			ACOE'90	1988	260,000	Santa Barbara Harbor	beach fill		
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			FC	2/24/86 - 5/15/86	250,000	Santa Barbara Harbor	discharge point = 2300' E of Stearn's Wharf within surf zone		DS, DR

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Applicant/Sponsor	Duration of Fill/Performance	Funding	Environmental Effects	Monitoring	Notes	Ref. ID	Permit/FC Ref.	See Also
USACOE		via navigation Project						
USACOE						CD-020-94		
USACOE			loss of benthic communities; loss of beach communities		80,000 - 90,000 yd ³ disposed of at end of pier in disposal site SF-12 in 20 ft below MLLW	CD-038-83		CD-11-81
USACOE		lowest cost disp.alt.			source: Converse 1982			
					source: Hall 1952; USACOE-LA 1974(Morro Bay)			
					source: Hall 1952; USACOE-LA 1974(Morro Bay)			
					source: Hall 1952; USACOE-LA 1974(Morro Bay)			
					source: Hall 1952; USACOE-LA 1974(Morro Bay)			
					source: Hall 1952; USACOE-LA 1974(Morro Bay)			
	lost w/in 2 years				source: Sears 1987			
	2 years				source: David Sears, Morro Beach State Park, CA dept of P & R, 1987			
USACOE		lowest cost disp.alt.						
		\$155,000			source: Hall 1952; USACOE-LA 1974(Morro Bay)			
					source: Hall 1952; USACOE-LA 1974(Morro Bay)			
					source: Hall 1952; USACOE-LA 1974(Morro Bay)			
					source: Hall 1952; USACOE-LA 1974			
	sand lost to offshore off "reef"		little storm recovery observed		source: Converse 1982; Armstrong 1987; Sears 1987			
USACOE			potential impacts on: eelgrass beds, grunion, peregrine falcon, CA brown pelican, southern sea otter, Morro Bay kangaroo rat; project timed to avoid impacts, but dredging will impact clam feeding ground of otters in channel	Corps will monitor to define impacts to endangered sea otters	location is site of dune blowouts; replenishment is paired with revegetation effort	CD-058-84	CDP 4-84-380	CD-39-86, CDP 4-86-218
USACOE			impacts to: eel grass beds in bay, grunions, peregrine falcons, brown pelicans, southern sea otters	COE will monitor material using pre- and post- bathymetric surveys to determine fate of material	previous monitoring of effects of dredging on clams (otter food supply) revealed no detrimental effect.	CD-039-86	CDP 4-84-380; CDP 4-86-218	CD-58-84; CD-11-87
USACOE		\$2,192,000 start-up; 80% Corps/20% City of Morro Bay	reefs in disposal area	COE will monitor material using pre- and post- bathymetric surveys to determine fate of material	more likely disposal choice; "Final disposal site will be selected prior to construction and based upon specific need for beach nourishment material, weather conditions, and other temporally variable factors."	CD-029-90		CD-39-86; CD-58-84; CD-11-87
USACOE			adverse impacts to Southern Sea Otter (dredging); area around Morro Creek left clear for steelhead; no dune disturbance		site is from 400' N of rock to 400' N of Morro Creek, from 5-20' below MLLW to 12' above MLLW; lead to rapid shoaling of harbor to S (CD-39-84)	CD-081-91		CD-9-90; CD-9-86; CD-8-84; ND-1-87
USACOE			impacts to: eel grass beds in bay, grunions, peregrine falcons, brown pelicans, southern sea otters	COE will monitor material using pre- and post- bathymetric surveys to determine fate of material	previous monitoring of effects of dredging on clams (otter food supply) revealed no detrimental effect.	CD-058-84	CDP 4-84-380	CD-39-86, CDP 4-86-218
USACOE		\$2,192,000 start-up; 80% Corps/20% City of Morro Bay	reefs in disposal area		less likely disposal choice; "Final disposal site will be selected prior to construction and based upon specific need for beach nourishment material, weather conditions, and other temporally variable factors."	CD-029-90		CD-39-86; CD-58-84; CD-11-87
USACOE			effects on clams -> otters			CD-081-91		CD-9-90; CD-9-86; CD-8-84; ND-1-87
	still there		"The expectation was that this sand would be carried shoreward and downcoast by natural wave activity. Unfortunately, however, the ridge remained in place, slightly reduced in height, but essentially unaltered (USACOE 1986)."			CD-044-93		
	bar still visible in '86 offshore; no migration onshore	\$26,260			source: Hall 1952; USACOE-LA 1986; Griggs and Savoy 1986			
	sand out of disposal area by 1940	\$122,787			source: Griggs and Savoy 1986; Hall 1952			
		\$131,424			source: O'Brien 1938; USACOE-CERC 1984; O'Brien 1940; USCOE-LA 1986 (oral history)			
		\$170,112			source: USACOE-LA 1986 (oral)			
		\$109,306			source: Hall 1952			
		\$122,525			source: Hall 1953			
					source: Hall 1954			
					source: Hall 1955			
					source: Shaw 1980; USACOE-CERC 1984			
					source: Shaw 1980			
					source: Shaw 1980			
					source: Shaw 1980			
					source: Shaw 1980			
	erosion checked but beach not recovered				source: Shaw 1980; USACOE-LA 1986 (oral)			
		Section 111, RHA 1968						
		Section 111, RHA 1968						
		Section 111, RHA 1968						
USACOE			scheduled during grunion spawning, but deposition in surf zone; monitoring planned to determine impacts	beach profile monitoring to document impacts of single-pt surf zone disposal on grunion		CD-009-86		

TABLE2TASK3CSMW.xls

Site	Cell	City/County	Latitude	Longitude	Database	Date of project	Dredge/Fill Volume (yd ³)	Fill Source/Site	Dredge/Transport Method	Dredge/Fill Characteristics	Activity
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			FC	9/15/86 - 3/1/88	-100,000/yr	Santa Barbara Harbor	placement b/w sand dikes to enhance settling of sand		DS, DR
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			FC	Fall '89 to Spring '92	600,000	Santa Barbara Harbor mouth	(2300' S of Stearn's Wharf)		DS, DR
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			FC	Oct '92 - Feb '93 or March 1 - April 30 '93	600,000	Santa Barbara Harbor, including West Beach	maintenance and advance maintenance dredging; disposal either on beach or single-point discharge in surf zone	dredge spoils compatible w/ local sediment on East Beach	DS, DR
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			FC	10/1/94 - 4/30/95; 10/1/95 - 4/30/96; 10/1/96 - 4/20/97	600,000	Santa Barbara Harbor and sand traps	maintenance dredging; disposal either on beach or in surf zone via pipeline oriented perpendicular to shore below MHW		DS, DR
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			FC	Fall '99 to Spring '05	600,000	Santa Barbara Harbor mouth	beach and surfzone disposal		DS, DR
East Beach	Santa Barbara	Santa Barbara, Santa Barbara			TC'89	every 1-2 years since 1935		Santa Barbara Harbor	bypassing directly onto beaches		B, N
San Buenaventura State Beach	Santa Barbara	Ventura, Ventura County			TC'89	1962	200,000		placed as part of groin project		R
San Buenaventura State Beach	Santa Barbara	Ventura, Ventura County			TC'91	1962	197,500		-1.4 mi long, 139-261 ft wide		beach erosion control (groin)
San Buenaventura Beach	Santa Barbara	Ventura, Ventura County			Shaw'80	1962	196050	Ventura Harbor	initially formed beach area 42-79 m. by 1121 m long; deposited South of groins 5,4, and 2	migrated south	
San Buenaventura Beach	Santa Barbara	Ventura, Ventura County			Shaw'80	1963	522800	Ventura Harbor	deposited north of groins 4 and 7		
San Buenaventura State Beach	Santa Barbara	Ventura, Ventura County			TC'91	1963	533,333				
San Buenaventura State Beach	Santa Barbara	Ventura, Ventura County			TC'91	1965	235,000		0.5 mi long; 150-170 ft wide		beach erosion control (groin)
San Buenaventura State Beach	Santa Barbara	Ventura, Ventura County			RW'94	1966	882,000	Ventura Marina			R (groin)
San Buenaventura State Beach	Santa Barbara	Ventura, Ventura County			TC'91	1967	449,800		1.0 mi long; 130-200 ft wide		beach erosion control (groin)
San Buenaventura Beach	Santa Barbara	Ventura, Ventura County			Shaw'80	1967	163375	Ventura Harbor	deposited north of groins 7 and 9		
San Buenaventura Beach	Santa Barbara	Ventura, Ventura County			Shaw'80	1973	5228	Ventura Harbor	emergency fill		
San Buenaventura State Beach	Santa Barbara	Ventura, Ventura County			TC'91	1976					harbor bypassing
San Buenaventura State Beach	Santa Barbara	Ventura, Ventura County			FC	January - March '90	100,000 - 150,000	Ventura Harbor	maintenance dredging (Ventura-Pierpont Groin Field)		N, R, DS, DR
San Buenaventura State Beach	Santa Barbara	Ventura, Ventura County			SPCA'76	1967					7 groins & fill
San Buenaventura State Beach	Santa Barbara	Ventura, Ventura County			SPCA'76	1973					groin and fill
South Beach	Santa Barbara	Ventura, Ventura Co.			FC	March - July, 1983	150,000	dredging of Ventura Harbor	hydraulically dredge Harbor mouth; transport through pipe, deposit on dry beach until winter, then bulldoze onto active beach face (b/w Harbor and Santa Clara River mouth)		DS, DR
Ventura	Santa Barbara	Ventura, Ventura Co.			FC	June/July '84	200,000	Ventura Harbor	disposal area: 1000 ft long, high on beach, 2 discharge points	clean sand	
Ventura	Santa Barbara	Ventura, Ventura Co.			ACOE'90	1986	1,000,000	Ventura Harbor	beach fill		DR, DS
Ventura	Santa Barbara	Ventura, Ventura Co.			ACOE'90	1987	550,000	Ventura Harbor	beach fill		DR, DS
Ventura	Santa Barbara	Ventura, Ventura Co.			ACOE'90	1988	800,000	Ventura Harbor	beach fill		DR, DS
Ventura	Santa Barbara	Ventura, Ventura Co.			FC	1997	19,500	Ventura Harbor south jetty repair and modification	either cutter head pipeline dredge or hopper dredge (nearshore)	clean sandy sediments	DS, DR
Marina Park Beach	Santa Barbara	Ventura, Ventura County			FC	12/23/84 - 3/15/85	150,000	Ventura Harbor sand traps and entrance channel	hydraulic dredge	fine sand (>91% on 200 sieve)	R, DS, DR
McGrath State Beach	Santa Barbara	Ventura, Ventura County			TC'91	1970	249,333				harbor bypassing
McGrath State Beach Park	Santa Barbara	Ventura, Ventura County			Shaw'80	1970	244409	Ventura Harbor			
McGrath State Beach Park	Santa Barbara	Ventura, Ventura County			Shaw'80	1971	924049	Ventura Harbor			
McGrath State Beach	Santa Barbara	Ventura, Ventura County			TC'91	1971	942,667				harbor bypassing
McGrath State Beach	Santa Barbara	Ventura, Ventura County			TC'91	1973	764,000				harbor bypassing
McGrath State Beach Park	Santa Barbara	Ventura, Ventura County			Shaw'80	1973	748911	Ventura Harbor			
McGrath State Beach Park	Santa Barbara	Ventura, Ventura County			Shaw'80	1974	320215	Ventura Harbor			
McGrath State Beach	Santa Barbara	Ventura, Ventura County			TC'91	1974	326,667				harbor bypassing
McGrath State Beach	Santa Barbara	Ventura, Ventura County			TC'91	1975	154,667				harbor bypassing
McGrath State Beach Park	Santa Barbara	Ventura, Ventura County			Shaw'80	1975	151612	Ventura Harbor			
McGrath State Beach Park	Santa Barbara	Ventura, Ventura County			Shaw'80	1977	748911	Ventura Harbor			
McGrath State Beach	Santa Barbara	Ventura, Ventura County			TC'91	1977	764,000				harbor bypassing
McGrath State Beach	Santa Barbara	Ventura, Ventura County				1981		dredging of Ballona Creek		black, odoriferous, trashy	DS, DR
McGrath State Beach	Santa Barbara	Ventura, Ventura County			FC	March - July, 1983	750,000	dredging of Ventura Harbor	hydraulically dredge Harbor mouth; transport through pipe, deposit on dry beach until winter, then bulldoze onto active beach face		DS, DR
McGrath State Beach	Santa Barbara	Ventura, Ventura County			TC'91	periodically since 1970					harbor bypassing
McGrath State Beach	Santa Barbara	Ventura, Ventura County			TC'89	12/23/84 - 3/15/85		Ventura Marina	maintenance dredging and beach replenishment		DR, N
McGrath State Beach	Santa Barbara	Ventura, Ventura County			FC	12/23/84 - 3/15/85	800,000	Ventura Harbor sand traps and entrance channel	hydraulic dredge; placed ~6100' S of entrance channel	fine sand (>91% on 200 sieve)	R, DS, DR
McGrath State Beach (nearshore)	Santa Barbara	Ventura, Ventura County			FC	9/15 - 3/15	600,000	Ventura Harbor	clamshell and hopper dredge alternatives proposed		DS, DR
McGrath State Beach (surf and/or nearshore)	Santa Barbara	Ventura, Ventura County			FC	9/15/94 - 3/15/95	800,000	Ventura Harbor sand traps and entrance channel	hydraulic, hopper and/or clamshell dredges; beach, surf zone, and/or nearshore disposal (<30'MLLW)	predominantly sandy	R, DS, DR
McGrath State Beach (surf and/or nearshore)	Santa Barbara	Ventura, Ventura County			FC	9/15/98 - 3/15/99; 9/15/99 - 3/15/00; 9/15/00 - 3/15/01; 9/15/01 - 3/15/02; 9/15/02 - 3/15/03; 9/15/03 - 3/15/04;	500,000	Ventura Harbor entrance, navigation channels and sand traps	hydraulic cutterhead pipeline dredge (maybe hopper or clamshell)	>80% sand	DR, R

TABLE2TASK3CSMW.xls

Applicant/Sponsor	Duration of Fill/Performance	Funding	Environmental Effects	Monitoring	Notes	Ref. ID	Permit/FC Ref.	See Also
USACOE			grunion			CD-025-86		CD-2-83; CD-12-84; CD-25-84
USACOE						CD-046-89		
USACOE			impacts to grunion spawning if contingency dredging necessary; creation of sand traps in harbor intended to mitigate need for this dredging	effects of March disposal on grunion spawning		CD-040-92		CD-25-86; CD-46-89
USACOE				April extension to monitor impacts of surf zone disposal on grunion		CD-032-93		CD-21-83; CD-25-86; CD-46-89; CD-58-90; CD-79-91; ND-4-92; CD-40-92
USACOE				nightly surveys of grunion to detect onset of spawning		CD-048-98		CD-21-83; CD-25-86; CD-46-89; CD-58-90; CD-79-91; ND-4-92; CD-40-92; CD-32-93
USACOE								
	"migrated south"		"impounded on N side of groins"		source: USACOE-LA 1976; Shaw 1980			
			"accretion on N side of groins"		source: Shaw 1980			
					source: USACOE-LA 1976			
		\$2,157,000 (7 groins plus fill)	"accretion on N side of groins"		source: USACOE-LA 1976; CA Dept of Nav and Ocean Dev 1976;			
	current bypassing has problems				source: Herron 1987			
USACOE		\$2,157,000 \$370,000		beach profiles by Ventura Port District, annually in September		CD-036-89		
					source: CA-DNOD 1976 source: CA-DNOD 1976			
USACOE						CD-002-83	CDP 4-83-257A (in lieu of CD-43-84)	CD-25-84; CD-30-85; CD-42-88; CD-17-89
USACOE			to mitigate impacts to access, Corps will fill beach in stages; will operate single discharge points to mitigate tern and grunion impacts		2600 ft beach frontage	CD-025-84	CP 4-83-257	
USACOE		Section 111, RHA 1968						
USACOE		Section 111, RHA 1968						
USACOE		Section 111, RHA 1968						
USACOE					sand dredged from around pier; will be placed either in sand trap to be dredged with next maintenance dredging or directly into nearshore somewhere downdrift.	CD-168-97		
USACOE			least turn nesting, brown pelican (dredging)	Corps will monitor to define erosion issues	disposal site ~1400 ft long, from first groin in Pierpont groin field	CD-030-85		CD-25-84; CD-42-88; CD-17-89
					source: Shaw 1980			
					source: Shaw 1980			
					source: Shaw 1980			
					source: Shaw 1980			
LA Co/ USACOE			storing sand in backshore until winter to avoid grunion and least turn spawning season		noted in CD-02-83			
USACOE			storing sand in backshore until Sept. 1 to avoid grunion and least turn spawning season		dredging-induced opportunistic surf zone nourishment was conducted prior to this project	CD-002-83		
			"1977: Effect of bypassing overshadowed by extremely high sediment flows in Santa Clara River."		source: Shaw 1980			
					source: Shaw 1980			
USACOE			grunion spawning, salt marsh bird's beak, The Belding's Savannah Sparrow (nourishment); least turn nesting (dredging)		disposal site ~4400 ft long	CD-030-85		CD-25-84; CD-42-88; CD-17-89
USACOE/Ventura Port District			increased turbidity, loss of O2, loss of benthics, impacts to least tern, grunion	beach profiles by Ventura Port District	nearshore disposal -> berm: -15' MLLW, 4300' long, 900' footprint, b/w -15' and -10' contours	CD-053-91	CDP 4-83-257	ND-42-88; CD-17-89
USACOE			terns, grunions, plover		beginning 100' S of Santa Clara River mouth and extending S for 4300'	CD-054-94		
USACOE			grunion, least terns, snowy plovers; single point diked discharge to minimize turbidity; discharge further than 200' from mouth of Santa Clara River to minimize impacts to steelhead trout in estuary			CD-64-98		CD-54-94; CD-53-91; CD-42-88; CD-51-86; CD-30-85; CD-2-83

TABLE2TASK3CSMW.xls

Site	Cell	City/County	Latitude	Longitude	Database	Date of project	Dredge/Fill Volume (yd ³)	Fill Source/Site	Dredge/Transport Method	Dredge/Fill Characteristics	Activity
Silver Strand Beach	Santa Barbara	Port Hueneme, Ventura Co.			RW94	1973	75000	Channel Islands Harbor maintenance dredging			R
Silver Strand Beach	Santa Barbara	Port Hueneme, Ventura Co.			RW94	1975	100000	Channel Islands Harbor maintenance dredging			R
Silver Strand Beach	Santa Barbara	Port Hueneme, Ventura Co.			RW94	1977	100000	Channel Islands Harbor maintenance dredging			R
Silver Strand Beach	Santa Barbara	Port Hueneme, Ventura Co.			RW94	1981	100000	Channel Islands Harbor maintenance dredging			R
Silver Strand Beach	Santa Barbara	Port Hueneme, Ventura Co.			RW94	1983	150000	Channel Islands Harbor maintenance dredging			R
Silver Strand Beach	Santa Barbara	Port Hueneme, Ventura Co.			RW94	1987	378000	Channel Islands Harbor maintenance dredging			R
Silver Strand Beach	Santa Barbara	Port Hueneme, Ventura Co.			FC	9/1/88 - 3/15/89; 9/1/90 - 3/15/91; 9/1/92 - 3/15/93	300,000	maintenance dredging of Channel Islands Harbor sand trap, entrance basin, channel	diesel or electric cutterhead hydraulic dredge; buried hydraulic pipeline (placed 800' downcoast of harbor S jetty)	initially black and smelly	DS, DR
Silver Strand Beach	Santa Barbara	Port Hueneme, Ventura Co.			TC89	occasionally	200,000/yr	nearby maintenance dredging			N
Silver Strand Beach	Santa Barbara	Port Hueneme, Ventura Co.			TC91	occasionally	200,000 cu/yr				harbor bypassing
Silver Strand Beach	Santa Barbara	Port Hueneme, Ventura Co.			FC	Sept. '83 to March '84	150,000	Channel Islands Harbor	dredged from harbor, transported via buried discharge pipeline	?	DS, DR
Silver Strand Beach	Santa Barbara	Port Hueneme, Ventura Co.			FC	10/94 - 3/95; 10/96 - 3/97; 10/98 - 3/99	6,900,000 (over 6 years)	Channel Islands Harbor and Port Hueneme	maintenance dredging	predominantly sandy	DR, R
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura Co.			TC'89	1935-1940	1,500,000	excavation of Port Hueneme harbor			R
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			Shaw'80	1939	2,614,000	Port Hueneme			
Hueneme Beach	Santa Barbara	Port Hueneme, Ventura Co.			TC'91	1940	1,360,000	Port Hueneme harbor excavation			Harbor construction
Hueneme Beach	Santa Barbara	Port Hueneme, Ventura Co.			TC'91	1941					
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			Shaw'80	1953-1954	1,986,640	Port Hueneme	bypassed		
Hueneme Beach	Santa Barbara	Port Hueneme, Ventura Co.			TC'91	1954	2,033,000				harbor bypassing
Hueneme Beach	Santa Barbara	Port Hueneme, Ventura Co.			RW94	1960	3,700,000	Channel Islands Harbor excavation			harbor construction
Hueneme Beach	Santa Barbara	Port Hueneme, Ventura Co.			TC'89	1960		Channel Islands harbor excavation and bypassing			B, N
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			Shaw'80	1960-1961	6,234,390	Channel Islands Harbor sand trap			
Hueneme Beach	Santa Barbara	Port Hueneme, Ventura Co.			TC'91	1961	6,000,000	Channel Islands harbor			Harbor construction
Hueneme Beach	Santa Barbara	Port Hueneme, Ventura Co.			TC'91	1963	1,986,000				harbor bypassing
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			Shaw'80	1963	1984026	Channel Islands Harbor sand trap			
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			Shaw'80	1965	3524979	Channel Islands Harbor sand trap			
Hueneme Beach	Santa Barbara	Port Hueneme, Ventura Co.			TC'91	1965	3,527,000				harbor bypassing
Hueneme Beach	Santa Barbara	Port Hueneme, Ventura Co.			TC'91	1968	1,704,000				harbor bypassing
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			Shaw'80	1968	1670346	Channel Islands Harbor sand trap			
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			Shaw'80	1969-1970	2722481	Channel Islands Harbor sand trap	initially widened beach 30 m		
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura Co.			TC'91	1970	2,777,333		widened beach 99 ft		harbor bypassing
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura Co.			TC'91	1971	2,533,333		widened beach 99 ft		harbor bypassing
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			Shaw'80	1971	2483300	Channel Islands Harbor sand trap and entrance channel			
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			Shaw'80	1973	2483300	Channel Islands Harbor sand trap and entrance channel			
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura Co.			TC'91	1973	2,533,333				harbor bypassing
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			Shaw'80	1975	109,788	Port Hueneme			
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura Co.			TC'91	1975	1,768,000				harbor bypassing
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			Shaw'80	1975	1623294	Channel Islands Harbor sand trap and entrance channel			
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			Shaw'80	1977	2483300	Channel Islands Harbor sand trap and entrance channel			
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura Co.			TC'91	1977	2,533,333				harbor bypassing
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura Co.			TC'89	1941, 1943, 1954,					R
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			FC	1985? In the future	61,000	Channel A, Port Hueneme, below +1' MLLW	hydraulic dredge from MLLW down to -20'; placed in surf zone unless grunion season; then placed above H20 line	compatible w/ local sediment	N, R, DS, DR
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura Co.			TC'89	every two years since 1960		Channel Island Harbor and Port Hueneme Harbor bypassing			B, N
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			FC	October '84 to March '85	2,000,000	Channel Islands Harbor (sand trap and entrance channel)	hydraulic cutterhead dredge; deposited hydraulically via buried pipeline (+10 ft MLLW, 50 ft. from HWL); (downcoast of E Jetty to beyond pier)		R, DS, DR
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			FC	Sept. '83 to March '84	1,350,000	Channel Islands Harbor	dredged from harbor, transported via buried discharge pipeline	?	DS, DR
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			FC	Sept. '83 to March '84	200,000	Hueneme Harbor	dredged from harbor, transported via buried discharge pipeline	clean sand	DS, DR
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			ACOE'90	1987	2,000,000	Channel Islands Harbor	beach disposal		DR, DS

TABLE2TASK3CSMW.xls

Applicant/Sponsor	Duration of Fill/Performance	Funding	Environmental Effects	Monitoring	Notes	Ref. ID	Permit/FC Ref.	See Also	
					source: USA/CESPL as given in Noble 89 as given in Wiegel '94				
					source: USA/CESPL as given in Noble 89 as given in Wiegel '94				
					source: USA/CESPL as given in Noble 89 as given in Wiegel '94				
					source: USA/CESPL as given in Noble 89 as given in Wiegel '94				
					source: USA/CESPL as given in Noble 89 as given in Wiegel '94				
					source: USA/CESPL as given in Noble 89 as given in Wiegel '94				
USACOE					3000' along beach source: CA-DNOD 1977; Armstrong 1987 source: Herron and Harris 1966; Armstrong 1987	CD-004-89		CD-25-83; CD-53-84; CD-43-86/CD-60-86	
USACOE						CD-025-83	CDP 4-83-257		
USACOE			need to protect least terns, grunions, snowy plover; limit post-March 31 disposal to diked or single-point disposal; map for plovers pre-disposal; mitigate impacts to pismo clams			CD-052-94		CD-4-89; CD-7-89; CD-80-86; CD-43-86; CD-53-84; CD-25-83; CD-15-90; CD-12-85	
	3 years								
	total loss and beyond w/in 3 years	\$295,800			source: USACOE-LA 1954 source: USACOE-LA 1954				
					*Plan only partially successful. Bypassed only half the planned volume, b/c of difficulty of dredging in surf zone. Gave temporary respite, but by 1958, city of Port Hueneme again building emergency seawall. " source: USACOE-CERC 1984				
		\$1,250,000 \$951,000			source: Herron 1987; Herron and Harris 1966 source: Herron and Harris 1966				
			"Of 14M cy pumped to feeder beach b/w 1960 and 1966, some 9M cy have moved on downcoast."		source: Herron and Harris 1966 source: Shaw 1980, Herron and Harris 1966				
		\$852,000							
					source: Shaw 1980 source: Shaw 1980				
					source: Shaw 1980				
					source: Shaw 1980				
	bypassing has overcome problem				source: Shaw 1980; Armstrong 1987; Herron 1987; USACOE-CERC 1984 source: Hall 1952; Herron and Harris 1962)				
USACOE					additional 163,000 yd³ needed to be dredged/disposed in 1986 source: Shaw 1980	CD-012-85	CDP 4-86-204		
USACOE			coverage/disturbance/elimination of benthic communities; turbidity; fish displacement			CD-053-84		CD-25-83; CD-12-85; CD-62-87	
USACOE			no fill deposition after March 31 due to grunion spawning; avoid least turn nesting			CD-025-83	CDP 4-83-473	CD-53-84; CD-12-85;	
USACOE						CD-025-83	CDP 4-83-257		
USACOE		Section 111, RHA 1968							

TABLE2TASK3CSMW.xls

Site	Cell	City/County	Latitude	Longitude	Database	Date of project	Dredge/Fill Volume (yd ³)	Fill Source/Site	Dredge/Transport Method	Dredge/Fill Characteristics	Activity
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			FC	3/15/87 - 5/30/87	500,000	Channel Islands harbor entrance, basin, sand trap	routine dredging; diesel dredge; bermed disposal site >25' from highest contour of wave runup, 1700' long, 7' above MLLW; single return water discharge point	littoral drift material	DS, DR
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			FC	1989	2,200,000	maintenance dredging of Channel Islands Harbor sand trap, entrance basin, channel	diesel or electric cutterhead hydraulic dredge; hydraulic pipeline on beach surface	initially black and smelly	DS, DR
Hueneme Beach Park	Santa Barbara	Port Hueneme, Ventura County			FC	10/94 - 3/95; 10/96 - 3/97; 10/98 - 3/99	6,900,000 (over 6 years)	Channel Islands Harbor and Port Hueneme	maintenance dredging	predominantly sandy	DR, R
Hueneme Beach	Santa Barbara	Port Hueneme, Ventura County			FC	1999-2000	630,000	Port Hueneme	maintenance dredging; on or nearshore disposal	clean sediment	
Pacific Missile Range	Santa Barbara	Point Mugu, Ventura County			TC'89	1947	700,000	Mugu lagoon			DR, N
Pacific Missile Range	Santa Barbara	Point Mugu, Ventura County			TC'91	1947	709,333				
Pacific Missile Range	Santa Barbara	Point Mugu, Ventura County			Shaw'80	1947	695,324	Mugu Lagoon		fill degraded rapidly	
Pacific Missile Range	Santa Barbara	Point Mugu, Ventura County			RW'94	1961			3 groins constructed with fill	sand	groins and fill
Las Tunas Beach	Santa Monica	Malibu, Los Angeles Co.			TC'89	1960-1974	50,000				R
Las Tunas Beach	Santa Monica	Malibu, Los Angeles Co.			TC'91	1960-1974	-50,000				beach erosion control
Will Rogers State Beach	Santa Monica	Pacific Palisades, Los Angeles Co			TC'91						
Santa Monica State Beach	Santa Monica	Santa Monica, Los Angeles Co.			TC'91	1939					
Santa Monica Beach	Santa Monica	Venice Beach, Los Angeles County			Shaw'80	1939	60,122	Santa Monica Breakwater	Ocean Park to Santa Monica Pier		
Santa Monica State Beach	Santa Monica	Santa Monica, Los Angeles Co.			TC'91	1943	150,000				beach erosion control
Santa Monica Beach	Santa Monica	Venice Beach, Los Angeles County			Shaw'80	1949	396,021	Santa Monica Breakwater	deposited from Ocean Park Pier to Santa Monica Pier		
Santa Monica State Beach	Santa Monica	Santa Monica, Los Angeles Co.			TC'91	1950	1,000,000				
Santa Monica State Beach	Santa Monica	Santa Monica, Los Angeles Co.			TC'89	1939, 1949, 1950					R
Santa Monica State Beach	Santa Monica	Santa Monica, Los Angeles Co.			RW'94	1945	150,000				R
Santa Monica State Beach	Santa Monica	Santa Monica, Los Angeles Co.			LHW'94	1939	60,000	Santa Monica Breakwater	bypassing		
Santa Monica State Beach	Santa Monica	Santa Monica, Los Angeles Co.			LHW'94	1949-50	960,000	Santa Monica Breakwater	bypassing		
Santa Monica State Beach	Santa Monica	Santa Monica, Los Angeles Co.			LHW'94	1957-58	780,000	Santa Monica Breakwater	bypassing		
Venice City Beach	Santa Monica	Venice, Los Angeles County			LHW'94	1945	150,000	Hyperion excavation			DS
Venice City Beach	Santa Monica	Venice, Los Angeles County			RW'94	1945	150,000	Hyperion sewage disposal plant			erosion control
Venice City Beach	Santa Monica	Venice, Los Angeles County			TC'89	1945	140,000	nearby dunes	trucked from dunes to beach		R
Venice City Beach	Santa Monica	Venice, Los Angeles County			TC'91	1945	140,000		0.6 mi long; 75 ft fill width		beach restoration
Venice Beach	Santa Monica	Venice Beach, Los Angeles County			Shaw'80	1945	148,998	Santa Monica Breakwater	Venice Pier to Washington St.		
Venice City Beach	Santa Monica	Venice, Los Angeles County			RW'94	1947		Hyperion sewage disposal plant			R
Venice Beach	Santa Monica	Venice Beach, Los Angeles County			Shaw'80	1948	1,390,648	Santa Monica Breakwater	El Segundo to Ocean Park; widened beach ~180 m (x ft)		
Venice City Beach	Santa Monica	Venice, Los Angeles County			RW'94	1973	17,000	entrance of Marina Del Rey			maintenance dredging
Venice City Beach	Santa Monica	Venice, Los Angeles County			TC'89	1975	11,000				R
Venice City Beach	Santa Monica	Venice, Los Angeles County			TC'91	1975	11,000				R
Venice Beach	Santa Monica	Venice Beach, Los Angeles County			Shaw'80	1975	10,456	Marina Del Rey	bypassing		
Venice City Beach	Santa Monica	Venice, Los Angeles County			FC	March - May 1998	<123,000	Marina Del Rey Harbor (sand trap)	either hopper dredge, clamshell dredge with disposal barge or hydraulic cutterhead with pipeline; pipeline w/ single-pt. discharge in intertidal zone	99% sand	DS, DR
Venice City Beach/Dockweiler	Santa Monica	Venice, Los Angeles County			LHW'94	1947	13,900,000	Hyperion excavation			DS
Venice City Beach/Dockweiler	Santa Monica	Santa Monica, Los Angeles Co.			RW'94	1946-48	-14,000,000	Hyperion sewage disposal plant excavation	hydraulically excavated from sand dunes		DS, R
Venice City Beach/Dockweiler	Santa Monica	Santa Monica, Los Angeles Co.			TC'89	1947-48	14,000,000	Hyperion sewage disposal plant excavation		sand from sand hills	R
Venice City Beach/Dockweiler	Santa Monica	Playa Del Rey, Los Angeles County			Shaw'80	1948	13,984,900	nearby sand hills (Hyperion excavation)	sand hydraulically removed from hills, transported to beach via discharge pipes		
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			LHW'94	1938	1,800,000	Hyperion excavation			DS
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles County			Shaw'80	1938	1,803,660	nearby sand hills			
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			LHW'94	1969	389,000	Marina Del Rey Harbor (sand trap) bypassing	bypassed		
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			LHW'94	1975	10,000	Marina Del Rey Harbor (sand trap) bypassing	bypassed		
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			LHW'94	1981	217,000	Marina Del Rey Harbor (sand trap) bypassing	bypassed		
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			LHW'94	1987	35,000	Marina Del Rey Harbor (sand trap) bypassing	bypassed		
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			TC'89	1938	1,800,000	nearby hills	Dockweiler: from El Segundo/LA City border to Marina Del Rey		R
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			TC'91	1938	1,840,000				upland excavation fill
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			RW'94	1956	2,400,000	electric power plant excavation	"placed along 8,600 ft of Dockweiler beach southerly from the Ballona Creek jetties. Bulldozers, conveyor belts and dump trucks were used to move the sand."		upland excavation fill
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			LHW'94	1956	2,400,000	Scattergood power plant			DS
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles County			Shaw'80	1962	3,202,150	Marina Del Rey	downcoast of Ballona Creek		
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			LHW'94	1960-62	3,200,000	Marina Del Rey			DS
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			TC'91	1962	3,000,000				harbor construction
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			LHW'94	1963	6,900,000	Marine Del Rey			DS
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			TC'91	1963	<7,022,667				
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			RW'94	1969	389,000	entrance of Marina Del Rey			maintenance dredging
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			TC'91	1975	10,667				
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			RW'94	1981	217,000	entrance of Marina Del Rey			maintenance dredging
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			RW'94	1987	35,000	entrance of Marina Del Rey			maintenance dredging

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Applicant/Sponsor	Duration of Fill/Performance	Funding	Environmental Effects	Monitoring	Notes	Ref. ID	Permit/FC Ref.	See Also
USACOE			disposal site diked to minimize impacts to grunion; return flow clearer due to dike decanting		notes ocean disposal is more costly than beach disposal	CD-060-86		CD-43-86; CD-25-83; CD-53-84
			use of diked beach disposal proposed to minimize impacts to grunion spawning after March 15			CD-004-89		CD-25-83; CD-53-84; CD-43-86/CD-60-86
USACOE DR, DS	USACOE		need to protect least terns, grunions, snowy plover; limit post-March 31 disposal to diked or single-point disposal; map for plovers pre-disposal			CD-052-94 CD-030-99		
	degraded rapidly							
	fill downgraded rapidly				source: Shaw 1980			
					source: USACOE-LA 1974			
					source: USCOE-LA (Las Tunas) 1974			
					source: Griggs and Savoy 1986			
					source: Shaw 1980			
		\$88,000			source: USACOE-LA 1986 (oral)			
		\$250,000	"Nullified downdrift erosion damage caused by Santa Monica breakwater and resultant. Today's beach is totally artificial & much wider today than natural beach of 50 years ago."		source: Hall 1952			
	major portion there after 4yrs 1949 still there; estimated life=10 yr	\$10,500			source: Johnson 1950			
					sources: Johnson, 1950; Hall 1952; Shaw 1980			
		\$7,000			source: Shaw 1980			
					source: Shaw 1980			
USACOE			severe impacts to least tern nesting			CD-002-98		
	1 mil.yd ³ /yr initially				widened beach to avg. width of 600' (Johnson 1950) to 800' (Kenyon 1950)			
					source: Shaw 1980			
					source: Shaw 1980			
					placed in anticipation of downcoast erosion from Marina Del Rey jetties; no serious erosion in 1986. Source: USCOE-LA 1986			
					source: Shaw 1980			
					source: Shaw 1980			

TABLE2TASK3CSMW.xls

Site	Cell	City/County	Latitude	Longitude	Database	Date of project	Dredge/Fill Volume (yd ³)	Fill Source/Site	Dredge/Transport Method	Dredge/Fill Characteristics	Activity
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			ACOE'90	1987	31,000	Marina Del Rey	beach fill		DR, DS
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			FC	February 2, 1987 March 15, 1987	200,000	Marina Del Rey Harbor entrance and approach channels, and Ballona Creek mouth	electric or diesel dredge; discharge pipeline on sand above supratidal zone	predominantly sand	DS, DR
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			RW'94	1988	155,000	Hyperion excavation expansion			DS
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			LHW'94	1988	155,000	Hyperion excavation expansion			DS
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			RF '93	1989	1,097,880	Hyperion sewage disposal plant excavation	"transported by conveyor belt..across Pacific Coast Highway to Dockweiler Beach"		R
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			RW'94	1989	1,100,000	Hyperion sewage disposal plant excavation	"The sand was transported from the excavation site by a dry-haul conveyor system through a 9-ft diameter steel casing installed under the 4-lane coastal highway (Vista Del Mar) and the bicycle path seaward of the highway to the beach, then along the beach by conveyor to the placement site (either upcoast or downcoast), and finally handled by use of bulldozers."		R
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			FC	March - May 1998	<123,000	Marina Del Rey Harbor (sand trap)	either hopper dredge, clamshell dredge with disposal barge or hydraulic cutterhead with pipeline; pipeline w/ single-pt. discharge in intertidal zone	99% sand	DS, DR
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			TC'89	occasionally		Marina del Rey	dredging		
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			FC	1999	150,000	Marina Del Rey Harbor		clean sand	DR, DS
Dockweiler Beach	Santa Monica	Playa Del Rey, Los Angeles Co			CDP	1999	215,655	Marina Del Rey	North Jetty dredging and related federal project; to widen beach by 100 ft at end of Torrance Blvd, Redondo Beach and Dockweiler	clean sand	DR, DS
El Segundo	Santa Monica	El Segundo, Los Angeles Co.			TC'89	1936	1,800,000	nearby dunes			R
El Segundo	Santa Monica	El Segundo, Los Angeles Co.			TC'91	1936	1,800,000		1.8 mi long; 200 ft wide		upland excav./ beach rest.
El Segundo	Santa Monica	El Segundo, Los Angeles Co.			TC'89	early 1980s	750,000		in conjunction with groin construction		R
El Segundo	Santa Monica	El Segundo, Los Angeles Co.			TC'91	early 1980s	750,000				beach widening
El Segundo	Santa Monica	El Segundo, Los Angeles Co.			LHW'94	1984	620,000	offshore			nourishment
El Segundo	Santa Monica	El Segundo, Los Angeles Co.			RW'94	1988	550,000	Hyperion excavation expansion	downcoast of Chevron groin		R
El Segundo	Santa Monica	El Segundo, Los Angeles Co.			RW'94	1989-90	945,000	Hyperion excavation expansion			R
El Segundo	Santa Monica	El Segundo, Los Angeles Co.			LHW'94	1989-90	945,000	Hyperion excavation expansion			DS
Redondo Beach	Santa Monica	Redondo Beach, Los Angeles Cc			LHW'94	1947	100,000	onshore			nourishment
Redondo Beach	Santa Monica	Redondo Beach, Los Angeles Cc			TC'91	1947	57,000				beach restoration
Redondo Beach	Santa Monica	Redondo Beach, Los Angeles Cc			RW'94	1947	?220,000				
Redondo Beach	Santa Monica	Redondo Beach, Los Angeles Co			TC'89	once during 1940s					R
Redondo Beach	Santa Monica	Redondo Beach, Los Angeles Co			TC'89	once during 1950s					R
Redondo Beach	Santa Monica	Redondo Beach, Los Angeles Co			TC'91	1956-58					navigation/beach erosion control
Redondo Beach	Santa Monica	Redondo Beach, Los Angeles Cc			RW'94	1962	?220,000				
Redondo Beach	Santa Monica	Redondo Beach, Los Angeles Co			TC'89	1968	1,400,000	offshore	pumped		R
Redondo Beach	Santa Monica	Redondo Beach, Los Angeles Co			TC'91	1968	1,405,961				beach erosion control
Redondo Beach	Santa Monica	Redondo Beach, Los Angeles Co			RW'94	1968	1,400,000	offshore	7800ft long; source was 30-60 ft below MLLW, ~1700' offshore; "A hopper dredge and floating pipeline operated in a water depth of about 37 ft, and pumped sand to shore," deposited on Redwood Beach, Topaz St. to Malaga Cove, using hydraulic pipeline from 9-20 m below MLLW	fill: 0.4-0.7 mm med. Diameter; native 0.5 mm ~400.00 cy migrated N into King Harbor by mid-1969	
Redondo Beach	Palos Verdes County	Redondo Beach, Los Angeles			Shaw'80	1968	1,398,490	offshore			nourishment
Redondo Beach	Santa Monica	Redondo Beach, Los Angeles Cc			LHW'94	1968-69	1,400,000	offshore			groin and replenishment
Redondo Beach	Santa Monica	Redondo Beach, Los Angeles Co			SPCA'76	1970					
Redondo Beach	Santa Monica	Redondo Beach, Los Angeles Co			TC'91	1971	1,020,000				
Redondo Beach	Santa Monica	Redondo Beach, Los Angeles County			Shaw'80	1971	999,855	offshore	deposited beach using hydraulic pipeline from 9-20 m below MLLW		
Redondo Beach	Santa Monica	Redondo Beach, Los Angeles Co			FC	proposed 1991	6,000	King Harbor, harbor side of N breakwater	disposal in surf zone	fine to medium grained sands, with only minor amounts of gravel and/or fines	R, DS, DR
Redondo Beach	Santa Monica	Redondo Beach, Los Angeles Co				2000	230,000	nearshore deposits from previous Harbor dredging	transported by barge from dredge site to dump site, then hydraulically pumped from nearshore to onshore		R
Santa Monica Bay Beaches	Santa Monica	Santa Monica, Los Angeles Co.			RF '93	1947	14,377,000	Hyperion sewage disposal plant excavation			upland excavation fill
Santa Monica Bay Beaches	Santa Monica	Santa Monica, Los Angeles Co.			RF '93	1960-1963	10,063,900	Marina Del Rey excavation			harbor excavation
Santa Monica Bay Beaches	Santa Monica	Santa Monica, Los Angeles Co.			TC'91	1947-1948	14,000,000		-7 mi. long; avg. beach width 600-800 ft		upland excavation fill
Cabrillo Beach	San Pedro	San Pedro, Los Angeles Co.			TC'89	1927					R
Cabrillo Beach	San Pedro	San Pedro, Los Angeles Co.			TC'91	1927	500,000		0.2 mi long; beach width 200ft		beach restoration
Cabrillo Beach	San Pedro	San Pedro, Los Angeles Co.			RW'94	1927	500,000	Outer LA Harbor			
Cabrillo Beach	San Pedro	Los Angeles, Los Angeles County			Shaw'80	1927	496660	Fillet south of San Gabriel River jetty		migrated E along breakwater into harbor	
Cabrillo Beach	San Pedro	Los Angeles, Los Angeles County			Shaw'80	1948	2866251	Fillet south of San Gabriel River jetty		migrated into harbor and offshore	
Cabrillo Beach	San Pedro	San Pedro, Los Angeles Co.			TC'91	1948	2,536,500		0.4 mi long; beach width 500 ft		beach restoration
Cabrillo Beach	San Pedro	San Pedro, Los Angeles Co.			RW'94	1948	2,900,000	Outer LA Harbor			
Cabrillo Beach	San Pedro	Los Angeles, Los Angeles County			Shaw'80	1963	1202440	Los Angles Harbor, West Basin		stabilized beach at groin	

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Applicant/Sponsor	Duration of Fill/Performance	Funding	Environmental Effects	Monitoring	Notes	Ref. ID	Permit/FC Ref.	See Also
USACOE		Section 111, RHA 1968						
USACOE			no effects on endangered species; time to accommodate grunion			CD-057-86	CDP 129-81	
					source: Woodell and Hollar, 1991			
USACOE			severe impacts to least tern nesting			CD-002-98		CD-23-88; CD-31-91; CD-53-92; CD-68-94; CD-88-94; ND-112-94; ND-22-96
					result of periodic nourishment: "wide beach stabilized by groins and by the King Harbor breakwater (CA-DNOD 1977)."			
USACOE						CD-022-99		
LA County							App. #5-99-232 (PE-LB)	
					1.8 miles of beach; source: Hall 1952			
					source: Hall 1952			
Chevron USA, Inc				3 years required by permit; no report				
					source: Pratt 1984			
					source: Coastal Frontiers Corp. 1992			
		\$7,000			source: Hall 1952			
LA County								
					source: USACOE-LA 1959 (So.Cal.)			
USACOE	by mid-1969 30% of fill had migrated N 30% lost in year 1; reshaped and terminated successfully							
		\$1,500,000	sand tends to migrate N and S; causes shoaling in King Harbor, Redondo Harbor					
					source: USACOE 1970, Shaw 1980			
					sources: Shaw 1980; USACOE-LA 1970; Saville 1981			
		\$2,400,000			source: CA-DNOD 1976			
	destroyed, winter 1983	\$2,400,000			source: Pipkin 1986; questioned and doubted by Weigel 1994 for lacking original source			
USACOE			exceptionally dense marine fauna			CD-025-91		
city of Los Angeles			beach is 180 ft. wide		from http://beaches.co.la.ca.us/scripts/redondo1.htm			
					source: Flick 1993			
					source: Flick 1993			
	initial losses 1cm/yr				sources: Johnson, 1950; Kenyon, 1950; USACOE 1986 (oral)			
			sand migrated E into harbor					
	migrated E into LA harbor	\$100,000			source: Hall 1952; Shaw 1980			
	"sand moved away"				source: USA/CESPL Cabrillo Report, 1989			
	migrated E into LA harbor and offshore	\$1,014,600			source: Hall 1952; Shaw 1980			
	"sand moved away"				source: USA/CESPL Cabrillo Report, 1989			

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Site	Cell	City/County	Latitude	Longitude	Database	Date of project	Dredge/Fill Volume (yd ³)	Fill Source/Site	Dredge/Transport Method	Dredge/Fill Characteristics	Activity
Cabrillo Beach	San Pedro	San Pedro, Los Angeles Co.			RW94	1963	1,200,000	West Basin, LA Harbor	pumped		
Cabrillo Beach	San Pedro	San Pedro, Los Angeles Co.			TC'89	1964	1,300,000		in conjunction with terminal groin built in 1962		R
Cabrillo Beach	San Pedro	San Pedro, Los Angeles Co.			TC'91	1964	1,226,667				navigation
Cabrillo Beach	San Pedro	San Pedro, Los Angeles Co.			RW94	1991	220,000	Hyperion facility	trucked	coarser than original sand	
Long Beach	San Pedro	Long Beach, Los Angeles Co.			TC'91	1955					harbor construction
Long Beach	San Pedro	Long Beach, Los Angeles Co.			TC'91	1942-43	>6,000,000		-4 mi long		beach widening/ navigation
Long Beach	San Pedro	Long Beach, Los Angeles Co.			TC'91	1945-46	800,000				navigation
Long Beach	San Pedro	Long Beach, Los Angeles Co.			RW94	1943-46	-6,000,000	Los Angeles River delta	placed along 4 miles from Rainbow Pier east to - Belmont Pier		flood control dredging
Long Beach	San Pedro	Long Beach, Los Angeles Co.			RW94	1945-46	800,000	channel dredged in Alamitos Bay	placed along beach updrift of entrance channel to Bay		
Long Beach City Beach	San Pedro	Long Beach, Orange Co.			Shaw'80	1946	794656	Alamitos Bay Channel			
Long Beach	San Pedro	Long Beach, Los Angeles Co.			TC'89	1946 to 1989	9,000,000 +				R
Long Beach	San Pedro	Long Beach, Los Angeles Co.			TC'91	1975-85	-2,026,670		beach 300-1200 ft wide		navigation
Long Beach	San Pedro	Long Beach, Los Angeles Co.			FC	1996-1998	109,000	Golden Shore Public boat launch	4000 truck trips (placed b/w 1st Pl and 15th Pl.)	90-95% sand = fill; 88.6 - 99.2% sand = site	DR, R
Long Beach (surf zone)	San Pedro	Long Beach, Los Angeles Co.			FC	1999	100-120,000	West Basin, Long Beach Harbor	disposal in surf zone west of Alamitos Bay west jetty		DR, R
Seal Beach	San Pedro	Seal Beach, Orange County			LAD93-1	1954	800,000	?			
Seal Beach	San Pedro	Seal Beach, Orange County			LAD93-1	1955	400,000	Long Beach Marina excavation			replenishment
Seal Beach	San Pedro	Seal Beach, Orange County			LAD93-1	1956	200,000	Outer Anaheim Harbor			replenishment
Seal Beach	San Pedro	Seal Beach, Orange County			TC'91	1958	800,000				
Seal Beach	San Pedro	Seal Beach, Orange County			RW94	1959	?250,000 or 200,000	San Gabriel River or Navy harbor	placed on SE section of beach bisected by groin		
Seal Beach	San Pedro	Seal Beach, Orange County			Shaw'80	1959	248330	Anaheim Bay			
Seal Beach	San Pedro	Seal Beach, Orange County			LAD93-1	1959	225,000	?			replenishment
Seal Beach	San Pedro	Seal Beach, Orange County			SPCA'76	1960					groin and fill
Seal Beach	San Pedro	Seal Beach, Orange County			TC'91	1960	250,000		1.0 mi long		beach erosion control
Seal Beach	San Pedro	Seal Beach, Orange County			LAD93-1	1967	70,000	San Gabriel River			replenishment
Seal Beach	San Pedro	Seal Beach, Orange County			TC'91	1968	70,000				
Seal Beach	San Pedro	Seal Beach, Orange County			LAD95	1983	250,000	Anaheim Bay Naval Weapons Station			R
Seal Beach	San Pedro	Seal Beach, Orange County			FC	1983	350,000	Anaheim Bay Naval Weapons Station	dredged via hydraulic suction dredge; discharged into intertidal zone from 16-26" diameter pipeline running from harbor entrance to beach; Sept. '82 - Feb. '83		R, DS, DR
Seal Beach	San Pedro	Seal Beach, Orange County			RW94	1983	250,000	Anaheim Bay Naval Weapons Station	maintenance dredging		
Seal Beach	San Pedro	Seal Beach, Orange County			P,Y'89	1983	250,000	Anaheim Bay Naval Weapons Station			
Seal Beach	San Pedro	Seal Beach, Orange County			LAD93-1	1983	80,000 - 250,000	Anaheim Bay Naval Weapons Station	dredged from Bay approach and placed on East Beach	very fine sand	replenishment
Seal Beach	San Pedro	Seal Beach, Orange County			LAD93-1	1988	110,000	Anaheim Bay Naval Weapons Station	dredged from Outer Bay and placed on East Beach		replenishment
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD95	1945	202,000	Anaheim Bay Naval Weapons Station			R
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			P,Y'89	1945	202,000	Anaheim Bay Naval Weapons Station			R
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			RW94	1945	202,000	Anaheim Bay Anaheim Bay Naval Weapons Station	new harbor construction		
Surfside-Sunset Beach	San Pedro	Huntington Beach, Orange Co.			Shaw'80	1945	201278	Santa Ana River		eroded steadily	
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			TC'91	1945	205,333				
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD95	1947	1,220,000	Anaheim Bay Naval Weapons Station			R
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			P,Y'89	1947	1,220,000	Anaheim Bay Naval Weapons Station			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			RW94	1947	1,220,000	Anaheim Bay Anaheim Bay Naval Weapons Station	new harbor construction		
Surfside-Sunset Beach	San Pedro	Huntington Beach, Orange Co.			Shaw'80	1947	1220738	Santa Ana River		eroded steadily	
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			TC'91	1947	1,245,333				
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD95	1956	874,000	Anaheim Bay Naval Weapons Station			R
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			P,Y'89	1956	874,000	Anaheim Bay Naval Weapons Station			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			RW94	1956	874,000	Anaheim Bay Anaheim Bay Naval Weapons Station			
Surfside-Sunset Beach	San Pedro	Huntington Beach, Orange Co.			Shaw'80	1956	873076	Santa Ana River		eroded steadily	
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			TC'91	1956	890,667				
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			TC'91	1961			restored beach buffer		emergency
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD95	1964	4,000,000	Anaheim Bay Naval Weapons Station			R
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD95	1964	1,315,000	Anaheim Bay Naval Weapons Station			R
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD99	1964	4,000,000	Seal Beach Naval Weapons Station	created feeder beach, 500' wide x 9200' long; June		R
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			P,Y'89	1964	4,000,000	Anaheim Bay Naval Weapons Station			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			P,Y'89	1964	1,315,000	Anaheim Bay Naval Weapons Station			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			RW94	1964	4,000,000	Anaheim Bay Anaheim Bay Naval Weapons Station	construction/channel deepening		
Surfside-Sunset Beach	San Pedro	Huntington Beach, Orange Co.			Shaw'80	1964	3999420	Anaheim Bay	initially expanded 150 m (x ft) in width (2790m/xf long)	migrated south	

TABLE2TASK3CSMW.xls

Site	Cell	City/County	Latitude	Longitude	Database	Date of project	Dredge/Fill Volume (yd ³)	Fill Source/Site	Dredge/Transport Method	Dredge/Fill Characteristics	Activity
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			TC'91	1964	4,000,000	Anaheim Bay Naval Weapons Station	1.7 mi long; ~450 ft wide feeder beach		beach erosion control
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD95	1971	2,260,000	Seal Beach Naval Weapons Station			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD99	1971	2,300,000	Anaheim Bay Naval Weapons Station	May		R
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			P,Y'89	1971	2,250,000	Anaheim Bay Naval Weapons Station			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			RW'94	1971	2,260,000	Anaheim Bay Anaheim Bay Naval Weapons Station			
Surfside-Sunset Beach	San Pedro	Huntington Beach, Orange Co.			Shaw'80	1971	2258496	Anaheim Bay	bypassing?		
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			SPCA'76	1971					replenishment
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			TC'91	1971	2,364,000		1.1 mi long		beach erosion control
Surfside-Sunset Beach	San Pedro	Huntington Beach, Orange Co.			Shaw'80	1978	1489980	offshore			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD95	1979	1,664,000	offshore borrow			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD99	1979	1,600,000	offshore borrow	June: onto feeder beach		DR, R
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			P,Y'89	1979	1,544,000	offshore borrow			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			RW'94	1979	1,644,000	offshore			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			TC'91	1979	1,664,000		1.7 mi long; 500 ft wide		beach erosion control
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			87-10	1982	1,500,000				
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD95	1983	500,000	Anaheim Bay Naval Weapons Station			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			P,Y'89	1983	500,000	Anaheim Bay Naval Weapons Station			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			RW'94	1983	500,000	Anaheim Bay Anaheim Bay Naval Weapons Station			maintenance dredging
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			FC	1983	150,000	dredging of Anaheim Bay	discharged into intertidal zone from 16-26" diameter pipeline running from harbor entrance to beach; Sept. '82 - Feb. '83		R, DS, DR
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD95	1984	1,500,000	offshore borrow			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD95	1984	650,000	Anaheim Bay Naval Weapons Station			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			P,Y'89	1984	1,500,000	offshore borrow			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			P,Y'89	1984	650,000	Anaheim Bay Naval Weapons Station			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			RW'94	1984	1,500,000	offshore			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			RW'94	1984	650,000	Anaheim Bay Anaheim Bay Naval Weapons Station	construction		
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			FC	1984	1,500,000	3 borrow sites offshore of Anaheim Bay and Surfside Beach (155 acres)	hydraulic suction dredge; discharge via 16-26" diameter pipeline on surface of beach into surf zone; Oct. '83 - March '84	sand with 8% fines	N, R, DR
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			TC'91	1985	2,293,000		1.1 mi long; 480 ft wide		beach erosion control
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD99	1985	2,700,000	offshore borrow sites and Anaheim Bay Naval Weapons Station	dredged from offshore and from adjacent approach channel and placed on feeder beach		DR, R
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			TC'91	1987					no project
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			RW'94	1988	180,000	Anaheim Bay Naval Weapons Station	maintenance dredging		
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD95	1990	1,300,000	offshore borrow			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD95	1990	522,000	offshore borrow			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD99	1990	1,800,000	offshore borrow			DR, R
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			RW'94	1990	1,300,000	offshore borrow			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			RW'94	1990	522,000	offshore borrow			
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD-BNSS	1990	1,826,000		26" cutter head suction dredge, dredged onto beach		DS
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			FC	1990	3,000,000	two borrow sites offshore of Anaheim Bay jetties	dredged by hydraulic suction dredge and transported to the beach by floating pipeline; mid-Sept. 1989 - mid-March 1990	slightly contaminated with PCBs and DDT; composite samples average 8% fines	R, DS, DR
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			FC	1997	1,600,000	offshore borrow	March-June		N, DS
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD95	1997	1,600,000	offshore borrow	Oct. '96 - March '97; cutterhead dredge in 30-45' H2O offshore of Bolsa Chica Beach; floating pipeline to beach disposal in berm 350-900' wide, 5700' long, +- 13' MLLW	slightly finer than receiver beach	R
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			LAD99	1997	1,600,000	offshore borrow	dredged from -30' MLLW		DR, R
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			FC	1997			June-July		N
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			FC	1998		3 offshore borrow sites covered under CD-36-83	(East Jetty to Phillips St)		N, R, DS, DR
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			FC	1999	133,000	Anaheim Bay	pump over jetty, spread on beach using bulldozer		DR, DS
Surfside/Sunset Beach	San Pedro	Huntington Beach, Orange Co.			FC	1999	700,000	approach channel, Anaheim Bay	dredge offshore, then discharge behind training dike placed at +-12 ft MLLW, return H2O downcoast (East Jetty to Phillips St)		N, R, DS, DR
Huntington Beach (Santa Ana River Project)	San Pedro	Huntington Beach, Orange Co.			FC	1988	1,000,000	Santa Ana River			N, DR

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Applicant/Sponsor	Duration of Fill/Performance	Funding	Environmental Effects	Monitoring	Notes	Ref. ID	Permit/FC Ref.	See Also	
	~ half of fill lost in two years downcoast	\$2,082,000			source: USACOE-LA 1969; 1986 (report)				
		Stage 4a, Public Law 87-874 1962			source: USACOE-LA 1995 (Surfside-Sunset/Newport)				
USACOE		Stage 4a			source: USACOE-LA 1999 CCSTWS Chapter 4 draft				
		\$1,074,000			source: CA-DNOD 1976				
	"has controlled erosion in this area"				source: USACOE-LA 1980(equity study, unpublished); 1986 (report)				
		Stage 7, Public Law 87-874 1962			source: USACOE-LA 1995 (Surfside-Sunset/Newport)				
USACOE									
	"has controlled erosion in this area"				source: USACOE-LA 1980(Seal Beach); 1986 (report) source: Corps of Engineers records, A. Fuentes, 1986				
USACOE					source: USACOE-LA 1995 (Surfside-Sunset/Newport)				
			mortality of intertidal invertebrates; temporary increase in turbidity; nourishment timed to avoid grunion spawning		CD report notes that USACOE replenished sand in '56, '64, '71, '79 source: USACOE-LA 1995 (Surfside-Sunset/Newport)	CD-011-82			
USACOE					source: USACOE-LA 1995 (Surfside-Sunset/Newport)				
			offshore impacts minimized by creation of shallow multiple, rather than single, dredge pit		previous nourishments by Corps: 1956, 64, 71, 79	CD-036-83			
	"periodic beach nourishment maintains stability"				source: USACOE-LA 1986 (oral and report); CA Dept of Nav and Ocean Dev 1977 (atlas of erosion and study of nourishment)				
USACOE		Stage 8			source: USACOE-LA 1999 CCSTWS Chapter 4 draft				
	required interval: 5-6 years		"stable beach with seasonal variations....sand is eventually transported offshore and south..."		source: Armstrong 1987; Spencer 1987; USACOE-LA 1987(unpublished project summary)				
		Stage 9, Public Law 87-874 1962			source: USACOE-LA 1995 (Surfside-Sunset/Newport) source: USACOE-LA 1995 (Surfside-Sunset/Newport) source: USACOE-LA 1999 CCSTWS Chapter 4 draft				
USACOE		Stage 9							
USACOE		\$6.9 mill; \$3.78/yd3			M. Change, pers. Communication in report				
USACOE						CD-027-89		CD-11-82; CD-36-83; CD-12-84; CD-40-89; CD-34-90; CD-52-90	
USACOE			single-point discharge to minimize impacts to grunion and least terns.	project extension; placement limited to non-public portion of beach; in addition, turbidity monitoring to determine efficacy of filter system		CD-028-97		ND-58-95; CD-27-89	
USACOE					source: USACOE-LA 1995 (Surfside-Sunset/Newport)				
USACOE		Stage 10			source: USACOE-LA 1999 CCSTWS Chapter 4 draft				
USACOE			excavation of settling pond and discharge of sand on public beach with filter fabrics to minimize turbidity	turbidity monitoring; change in project due to unacceptable turbidity in previous design	modification to previously-approved beach replenishment project including relocation of discharge site, modification of discharge method, and extension of time.	CD-067-97		CD-27-89; CD-28-97; ND-58-95; ND-03-97; ND-20-97	
USACOE					project updates timing of CD-36-83; feeder beach area is 1700 ft long			CD-11-82; CD-36-83	
USACOE						CD-065-99		CD-21-88; CD-27-89; CD-52-90; CD-34-90	
USACOE			to minimize grunion impacts: 1) single discharge point; 2) material restricted to feeder beach; 3) no discharge after 3/1/84; 4) discharge behind dike on backbeach		updates/supplements CD-12-82	CD-012-84			
USACOE				COE will monitor turbidity and its effects on least terns in consultation w/ USFWS		CD-029-88		CD-13-81	

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Site	Cell	City/County	Latitude	Longitude	Database	Date of project	Dredge/Fill Volume (yd ³)	Fill Source/Site	Dredge/Transport Method	Dredge/Fill Characteristics	Activity
Santa Ana River County Beach	San Pedro	Newport Beach, Orange Co.			LAD99	1997	-140,000	Newport Beach (adjacent)	excavated above MSL and transported downcoast to west Newport and placed above MSL		excavation
Newport Beach	San Pedro	Newport Beach, Orange Co.			TC'91	1920					
Newport Beach	San Pedro	Newport Beach, Orange Co.			TC'91	1929					
Newport Beach	San Pedro	Newport Beach, Orange Co.			Shaw'80	1919-1930	1,594,540	Newport Harbor	between Newport Pier and Harbor entrance		
Newport Beach	San Pedro	Newport Beach, Orange Co.			Shaw'80	1933-1935	1,895,150	Newport Harbor	46th St. to Newport Pier		
Newport Beach	San Pedro	Newport Beach, Orange Co.			TC'91	1933-35	1,933,333				
Newport Beach	San Pedro	Newport Beach, Orange Co.			Shaw'80	1934-1936	5,593,960	Newport Harbor	Newport Pier to Newport Harbor Entrance		
Newport Beach	San Pedro	Newport Beach, Orange Co.			TC'91	1934-35	5,706,667				
Newport Beach	San Pedro	Newport Beach, Orange Co.			LAD95	1935	3,700,000	Newport Harbor			R
Newport Beach	San Pedro	Newport Beach, Orange Co.			LAD95	1935	1,900,000	Newport Harbor			R
Newport Beach	San Pedro	Newport Beach, Orange Co.			RW'94	1935	3,700,000	Newport Harbor			
Newport Beach	San Pedro	Newport Beach, Orange Co.			RW'94	1935	1,900,000	Newport Harbor			
Newport Beach	San Pedro	Newport Beach, Orange Co.			P,Y'89	1935	3,700,000	Newport Harbor			
Newport Beach	San Pedro	Newport Beach, Orange Co.			P,Y'89	1935	1,900,000	Newport Harbor			
Newport Beach	San Pedro	Newport Beach, Orange Co.			DS'85	1935	1,900,000	Newport Harbor	placed between Santa Ana River and Newport Pier		
Newport Beach	San Pedro	Newport Beach, Orange Co.			LAD95	1965	124,000	Newport (Balboa)	36th - 47th St.s		R
Newport Beach	San Pedro	Newport Beach, Orange Co.			RW'94	1965	124,000	Newport (Balboa)	36-47 St.s		
Newport Beach	San Pedro	Newport Beach, Orange Co.			P,Y'89	1965	124,000	Newport (Balboa)	36-47 St.s		
Newport Beach	San Pedro	Newport Beach, Orange Co.			TC'91	1965	124,000				
Newport Beach	San Pedro	Newport Beach, Orange Co.			Shaw'80	1965-1967	333,285	Newport Harbor	deposited b/w Newport Pier and 50th St.		
Newport Beach	San Pedro	Newport Beach, Orange Co.			LAD95	1966	60,000	Newport (Balboa)	36th - 47th St.s		R
Newport Beach	San Pedro	Newport Beach, Orange Co.			RW'94	1966	60,000	Newport (Balboa)	36-47 St.s		
Newport Beach	San Pedro	Newport Beach, Orange Co.			P,Y'89	1966	60,000	Newport (Balboa)	36-47 St.s		
Newport Beach	San Pedro	Newport Beach, Orange Co.			TC'91	1966	60,000				
Newport Beach	San Pedro	Newport Beach, Orange Co.			LAD95	1967	150,000	Newport (Balboa)	36th - 47th St.s		R
Newport Beach	San Pedro	Newport Beach, Orange Co.			RW'94	1967	150,000	Newport (Balboa)	36-47 St.s		
Newport Beach	San Pedro	Newport Beach, Orange Co.			P,Y'89	1967	150,000	Newport (Balboa)	36-47 St.s		
Newport Beach	San Pedro	Newport Beach, Orange Co.			TC'91	1967	150,000				
Newport Beach	San Pedro	Newport Beach, Orange Co.			LAD95	1968	494,000	Newport (Balboa)	36th - 47th St.s, with steel groins at 40, 44, 48th St.s)		R
Newport Beach	San Pedro	Newport Beach, Orange Co.			LAD95	1968	264,000	Newport (Santa Ana)	40-46th St.s		R
Newport Beach	San Pedro	Newport Beach, Orange Co.			LAD99	1968	495,000		February: placed on beach between 32nd, 50th Streets with 258' steel sheetpile groin at 40th St.		R
Newport Beach	San Pedro	Newport Beach, Orange Co.			LAD99	1968	246,000		November: placed on beach between 32nd, 50th Streets with groins at 44th St. (191') and 48th St. (200')		R
Newport Beach	San Pedro	Newport Beach, Orange Co.			RW'94	1968	494,000	Newport (Balboa)	36-47 St.s, with steel groins at 40, 44, 48 Sts		
Newport Beach	San Pedro	Newport Beach, Orange Co.			RW'94	1968	264,000	Newport (Santa Ana)	40-46 St.s		
Newport Beach	San Pedro	Newport Beach, Orange Co.			P,Y'89	1968	494,000	Newport (Balboa)	36-47 St.s, with steel groins at 40, 44, 48 Sts		
Newport Beach	San Pedro	Newport Beach, Orange Co.			P,Y'89	1968	254,000	Newport (Balboa)	40-46 St.s		
Newport Beach	San Pedro	Newport Beach, Orange Co.			Shaw'80	1968	494,046	Newport Beach (adjacent)	placed around groin at 40th St.	upcoast eroded severely;	
Newport Beach	San Pedro	Newport Beach, Orange Co.			Shaw'80	1968	240,488	Newport Harbor	44th St. groin; temporarily widened to 30 to 75 m (x to y ft)	downcoast stable	
Newport Beach	San Pedro	Newport Beach, Orange Co.			SPCA'76	1968					2 groins & replenishment
Newport Beach	San Pedro	Newport Beach, Orange Co.			TC'91	1968	494,000		"extended beach berm to avg. width of 250 ft"		beach erosion control
Newport Beach	San Pedro	Newport Beach, Orange Co.			TC'91	1968	240,000		"beach widened to width of 99-248 ft."		beach erosion control
Newport Beach	San Pedro	Newport Beach, Orange Co.			LAD95	1969	750,000	Santa Ana River	40-46th St.s, with rock groins at 36, 48, 52, 56th St.s		R
Newport Beach	San Pedro	Newport Beach, Orange Co.			LAD99	1970	874,000	Santa Ana River	February: placed on West Newport Beach between Santa Ana River and 36th St.		R
Newport Beach	San Pedro	Newport Beach, Orange Co.			RW'94	1969	750,000	Santa Ana River	40-46 St.s, with rock groins at 36, 48, 52, 56 Sts		
Newport Beach	San Pedro	Newport Beach, Orange Co.			P,Y'89	1969	750,000	Santa Ana River	40-46 St.s, with rock groins at 36, 48, 52, 56 Sts		
Newport Beach	San Pedro	Newport Beach, Orange Co.			Shaw'80	1969-1970	747,604	Santa Ana River	between groins at 36th, 48th, 52nd, 56th Streets; beach widened to 45 to 106 m (x to y ft)		
Newport Beach	San Pedro	Newport Beach, Orange Co.			LAD95	1970	124,000	Santa Ana River	31-46th St.s		R
Newport Beach	San Pedro	Newport Beach, Orange Co.			RW'94	1970	124,000	Santa Ana River	31-36 St.s		
Newport Beach	San Pedro	Newport Beach, Orange Co.			P,Y'89	1970	124,000	Santa Ana River	31-36 St.s		
Newport Beach	San Pedro	Newport Beach, Orange Co.			SPCA'76	1970					4 groins & replenishment
Newport Beach	San Pedro	Newport Beach, Orange Co.			TC'91	1970	900,000	Santa Ana River	1.6 mi length; 150-360 ft wide		beach erosion control/flood control spoils
Newport Beach	San Pedro	Newport Beach, Orange Co.			LAD95	1973	350,000	Santa Ana River	28-48th St.s, with rock groins at 28, 32, 40, 48th St.s		R
Newport Beach	San Pedro	Newport Beach, Orange Co.			LAD99	1973	358,000		March: added on to existing groins at 40th (480') and 44th (470') Streets with rock; new rubblemound groins at 32nd (540') and 28th (600') Streets. Replenished b/w 32nd, 28th Streets		R
Newport Beach	San Pedro	Newport Beach, Orange Co.			Shaw'80	1973	355,504	Santa Ana River	between groins at 28th and 32nd Streets		
Newport Beach	San Pedro	Newport Beach, Orange Co.			RW'94	1973	358,000	Santa Ana River	28-48 St.s, with rock groins at 40, 48, 28, 32 Sts		
Newport Beach	San Pedro	Newport Beach, Orange Co.			P,Y'89	1973	358,000	Santa Ana River	28-48 St.s, with rock groins at 40, 48, 28, 32 Sts		
Newport Beach	San Pedro	Newport Beach, Orange Co.			SPCA'76	1973					3 groins & replenishment
Newport Beach	San Pedro	Newport Beach, Orange Co.			TC'91	1973	358,000				beach erosion control
Newport Beach	San Pedro	Newport Beach, Orange Co.			LAD95	1992	1,227,000	Santa Ana River	nearshore deposition dredged from river channel; sieved; placed 300 ft offshore, 20 ft deep water, 3000 ft long mound	fine to medium sand with some rocks	R, nearshore
Newport Beach	San Pedro	Newport Beach, Orange Co.			RW'94	1992	1,300,000	Santa Ana River	placed in nearshore		dredging
Newport Beach	San Pedro	Newport Beach, Orange Co.			ACOE95	1992	1,227,000	Santa Ana River			

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Site	Cell	City/County	Latitude	Longitude	Database	Date of project	Dredge/Fill Volume (yd ³)	Fill Source/Site	Dredge/Transport Method	Dredge/Fill Characteristics	Activity
Newport Beach	San Pedro	Newport Beach, Orange Co.			LAD95	1997	140,000	Santa Ana County Beach Park	proposed for '96/'97; transport via trucks from beach source site to disposal site 2000' downcoast. Fill characteristics: +2' to -13' MLLW	same as receiver beach	DR, R
Newport Beach	San Pedro	Newport Beach, Orange Co.			LAD99	1997	140,000	Santa Ana County Beach Park	excavated from above MSL, transported downcoast and placed above MSL		excavation
Corona State Beach	San Pedro	Newport Beach, Orange Co.			ACOE93	1935	?	Newport Bay entrance channel			N
Doherty State Beach Park	Oceanside	Dana Point City, Orange Co.			TC'91	1928-30	*considerable amount				upland excavation spoils
Doherty State Beach Park	Oceanside	Dana Point City, Orange Co.			TC'89	1930					R
Doherty State Beach Park	Oceanside	Dana Point City, Orange Co.			SPCA'76	1964					groin and fill
Doherty State Beach Park	Oceanside	Dana Point City, Orange Co.			RW'94	1964	94,000	San Juan Creek	1400' pocket beach created between N training wall of creek and Dana Point Harbor E breakwater		
Doherty State Beach Park	Oceanside	Dana Point City, Orange Co.			TC'91	1964	94,000		0.3 mi. long; 100-300 ft wide beach		beach erosion control
Doherty State Beach Park	Oceanside	Dana Point City, Orange Co.			NRC'94	1964	94,104		~1400 ft. long; constructed with sand tight rubblemound jetty to Dana Point Harbor		DS
Doherty State Beach Park	Oceanside	Dana Point City, Orange Co.			Shaw'80	1964	94104	San Juan Creek	placed upcoast of creek and retained by groin (N training wall)		
Doherty State Beach Park	Oceanside	Dana Point City, Orange Co.			RW'94	1966	690,000	Camp Pendleton terrace deposits	hauled by truck; placed E from San Juan Creek for ~4500 ft		
Doherty State Beach Park	Oceanside	Dana Point City, Orange Co.			SPCA'76	1966					replenishment
Doherty State Beach Park	Oceanside	Dana Point City, Orange Co.			TC'91	1966	840,000		0.9 mi. long; 100-300 ft wide beach		beach erosion control
Doherty State Beach Park	Oceanside	Dana Point City, Orange Co.			Shaw'80	1966	840401	San Juan Creek	downcoast bank creek	migrated south	
Doherty State Beach Park	Oceanside	Dana Point City, Orange Co.			Shaw'80	1969	364653	San Juan Creek	upcoast of creek		
Doherty State Beach Park	Oceanside	Dana Point City, Orange Co.			TC'91	1969	365,000				
Doherty State Beach Park	Oceanside	Dana Point City, Orange Co.			RW'94	1969	212,000	San Juan Creek flood control restoration dredging			
Doherty State Beach Park	Oceanside	Dana Point City, Orange Co.			TC'91	1970	128,000				
Doherty State Beach Park	Oceanside	Dana Point City, Orange Co.			TC'91	1970	908,667				
Capistrano Beach Park (nearshore)	Oceanside	Dana Point City, Orange Co.			Shaw'80	1970	125472	Dana Point Harbor	deposited downcoast of harbor as surfing reef		
Capistrano County Beach (nearshore)	Oceanside	Dana Point City, Orange Co.			CDP	1997	35,500	Dana Point Harbor (West Breakwater)		96% sand	DR, N
San Onofre State Beach	Oceanside	San Onofre, San Diego County			TC'89	occasionally since 1964		SONGS power plant excavation	deposited as hump in 1984		R
San Onofre State Beach South	Oceanside	San Clemente, San Diego County			RW'94	1964	306,000	SONGS power plant excavation	placed SE of SONGS to nourish beach		
San Onofre State Beach	Oceanside	San Onofre, San Diego County			TC'91	1964	204,000				upland excavation fill
San Onofre State Beach	Oceanside	San Onofre, San Diego Co.			Shaw'80	1964	203892	SONGS bluff excavation	placed south of pipeline		
San Onofre State Beach	Oceanside	San Onofre, San Diego Co.			Shaw'80	1966	254865	SONGS bluff excavation	placed south of pipeline		
San Onofre State Beach	Oceanside	San Onofre, San Diego County			TC'91	1966	255,000				upland excavation fill
San Onofre State Beach	Oceanside	San Onofre, San Diego County			TC'91	1967	10,000				upland excavation fill
San Onofre State Beach	Oceanside	San Onofre, San Diego Co.			Shaw'80	1967	10456	SONGS bluff excavation	placed south of pipeline		
San Onofre State Beach	Oceanside	San Onofre, San Diego Co.			Shaw'80	1974	1601075	offshore	placed south of pipeline as nourishment		
San Onofre State Beach	Oceanside	San Onofre, San Diego County			TC'91	1974	1,605,000				
San Onofre State Beach	Oceanside	San Onofre, San Diego County			TC'91	1977	220,000				upland excavation fill
San Onofre State Beach	Oceanside	San Onofre, San Diego Co.			Shaw'80	1977	219576	offshore	placed south of pipeline as nourishment		
San Onofre State Beach	Oceanside	San Onofre, San Diego County			TC'91	1978	46,000				upland excavation fill
San Onofre State Beach	Oceanside	San Onofre, San Diego Co.			Shaw'80	1978	45745	offshore	placed south of pipeline as nourishment		
San Onofre State Beach	Oceanside	San Onofre, San Diego County			RW'94	1977-1980	270,000	offshore	placed SE of SONGS to nourish beach		
San Onofre State Beach	Oceanside	San Onofre, San Diego County			TC'91	1984	-				"laydown pad released"
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'91	1944	1,530,667			contained cobbles	navigation byproduct
Oceanside City Beach	Oceanside	Oceanside, San Diego Co.			Shaw'80	1958	799884	Del Mar Boat Basin and Oceanside Harbor	disposed 6th to 9th St.	lost immediately; migrated North	
Oceanside City Beach	Oceanside	Oceanside, San Diego Co.			Shaw'80	1960	41824	Del Mar Boat Basin and Oceanside Harbor	disposed 6th to 9th St.	eroded	
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'91	1960	17,500				navigation byproduct
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'91	1960	23,700				navigation byproduct
Oceanside City Beach	Oceanside	Oceanside, San Diego Co.			Shaw'80	1961	482283	Del Mar Boat Basin and Oceanside Harbor	disposed 6th to 9th St.	eroded 2.5 - 6.5 m/yr in width	
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'91	1961	222,350				navigation byproduct
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'91	1961	265,333				navigation byproduct
Oceanside Harbor	Oceanside	Oceanside, San Diego County			RF '93	1961	3,921,000		placed on area beaches		DR
Oceanside City Beach	Oceanside	Oceanside, San Diego Co.			Shaw'80	1963	3809905	Del Mar Boat Basin and Oceanside Harbor	9th St.	eroded immediately	contained cobbles
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'91	1963	265,333			cobbles	beach erosion control/ harbor construction
Oceanside City Beach	Oceanside	Oceanside, San Diego County			SPCA'76	1963					groin and replenishment
Oceanside City Beach	Oceanside	Oceanside, San Diego Co.			Shaw'80	1965	111095	Del Mar Boat Basin and Oceanside Harbor	disposed 9th to 3rd St.	eroded	
Oceanside City Beach	Oceanside	Oceanside, San Diego County			RW'94	1965	110,000	Oceanside Harbor			
Oceanside City Beach	Oceanside	Oceanside, San Diego Co.			Shaw'80	1966	683561	Del Mar Boat Basin and Oceanside Harbor	disposed 3rd to Minn. Ave	eroded	
Oceanside City Beach	Oceanside	Oceanside, San Diego County			RW'94	1966	690,000	Oceanside Harbor			
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'91	1966	690,000				harbor bypassing
Oceanside City Beach	Oceanside	Oceanside, San Diego Co.			Shaw'80	1967	177752	Del Mar Boat Basin and Oceanside Harbor	disposed 3rd to Tyson St.	eroded	

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Applicant/Sponsor	Duration of Fill/Performance	Funding	Environmental Effects	Monitoring	Notes	Ref. ID	Permit/FC Ref.	See Also
USACOE		proposed Stage 10, Public Law 87-874 1962						
USACOE		Stage 10			source: USACOE-LA 1999 CCSTWS Chapter 4 draft			
USACOE					source: USACOE-LA 1993 "Existing State of the Orange Co. Coast"			
					source: USACOE-LA 1987(Oceanside); Shaw 1980			
		\$247,000			replenished as byproduct of upland excavation operations			
					source: CA Dept of Nav and Ocean Dev 1976			
					source: Price, R.C., 1966. Statement of the CA Dept. of Water Resources. Shore and Beach, 34(1):22-32.			
		\$247,000 (groin and fill)			source: USACOE-LA 1978 (Doheny); CA Dept of Nav and Ocean Dev 1976; Shaw 1980			
					source: Price, R.C., 1966. Statement of the CA Dept. of Water Resources. Shore and Beach, 34(1):22-32.			
		\$713,000						
	12/66 and 1/67: groin failed--stream runoff	\$713,000			source: CA Dept of Nav and Ocean Dev 1976			
					source: USACOE-LA 1978 (Doheny), 1986 (report); CA Dept of Nav and Ocean Dev 1976; Shaw 1980			
					source: USACOE-LA 1987 (Oceanside)			
					source: USA/CESPL and CA/DNOD 1978 inspection tour report			
					source: USACOE-LA 1987 (Oceanside); Shaw 1980			
					source: USACOE-LA 1987 (Oceanside)			
County of Orange			no disposal during grunion spawning; kelp beds and reefs in Doheny Marine Life Refuge	monitoring plan; turbidity must remain less than 20% above natural non-storm conditions (0-50 NTUs) and dissolved O ₂ can't drop below 5.0 mg/l	15' depth, 1000' long	5-97-232	FC CC-138-97	
			substantial sand "hump" migrated downcoast, preceded by erosional wave larger in magnitude than hump itself	by Scripps; Grove et al. 1987				
					source: Flick and Wanetick, 1989, SIO Ref. No. 89-20, 51 pp.			
					source: USACOE-LA 1987 (Oceanside)			
					source: USACOE-LA 1987 (Oceanside)			
					source: USACOE-LA 1987 (Oceanside)			
					source: USACOE-LA 1987 (Oceanside)			
					source: USACOE-LA 1987 (Oceanside)			
					source: USACOE-LA 1987 (Oceanside)			
					source: USACOE-LA 1987 (Oceanside)			
					source: Flick and Wanetick, 1989, SIO Ref. No. 89-20, 51 pp.			
			1987: Sand hump migrated ~2m/day, Extremely rapid decay of volume (decreased to 1/2 every 200 days). Migrating hump preceded by erosion wave (8 km long in >2 years)...					
	"held them for a year or two"				source: USACOE-LA 1987 (Oceanside); Grove et al. 1987			
					source: USACOE-LA 1986 (oral); 1987 (Oceanside)			
	eroded				source: USACOE-LA 1987 (Oceanside); Shaw 1980			
	eroded				source: USACOE-LA 1987 (Oceanside)			
	eroded				source: USACOE-LA 1987 (Oceanside); Shaw 1980			
	eroded 8-22 ft/yr				source: Shaw 1980			
	all fill lost by 1968				source: USACOE-CERC 1984; Moffat and Nichol 1983; Shaw 1980			
		\$1,785,000			source: CA-DNOD 1976			
					source: USA/CESPL, 1987, Oceanside Littoral Cell Preliminary Sediment Budget Report, prepared by Tekmarine, inc, CCSTWS87-4			
					source: USA/CESPL, 1987, Oceanside Littoral Cell Preliminary Sediment Budget Report, prepared by Tekmarine, inc, CCSTWS87-4			
	eroded				source: USACOE-LA 1987 (Oceanside); Shaw 1980			

TABLE2TASK3CSMW.xls

Site	Cell	City/County	Latitude	Longitude	Database	Date of project	Dredge/Fill Volume (yd ³)	Fill Source/Site	Dredge/Transport Method	Dredge/Fill Characteristics	Activity
Oceanside City Beach	Oceanside	Oceanside, San Diego County			RW'94	1967	180,000	Oceanside Harbor			
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'91	1967	177,900				harbor bypassing
Oceanside City Beach	Oceanside	Oceanside, San Diego Co.			Shaw'80	1968	433924	Del Mar Boat Basin and Oceanside Harbor	disposed San Luis Rey to Wisconsin Ave	eroded	
Oceanside City Beach	Oceanside	Oceanside, San Diego County			RW'94	1968	430,000	Oceanside Harbor			
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'91	1968	433,900				harbor bypassing
Oceanside City Beach	Oceanside	Oceanside, San Diego Co.			Shaw'80	1969	352890	Del Mar Boat Basin and Oceanside Harbor	disposed San Luis Rey to 3rd St	eroded	
Oceanside City Beach	Oceanside	Oceanside, San Diego County			RW'94	1969	350,000	Oceanside Harbor			
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'91	1969	353,000				harbor bypassing
Oceanside City Beach	Oceanside	Oceanside, San Diego Co.			Shaw'80	1971	551554	Del Mar Boat Basin and Oceanside Harbor	disposed 3rd St. to Wisconsin Ave	eroded	
Oceanside City Beach	Oceanside	Oceanside, San Diego County			RW'94	1971	550,000	Oceanside Harbor			
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'91	1971	551,750				harbor bypassing
Oceanside City Beach	Oceanside	Oceanside, San Diego Co.			Shaw'80	1973	433924	Del Mar Boat Basin and Oceanside Harbor	disposed Tyson to Hay St	eroded	
Oceanside City Beach	Oceanside	Oceanside, San Diego County			RW'94	1973	440,000	Oceanside Harbor			
Oceanside City Beach	Oceanside	Oceanside, San Diego Co.			Shaw'80	1975	559396	Del Mar Boat Basin and Oceanside Harbor	disposed Pine to Witherby St.	eroded	
Oceanside City Beach	Oceanside	Oceanside, San Diego County			RW'94	1975	560,000	Oceanside Harbor			
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'91	1975	559,750				harbor bypassing
Oceanside City Beach	Oceanside	Oceanside, San Diego Co.			Shaw'80	1976	550247	Del Mar Boat Basin and Oceanside Harbor	disposed Ash to Witherby St.	eroded	
Oceanside City Beach	Oceanside	Oceanside, San Diego County			RW'94	1976	550,000	Oceanside Harbor			
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'91	1976	550,000				harbor bypassing
Oceanside City Beach	Oceanside	Oceanside, San Diego County			RW'94	1977	320,000	Oceanside Harbor			
Oceanside City Beach	Oceanside	Oceanside, San Diego Co.			Shaw'80	1978	318908	Del Mar Boat Basin and Oceanside Harbor	disposed Ash to Witherby St.	eroded	
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'91	1978	318,550		February	cobbles	harbor bypassing
Oceanside City Beach	Oceanside	Oceanside, San Diego County			RW'94	1981	460,000	Oceanside Harbor			
Oceanside City Beach	Oceanside	Oceanside, San Diego County			RW'94	1981	400,000	nearshore off Oceanside	placed SE from Harbor on beach		
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'91	1981	463,000		1.5 miles long	not coarse enough	harbor bypassing
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'91	1982	920,000				harbor bypassing/ beach erosion control
Oceanside City Beach	Oceanside	Oceanside, San Diego County			RF '93	1982	1,300,000	San Luis Rey River bed	trucked		R
Oceanside City Beach	Oceanside	Oceanside, San Diego County			CE'99	1986	450,000	Oceanside harbor	placed on beach near Tyson St.		DR, DS
Oceanside City Beach	Oceanside	Oceanside, San Diego County			ACOE'90	1986	350,000	Oceanside harbor	beach fill		DR, DS
Oceanside City Beach	Oceanside	Oceanside, San Diego County			ACOE'90	1988	257,000	Oceanside harbor	beach fill		DR, DS
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'89	1944 (frequently since)		harbor excavation, harbor bypassing			R
Oceanside City Beach	Oceanside	Oceanside, San Diego County			TC'91	1951-58	700,000				nav. byproduct/ beach erosion control
Oceanside City Beach	Oceanside	Oceanside, San Diego County			RW'94	1962-1963	3,800,000	Oceanside Harbor excavation			
Oceanside City Beach	Oceanside	Oceanside, San Diego County			RW'94	1965-1981	-5,000,000			sand and riverine cobbles	
Oceanside City Beach	Oceanside	Oceanside, San Diego County			FC	1981 (12 mos)	800,000	San Luis Rey River (Whelan Lake to Murray Rd) (San Luis Rey Flood Control Project)	transported via surface roads, placed using bulldozers, graded, above and below MLLW datum	medium grain size (95% on 200 sieve)	R
Oceanside City Beach	Oceanside	Oceanside, San Diego County			RW'94	1981-1982	923,000	San Luis Rey riverbed	trucked from site 7 miles from coast		
Oceanside City Beach	Oceanside	Oceanside, San Diego County			FC	1983 August to November	450,000	Camp Pendleton/Oceanside Harbor	hydraulic pipeline dredge, pump, discharged in surf zone (Municipal Pier to Forster St.)	silty sand	R, DS, DR
Oceanside City Beach	Oceanside	Oceanside, San Diego County			FC	1984-1989	400,000	sediment bypasses Oceanside Harbor-one beach site and two harbor sites	jet-pumped sand bypassing with underwater slurry pipeline	sand and silt, clean and dirty, light and dark	R, DR
Oceanside City Beach	Oceanside	Oceanside, San Diego County			FC	3/15/90 - 7/30/90; 9/15/92 - 3/15/93; 9/15/94 - 3/15/95; 9/15/96 - 3/15/97	500,000	Oceanside Harbor entrance and navigation channels and sand trap	hydraulic dredge, buried/exposed pipeline (S of Oceanside Public Pier and S of Tyler St.)		DS, DR
Oceanside City Beach	Oceanside	Oceanside, San Diego County			FC	9/15/94 - 3/15/95	400,000	Oceanside Harbor (entrance, navigation channels, sand trap)	hydraulic or hopper dredge (south of Oceanside Pier) (beach or nearshore disposal)		R, DS, DR
Oceanside City Beach	Oceanside	Oceanside, San Diego County			FC	as of 1-11-98	102,000	San Diego Bay main channel (dredge area 1)		sand with munitions	DR, DS, R
Oceanside City Beach	Oceanside	Oceanside, San Diego County				Mar-00		Oceanside Harbor			
Oceanside City Beach*	Oceanside	Oceanside, San Diego County				8/24/01 - 9/23/01	421,000	Offshore	Trailing suction hopper dredge	Median grain size of fill = 0.62 mm	N
North Carlsbad	Oceanside	Carlsbad, San Diego County				7/6/01 - 8/2/01	225,000	Offshore	Trailing suction hopper dredge	Median grain size of fill = 0.14-0.62 mm	N

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Applicant/Sponsor	Duration of Fill/Performance	Funding	Environmental Effects	Monitoring	Notes	Ref. ID	Permit/FC Ref.	See Also	
					source: USA/CESPL, 1987, Oceanside Littoral Cell Preliminary Sediment Budget Report, prepared by Tekmarine, inc, CCSTWS87-4 source: USACOE-LA 1987 (Oceanside); Shaw 1980				
	eroded								
					source: USA/CESPL, 1987, Oceanside Littoral Cell Preliminary Sediment Budget Report, prepared by Tekmarine, inc, CCSTWS87-4 source: USACOE-LA 1987 (Oceanside); Shaw 1980				
	eroded								
					source: USA/CESPL, 1987, Oceanside Littoral Cell Preliminary Sediment Budget Report, prepared by Tekmarine, inc, CCSTWS87-4 source: USACOE-LA 1987 (Oceanside); Shaw 1980				
	eroded								
					source: USA/CESPL, 1987, Oceanside Littoral Cell Preliminary Sediment Budget Report, prepared by Tekmarine, inc, CCSTWS87-4 source: USACOE-LA 1987 (Oceanside); Shaw 1980				
	eroded								
					source: USA/CESPL, 1987, Oceanside Littoral Cell Preliminary Sediment Budget Report, prepared by Tekmarine, inc, CCSTWS87-4 source: USACOE-LA 1987 (Oceanside); Shaw 1980				
	eroded								
					source: USA/CESPL, 1987, Oceanside Littoral Cell Preliminary Sediment Budget Report, prepared by Tekmarine, inc, CCSTWS87-4 source: USACOE-LA 1987 (Oceanside); Shaw 1980				
	eroded								
					source: USA/CESPL, 1987, Oceanside Littoral Cell Preliminary Sediment Budget Report, prepared by Tekmarine, inc, CCSTWS87-4 source: USACOE-LA 1987 (Oceanside); Shaw 1980				
	eroded								
					source: USA/CESPL, 1987, Oceanside Littoral Cell Preliminary Sediment Budget Report, prepared by Tekmarine, inc, CCSTWS87-4 source: USACOE-LA 1987 (Oceanside); Shaw 1980				
	eroded								
					source: USA/CESPL, 1987, Oceanside Littoral Cell Preliminary Sediment Budget Report, prepared by Tekmarine, inc, CCSTWS87-4 source: USACOE-LA 1987 (Oceanside); Shaw 1980				
	eroded								
					source: USA/CESPL, 1987, Oceanside Littoral Cell Preliminary Sediment Budget Report, prepared by Tekmarine, inc, CCSTWS87-4 source: USACOE-LA 1987 (Oceanside); Shaw 1980				
	eroded 2/78				source: USACOE-LA 1987 (Oceanside) (Coastal Cliff Sediments) source: USA/CESPL, 1987, Oceanside Littoral Cell Preliminary Sediment Budget Report, prepared by Tekmarine, inc, CCSTWS87-4 source: Ryan, Joe, personal communications with Weigel source: USACOE-LA 1987 (Oceanside)				
					source: USACOE-LA 1987 (Oceanside); Spencer 1987; USACOE-CERC 1984; Moffat and Nichol Engineers 1983				
	one season (expected 2-3 seasons)	\$4,000,000	bypassing inadequate						
					source: Coastal Environments 1999 Agua Hedionda Lagoon study				
USACOE		lowest cost disp. Alt.							
USACOE		lowest cost disp. Alt.							
	total loss +300,000 add'l by 12/59		fill migrated upcoast into nav. Channel		source: USACOE-LA 1960; Shaw 1980				
					source: USACOE-LA 1987 (Oceanside); Shaw 1980				
USACOE		Congressional authorization for <\$3,000,000		none		CD-006-81			
					source: Bagley and Whitson, Shore and Beach 1982				
USACOE			dredging: elimination of benthic organisms. DR and N: turbidity; timed after nesting season		3 prior coastal permits for same activity	CD-020-83		CD-6-81; Appeal #218-80	
USACOE		\$11,447,000 total estimated cost	50 acres of continual disturbance at dredge pit	COE biological monitoring; sediment at downdrift beaches		CD-003-84			
					post-march disposal allowed due to lack of beach at site; final CCC recommendation unclear in light of objections to 6-year time period				
USACOE			dike disposal if during grunion season	COE will monitor surface water turbidity at dredge & disposal sites to determine effects on sight-feeding birds		CD-063-89		CD-8-90; CD-3-84; CD-3-89	
USACOE			no disposal after March 15 to minimize impacts to plover, grunion and terns	impacts to plover nesting; Surface Water Turbidity Monitoring Program		CD-053-94		CD-63-89; CD-3-84; CD-20-83; ND-8-90; ND-95-92	
USN		Congressional authorization				CD-009-98		CD-95-95; CD-140-97; CD-161-97	
SANDAG	Indicator Transect (2003): MSL Shoreline Change =+72' Volume Change = +66 cy/ft			Part of annual Regional Beach Monitoring Program of SANDAG Regional Beach Sand Project.	source: CFC, 2004				
SANDAG	Indicator Transect (2003): MSL Shoreline Change =+105' Volume Change = +33 cy/ft			Part of annual Regional Beach Monitoring Program of SANDAG Regional Beach Sand Project.	source: CFC, 2004				

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Site	Cell	City/County	Latitude	Longitude	Database	Date of project	Dredge/Fill Volume (yd ³)	Fill Source/Site	Dredge/Transport Method	Dredge/Fill Characteristics	Activity
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			TC'91	1954	4,080,000		1.0 mile long, widened beach 396 ft		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			TC'91	1955	111,000				
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			TC'91	1957	232,000				
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			TC'91	1960	371,000				
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			TC'91	1961	225,000				
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			TC'91	1963	308,000				
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			TC'91	1965	223,000				
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			TC'91	1967	160,000				
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			TC'91	1969	97,000				
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			TC'91	1972	200,000				
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			TC'91	1974	341,000				
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			TC'91	1976	392,000				
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego Co.			Shaw'80	1954	3999420	Agua Hedionda Lagoon	placed from 1060 m upcoast of mouth to 600 m S of outlet; widened beach avg. 30m (x ft)		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego Co.			Shaw'80	1955	111095	Agua Hedionda Lagoon	placed to south of Lagoon outlet		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego Co.			Shaw'80	1957	231339	Agua Hedionda Lagoon	placed to south of Lagoon outlet		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego Co.			Shaw'80	1960	369881	Agua Hedionda Lagoon	placed to south of Lagoon outlet		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego Co.			Shaw'80	1961	224804	Agua Hedionda Lagoon	placed to south of Lagoon outlet		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego Co.			Shaw'80	1963	307145	Agua Hedionda Lagoon	placed to south of Lagoon outlet		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego Co.			Shaw'80	1965	222190	Agua Hedionda Lagoon	placed to south of Lagoon outlet		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego Co.			Shaw'80	1967	159454	Agua Hedionda Lagoon	placed to south of Lagoon outlet		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego Co.			Shaw'80	1969	96718	Agua Hedionda Lagoon	placed to south of Lagoon outlet		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego Co.			Shaw'80	1972	199971	Agua Hedionda Lagoon	placed to N and S of lagoon outlet		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego Co.			Shaw'80	1974	339820	Agua Hedionda Lagoon	placed to N and S of lagoon outlet		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego Co.			Shaw'80	1976	390793	Agua Hedionda Lagoon	placed to N and S of lagoon outlet		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego Co.			Shaw'80	1979	418240	Agua Hedionda Lagoon	placed to N and S of lagoon outlet		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			TC'91	1979	419,000				
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			TC'91	1979	430,667				
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			TC'89	frequently since 1944		Agua Hedionda Lagoon			R
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1954	-4,000,000	Agua Hedionda Lagoon	excavated for San Diego G&E Co. plant; placed from 3500 ft N of lagoon entrance jetties to 2000 ft S of discharge jetties		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1955	110,000	Agua Hedionda Lagoon	pumped as slurry into surf zone; placed downdrift of discharge jetties		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1957	230,000	Agua Hedionda Lagoon	pumped as slurry into surf zone; placed downdrift of discharge jetties		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1960	370,000	Agua Hedionda Lagoon	pumped as slurry into surf zone; placed downdrift of discharge jetties		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1961	225,000	Agua Hedionda Lagoon	pumped as slurry into surf zone; placed downdrift of discharge jetties		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1963	307,000	Agua Hedionda Lagoon	pumped as slurry into surf zone; placed downdrift of discharge jetties		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1965	222,000	Agua Hedionda Lagoon	pumped as slurry into surf zone; placed downdrift of discharge jetties		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1967	159,000	Agua Hedionda Lagoon	pumped as slurry into surf zone; placed downdrift of discharge jetties		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1969	97,000	Agua Hedionda Lagoon	pumped as slurry into surf zone; placed downdrift of discharge jetties		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1972	200,000	Agua Hedionda Lagoon	pumped as slurry; placed downdrift and updrift of discharge jetties		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1974	340,000	Agua Hedionda Lagoon	pumped as slurry; placed downdrift and updrift of discharge jetties		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1976	391,000	Agua Hedionda Lagoon	pumped as slurry; placed downdrift and updrift of discharge jetties		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1979	418,000	Agua Hedionda Lagoon	pumped as slurry; placed downdrift and updrift of discharge jetties		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1981	235,000	Agua Hedionda Lagoon	pumped as slurry		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1983	222,000	Agua Hedionda Lagoon	pumped as slurry		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1985	404,000	Agua Hedionda Lagoon	pumped as slurry		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1988	347,000	Agua Hedionda Lagoon	pumped as slurry into surf zone S of discharge jetties; also pumped behind dikes along beach		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1991	489,000	Agua Hedionda Lagoon			
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1992	126,000	Agua Hedionda Lagoon			
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			RW'94	1993	115,000	Agua Hedionda Lagoon			
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			CE'99	Apr-91	459,000	Agua Hedionda Lagoon	placed on Middle and South Beaches		DR_DS
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			CE'99	Feb.-Apr. 1991	115,395	Agua Hedionda Lagoon	placed on Middle beach (600-900 yd length)		DR_DS
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			CE'99	Feb.-Apr. 1988	347,782	Agua Hedionda Lagoon?	placed on North, Middle and South Beaches		DR_DS
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			CE'99	Apr-92	125,976	Agua Hedionda Lagoon?	placed on North Beach		DR_DS
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			CE'99	1994	158,996	Agua Hedionda Lagoon?	placed on North, Middle and South Beaches		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			CE'99	1996	443,130	Agua Hedionda Lagoon?	placed on North, Middle and South Beaches		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			CE'99	1997	197,342	Agua Hedionda Lagoon?	placed on Middle Beach		
Carlsbad State Beach Park	Oceanside	Carlsbad, San Diego County			CE'99	1998	273,581	Agua Hedionda Lagoon?	placed on Middle and South Beaches		
Agua Hedionda Lagoon	Oceanside	Carlsbad, San Diego County			RF '93	1954	3,921,000	placed on area beaches			DR
South Carlsbad	Oceanside	Carlsbad, San Diego County				6/25/01 - 7/6/01	158,000	Offshore	Trailing suction hopper dredge	Median grain size of fill = 0.62 mm	N

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Applicant/Sponsor	Duration of Fill/Performance	Funding	Environmental Effects	Monitoring	Notes	Ref. ID	Permit/FC Ref.	See Also	
		\$2,500,000 dredging and jetty construction	"spoil immediately moved out into the surf zone.."		source: Shaw 1980; USACOE-LA 1987 (Oceanside) (Cliff Sediments) source: USACOE-LA 1987 (Oceanside) source: USACOE-LA 1987 (Cliff Sediments) source: USACOE-LA 1987 (Cliff Sediments) source: USACOE-LA 1987 (Cliff Sediments) source: USACOE-LA 1987 (Oceanside) source: USACOE-LA 1987 (Oceanside) source: USACOE-LA 1987 (Oceanside) source: USACOE-LA 1987 (Oceanside) source: USACOE-LA 1987 (Oceanside) source: USACOE-LA 1987 (Oceanside) source: USACOE-LA 1987 (Oceanside)				
			"Storm waves and high tides eroded beach and removed all sand south of Encina Power Plant, Carlsbad"		source: USACOE-LA 1987 (Oceanside) (Cliff Sediments)				
					source: Shaw 1980				
					source: Shaw 1980				
					source: Shaw 1980				
					source: Shaw 1980				
					source: Shaw 1980				
					source: Shaw 1980				
					source: Shaw 1980				
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					source: Shaw 1980				
					source: Shaw 1980				
					source: Shaw 1981				
					source: Shaw 1982				
					source: Shaw 1983				
					source: Shaw 1984				
	>18 months				source: Coastal Environments 1999 Agua Hedionda Lagoon study				
	<6 months				source: Coastal Environments 1999 Agua Hedionda Lagoon study				
	<6 months				source: Coastal Environments 1999 Agua Hedionda Lagoon study				
	0-6 months				source: Coastal Environments 1999 Agua Hedionda Lagoon study				
					source: Coastal Environments 1999 Agua Hedionda Lagoon study				
					source: Coastal Environments 1999 Agua Hedionda Lagoon study				
					source: Coastal Environments 1999 Agua Hedionda Lagoon study				
					source: Coastal Environments 1999 Agua Hedionda Lagoon study				
					source: Coastal Environments 1999 Agua Hedionda Lagoon study				
SANDAG	Indicator Transect (2003): MSL Shoreline Change =+31' Volume Change = -6 cy/ft			Part of annual Regional Beach Monitoring Program of SANDAG Regional Beach Sand Project.	source: CFC, 2004				

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Site	Cell	City/County	Latitude	Longitude	Database	Date of project	Dredge/Fill Volume (yd ³)	Fill Source/Site	Dredge/Transport Method	Dredge/Fill Characteristics	Activity
Batiquitos	Oceanside	Leucadia, San Diego County				8/16/01 - 8/23/01	117,000	Offshore	Trailing suction hopper dredge	Median grain size of fill = 0.62 mm	N
Leucadia	Oceanside	Leucadia, San Diego County				6/4/01 - 6/15/01	132,000	Offshore	Trailing suction hopper dredge	Median grain size of fill = 0.62 mm	N
Moonlight Beach	Oceanside	Encinitas, San Diego County				8/10/01 - 8/16/01	105,000	Offshore	Trailing suction hopper dredge	Median grain size of fill = 0.34-0.62 mm	N
Cardiff	Oceanside	Cardiff-by-the-Sea, San Diego County				8/2/01 - 8/10/01	101,000	Offshore	Trailing suction hopper dredge	Median grain size of fill = 0.34 mm	N
Fletcher Cove	Oceanside	Solana Beach, San Diego County				6/15/01 - 6/24/01	146,000	Offshore	Trailing suction hopper dredge	Median grain size of fill = 0.14 mm	N
Del Mar	Oceanside	San Diego Co.			FC	as of 1-11-98	170,000	San Diego Bay main channel (dredge area 1)		sand with munitions	DR, DS, R
Del Mar	Oceanside	Del Mar, San Diego County				4/27/01 - 5/10/01	183,000	Offshore	Trailing suction hopper dredge	Median grain size of fill = 0.14 mm	N
Torrey Pines	Oceanside	Del Mar, San Diego County				4/6/01 - 4/27/01	245,000	Offshore	Trailing suction hopper dredge	Median grain size of fill = 0.14 mm	N
Pacific Beach	Mission Bay	Pacific Beach, San Diego Co.			TC'91	1948	613,333		beach widened 300 ft max		beach restoration
Pacific Beach	Mission Bay	Pacific Beach, San Diego Co.			RW'94	1948	-600,000	Mission Bay	placed North of North Jetty		
Pacific Beach	Mission Bay	Pacific Beach, San Diego Co.			Shaw'80	1948	601,220	Mission Bay	widened beach max. 91 m (x ft)	migrated south; lost by 1957	
Pacific Beach	Mission Bay	Pacific Beach, San Diego Co.			TC'91	1973	306,667				
Pacific Beach	Mission Bay	Pacific Beach, San Diego Co.			RW'94	1973	300,000	Mission Bay entrance			
Pacific Beach	Mission Bay	Pacific Beach, San Diego Co.			Shaw'80	1973	300,610	Mission Bay		migrated south	
Mission Beach	Mission Bay	Mission Beach, San Diego Co.			TC'91	1948	-600,000	Mission Bay	beach widened ~300 ft		DR, R
Mission Beach	Mission Bay	Mission Beach, San Diego Co.			RW'94	1958	150,000	Mission Bay			DR, R
Mission Beach	Mission Bay	Mission Beach, San Diego Co.			FC	October '83 to January '84	490,000	Mission Bay Harbor	cutter-head hydraulic suction or hopper dredge, discharged onto beachface from 16-26" surface pipeline (from N Jetty to Crystal Pier)	fine sand and silty sand	R, DS, DR
Mission Beach	Mission Bay	Mission Beach, San Diego Co.			RW'94	1984	246,000	Mission Bay entrance	placed N of jetties		R, DS, DR
Mission Beach	Mission Bay	Mission Beach, San Diego Co.			FC	as of 1-11-98	12,000	San Diego Bay main channel (dredge area 1)	(nearshore)	sand with munitions	DR, DS, R
Mission Beach	Mission Bay	Mission Beach, San Diego Co.				5/10/01 - 5/21/01	151,000	Offshore	Trailing suction hopper dredge	Median grain size of fill = 0.52 mm	N
Ocean Beach	Mission Bay	Ocean Beach, San Diego Co.			RW'94	1950	67,000	Mission Bay			DR, DS, R
Ocean Beach	Mission Bay	Ocean Beach, San Diego Co.			Shaw'80	1950	66,657	Mission Bay	Newport Ave. to Saratoga Ave.; widened beach max. 45 m (x ft)	migrated north; lost in 6 months	
Ocean Beach	Mission Bay	Ocean Beach, San Diego Co.			SPCA'76	1955					groin and fill
Ocean Beach	Mission Bay	Ocean Beach, San Diego Co.			RW'94	1955	275,000	Mission Bay entrance	1700 ft long beach		
Ocean Beach	Mission Bay	Ocean Beach, San Diego Co.			Shaw'80	1955	274,470	Mission Bay	Niagara Ave. to Cape May Ave.; widened beach max. 109 m (x ft)	some migrated north; remainder stable	
Ocean Beach	Mission Bay	Ocean Beach, San Diego Co.			87-10	1959	275,000		contained at N end by groin		
Ocean Beach	Mission Bay	Ocean Beach, San Diego Co.			RW'94	1984	30,000	Mission Bay entrance	placed S of groin		
Ocean Beach	Mission Bay	Ocean Beach, San Diego Co.			FC	October '83 to January '84	50,000	Mission Bay Harbor	cutter-head hydraulic suction or hopper dredge, discharged onto beachface from 16-26" surface pipeline (from S Jetty to S Groin)	fine sand and silty sand	R, DS, DR
North Island Oceanside Beach	Silver Strand	Coronado, San Diego County			RW'94	1941	2,200,000	San Diego Bay			
North Island Oceanside Beach	Silver Strand	Imperial Beach, San Diego Co.			Shaw'80	1940-1941	2248040	San Diego Harbor	temporarily widened beach max. 272 m (x ft)		
Coronado City Beach	Silver Strand	Coronado, San Diego County			FC	July-December '85	1,100,000	offshore borrow site ~1500' offshore, 1 mi. downcoast of Amphibious base, 20-40' below MLLW	cutterhead hydraulic dredge, pumped through submerged pipeline to beach	sand retreated back 152 m (199 ft) by 1958	R, DR
Coronado Shores Beach	Silver Strand	Imperial Beach, San Diego Co.			Shaw'80	1946	26009300	San Diego Harbor	widened beach max. 333 m (x ft)		
Gator Beach	Silver Strand	Coronado, San Diego County			RW'94	1977	1,100,000	San Diego Bay			
Gator Beach	Silver Strand	Coronado, San Diego County			RW'94	1985	1,100,000	San Diego Bay			

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Applicant/Sponsor	Duration of Fill/Performance	Funding	Environmental Effects	Monitoring	Notes	Ref. ID	Permit/FC Ref.	See Also		
SANDAG	Indicator Transect (2003): MSL Shoreline Change =+56' Volume Change = -5 cy/ft			Part of annual Regional Beach Monitoring Program of SANDAG Regional Beach Sand Project.	source: CFC, 2004					
SANDAG	Indicator Transect (2003): MSL Shoreline Change =+28' Volume Change = +26 cy/ft			Part of annual Regional Beach Monitoring Program of SANDAG Regional Beach Sand Project.	source: CFC, 2004					
SANDAG	Indicator Transect (2003): MSL Shoreline Change =+103' Volume Change = -27 cy/ft			Part of annual Regional Beach Monitoring Program of SANDAG Regional Beach Sand Project.	source: CFC, 2004					
SANDAG	Indicator Transect (2003): MSL Shoreline Change =+97' Volume Change = +54 cy/ft			Part of annual Regional Beach Monitoring Program of SANDAG Regional Beach Sand Project.	source: CFC, 2004					
SANDAG	Indicator Transect (2003): MSL Shoreline Change =+48' Volume Change = +10 cy/ft			Part of annual Regional Beach Monitoring Program of SANDAG Regional Beach Sand Project.	source: CFC, 2004					
USN		Congressional authorization				CD-009-98		CD-95-95; CD-140-97; CD-161-97		
SANDAG	Indicator Transect (2003): MSL Shoreline Change =+96' Volume Change = +11 cy/ft			Part of annual Regional Beach Monitoring Program of SANDAG Regional Beach Sand Project.	source: CFC, 2004					
SANDAG	Indicator Transect (2003): MSL Shoreline Change =+73' Volume Change = +17 cy/ft			Part of annual Regional Beach Monitoring Program of SANDAG Regional Beach Sand Project.	source: CFC, 2004					
	by '57, returned to '40 width				source: Shaw 1980					
	fill moved south				source: Shaw 1980					
			sand migrated south to Mission beach							
USACOE	returned to '40 position by 1960		beachfill transported S; by 1958 shoreline had returned to 1948 position; shoreline retreated 200 ft. in reach S of Crystal Pier		source: USACOE-LAD 1960, 1964, 1987 (Cliff Sediments)					
USACOE					source: USACOE-LAD 1964					
USACOE			"Turbidity during dredging and disposal operations will reduce dissolved oxygen concentration in the water column and may temporarily clog respiratory and feeding mechanisms of fish and benthic animals."		suspended sediment levels w/ discharge flow regulated through use of weir system	CD-032-83				
USACOE	moved N after placement near amusement park				source: Castens, Corps of Eng. Records, per. Comm. (see CCSTWS 87-10)					
USN		Congressional authorization				CD-009-98		CD-95-95; CD-140-97; CD-161-97		
SANDAG	Indicator Transect (2003): MSL Shoreline Change =+91' Volume Change = +41 cy/ft			Part of annual Regional Beach Monitoring Program of SANDAG Regional Beach Sand Project.	source: CFC, 2004					
USACOE				migrated N, filled in mouth of San Diego River	source: Walker and Brodeur, 1993; USACE-LAD, 1970					
		\$161,000			source: CA-DNOD 1976					
USACOE					source: USACE-LAD 1970					
USACOE			"Turbidity during dredging and disposal operations will reduce dissolved oxygen concentration in the water column and may temporarily clog respiratory and feeding mechanisms of fish and benthic animals."		suspended sediment levels w/ discharge flow regulated through use of weir system	CD-032-83				
					source: Shaw 1980; Walker and Brodeur, 1993					
USACOE			scheduled to avoid grunion spawning and least tern nesting	post-construction monitoring at borrow site for recolonization and sand movement into pit	receiver beach is ~3300' long;	CD-003-85				
					source: Shaw 1980; Walker and Brodeur, 1993					
					source: Shaw 1980; Walker and Brodeur, 1993					

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Applicant/Sponsor	Duration of Fill/Performance	Funding	Environmental Effects	Monitoring	Notes	Ref. ID	Permit/FC Ref.	See Also	
USACOE			scheduled around least tern nesting		Gator Beach selected b/c: 1) extant underground pipeline; 2) extant nourishment project in the area; 3) eroding condition 4) extant archeological and biological surveys BUT Gator Beach off-limits to public for military reasons	CD-033-85			
	eventually migrated N				source: Moffat and Nichol, Engineers 1987; Shaw 1980				
		\$1,260,000	"After 1960, shoreline behaved approximately as it had before 1933. Indicates the beachfill-forced shoreline adjusted to a dynamic equilibrium platform b/w 1954 and 1960."		source: Moffat and Nichol, Engineers 1987; Shaw 1980; Inman 1976; Converse 1982 source: USACOE-LA 1986 (oral) source: Inman 1976 source: Shaw 1980; Walker and Brodeur, 1993 source: Shaw 1980; Walker and Brodeur, 1993				
			"Net migration to N. Ultimately impounded by Zuniga Jetty or swept offshore to depths of 495-990 ft by ebb currents."		source: Moffat and Nichol, Engineers 1987; Shaw 1980				
					source: Shaw 1980; Walker and Brodeur, 1993				
			"1987: Since 1978, the beach has eroded and the buildings constructed on the 1941-1976 fill can be completely surrounded by the sea during even small storm events."		source: Moffat and Nichol, Engineers 1987 source: Moffat and Nichol, Engineers 1987				
	sand moved shoreward								
			"Since 1941, most of the fill has remained in the system. Appears 20-30% moved offshore because too fine to remain in dynamic equilibrium on shoreline. Somewhat <40% of the beachfill that was reworked was lost offshore."		source: Moffat and Nichol, Engineers 1987; Surfrider Foundation, 1987/88 source: DRP-1-01, August 1990, "Construction and Monitoring of Nearshore Placement of Dredged Material at Silver Strand State..."				
USACOE	migrated on and downshore								
USACOE						CD-071-95		CD-53-87; CD-3-87; CD-91-93	
USACOE			increased turbidity, loss of O2, loss of benthics, impacts to least tern, grunion, kelp; dredging activity modified to prevent turbidity in upper 1/3 of H2O column			CD-053-87			
USN					to improve least tern nesting habitat; loss of sand from ocean-side littoral system to be offset by homeporting dredge spoils	CD-128-95			
USN			to protect nesting tern colonies			CD-128-95			
	50% lost by 6/1978				source: Van Deerlin 1978; Shaw 1980; USACOE-LA 1983; Moffat and Nichol 1987				
			"demonstrated winnowing will clean sand." 1986: "Groins have not worked very well because of fine nature of sand."		source: USACOE-CERC 1984; Converse 1982; USACOE-LA 1986 (oral)				
			migrated to N		sources: Shaw 1980, Converse 1982, USACOE 1984, 1986				
USFWS			work scheduled to avoid impacts to: light-footed clapper rails, CA least terns, Western snowy plovers; sited to avoid impacts to salt-marsh birds-beak			CD-041-84			
US Coast Guard			kelp beds avoided during disposal; pre-disposal survey w/ NMFS and demarcation of kelp area; nearshore disposal minimizes impacts to grunions			CD-026-94		CD-91-93	
USN			kelp beds	kelp bed monitoring		CD-091-93			
SANDAG	Indicator Transect (2003): MSL Shoreline Change = +137 Volume Change = +52 cy/ft			Part of annual Regional Beach Monitoring Program of SANDAG Regional Beach Sand Project.	source: CFC, 2004				
CA Coastal Conservancy			disposal during rainy season, during outgoing tides to simulate natural high turbidity situations			CC-054-96			
							R=REPLENISHMENT		
							DS=DISPOSAL		
							N=NOURISHMENT		
							DR=DREDGING		
							B=BYPASSING		
							M=MAINTENANCE		
							TC=TonyaClayton		
							SPCA=ShoreProtectionInCalifornia-DNOD1976		
							RF=RonFlick-S&B'93		
							RW=RobertWeigel-S&B'94		
							CE=Coastal Environments 1999 Agua Hedionda Lagoon Study		
							NRC=National Research Council Beach Nourishment and Protection		
							ACOE=US ACOE 1990 Beach and Nearshore Placement of Material Dredged from Federally authorized navigation projects		
							P,Y89=Patterson and Young, Coastal Zone '89		

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Applicant/Sponsor	Duration of Fill/Performance	Funding	Environmental Effects	Monitoring	Notes	Ref. ID	Permit/FC Ref.	See Also
						LHW94=Leidersdorf, Hollar and Woodell, Shore and Beach 1994		
						Shaw80=Martha Shaw 1980 Scripps Report		
						LAD95=ACOE LA District Surfside-Sunset/West Newport Beach Nourishment Project, Orange Co., CA; May 1995		
						DS'85=Donald Spencer, The Newport Beach Groin Field, Orange Co CA, in CA's Battered Coast, 1985		
						87-10=US ACOE 1987 CCSTWS 87-10 Shoreline Movement Investigations Report		
						LAD93-1=ACOE LA District CCSTWS Final Report 93-1		
						LAD-BNSS=Beach Nourishment Sediment Sources: Previous Studies and results from vibracoring field program, Orange Co. CA, Final Report, 1993		
						LAD99=ACOE LA District CCSTWS Chapter 4 Draft Report December 1999		

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TABLE 3 - List of References to Accompany Table 2 (Beach Nourishment Projects in California)											
have?	Authors	Year	Title	Journal	Vol.No.	pages	topics	subtopic	locator code	sponsor	notes
yes	Nelson, Ross	1998	Beachfront Management on the Isle of Palms, South Carolina's Coastal Natural Hazards	Coastal Management	26	315-325					
yes		1998		proceedings from the conference hosted by the CA Shore and Beach Preservation Association and the University of Southern CA Sea Grant Program, November 12-14, 1997, Santa Barbara	USCSG-TR-01-98	162 p.			Call numbers: UCB WRCA G4096 N8-	Lesley Ewing and Douglas Sherman, eds.	
yes	Li, R.; Cho, W.K.; Ramcharan, E.; Kjerfve, B.; and Willis, D.	1998	A Coastal GIS for shoreline monitoring and management—case study in Malasia		58:3	157-166					
yes	Finkl, Charles W.	1996	What might happen to America's shorelines if artificial beach replenishment is curtailed: A prognosis for southeastern Florida and other sandy regions along	Journal of Coastal Research	12:1	iii-ix					
yes	San Diego Association of Governments	1995	Shoreline preservation strategy for the San Diego region	Shore & Beach	63:02	p. 17-30			UCB WRCA 25.9 W: UCB Engrn TC330 A1		
yes	Walker, J. R.; Brodeur, S. M.	1993	The CA Beach Nourishment Success Story	Beach Preservation Technology: 6th National Conference proceedings; Feb. 1993, St Petersburg FL		pp. 239-258.				FSBPA	
yes	Pilkey, Orrin H.	1990	A time to look back at beach replenishment	Journal of Coastal Research	6:1	iii-vii					
yes	Pompe, Jeffrey J.; Rinehart, James R.	1999	Establishing Fees for Beach Protection: Paying for a Public Good	Coastal Management	27	57-67					
yes	Griggs, Gary B.	1999	The Protection of California's Coast: Past, Present and Future	Shore & Beach	67:1	18-28					
yes	Jones, Christopher P.; Hernandez, Debra L.; Eiser, William C.	1998	Lucas vs. South Carolina Coastal Council, Revisited	Annual Conference of the Assn. Of State Floodplain Managers	5/20/1998	9 pp.	policy		takings law/ Lucas		
yes	Hansch, Susan; Locklin, Linda; Willis, Cope; Ewing, Lesley	1998	Coastal Impacts of the 1997-98 El Nino and Predictions for La Nina	California Coastal Commission Memo	Tu-11		coastal erosion		CA/EI Nino		
yes	Dobkowski, Aleksandra H.	1998	Dumptrucks versus Dredges: An Economic Analysis of Sand Sources for Beach Nourishment	Coastal Management	26	303-314					
yes	Elwany, Hany; Flick, Reinhard; Ritzel, John; Lindquist Anne-Lise; Deysher, Larry	1998	Possible Impacts of the Southern California Edison Kelp Reef off San Clemente on the Marine Environment	in Final Program Environmental Impact Report for the Construction and Management of an artificial reef in the Pacific Ocean near San Clemente, C.	Vol. II; 1999	32 p.				John Dixon personal library	
yes	Cialone, Mary A.; Stauble, Donald K	1998	Historical findings on ebb shoal mining	Journal of Coastal Research	14:02	537-563	beach nourishment		dredging		
yes	Douglas, Bruce C.; Crowell, Mark; Leatherman, Stephen P.	1998	Considerations for Shoreline Position Prediction	Journal of Coastal Research	14:03	1025-1033	shoreline change		analysis		
yes	Makaska, Bart; Augustinus, Pieter G E.F.	1998	Morphologic changes of a micro-tidal, low wave energy beach face during a spring-neap tide cycle, Rhone-Delta	Journal of Coastal Research	14:02	632-645	shoreline change		morphology		
yes	Masselink, Gerhard; Pattiaratchi, Charitha	1998	Morphodynamic Impact of Sea Breeze Activity on a beach with beach cusp morphology	Journal of Coastal Research	14:02	393-406	shoreline change		morphology		
yes	Tanner, William F.	1998	Red Flags on the Beach	Journal of Coastal Research	14:02	iii-vi	beach concepts		analysis		
yes	Trembaris, Arthur C.; Pilkey, Orrin H.	1998	Summary of Beach nourishment along the US Gulf of Mexico Shoreline	Journal of Coastal Research	14:02	407-417	beach nourishment		US		
yes	Tait, James F.; Revenaugh, Justin	1998	Source-Transport Inversion: An application of geophysical inverse theory to sediment transport in Monterey Bay, C	Journal of Geophysical Research	103:C1	1275-1283					
yes	Kraus, Nicholas C; Larson, Magnus	1998	Numerical Simulation of beach-profile change accounting for hard-bottom features	Rethinking the role of structures in shore protection: proceedings of the 11th conference on beach preservation technology	2/4-6/98	123-138				FSBPA	
yes	anonymous	1998	California's Beaches: Out to Sea	The Economist	6/20/1998	p. 34	beach loss		CA		
yes	Bidler, Mike; Sachs, Steve; Kramer, Ann	1997	Governing a river of sand—developing policies, plans and programs to manage the San Diego Region's beaches	California and the World Ocean '97	2	1490-1493	policy		CZM		conference proceedings, San Diego
yes	Coleman, Howard D.	1997	The coastal boundary line in California: from certainty to chaos	California and the World Ocean '97	2	1152-1161	policy		morphology		conference proceedings, San Diego
yes	Ewing, Lesley	1997	Beach nourishment in the 21st Century	California and the World Ocean '97	2	1386-1373	beach nourishment		policy		conference proceedings, San Diego
yes	Flick, Reinhard E.; Elwany, M. Hany S	1997	Tide and beach fluctuations and the mean high water line	California and the World Ocean '97	2	943-949	shoreline change		morphology		conference proceedings, San Diego
yes	Gadd, Peter E.	1997	Limitations of "Averaging" coastal survey data in the determination of coastal boundaries	California and the World Ocean '97	2	966-973	shoreline change/policy		morphology		conference proceedings, San Diego
yes	Griggs, Gary B.	1997	The armoring of California's Coast	California and the World Ocean '97	1	515-526	beach concepts		CA		conference proceedings, San Diego
yes	Inman, Douglas L.; Jenkins, Scott A.	1997	Changing wave climate and littoral drift along the California Coast	California and the World Ocean '97	1	538-549	beach concepts		CA		conference proceedings, San Diego
yes	Moore, Laura J.; Griggs, Gary B.	1997	Measuring Shoreline Erosion Rates: Strategy, Techniques and accuracy	California and the World Ocean '97	1	719-730	shoreline change		analysis		conference proceedings, San Diego
yes	Patterson, Jamee Jordan	1997	Public Beach or Private backyard: a case study of Del Mar Beach and how the sand was divided u	California and the World Ocean '97	2	950-957	policy		sand rights		conference proceedings, San Diego
yes	Seymour, Richard J.	1997	Implications for CA of the Marine Board Study on beach nourishment and shoreline protection	California and the World Ocean '97	2	1361-1365	beach nourishment		policy		conference proceedings, San Diego
yes	Sherman, Douglas J.	1997	Human Impacts on California's Coastal Sediment Budget	California and the World Ocean '97	1	550-560	beach concepts		CA		conference proceedings, San Diego
yes	Uzes, F.D. Bud	1997	Locating the landward limit of the MHWI	California and the World Ocean '97	2	958-965	shoreline change		morphology		conference proceedings, San Diego
yes	Washburn, Edgar B.; Flushman, Bruce S	1997	Private and Public rights in the beach and shore ir	California and the World Ocean '97	2	1162-1173	policy		sand rights		conference proceedings, San Diego
yes	Benuhof, Benjamin T.; Griggs, Gary B.; Moore, Laura J.	1997	Coastal Erosion: the state of the problem and the problem of the state	California and the World Ocean '97: conference proceedings	1	505-514	coastal erosion		CA		conference proceedings, San Diego
yes	Tibbetts, John	1997	Armoring the Coast: Beachfront Battles over seawall	Coastal Heritage	Fall	3 to 12	beach loss		US		
yes	Amin, S.M.N.; Davidson-Arnott, Robin G.D.	1997	A statistical analysis of the controls on shoreline erosion rates, Lake Ontario	Journal of Coastal Research	13:04	1093-1101	shoreline change		analysis		
yes	Pope, Joan	1997	Responding to coastal erosion and flooding damage	Journal of Coastal Research	13:03	704-710	policy		CZM		
yes	Ackerman, Jennifer	1997	Islands at the edge	National Geographic	August	2 to 31	beach loss		US		
yes	Creed, Christopher G.; Bodge, Kevin R.; Suter, Carrie L.	1997	Construction Slopes for Beach Nourishment Projects	New Insights into Beach Preservation: proceeding from the 10th conference on Beach Preservation Technology	1/22-24/97	44-58					
yes	Fitch, Eric J.	1997	Organizational Structure of State and Federal Coastal Zone Management: Impacts on Public Trust Protection	New Insights into Beach Preservation: proceeding from the 10th conference on Beach Preservation Technology	1/22-24/97	278-289					
yes	Keehn, Stephen; Campbell, Thomas J.	1997	The renourishment planning and design process for Captiva Island, Florida	New Insights into Beach Preservation: proceeding from the 10th conference on Beach Preservation Technology	1/22-24/97	75-89					
yes	Kraus, Nicholas C.	1997	Distinguishing cross-shore and longshore processes in shoreline change evaluation	New Insights into Beach Preservation: proceeding from the 10th conference on Beach Preservation Technology	1/22-24/97	135-150					
yes	Zheng, Jie; Dean, Robert G.	1997	Shoreline and Dune Recession Variability and Cross-Shore Modeling	New Insights into Beach Preservation: proceeding from the 10th conference on Beach Preservation Technology	1/22-24/97	151-166					
yes	Everts, Craig H.	1997	Seizing the opportunity for CA sand manager	Newsbreaker, newsletter of the CSBP	March	2 pp.	policy		CZM		
yes	Novarro, Ler	1997	Turning the Tide	San Diego Home/Garden lifestyle	Dec-97	12-20, 103	beach loss		CA		
yes	Brandon, Karen	1997	Swap for sand spotlight's beach crisis	San Francisco Examine	10/29/1997	A-10	beach loss		CA		
yes	Griggs, Gary B.; Scholar, Deirdre	1997	Coastal Erosion caused by earthquake-induced slope	Shore & Beach	65:04	2 to 7	coastal erosion		CA		
yes	Komar, Paul D.	1997	Erosion of a massive artificial "landslide" on the California coast	Shore & Beach	65:04	8 to 14	coastal erosion		CA		
yes	Rinehart, James R.; Pompe, Jeffrey J	1996	Footing the bill for beach nourishment	B&E Review	April/June	14-17	beach nourishment		policy		
yes	Bay, John; Bay, Malee	1996	Reducing Hazards in shoreline areas: Policy and legal options	Coastal Acquisition Project, Phase II report	November	15 pp.	policy		CZM		
yes	Gaffney, Douglas A.; Kelly, Wilden A	1996	Under the Boardwalk: A Shore-Protection Plan Emerges	Geo Info Systems	6:10	22-29					
yes	Cleary, W.J.; Riggs, S.R.; Marcy, D.C.; Snyder, S.W.	1996	The influence of inherited geological framework upon a hardbottom-dominated shoreface on a high-energy shelf: Onslow Bay, NC, USA	Geology of Siliciclastic Shelf Seas	No. 117	249-266				Geological Society Special Publication, ed. De Batist, M. & Jacobs, P.	
yes	Kraus, Nicholas C.; McDougal, William G.	1996	The Effects of seawalls on the beach: Part I, an updated literature review	Journal of Coastal Research	12:03	691-701	beach loss		morphology		
yes	Finkl, Charles W.	1996	Beach fill from recycled glass: a new technology for mitigation of localized erosional "hot spots" in FL	The Future of Beach Nourishment: Proceedings of the 9th conference on beach preservation technology	1/24-26/98	174-175	beach nourishment		alternatives		

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have?	Authors	Year	Title	Journal	Vol. No.	pages	topics	subtopic	locator code	sponsor	notes
yes	Goss, Chauncey; Gooderham, Kate	1996	The importance of citizen involvement in developing a local beach management plan	The Future of Beach Nourishment: Proceedings of the 9th conference on beach preservation technology	1/24-26/98	339-349	policy	CZM			
yes	Gray, Donald H.; Hryciw, Roman D.; Ghiassian, Hossain	1996	Protection of coastal sand dunes with anchored geonets	The Future of Beach Nourishment: Proceedings of the 9th conference on beach preservation technology	1/24-26/98	255-270	beach concepts	alternatives			
yes	Hamilton, Robert P.; Ramsey, John S.; Aubrey, David S.	1996	Numerical Predictions of Erosional "Hot-Spots" at Jupiter Island, Florida	The Future of Beach Nourishment: Proceedings of the 9th conference on beach preservation technology	1/24-26/98	75-90	shoreline change	methodology			
yes	Kitsos, Thomas R.	1996	New Requirements for obtaining beach sand from federal waters	The Future of Beach Nourishment: Proceedings of the 9th conference on beach preservation technology	1/24-26/98	329-338	beach nourishment	methodology			
yes	Mann, Douglas W.	1996	Beach nourishment benefit estimates: Past Present and Future?	The Future of Beach Nourishment: Proceedings of the 9th conference on beach preservation technology	1/24-26/98	146-156	beach nourishment	economics			
yes	Nash, Lou; Sawyer, Rick	1996	Utilization of surveying technologies for efficient beach monitoring surveys	The Future of Beach Nourishment: Proceedings of the 9th conference on beach preservation technology	1/24-26/98	107-116	beach nourishment	monitoring			
yes	Hillyer, Theodore M.	1996	Shoreline Protection and Beach Erosion Control Study: Final Report: An Analysis of the U.S. Army Corps of Engineers Shore Protection Program	U.S. Army Corps of Engineers, Institute for Water Resources Policy Study 96-PS-1	June				Lesley Ewing - personal library	USACOE Water Resources Support Center	
yes	Lucas, David H. (et al.)	1996	Private Property Owner's Perspective			41-52	policy	takings law/ Lucas			
yes	U.S. Army Corps of Engineers, Los Angeles District	1995	Silver Strand Shoreline	Beach Erosion and Storm Damage Reconnaissance Study	15-Mar				Kim Sterrett - Boating and Waterways	USACOE Coastal Resources Branch	
yes	Lee, Guan-hong; Nicholls, Robert J.; Birkemeier, William A.; Leatherman, Stephen P.	1995	A conceptual fairweather-storm model of beach nearshore profile evaluation at Duck, NC, US/	Journal of Coastal Research	11:04	1157-1166	shoreline change	morphology			
yes	National Research Council	1995	Beach Nourishment and Protection	National Academy Press, Washington DC		334 pp.					
yes	Wasserman, Elizabeth	1995	Coastal Erosion Crisis?	San Jose Mercury News	5/28/1995		coastal erorior	CA			
yes	Kraus, Nicholas C.	1995	The use of structures to hold beachfill: an overview	Sand Wars, Sand Shortages & Sand-Holding Structures: Proceedings of the 8th conference on beach preservation technology	1/25-27/95	335-347				FSBPA	
yes	Peterson, Ivars	1995	Off the Beach: how waves create sand ridges on the continental shelf	Science News		148	120-121	shoreline change	morphology		
yes	Griggs, Gary B.	1995	Relocation or reconstruction of threatened coastal structures: a second look	Shore & Beach	63:02	31-36		policy	CZM		
yes	Houston, James R.	1995	Beach Nourishment	Shore & Beach	63:01	21-24	beach nourishment	policy			
yes	Stoddard, Gerard	1995	Coastal policy implications of right to rebuild question	Shore & Beach	63:01	25-33	policy	CZM			
yes	Stronge, William B.	1995	The Economics of Government funding for beach nourishment projects: the Florida case	Shore & Beach	63:03	4 to 6	beach nourishment	policy			
yes	Weggel, J. Richard	1995	A primer on monitoring beach nourishment project	Shore & Beach	63:03	20-24	beach nourishment	monitoring			
yes	Cordes, Joseph J. and Anthony M. Yezar	1995	Shoreline Protection and Beach Erosion Control Study: Economic Effects of Induced Development in Corps-Protected Beachfront Communities	U.S. Army Corps of Engineers, Institute for Water Resources Policy Study 95-PS-1	February				Lesley Ewing - personal library	USACOE Water Resources Support Center	
yes	Andrews, Jeffrey L.; Beachler, Kim E.; Beumel, Norma H.	1994	Application of sea sled survey and techniques to beach nourishment monitoring programs	Alternative Technologies in Beach Preservation: 7th conference on beach preservation technology	2/9-11/94	429-441	beach nourishment	monitoring		FSBPA	
yes	Lin, Paul C.-P.; Hansen, Inger E.; Sasso, R. Harvey	1994	Regional sand movement and performance of successive beach nourishment projects	Alternative Technologies in Beach Preservation: 7th conference on beach preservation technology	2/9-11/94	216-228	beach nourishment	monitoring		FSBPA	
yes	Spadoni, Richard H.; Cummings, Sandra L.	1994	Environmental considerations for beach nourishment projects in Florida	Alternative Technologies in Beach Preservation: 7th conference on beach preservation technology	2/9-11/94	608-623	beach nourishment	policy		FSBPA	
yes	Stauble, Donald K.	1994	Evaluation of erosion "hot spots" for beach fill project performance	Alternative Technologies in Beach Preservation: 7th conference on beach preservation technology	2/9-11/94	198-215	beach nourishment	monitoring		FSBPA	
yes	Stronge, William B.	1994	Beaches, Tourism and Economic Development	Alternative Technologies in Beach Preservation: 7th conference on beach preservation technology	2/9-11/94	526-527	policy	economics		FSBPA	
yes	Ulrich, Cheryl P.; King, Mona J.; Brown, Evelyn H.; Miselis, Paul L.	1994	A Methodology for quantifying "hot spot" erosion benefits for shore protection projects	Alternative Technologies in Beach Preservation: 7th conference on beach preservation technology	2/9-11/94	454-473	shoreline change	analysis		FSBPA	
yes	Wang, Ping; Davis, Richard A.	1994	Field measurement of longshore sediment transport rates the surf zone: preliminary results	Alternative Technologies in Beach Preservation: 7th conference on beach preservation technology	2/9-11/94	413-428	beach concepts	monitoring		FSBPA	
yes	California State Lands Commission	1994	California Comprehensive Offshore Resource Stud	CA Office of State Printing #93-83361-60x	I & II				CCC 10-02-L15-R37 1994		
yes	Shih, S.M.; Komar, P.D.; Tillotson, K.J.; McDougal, W.G.; Ruggiero, P.	1994	Wave run-up and sea-cliff erosion	Coastal Engineering '94		2170-2182	coastal erosion	morphology		ASCE	Proceedings
yes	Chasten, Monica A.; McCormick, John W.; Rosati, Julie D.	1994	Using detached breakwaters for shoreline and wetland stabilization	Shore & Beach	62:02	17-22	shoreline protection	alternatives			
yes	Griggs, Gary B.; Tait, James F.; Corona, Wendy	1994	The Interaction of seawalls and beaches: seven years of monitoring, Monterey Bay, CA	Shore & Beach	62:03	21-28	shoreline change	morphology			
yes	Grosskopf, William G.; Kraus, Nicholas C.	1994	Guidelines for surveying beach nourishment project	Shore & Beach	62:02	9 to 16	beach nourishment	monitoring			
yes	Inman, Douglas L.; Masters, Patricia M.	1994	Status of research on the nearshore	Shore & Beach	62:03	11 to 20	policy	morphology			
yes	Ludensdorf, Craig B.; Hollar, Ricky C.; Woodell, Gregory	1994	Human Intervention with the beaches of Santa Monica Bay, California	Shore & Beach	62:03	29-38	beach loss	CA			
yes	Stronge, William B.	1994	Beaches, Tourism and Economic Development	Shore & Beach	62:02	6 to 8	beach nourishment	policy			
yes	Wiegel, Robert L.	1994	Ocean beach nourishment on the USA Pacific Coast	Shore & Beach	62:01	11 to 36	beach nourishment	history			
yes	Wiegel, Robert L.	1994	Beaches-Tourism-Jobs	Shore & Beach	62:02	4 to 5	beach nourishment	policy			
yes	Shoreline Protection and Beach Erosion Control Task Force	1994	Shoreline Protection and Beach Erosion Control Study: Phase 1: Cost Comparison of Shoreline Protection Projects of the U.S. Army Corps of Engineers	U.S. Army Corps of Engineers, Institute for Water Resources Policy Study 94-PS-1	January	119 pp.			Lesley Ewing - personal library	USACOE Water Resources Support Center; The Office of Management and Budget	
yes	U.S. Army Corps of Engineers, Los Angeles District	1993	Beach nourishment sediment sources: previous studies and results of vibroacoring field program: final repo	Coast of CA Storm and Tidal Waves Study, South Coast Region, Orange County	Report 94-2 December				UCB WRCA G4713 N3-1; CCC-ID: 89008430 SF 03-06C-C56-B31.1993	USACOE	
yes	U.S. Army Corps of Engineers, Los Angeles District	1993	Existing State of Orange County Coast	Coast of CA Storm and Tidal Waves Study, South Coast Region, Orange County	Report 93-1 April						
yes	Dailey, Murray D.; Reish, Donald J.; Anderson, Jack W. (eds)	1993	Human Impacts: Dredging, Filling and Offshore Disposal of Sediments	Ecology of the Southern California Bight: a synthesis and interpretation, Univ. of California Press		pp 731-733			John Dixon personal library		
yes	Bruun, Per; Esposito, John	1993	What the "Jones Act" means to dredging in america	Journal of Coastal Research	9:7	v-vii	beach nourishment	policy			
yes	Pilkey, Orrin H.	1993	Can we predict the behavior of sand: in a time and volume framework of use to humankind	Journal of Coastal Research	9:7	iii-iv	beach concepts	morphology			
yes	Pilkey, Orrin H.; Young, Robert S.; Riggs, Stanley R.; Smith, A.W. Sam; Wu, Huiyan; Pilkey, Walter D.	1993	The concept of shoreface profile of equilibrium: a critical review	Journal of Coastal Research	9:01	255-278	beach concepts	morphology			
yes	Camfield, Fred E.	1993	Different views of beachfill performance	Shore & Beach	61:04	4 to 15	beach nourishment	policy			
yes	Flick, Reinhard E.	1993	The Myth and Reality of Southern California Beaches	Shore & Beach	61:03	3 to 13					
yes	Grosskopf, William G.; Stauble, Donald K.	1993	Atlantic coast of Maryland (Ocean City) shoreline protection project	Shore & Beach	61:01	3 to 33	shoreline protection	projects			
yes	Grove, Robert S.	1993	Coastal Mitigation at a nuclear generating static	Shore & Beach	61:03	31-36					
yes	Ware, Rick	1993	Eelgrass (<i>Zostera marina</i>) In Southern California Bays and Wetlands with Emphasis on Orange Co	Shore & Beach	61:03	20-30					
yes	Wiegel, Robert L.	1993	Dana Point Harbor, California	Shore & Beach	61:03	37-55					
yes	Wiegel, Robert L.	1993	Artificial beach construction with sand/gravel made by crushing rock	Shore & Beach	61:04	28-29	beach nourishment	alternatives			
yes	Coastal Frontiers Corporation	1992	Historical Changes in the beaches of Los Angeles County: Malaga Cove to Topanga Canyon, 1935-199	Agreement No. IS-10336, CFC-194-91	February				Lesley Ewing - personal library	County of Los Angeles, Department of Beaches and Harbors	
yes	Griggs, G.B., James E. Pepper and Martha E. Jordan	1992	California's Coastal Hazards: A Critical Assessment of Existing Land-Use Policies and Practices	California Policy Seminar Research Report		224 pp.			Lesley Ewing - personal library		

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yes	Culliton, Barbara J	1992	Save the beaches, not the building	Nature	357		beach nourishment	policy			
yes	Wiegel, Robert L.	1992	Beach nourishment, sand by-passing, artificial beaches: bibliography of articles in the ASBPA Journal Shore & Beach	Shore & Beach	60:03	3 to 5	beach nourishment	projects			
yes	County of Los Angeles, Dept. of Beaches and Harbors	1992	Lost and found: beach sand renourishment in L.A. County.						UCB WRCA G46051 N2 Video	Executive producers, Ken Johnson, Greg Woodell; producer and director, Mark Erickson ; writer, Mark Erickson.	Describes historical and contemporary beach nourishment projects in Los Angeles County. Discusses the effects of flood control engineering works on beach loss. Provides case study of Cabillo Beach in San Pedro, which was created with a beach nourishment project and has recently been renourished.
yes	Tait, James F.; Griggs, Gary B.	1991	Beach response to the presence of a seawall: comparison of field operations	CERC-91-1 final report		63 pp.	shoreline change	morphology			
yes	Armstrong, George A.	1991	Shore Protection Construction along the CA coast	Coastal Zone '91	1	246-260	shore protection	history			Proceedings of the Symposium on Coastal and Ocean Management
yes	Hales, Lyndell Z.; Byrnes, Mark R.; Dowd, Millard W.	1991	Numerical modeling of storm-induced beach erosion, Foley Beach, SC, beach fill alternative	Coastal Zone '91	1	495-509	beach concepts	modeling			Proceedings of the Symposium on Coastal and Ocean Management
yes	Harker, Allen H.; Flick, Reinhard E.	1991	Beach and cliff erosion processes at Solana Beach, CA, 1984-1990	Coastal Zone '91	3	2122-2133	coastal erosion	history			Proceedings of the Symposium on Coastal and Ocean Management
yes	Ibe, A.C.; Awosika, L.F.; Ibe, C.E.; Inegbedion, L.E.	1991	Monitoring of the 1985/86 beach nourishment project at Beach, Victoria Island, Nigeria	Coastal Zone '91	1	534-552	beach nourishment	monitoring			Proceedings of the Symposium on Coastal and Ocean Management
yes	Stauble, Donald K.; Holem, Garry W.	1991	Long term assessment of beach nourishment project performance	Coastal Zone '91	1	510-524	beach nourishment	monitoring			Proceedings of the Symposium on Coastal and Ocean Management
yes	Walker, James R.	1991	Down-drift effects of navigation structures on the California Coast	Coastal Zone '91	3	1889-1903	shore protection	history			Proceedings of the Symposium on Coastal and Ocean Management
yes	Woodell, Gregory; Hollar, Ricky	1991	Historical changes in the beaches of LA County	Coastal Zone '91	2	1342-1355	shoreline change	history			Proceedings of the Symposium on Coastal and Ocean Management
yes	Clayton, T.D.	1991	Beach Replenishment Activities on U.S. Continental Pacific Coast	Journal of Coastal Research		7:04	1195-1210	beach nourishment	history		
yes	Scientific Committee on Ocean Research Working Group 89	1991	The response of beaches to sea-level changes: a review of predictive models	Journal of Coastal Research		7:03	895-921	beach concepts	morphology		
yes	Leatherman, Stephen P.	1991	Modelling Shore response to sea-level rise on sedimentary coasts	Progress in Physical Geography		14	448-464	shoreline change	analysis		
yes	U.S. Army Corps of Engineers, Los Angeles District	1990	Sediment Budget Report: Oceanside Littoral Cell	Coast of CA Storm and Tidal Waves Study		Report 90-2 November			Kim Sterrett - Boating and Waterways	Coastal Resources Branch - Planning Division	
yes	Bottin, Robert R., Jr.	1990	Case study of a successful beach restoration project	Journal of Coastal Research		6:01	p. 1-14				
yes	Leonard, L.; Clayton, T.; Pilkey, O.	1990	An analysis of replenished beach design parameters of US East Coast barrier islands	Journal of Coastal Research		6:01	15-36		UCB Earth Sci OH541.5.C65 J86		
yes	Tait, James F.; Griggs, Gary B.	1990	Beach response to the presence of a seawall: a comparison of field operations	Shore & Beach		58:02	11 to 28	shoreline change	morphology		
yes	Juhnke, Leonard; Mitchell, T. and M. Piszker	1990	Construction and Monitoring of Nearshore Placement of Dredged Material at Silver Strand State Park, San Diego	U.S. Army Corps of Engineers, Dredging Research Technical Notes DRP-1-01		August	11 pp.	nearshore disposal			
yes	Vallianos, Lim	1990	Beach and Nearshore Placement of Material Dredged from Federally Authorized Navigation Project	U.S. Army Corps of Engineers, Institute for Water Resources Policy Study 90-PS-1		April	66 pp.	beach nourishment	Lesley Ewing - personal library	USACOE Water Resources Support Center	
yes	Lewis, R.D. and K.K. McKee	1989	A guide to the artificial reefs of Southern California	CA Dept. of Fish and Game, Nearshore Sportfish Habitat Enhancement Program			73 pp.		OCC ID: 02 -02E -L39 -A67 1989		
yes	Eliot, Ian, Clarke, Des	1989	Temporal and spatial bias in the estimation of shoreline rate-of-change statistics from beach survey information	Coastal Management		17:02	129-156	shoreline change	analysis		
yes	Clayton, T.D.	1989	Artificial beach replenishment on the US Pacific Shore: a brief overview	Coastal Zone '89		v. 6.	2033-2045	beach nourishment	history		Proceedings of the Symposium on Coastal and Ocean Management
yes	Cahill, John J.; Butcher, Chris C.; Dyson, William	1989	Beach nourishment with fine sand at Carlsbad, CA.	Coastal Zone '89		v. 6.	p. 2092-2103.		UCB WRCA 85.1.W-3	Magoon, Orville T.; Converse, Hugh; Miner, Dallas; Tobin, L. Thomas; Clark Delores, eds.	Proceedings of the Symposium on Coastal and Ocean Management
yes	Leonard, L.; Clayton, Tonya D.; Dixon, Kathie; Pilkey, Orrin H.	1989	US Beach Replenishment Experience: a comparison of the atlantic, pacific, and gulf coasts	Coastal Zone '89			1994-2006		UCB WRCA 85.1.W-3		Proceedings of the Symposium on Coastal and Ocean Management
yes	Patterson, David R.; Young, Donald T.	1989	Monitoring the Beach Nourishment Project at Surfside-Sunset Beach	Coastal Zone '89		v. 6	p. 1963-1977.		UCB WRCA 85.1.W-3	Magoon, Orville T.; Converse, Hugh; Miner, Dallas; Tobin, L. Thomas; Clark Delores, eds.	Proceedings of the Symposium on Coastal and Ocean Management
yes	Woodell, Gregory J.; Egense, Anders K.; Butcher, Chris C.	1989	Beach nourishment project compatible with multiple concerns, Santa Monica Bay, CA.	Coastal Zone '89		v. 6	p. 2076-2091.		UCB WRCA 85.1.W-3	Magoon, Orville T.; Converse, Hugh; Miner, Dallas; Tobin, L. Thomas; Clark Delores, eds.	Proceedings of the Symposium on Coastal and Ocean Management
yes	Griggs, Gary B.; Tait, James F	1989	Observations on the end effects of seawall	Shore & Beach		57:01	25-26	beach concepts	morphology		
yes	Schwartz, Maurice L	1989	Commentary: The rest of the story	Shore & Beach		57:01	23-24	beach concepts	morphology		
yes	Smith, A. W. Sam	1989	Reflected Edge Waves	Shore & Beach		57:01	20-22	beach concepts	morphology		
yes	Stone, Steven J.	1989	The CA Coastal Act: A method of coastal protection, or does the Coastal Commission still live after Nollan	Shore & Beach		57:01	4 to 10	policy	CA		
yes	U.S. Army Corps of Engineers, Los Angeles District	1988	Coastal Cliff Sediments, San Delgo Region (1987-1947)	Coast of CA Storm and Tidal Waves Study, San Diego Region		88-8			Lesley Ewing, private library		
yes	U.S. Army Corps of Engineers, Los Angeles District	1988	Sedimentation in Submarine Canyons, San Diego County, California, 1984-1987	Coast of CA Storm and Tidal Waves Study, San Diego Region		88-2			Lesley Ewing, private library		
yes	Kraus, Nicholas C.	1988	The effects of seawalls on the beach: an extended literature review	Journal of Coastal Research		SI4	1 to 28	beach concepts	morphology		
yes	Pilkey, Orrin H.; Wright, Howard L., II	1988	Seawalls versus beaches	Journal of Coastal Research		SI4	41-64	beach concepts	morphology		
yes	Terchunian, Aram V.	1988	Permitting Coastal Armoring structures: can seawalls and beaches coexist?	Journal of Coastal Research		SI4	65-75	beach concepts	morphology		
yes	Strobel, Caroline D.; Woodward, Douglas P.	1988	The economic impact of proposed coastal setback and nourishment legislation on south carolin	prepared for SC Coastal Council and SC Dept. of Parks, Recreation and Tourism		January	64 pp.	policy	economics		
yes	Dean, Robert G.	1988	Recommended modifications in benefit/cost sand management methodology	Shore & Beach		56:04	13-19	policy	economics		
yes	Griggs, Gary B.; Fulton-Bennett, Kim	1988	Rip Rap revetments and seawalls and their effectiveness along the central california coast	Shore & Beach		56:02	3 to 11	shore protection	alternatives		
yes	Hotten, Robert D	1988	Sand mining on Mission Beach, San Diego, C.	Shore & Beach		56:02	18-21	beach nourishment	history		
yes	Pilkey, Orrin H.	1988	A "Thumbnail Method" for beach communities: estimation of long-term beach replenishment requirement	Shore & Beach		56:03	23-31	beach nourishment	policy		
yes	U.S. Army Corps of Engineers, Los Angeles District	1987	Coastal Cliff Sediments, San Delgo Region	Coast of CA Storm and Tidal Waves Study, San Diego Region		87-2			Lesley Ewing, private library		
yes	Egense, Anders K.; Sonu, Choule J.	1987	Assessment of beach nourishment methodologies	Coastal Zone '87		5(3)	p. 4421-4433.		UCB WRCA 85.1.W-3	Magoon, Orville T.; Converse, Hugh; Miner, Dallas; Tobin, L. Thomas; Clark Delores, Domurat, George W., eds.	Proceedings of the Symposium on Coastal and Ocean Management
yes	Tanner, William F.	1987	The Beach: Where is the "River of Sand"?	Journal of Coastal Research		3:03	377-386	beach concepts	morphology		
yes	Lawrence, Sally	1987	How to feed a beach: where sand comes from and where it's going	Oceans		20:02	42-47	shore protection	policy		
yes	Thompson, Roger	1987	Defending our Shores: about face for the ACCO!	Oceans		20:02	34-41	shore protector	policy		
yes	Komar, Paul D.; Enfield, David B	1987	Short-term sea-level change and coastal erosion	SEPM Special Publication		41	17-27	coastal erosion	morphology		
yes	Herron, William J.	1987	Sand Replenishment in Southern California	Shore & Beach		55(3-4)	87-91				
yes	Domurat, George W.	1987	Beach Nourishment: A working solution	Shore & Beach		55(3-4)	92-95				
yes	Inman, Douglas Lama	1987	Accretion and Erosion Waves on Beaches	Shore & Beach		55(3-4)	61-66				
yes	Thompson, Warren C.	1987	Seasonal Orientation in California Beaches	Shore & Beach		55(3-4)	67-70				
yes	Edge, Billy L.; Czapinski, Richard E.; Schlueter, Roger E.	1987	A Comprehensive Approach to Beach Management	Shore & Beach		55(3-4)	122-127				
yes	Reynolds, Suzanne	1987	Sediment Dynamics on the Palos Verdes She			1-Nov	59 p.		Lesley Ewing - personal library	Los Angeles County Sanitation Distric	
yes	Komar, Paul D.; Holman, Robert /	1986	Coastal Processes and the development of shoreline	Annual Review of Earth and Planetary Science		14	237-265	beach loss	morphology		
yes	Griggs, G.B. and Savoy, L.	1986	Living with the California Shore	Duke University Press			393p.				
yes	Fischer, David W.	1986	Beach Erosion Control: Public Issues in Beach Stabilization Decisions, Florida	Journal of Coastal Research		2:01	51-59	shore protection	policy		
yes	U.S. Army Corps of Engineers, Los Angeles District	1986	Oral History of Coastal Engineering Activities in Southern California: 1930-1981			January			Lesley Ewing-personal library		
yes	Nelson, Walter G.	1985	Guidelines for beach restoration projects Part I: Biologic	Florida Sea Grant College Report 7		July	66 pp.	beach nourishment	methodology		
yes	Phillips, Jonathan D	1985	Estimation of Optimal Beach Profile Sample Interva	Journal of Coastal Research		1:02	187-191	shoreline change	methodology		

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yes	Wright, L.D.; Short, A.D.	1984	Morphodynamic variability of surf zones and beaches: a synthesis	Marine Geology	56	93-118	beach concepts	morphology			
yes	Kuhn, G.G. and F.P. Shepard	1984	Sea Cliffs, Beaches and Coastal Valleys of San Diego County	Univ. of CA Press		193 pp.			Lesley Ewing - personal library		
yes	Fischer, Peter J.	1983	Study on Quaternary Shelf Deposits (Sand and Gravel) of Southern California	Beach Erosion Control Project Report	1-Jun				Lesley Ewing - personal library	CA Dept. of Boating and Waterways	
yes	Osborne, Robert H.; Darigo, Nancy J.; and Robert C. Scheidemann, Jr.	1983	Report of Potential Offshore Sand and Gravel Resources of the Inner Continental Shelf of Southern California (with map appendix)		June	302 pp.			Lesley Ewing - personal library	CA Dept. of Boating and Waterways	
yes	Taylor and Little	1982		Ecology	63	135-146					
yes	Taylor, Phillip R. and Litter, Mark M.	1982	The roles of compensatory mortality, physical disturbance, and substrate retention in the development and organization of a sand-influenced, rocky-intertidal community	Ecology	63:1	135-146					
yes	Seapy and Litter	1982	Population and species diversity fluctuations in a rocky intertidal community relative to severe aerial exposure and sediment burial	Marine Biology	71	87-96					
yes	Shaw, Martha J.	1980	Artificial Sediment Transport and Structures in Coastal Southern California	Scripps Institution of Oceanography Reference Series	SIO 80-41, December	109 pp.			Kim Sterrett - Boating and Waterways	Shore Processes Lab, Center for Coastal Studies, SIC	
yes	CA Dept. of Boating and Waterways	1979	A Preliminary Investigation for Establishing Beach Sediment Supply Sites in Eastern Malibu		10-Oct				Lesley Ewing - personal library		
yes	Rosenberg, Rutger	1977	Effects of Dredging Operations on Estuarine Benthic Microfauna	Marine Pollution Bulletin	8:05	102-104			UCB Engin GC1080.M351		
yes	CA Dept. of Navigation and Ocean Development	1977	Assessment and Atlas of Shoreline Erosion along the California Coast	State of CA Resources Agency Report	July				Lesley Ewing - personal library		
yes	Morton, J.W.	1977	Ecological effects of dredging and dredge spoil disposal: a literature review	Technical Paper No. 94, US Fish and Wildlife Service					CCC ID: 02 -02D -07		
yes	CA Dept. of Navigation and Ocean Development	1977	Study of beach nourishment along the Southern California coastline		October	151 p.			CCC-ID: 89003689.SF.03-06-11; ID: 89004209.SF.03-06-11; ID: 89008908.SF.03-06-11; UCB Earth Sci TC330.C3; UCB WRCA G421.K7-2	State of California - The Resources Agency	
yes	Soule, D.F. and M. Oguni	1976	Marine Studies off San Pedro, CA, Part II: Potential Effects of Dredging on the biota of outer LA Harb	Toxicity, Bioassay, and recolonization studies: Rep. So. CA Sea Grant Program No. 2-8'	April	325 pp.			CCC ID: 33 -204-M16 V.11		
yes	CA Dept. of Navigation and Ocean Development	1976	Shore Protection in California			51p.			CCC-ID: 89003188 3-6-7	State of California - The Resources Agency	
yes	Dames and Moore	1971	National Shoreline Study California Regional Inventory		August				Lesley Ewing - personal library	U.S. Army Corps of Engineers, South Pacific Division	
no	Hamilton, Megan	1998	Grains of sand: GPS survey-grade technology provides critical data to understanding beach erosion	Earth Observation Magazine	7(4)	p. 12-14					
no	Kellejian, J., Apple, S.	1997	Restoring the State's Eroding Beaches: An Innovative Case Study-Sand Replenishment from a Railroad Grade Separation in the City of Solana Beach	California and the World Ocean '97		pp. 1499					conference proceedings, San Diego
no	U.S. Dept of the Navy	1997	Environmental assessment for beach replenishment at North Carlsbad, South Carlsbad, Encinitas, and Torrey Pines, San Diego, Calif	GOVDOC NO: D 201.45/3:B 35	May						Naval Facilities Engineering Command Southwest Division
no	U.S. Dept of the Navy	1997	Environmental assessment for beach replenishment at South Oceanside and Cardiff/Solana Beach, C.	GOVDOC NO: D 201.45/3:B 365	April						Naval Facilities Engineering Command Southwest Division
no	U.S. Dept of the Navy	1997	Beach sand transport and sedimentation report: Channel dredging, Naval Air Station North Island, Phase II: San Diego, CA, FY '97	MCON Project P-706, 28, May 1997. GOVDOC NO: D 201.2/2:C 36.							Naval Facilities Engineering Command Southwest Division
no	Douglass, Scott L	1995	Estimating landward migration of nearshore constructed sand mounds	Journal of Waterway, Port, Coastal and Ocean Engineering	121(5)	p. 247-250.			UCB WRCA 11.7 WW; UCB Engin TA1.A47.W3		
no	Magnusen, Craig Ellsworth	1995	The characterization of Huntington Beach and Newport Beach through Fourier grain-shape, grain-size, and longshore current analysis	Thesis (M.S.)		178 p.			UCB WRCA G4714.N5-1	University of Southern CA	
no	Griggs, Gary B.; Tait, James F.; Corona, Wendy W.	1994	The interaction of seawalls and beaches; seven years of monitoring, Monterey Bay, CA	Shore & Beach	62:03	p. 21-28.					
no	Laidersdorf, Craig B., Ricky C. Hollar and Gregory Woodell	1993	Beach enhancement through Nourishment and Compartmentalization: The Recent History of Santa Monica Bay	Beach Nourishment and Management Considerations		71-85				ASCE; ed. Donald K. Stauble and Nicholas C. Kraus	
no	Lu, Yi, Osborne, Robert H.	1993	Sources for Quaternary sand and the effects of selective transport on grain-shape composition, Santa Monica Bay, CA	Geological Society of America, 1993 annual meeting Abstracts with Programs	25(6)	p. 274.				Geological Society of America	
no	Lee, Arthur C.	1993	Sources and relative fluxes for foreshore sand from Point Arguello to the United States-Mexico border: Fourier grain-shape analysis	Thesis (Ph. D.)		193p.				University of Southern CA	
no	Everts, C.H.	1991	Seacliff Retreat and coarse sediment yields in Southern California	Coastal Sediments '91		1586-1598					
no	Santa Barbara Dept. of Public Works	1989	Shoreline inventory								
no	Orme, A.R.	1988	Coastal dunes, changing sea level and sediment budget	Journal of Coastal Research	3	127-129					
no	U.S. Army Corps of Engineers, Los Angeles District	1985	Seal Beach - Anaheim Bay Harbor, Orange County, C	Beach Erosion Control Study	May	12 p.			Call numbers: UCB WRCA G4714.M5		
no	Dingler, John R.; Laband, B.L.; Anima, R.J	1985	Geomorphology Framework Report: Monterey Bay	Coast of California Storm and Tidal Waves Stud	CCSTWS85-2					USACOE	
no	U.S. Army Corps of Engineers, Los Angeles District	1978	Surfside-Sunset and Newport Beach Orange County, CA: final supplement to the final environmental statement		June				Call numbers: UCI Main Lib TC225.S97 S9 1978 Government Information Locs		
no	U.S. Army Corps of Engineers, Los Angeles District	1978	Shore protection improvement design analysis for stage 7 construction: periodic beach nourishment at Surfside-Sunset Beach, Orange County, C'		June				UCB WRCA G4713.K8		
no	U.S. Army Corps of Engineers, Los Angeles District	1977	Surfside-Sunset and Newport Beach, Orange County, CA	environmental impact statement, draft supplement to the final	December	92 p			UCI Main Lib TC225.S97 S9 1977 Government Information Locs		
no	U.S. Army Corps of Engineers, Los Angeles District	1974	Surfside-Sunset and Newport Beach, Orange County, CA: final environmental statement	environmental impact statement, final	September				UCI Main Lib TC225.S97 S9 1974 Government Information Locs		
no	U.S. Army Corps of Engineers, Los Angeles District	1972	Surfside-Sunset and West Newport Beach, Orange County, CA	environmental impact statement, draft	May				UCI Main Lib TC225.S97 S9 1972 Government Information Locs		
no	Price, R.C.	1966	Statement of the California Department of Water	Shore and Beach	34:1	22-32					
no	Rubin, Howard	1969	Biological effects of beach nourishment	ACOE-NY District							
no	Colgan, Chuck	1996	Sands of time running out: oceanographer seeks solution for CA's dwindling beaches	Explorations (La Jolla, San Diego, Calif.)	5(1) (summer)	p. 11-14, 16-17			UCB WRCA 96.1 XU2-10		
no	Azramendi, Moi.; Hemphill, Mike	1998	Geotechnical considerations for the Batiquitos Lagoon Enhancement Project	Ports	Vol. 1 (3/8-11/98)	pp. 581-590.			UCB Engin TC203.5.P67		Conference Proceedings, Long Beach, CA
no	Chang, H.H.	1997	Modeling fluvial processes in tidal inlet	J. HYDRAUL. ENG	123(12)	pp. 1161-1165			UCB Engin TA1.A47.HB; UCB WRCA 11.7WH		
no	Kadib, Andrew L	1997	coastal population	Science	5341	1211-1212			UCB Main Q1.S354		
no	1996	Shoreline and volume changes along the Orange County coastline.	Coast of CA Storm and Tidal Waves Study, South Coast Region, Orange County	Report 95-5	February				Call numbers: UCB WRCA G4713.N6-4		
no	Everts Coastal	1996	Coast of Newport Beach: shoreline behavior and coastal processes		April	112p.			UCB WRCA G4713.N6		report prepared for city of Newport Beach, Public Works Dept.
no	U.S. Army Corps of Engineers, Los Angeles District	1996	PORT OF LONG BEACH MAIN CHANNEL DEEPENING AND NAVIGATION IMPROVEMENTS, SAN PEDRO BAY, LOS ANGELES COUNTY, CA		June 12	2 volumes					
no	U.S. Army Corps of Engineers, Los Angeles District	1995	Shore history, surveys and changes	Coast of CA Storm and Tidal Waves Study, South Coast Region, Orange County, Los Angeles, CA	Report 95-2	*October 1995 Preliminary report			Call numbers: UCB WRCA G4713.N5 Note: At NRLF.		
no	Everts, Craig H.	1995	Seacliff erosion and its sediment contributions: Dana Point to the San Gabriel River.	Coast of CA Storm and Tidal Waves Study, South Coast Region, Orange County.	Report 95-1	November 1995.	41 p.		Call numbers: UCB WRCA G4713.N5-1		
no	Lee and Osborne	1995	something about grain shape correlated to source	Journal of Coastal Research	11	1366-1345					
no	Ambrose, Richard F.	1995	Rocky intertidal and subtidal resources, Santa Barbara County Mainland: final report	MMS, Pacific OCS Region Study 95-0067	December	172 p.					

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have?	Authors	Year	Title	Journal	Vol.No.	pages	topics	subtopic	locator code	sponsor	notes
no	U.S. Army Corps of Engineers, Los Angeles District	1995	PORT OF LONG BEACH (DEEPENING) FEASIBILITY STUDY, LOS ANGELES COUNTY, CA		EPA number 950242D, June 6	313 pages.					
no	U.S. Dept of the Navy	1995	DEVELOPMENT OF FACILITIES TO SUPPORT THE HOMEPORTING OF ONE NIMITZ CLASS AIRCRAFT CARRIER, SAN DIEGO, SAN DIEGO COUNTY, CA		EPA number 950509F, October 31	3 volumes				Naval Facilities Engineering Command Southwest Division	
no	U.S. Dept of the Navy	1995	DEVELOPMENT OF FACILITIES IN SAN DIEGO TO SUPPORT THE HOMEPORTING OF ONE NIMITZ CLASS AIRCRAFT CARRIER, SAN DIEGO COUNTY, CA		EPA number 950188D, May 5	2 volumes				Naval Facilities Engineering Command Southwest Division	
no	U.S. Dept of the Navy	1994	DREDGED-MATERIAL DISPOSAL, SAN DIEGO BAY, CA	environmental impact statement, final programmatic	EPA number 940036F, February 4	3 volumes				Naval Facilities Engineering Command Southwest Division	
no	Everts, Craig	1994	Comments on CCC Methodology to address impacts of seawalls on the beach?								
no	San Diego Unified Port District	1994	Imperial Beach sand replenishment from U.S. Coast Guard dredging, Ballast Point. negative declaration.		Draft report, 7/26/1994 UPD #305.	32 p.			Call numbers: UCSD SSH C200 P83 I463 Documents San Diego		
no	U.S. Army Corps of Engineers, Los Angeles District	1994	Reconnaissance Report: Malibu/Los Angeles County Coastline, LA County, CA		April				Lesley Ewing - personal library		
no	U.S. Dept of the Navy	1993	DREDGED-MATERIAL DISPOSAL, SAN DIEGO BAY, CA	environmental impact statement, draft programmatic	EPA number 930006D, January 6	2 volumes				Naval Facilities Engineering Command San Diego, CA	
no	Jenkins, S.A.; Skelly, D.W.	1991	Development of a soft reef sandbar for offshore wave dissipation.	Bulletin of Marine Science: Proceedings of the 5th International Conference on Aquatic Habitat Enhancement, 1994	55(2-3)	p. 1338				Int. Conf. on Aquatic Habitat Enhancement: 3-7 Nov 1991, Long Beach, CA.	
no	Orme, A.R.	1991	Mass movement and seacliff retreat along the southern California Coast	Bulletin of Southern California Academy of Sciences	90	58-79					
no	Liu, C.C. et al	1991	Coastal Processes Study on BEACON shoreline	Coastal Sediments '91		2249-2261			UCB ENGIN GB450.2 S66; UCB WRCA 85 CCC-ID#8908214; CCC-ID#89009193		Proceedings
no	San Diego Association of Governments	1991	Shoreline preservation strategy for the San Diego region-volumes 1 and 2		September						
no	U.S. Army Corps of Engineers, Los Angeles District	1991	DEEP DRAFT NAVIGATION IMPROVEMENTS, LOS ANGELES AND LONG BEACH HARBORS, SAN PEDRO BAY, CA		EPA number 920208D, June 4, 1992	2 volumes					
no	U.S. Dept of the Navy	1991	FAST COMBAT SUPPORT SHIP (AOE-6 CLASS) U.S. WEST COAST HOMEPORTING PROGRAM, CA AND WASHINGTON		EPA number 910116D, April 12	421 pages.				Naval Facilities Engineering Command Washington, D.C.	
no	U.S. Dept of the Navy	1991	FAST COMBAT SUPPORT SHIP (AOE-6 CLASS) U.S. WEST COAST HOMEPORTING PROGRAM, CA AND WASHINGTON		EPA number 910331F, September 13, 1991	2 volumes.				Naval Facilities Engineering Command Washington, D.C.	
no	Humboldt State University	1990	Sediment Characteristics, Benthic Infauna....Humboldt Bay, CA (August 1989)	report to USACOE							
no	Coats, Robert, Michael Josselyn and Robert Lavenberg	1990	Conceptual plan for enhancement of the Edison and Picciorelli properties at Huntington Beach.	Southern CA wetlands inventory	library #711, October 18, 1990.				Call numbers: UCI Main Lib QH76.5.C22 H84 1990 Government Information Local	Philip Williams & Associates,	
no	U.S. Army Corps of Engineers, Coastal Engineering Research Center	1990	Los Angeles and Long Beach Harbors Model Enhancement Program : three-dimensional numerical model testing of tidal circulation		CERC-90-16, September	124 p.			Call numbers: UCB WRCA G200 Y-21 no. CERC- 90-16		
no	U.S. Army Corps of Engineers, Los Angeles District	1990	BATIQUITOS LAGOON ENHANCEMENT PROJECT, CARLSBAD, CA		EPA number 900229F, June 27	5 volumes					
no	Leonard, L.; Pilkey, O.; Clayton, T	1989	An assessment of beach replenishment parameters	Beach Preservation Technology: 1st National Conference Proceedings: Problems and Advancements in Beach Nourishment, 1988 (ed. Tall)		115-124				FSBPA	
no	Oregon State University	1989	report on sediment budgets and physical processes for coastline between WA and N. CA								
no	U.S. Army Corps of Engineers, Los Angeles District	1989	PROPOSED BATIQUITOS LAGOON ENHANCEMENT PROJECT, CARLSBAD, CA		EPA number 890100D, April 20	369 pages					
no	Leonard, L.; Pilkey, O.H.; Clayton, T.D	1988	An assessment of parameters critical to beach	FSBPA Proceedings		115-124					
no	Barbato, Lucai Sabini	1988	Effect of beach replenishment at Coronado, CA 1985-8	Thesis (M.A.)		118p.			UCLA SRLF D0001728096	UCLA	
no	U.S. Army Corps of Engineers, Los Angeles District	1987	Oceanside Littoral Cell Preliminary Sediment Budget Report	Coast of CA Storm and Tidal Waves Study, San Diego Region	87-4	158 pp.					
no	Moffatt and Nichol, Engineers	1987	Silver Strand Littoral Cell preliminary sediment budget report	Coast of CA Storm and Tidal Waves Study, South Coast Region	Report 87-3 December	157 pp.			UCB WRCA G4115 M7	US Army Corps of Engineers, LA District, Planning Division, Coastal Resources Branch	
no	Grove, Robert S.; Sonu, Choule J.; Dykstra, David H.	1987	Fate of massive sediment injection on a smooth shoreline San Onofre, CA	Coastal Sediments '87					UCB ENGIN GB450.2 S64		
no	Griggs, G.B.	1987	Littoral cells and harbor dredging along the California Coast	Environ. Geol. Water Sci	10(1)	p. 7-20			UCB Earth Sci QE1 E56		
no	U.S. Army Corps of Engineers, Los Angeles District	1987	Coastal Project: Surfside-Sunset and Newport beach	Project Information summary	January						
no	U.S. Army Corps of Engineers, Los Angeles District	1986	San Gabriel River to Newport Bay (Surfside-Sunset and Newport Beach), Orange County, CA. Condition of Improvement	Beach Erosion Control Study: Unpublished							
no	Wilcoxon, Peter J.	1986	Coastal zone erosion and sea level rise: implications for Ocean Beach and San Francisco's Westside Transport Project	Coastal Zone Management Journal	14; no 3	p.173-91			UCB EnvDesign HT392.A1.C6; UCB WRCA 85.1 W (NRLF)		ABSTRACT: Estimated erosion resulting from the greenhouse effect: costs of beach nourishment to protect the sewer facility
no	Santa Barbara Dept. of Public Works	1986	Beach Erosion Authority for Control Operations and Nourishment	recommendation to the Mayor and Councilmembers	5/2/1986				UCSB Main Lib TC332.B43 Sci-Eng		
no	Griggs, G.B.	1986	Relocation or reconstruction: viable approaches for structures in areas of high coastal erosion	Shore & Beach	54(1)	p. 8-16					
no	Berrigan, Paul D.	1986	Statement of Paul D. Berrigan at public hearing of CA Coastal Commission on Ocean Beach sand replenishment			1 envelope			UCB WRCA JOHNSON 202-25		Notes: Regarding erosion protection, seawall constructed within the boundaries of the Golden Gate National Recreation Area, etc
no	San Francisco Clean Water Program	1986	Ocean Beach beach nourishment plan		August	2 v.			UCB WRCA JOHNSON 202-26		
yes	Spencer, D	1985	The Newport Beach groin field, Orange Co. CA	California's Battered Coast	September	151-203			Lesley Ewing - personal library	McGrath, Jim (ed), California Coastal Commission	Proceedings from a conference on coastal erosion, San Diego, February 6-8 1988!
no	Drake, D.E.; Cacchione, Dave A.; Karl, Herman A.	1985	Bottom currents and sediment transport on San Pedro Shelf, California	Journal of Sedimentary Petrology	55.1	15-28					
no	U.S. Army Corps of Engineers, Coastal Engineering Research Center	1984	Shore Protection Manual	Government Printing Office 008-022-00218-9							
no	Seymour, R.J.; R. R. Strange III; D.R. Cayan and R.A. Nathan	1984	Influence of El Nino on California's Wave Climate	Proceedings of the 19th International Conference on Coastal Engineering		577-592				ASCE	
no	Massey, B.W. and J.L. Atwood	1984	Application of ecological information to habitat management for the California least tern	Progress Report No. 6, US Fish and Wildlife Service							
no	U.S. Army Corps of Engineers, Los Angeles District	1984	Coastal Storm Damage: Winter 1983			151p.					
no	Herbich, J.B. and S.B. Brahme	1983	Literature Review and Technical Evaluation of Sediment Suspension During Dredging	CDS Report No. 266, USACOE WES							
no	Littler, R. M., G. Whelan	1983	Littoral processes : U.S. Coast Guard Station, Fort Point, San Francisco	Marine Ecology Progress Series	11	129-139			UCB WRCA JOHNSON 215	U.S. Coast Guard	
no	Ecker, R. M., G. Whelan	1983	Littoral processes : U.S. Coast Guard Station, Fort Point, San Francisco	Pacific Northwest Laboratory, Richland, Wash.	October	84 p.					
no	Inman, D.L. and S.A. Jenkins	1983	Oceanographic Report for Oceanside Beach Facility	report for city of Oceanside	August	206 pp.	sediment budget				
no	U.S. Army Corps of Engineers, Los Angeles District	1983	Project Information Sheet: Imperial Beach, San Diego County, CA	unpublished	1/2/1983						
no	Moffatt and Nichol Engineers	1983	Experimental sand bypass system at oceanside harbor, CA Phase 1 Report: Data Collection and Analysis	unpublished report for USACOE-LA District							
no	Naqvi, S.M.; Pullen, E.J.	1982	Effects of beach nourishment and borrowing on marine organisms	USACOE CERC Miscellaneous report; no. 82-14		43 pp.				USACOE, Coastal Engineering Research Center	

TABLE 4 - Selected Sites of Offshore Sand Deposits in Southern California:

SITE	LOCATION	LATITUDE	LONGITUDE	ESTIMATED POTENTIAL VOLUME (Million Cu. Yds.)	REFERENCE
Isla Vista	Santa Barbara County			24	Noble Consultants (1989)
Santa Barbara	Santa Barbara County			23.5	Noble Consultants (1989)
Area C: Borrow Area C-II	Santa Barbara County (Santa Barbara)			15	Field (1974)
Carpinteria	Santa Barbara County			17.6	Noble Consultants (1989)
Ventura	Santa Barbara County			>250.0	Noble Consultants (1989)
Area C: Borrow Area C-I	Ventura County (Port Hueneme)			68 (marginal quality)	Field (1974)
Area C: Borrow Area C-	Ventura County (Port Hueneme)			25 (marginal quality)	Field (1974)
Area I: B-I	Los Angeles County (Redondo Beach)			20.9 - 34.0	Osborne and others (1983)
Area I: B-II	Los Angeles County (Manhattan Beach)			43.0 - 101.0	Osborne and others (1983)
Area I: B-III	Los Angeles County (El Segundo)			35.0 - 79.0	Osborne and others (1983)
Area I: B-IV	Los Angeles County (Santa Monica Shell)			325	Osborne and others (1983)
Area I: B-V	Los Angeles County (Santa Monica)			18.0 - 66.0	Osborne and others (1983)
Area II: A-I	Orange County (Newport Beach)			80.0 - 133.9	Osborne and others (1983)
Area II: A-II	Orange County (San Pedro Shelf)			194.0 - 220.0	Osborne and others (1983)
Area II: A-III	Los Angeles County (San Pedro Shelf)			44.5 - 103.1	Osborne and others (1983)
Area II: A-IV	Orange County (Huntington Beach)			14.8	Osborne and others (1983)
Area II: A-V	Orange County (San Pedro Shelf)			8.5 - 28.5	Osborne and others (1983)
Borrow Area E	Orange County (Surfside/Sunset Beach)			1	U.S. Army Corps of Engineers (1989)
Borrow Area C	Orange County (Surfside/Sunset Beach)			1.4-2.5	U.S. Army Corps of Engineers (1989, 1995)
Borrow Area C-2	Orange County (Surfside/Sunset Beach)			0.2	U.S. Army Corps of Engineers (1995)
Borrow Area C-3	Orange County (Surfside/Sunset Beach)			1.6	U.S. Army Corps of Engineers (1995)
Area IV: SD-I (SO-9)	San Diego County (Oceanside)			32.6	Osborne and others (1983); SANDAG (1993)
Area IV: SD-II (SO-8)	San Diego County (Oceanside)			27.1	Osborne and others (1983); SANDAG (1993)
Area V: SD-III (SO-7)	San Diego County (Carlsbad)			16.5	Osborne and others (1983); SANDAG (1993)
Area V: SD-IV (SO-6)	San Diego County (Encinitas)			12.4	Osborne and others (1983); SANDAG (1993)
Area V: SD-V (SO-5)	San Diego County (Solana Beach)			10.3	Osborne and others (1983); SANDAG (1993)
Area V: SD-VI (SO-4)	San Diego County (Del Mar)			2.9	Osborne and others (1983); SANDAG (1993)
Area VI: SD-VII (SO-3)	San Diego County (Torrey Pines)			3.1	Osborne and others (1983); SANDAG (1993)
SO-2	San Diego County (La Jolla)			0.03 per year	SANDAG (1993)
Area VI: SD-VIII (SO-1)	San Diego County (La Jolla)			5	Osborne and others (1983); SANDAG (1993)
Area VII: SD-IX (MB-1)	San Diego County (Mission Beach)			192	Osborne and others (1983); SANDAG (1993)
MB-2	San Diego County (Mission Beach)			0.01 per year	SANDAG (1993)
SS-3	San Diego County (North Island)			0.12 per year	SANDAG (1993)
Area VIII: SD-X (SS-2)	San Diego County (Silver Strand)			347.5	Osborne and others (1983); SANDAG (1993)
Area VIII: SD-XI (SS-1)	San Diego County (Imperial Beach)			31.5	Osborne and others (1983); SANDAG (1993)
Area VIII: SD-XII	San Diego County (Silver Strand)			0.5	Osborne and others (1983)
Borrow Area A	San Diego County (Imperial Beach)			7.9	U.S. Army Corps of Engineers (2002)
Borrow Area E	San Diego County (Imperial Beach)			8.1	U.S. Army Corps of Engineers (2002)

TABLE 5 - Retardation Basins in Orange County									
Name	Year Built	Sediment Production Area (mi²)	Capacity (yds³)	Sediment Stored (yds³)**	Sediment Removed (yds³)	County	Maintained By	Latitude	Longitude
Trabuco Retarding Basin	1996	1.52	0*	na	na	Orange	OCPF&RD	33.6755	117.7628
Bee Canyon Retarding Basin	1995	1.31	62,900	25,577	29,660	Orange	OCPF&RD	33.7083	117.7100
Round Canyon Retarding Basin	1995	1.81	45,200	0	15,400	Orange	OCPF&RD	33.6983	117.6933
Hicks Canyon Retarding Basin	1997	1.24	29,400	467	4,460	Orange	OCPF&RD	33.7350	117.7233
E. Hicks Canyon Retarding Basin	1997	0.69	8,100	150	2,500	Orange	OCPF&RD	33.7350	117.7233
Orchard Estates Retarding Basin	1998	0.69	46,000	0	na	Orange	OCPF&RD	33.7361	117.7531
Auga Chinon Retarding Basin	1998	2.17	64,500	42,616	9,300	Orange	OCPF&RD	33.6950	117.6967
* no designed sediment capacity.									
** as of September 22, 2003									
OCPF&RD = Orange County Public Facilities & Resources Department. Contact - Mr. John Gietzen, (714) 538-5525									