6. EFFECTIVENESS OF THE PROGRAM

Because the nourishment projects funded through the Public Beach Restoration Program are in the early stages of implementation, an evaluation of their effectiveness is premature. Judging from the success of prior nourishment projects, however, the current projects offer the potential for significant improvement of the state's beaches. To provide insight into the results achieved in the past, the sections that follow provide an overview of historical beach nourishment activities in the state, followed by an in-depth review of specific projects.

6.1 Overview

Beach nourishment has been conducted in California for most of the past century. Although we are inclined to regard the wide, sandy beaches of cities like Santa Monica, Venice, Newport Beach, and Mission Bay as part of the state's "natural" endowment, they were in fact created by nourishment programs that commenced as early as the 1920's. The pre-nourishment condition was distinctly different -- typically a narrow strip of dry beach on a sand-starved coast -- and totally incapable of accommodating the present-day demands for coastal access and recreation. Other benefits that accrue from past nourishment projects, in addition to coastal access and recreation, include enhanced public health and safety, restored wildlife habitats, increased protection for upland facilities against winter storm waves, and a significant revenue stream from coastal tourism.

The nature of beach nourishment has evolved as planners, scientists, and engineers have gained more knowledge of the coastal environment. Whereas structural means of shoreline stabilization (such as groins and detached breakwaters) were common 30 to 50 years ago, beach nourishment has emerged as the preferred method in recent decades. However, nourishment has long been recognized as a viable means of beach restoration in California (Wiegel, 1994). In a 1952 study of the California coast between Point Mugu and San Pedro, the U.S. Army Corps of Engineers Erosion Board drew the following conclusion (US Congress, 1953):

> *"Where conditions permit, probably the best means of protecting a beach or a shoreline against erosion of any type is to introduce a sandfill between the shoreline to be protected and the ocean and maintain that protective fill against long-term erosion."*

Numerous past projects have been associated with harbor construction, while others were undertaken to protect upland developments such as public and private structures, or transportation corridors such as the Pacific Coast Highway and railway links. Most projects can be segregated into two general categories:

1.) Deterministic Nourishment – Deterministic beach nourishment projects are those that are undertaken for the primary purpose of putting sand on beaches. Typical motivations for such projects include mitigating the adverse effects of nearshore and beach structures and compensating for the reduction in natural sediment supply from rivers and streams caused by dams and debris basins.

2.) Opportunistic Nourishment – Opportunistic beach nourishment projects are those that are undertaken when beach-quality sand becomes available from projects unrelated to beach nourishment. To date, the primary sources of this "sand of opportunity" in California have been harbor construction and maintenance dredging. Opportunistic nourishment is driven by economics, in that it often proves more cost effective to place the excavated material on nearby beaches than to dispose of it inland or offshore.

The following sections describe representative deterministic and opportunistic beach nourishment projects that have been conducted along the California coast.

6.2 Deterministic Beach Nourishment Projects

As indicated previously, nourishment projects planned and executed for the express purpose of beach restoration or maintenance can be categorized as deterministic. These projects range from large-scale regional beach nourishment programs to local erosion-control efforts.

6.2.1 Planned Regional Beach Nourishment in Orange County

The Orange County Beach Erosion Control Project was initiated by the U.S. Army Corps of Engineers, in concert with the State of California and the County of Orange, in 1964. The general objective of this regional beach nourishment program is to mitigate erosion along the Orange County shoreline between Surfside-Sunset Beach and Newport Harbor caused by extensive coastal and upland development during the early part of the 20^{th} century. The project consists primarily of ongoing periodic beach nourishment at Surfside-Sunset Beach, and beach nourishment in conjunction with sand containment devices at West Newport Beach.

The Orange County project is a representative model for large-scale beach replenishment programs for other regions in California. The SANDAG Regional Sand Project, for example, involved the placement of 2 million cubic yards of material along the San Diego County coastline. A similar program is currently being planned by BEACON for Santa Barbara and Ventura Counties. A central component of each program is the utilization of offshore borrow sources for beach nourishment.

Project History

Historically, sand was delivered naturally to the beaches of northern Orange County by the San Gabriel and Santa Ana Rivers, with modest input from coastal bluff erosion in the Huntington Beach area. Following construction of flood control measures on these rivers, the jetties at Anaheim Bay (for the U.S. Naval Weapons Station, Seal Beach) and the breakwaters of the Long Beach – Los Angeles Harbor Complex, significant changes occurred to the natural condition of the region. These changes include a reduction in the volume of sediment reaching the coast, modification of the wave energy available to move sand alongshore, impediments to sediment movement at major coastal barriers, and reversed sediment transport direction along certain segments of the coast. Some beaches benefited from these changed conditions, while others did not. Beach erosion was particularly severe in front of the communities of Surfside-Sunset Beach and West Newport Beach, where wave action has caused coastal flooding and property losses (USACE, 1999).

The chronic erosion problem at Surfside-Sunset Beach (Plate 6.1) became apparent soon after completion of the Naval Weapons Station in 1944. To provide protection for homes along the eroding beach, a revetment was built by the Navy in 1945 and most recently refurbished in the 1990's. The first beach nourishment operations also were conducted in 1945. Between 1945 and 1956, nearly 2.3 million cubic yards of material dredged from the Naval Weapons Station were used to replenish the eroding Surfside-Sunset shoreline (Shaw, 1980).

Plate 6.1 Surfside-Sunset Beach, November 2000

A 1962 U. S. Army Corps of Engineers cooperative study identified a significant need for beach restoration in the region (USACE, 1962). As a result, the Corps, in concert with the State of California and the County of Orange, initiated the Orange County Erosion Control Project in 1964. A primary component of the project is periodic and ongoing nourishment at Surfside-Sunset. The beach fills provide temporary protection for Surfside-Sunset, and also serve to nourish downcoast beaches as waves and currents move the sand alongshore towards Newport Beach.

To mitigate erosion at West Newport Beach, the project plan included beach nourishment and construction of sand retention devices. The shoreline stabilization measures were designed to minimize the loss of nourishment material and increase the intervals between beach fills. Only limited re-nourishment has been required since the initial beach fills and sand retention devices were constructed in the 1960's and 1970's.

The project was designed to be constructed in stages. The work pertaining to Stages 1, 4A, 7, 8, 9,10, and 11 of the project was located in the Surfside-Sunset Beach area and Stages 2, 3, 4B and 5 were located in West Newport Beach. Stage 6 never took place. A more detailed summary of each stage is provided in Table 6.1.

Project Performance

Northern Orange County beaches currently are wider and contain greater volumes of sand than existed prior to the initiation of the Orange County Beach Erosion Control Project. Beach nourishment has enhanced recreational opportunities, improved coastal access, and increased coastal protection while reducing the need for hard structural armoring. The beaches attract millions of visitors each year, providing sustainable economic benefits.

Beach width and sand volume changes provide a relatively objective measure of the effectiveness of the Orange County Beach Erosion Control Project. As part of the Coast of California Storm and Tidal Waves Study for the Orange County Coast (CCSTWS-OC), these tools were used to analyze the coastal changes in the region since the project was initiated. Salient findings from the study are discussed below (USACE, 1999).

Table 6.1 Orange County Beach Erosion Control Project Construction History

Date	Project Milestone	Beach Nourishment			Sand Retention Devices
		Quantity (cubic yards)	Placement Site	Borrow Site	
1964	Stage 1	4,000,000	Surfside-Sunset	Naval Weapons Station	---
1968	Stage 2	495,000	West Newport Beach	Santa Ana River & Balboa Peninsula	*Construction of Steel Sheetpile Groins* 40th, 44th St, and 48th Streets
1970	Stage 3	874,000	West Newport Beach	Santa Ana River	*Construction of Rubblemound Groins* 36th, 52nd, and 56th Streets *Rubble Encasement of Sheetpile Groin* 48th Street
1971	Stage 4A	2,300,000	Surfside-Sunset	Naval Weapons Station	---
1973	Stage 4B Stage 5	358,000	West Newport Beach	Santa Ana River	*Construction of Rubblemound Groins* 32nd and 28th Streets *Rubble Encasement of Sheetpile Groins* 40th and 44th Streets
Deferred	Stage 6	---	---	---	Proposed an offshore breakwater and south jetty extension at Santa Ana River. ***Deferred pending a demonstrated need***.
1979	Stage 7	1,600,000	Surfside-Sunset	Nearshore Borrow Pits	---
1985	Stage 8	2,700,000	Surfside-Sunset	Nearshore Borrow Pits/ Naval Weapons Station	---
1990	Stage9	1,800,000	Surfside-Sunset	Nearshore Borrow Pits	---
1997	Stage 10	1,600,000	Surfside-Sunset	Nearshore Borrow Pits	---
2001	Stage 11	1,800,000	Surfside-Sunset	Nearshore Borrow Pits	---

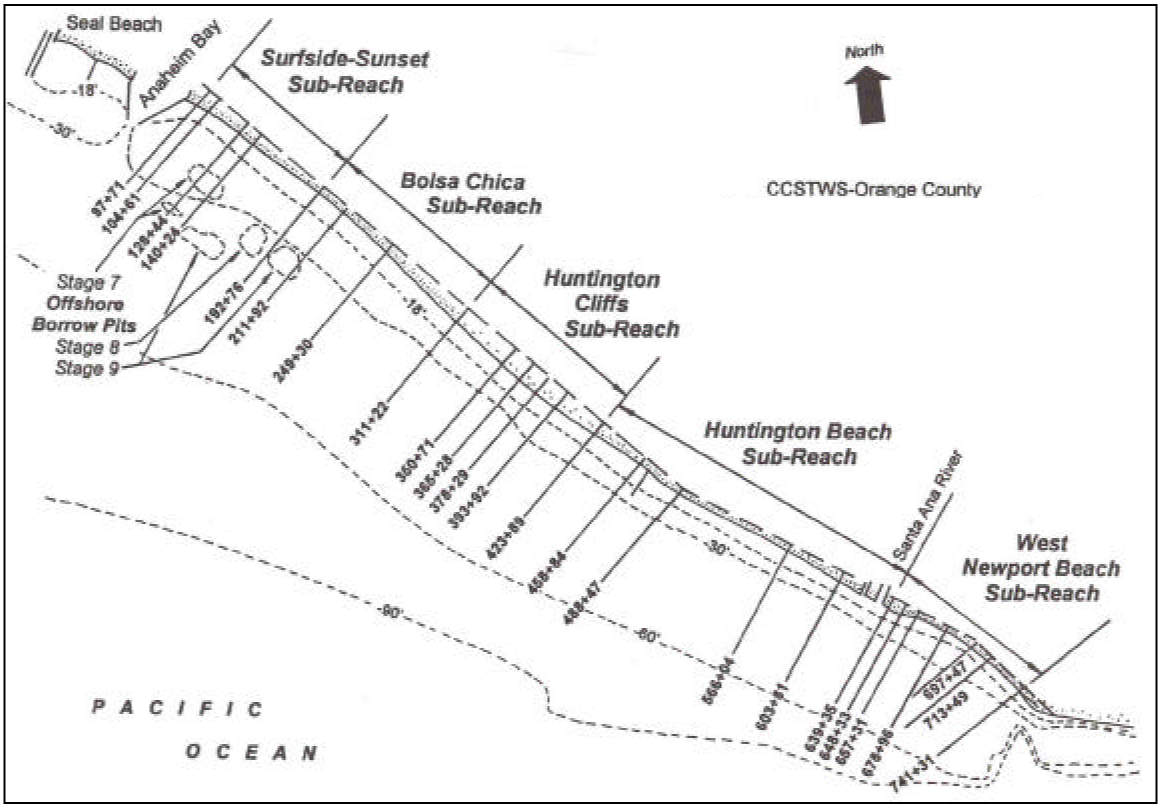

Figure 6.1 CCSTWS-Orange County study area with beach profile locations

To facilitate a discussion of these coastal changes, the study area was divided into five sub-reaches. The sub-reaches are shown in Figure 6.1 and characterized below.

- *Surfside-Sunset:* Adjacent to Anaheim Bay (Naval Weapons Station). Serves as a "feeder" beach and has received nearly 14 million cubic yards of nourishment material since 1963.
- *Bolsa Chica*: Contains wide, sandy beaches backed by a lowland marsh.
- *Huntington Cliffs:* Comprised of narrow beaches backed over much of its length by high coastal bluffs.
- *Huntington Beach:* Contains wide, sandy beaches. Coastal structures include the Huntington Beach Pier and the Santa Ana River Jetties.
- *West Newport Beach:* Consists of wide, stable beaches. Modified extensively by armor and beach nourishment. Coastal structures include a groin field and the Newport Pier.

The mean sea level (MSL) beach width is a measure of the above-water portion of the beach, and provides an indication of the protective capacity of the beach as well as the amount of dry sand available for recreation. Figure 6.2 shows the average MSL beach width for each sub-reach over the 34-year period between 1963 and 1997.

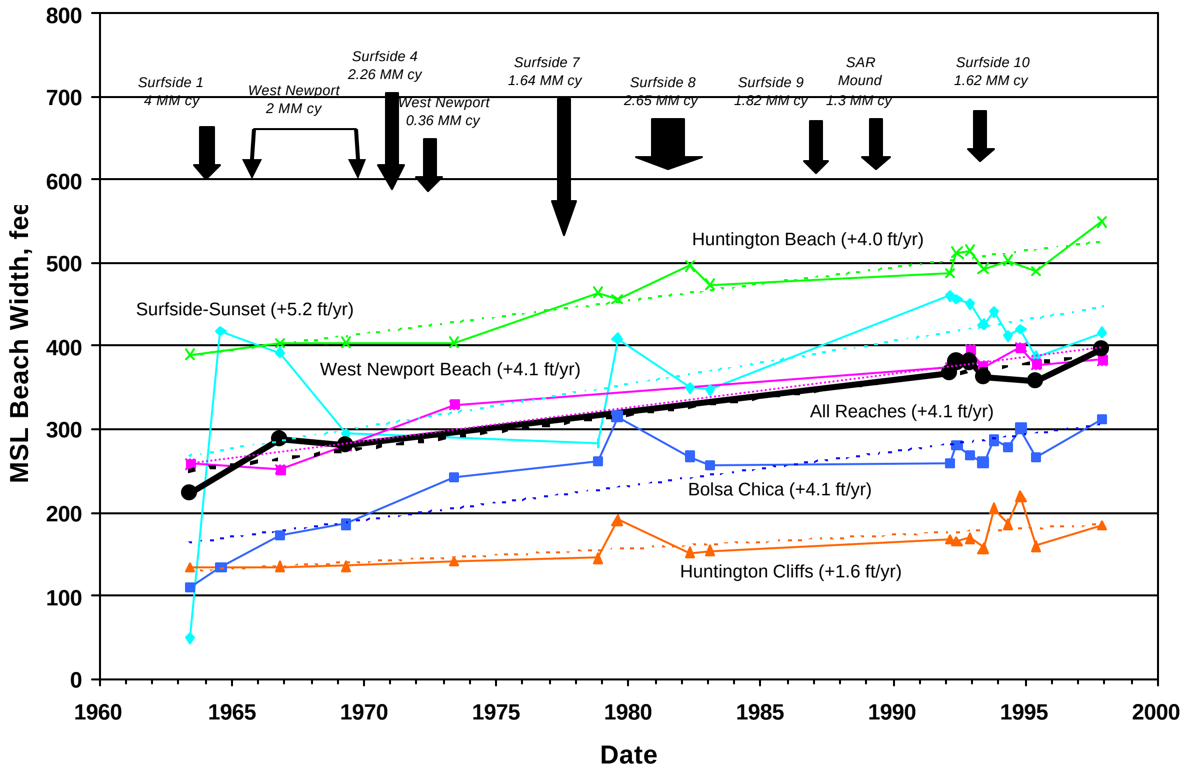

Figure 6.2 Average MSL beach width by sub-reach

Since the project was implemented, beach widths have increased in all sub-reaches. The rates of shoreline advance range from +1.6 ft/year at Huntington Cliffs to +5.2 ft/year at Surfside-Sunset. Over the entire study area, beach widths have increased at an average rate of +4.1 ft/year. The substantial fluctuations in beach width evident at the Surfside-Sunset sub-reach reflect the effects of periodic beach nourishment interspersed by periods of erosion.

Comparisons of the accumulated volume of sand in the nearshore region between Anaheim Bay and the Santa Ana River with the volume of nourishment material placed at Surfside-Sunset are shown in Figure 6.3. The nearshore volumes are representative of the material contained in the active littoral system. This includes not only the above-water beach, but also sand located in the nearshore waters that moves seasonally onshore and offshore.

When the accumulation of nearshore sediment volume is compared with the quantity of beach-quality sediment supplied at Surfside-Sunset, the agreement is found to be remarkably close.

This indicates that most of the nourishment material placed at Surfside-Sunset is still in the active littoral system and benefiting the region's beaches.

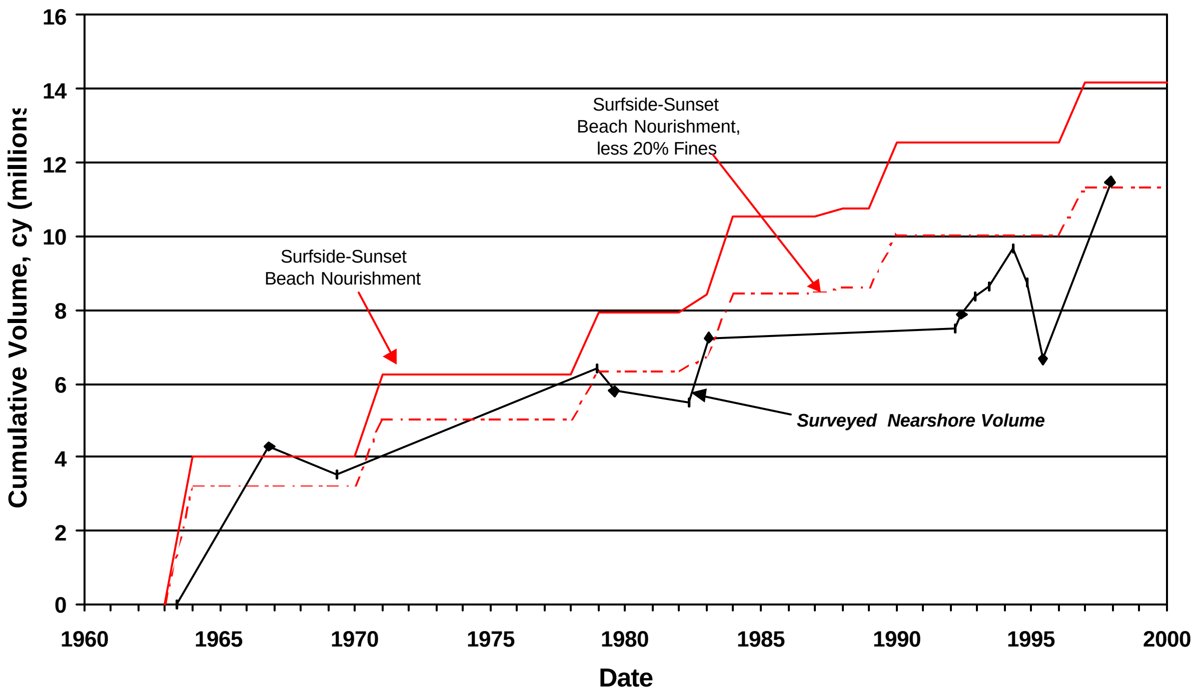

Figure 6.3 Comparison of surveyed nearshore volume with nourishment volume

The magnitude of the shoreline changes can be further illustrated by comparison of historical photographs. Plates 6.2 and 6.3 show Huntington Beach, near the municipal pier, in 1931 and 1986. The West Newport Beach shoreline in 1934 and 1992 is shown in Plates 6.4 and 6.5, respectively. The current beach is wider at both locations when compared to historical conditions.

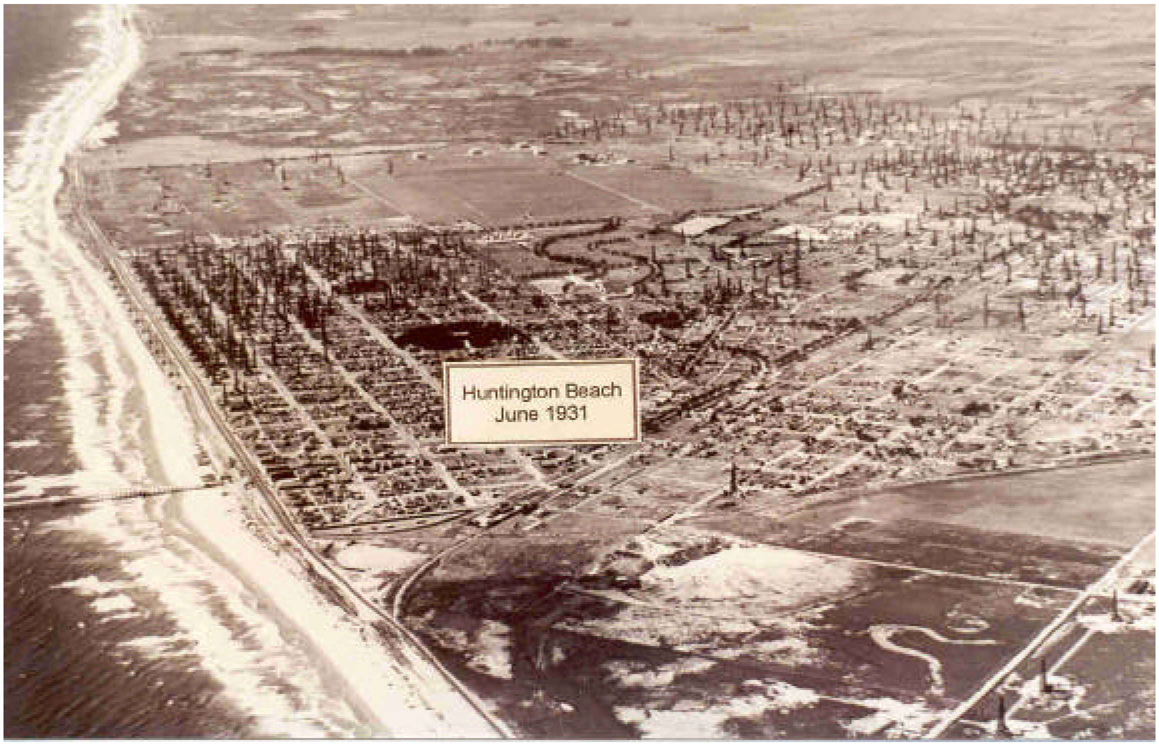

Plate 6.2 Huntington Beach, 1931 (looking northwest)

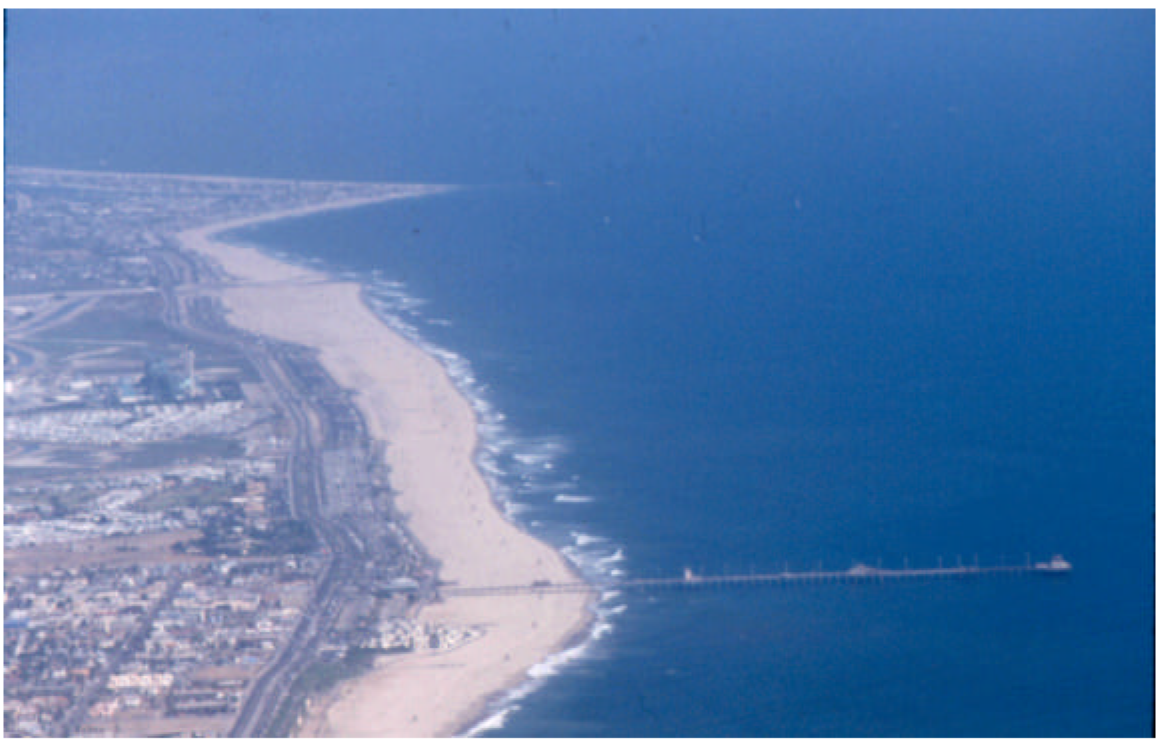

Plate 6.3 Huntington Beach, 1986 (looking southeast)

Plate 6.4 West Newport Beach, 1934 (looking southeast)

Plate 6.5 West Newport Beach, 1992 (looking south)

6.2.2 Sand Backpassing at Peninsula Beach, Long Beach

The City of Long Beach has conducted sand backpassing operations to nourish Peninsula Beach since 1994. The primary objectives of the program are to maintain recreational beaches and provide storm protection along 2,500 ft of eroding shoreline. The nourishment method consists of "recycling" sand from a wide stable beach to a nearby sediment-starved beach. Unlike conventional beach nourishment methods, no new material is added to the littoral system.

The program performed at Peninsula Beach is representative of similar operations that have been conducted elsewhere along the California coast. Backpassing between East and West Beach in nearby Seal Beach has been performed periodically since the 1960's (Moffatt and Nichol, 1984). In Orange County, sand has been transported from the wide beaches of Balboa to West Newport on several occasions (USACE, 1993). Another example can be found in Santa Monica Bay, where sand was backpassed from Marina del Rey to Venice Beach in 1973 (Leidersdorf et al., 1994).

Project History

Peninsula Beach, at the eastern end of Long Beach, has suffered chronic erosion for several years. The Long Beach breakwater protects the majority of the City's beaches from storm wave impacts; however, at the eastern end of the structure, waves proceed unimpeded to Peninsula Beach. The typical pattern of shoreline change consists of erosion and alongshore transport from Peninsula Beach to the sheltered beaches in the lee of the breakwater (Figure 6.4).

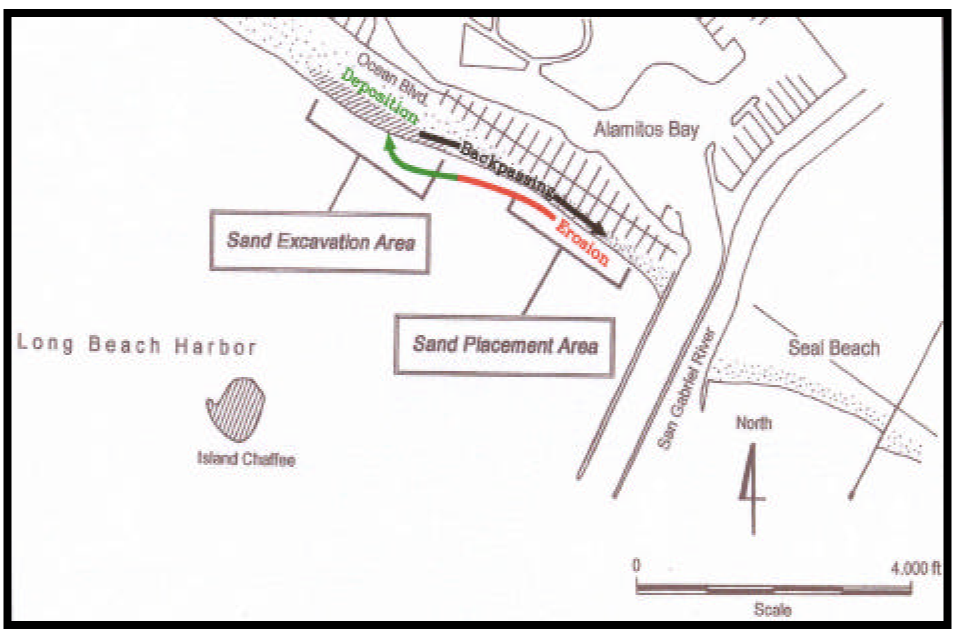

Figure 6.4 Peninsula Beach backpassing operation

Several investigations have been conducted to develop solutions to the recurring erosion problem. Structural means of protection are often burdened by high capital costs, environmental concerns, and public opposition. As a result, the City Council adopted the sand backpassing program in 1994 to address beach erosion at Peninsula Beach. The operation, shown schematically in Figure 6.4, utilizes large land excavation "scrapers" to collect sand from the borrow site located to the west and transfer the material to the eroding shoreline at Peninsula Beach to the east. Haul distances are typically less than 2 miles. Plate 6.6 shows the operation in progress.

Plate 6.6 Sand backpassing at Peninsula Beach, November 1994

Operations have been conducted on 9 occasions since November 1994, with the most recent backpassing effort completed in March 2001. Nourishment volumes have ranged between 60,000 and 100,000 cubic yards.

Project Performance

The sand backpassing program implemented by the City of Long Beach has been highly effective in replenishing Peninsula Beach. Plate 6.7 provides a pre- and post-nourishment view of the beach. Like any maintenance operation, the success of the project is dependent upon re-nourishing before erosion subjects upland development to coastal storm damage. Re-nourishment has been required at intervals ranging from 3 to 18 months.

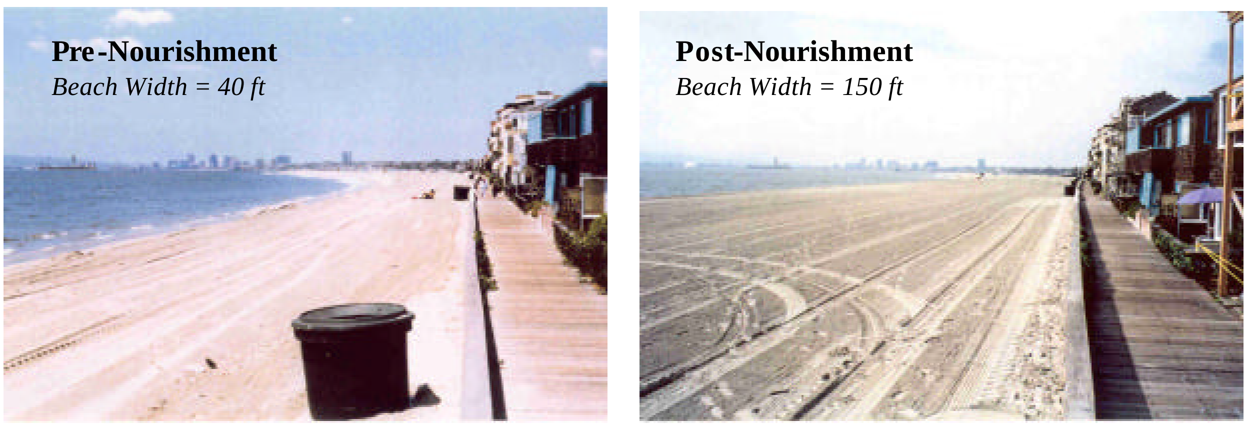

Plate 6.7 Pre- and post-nourishment condition near 65th Place (looking west)

The City conducts monthly beach width measurements to monitor the condition of the Peninsula Beach shoreline. When beach widths become critically narrow, typically 100 ft or less, the next backpassing episode is implemented. Figure 6.5 depicts the evolution of the nourished shoreline between 1994 and 2000. Eight backpassing operations were conducted during the period. The longevity of each nourishment episode is highly dependent on wave conditions at the site. Post-nourishment erosion rates varied from 0.3 ft/day to 3.8 ft/day.

Much of the program's success is due to the relatively modest construction costs. Because of the short transport distances, the average unit cost of the operation is typically less than $1.50 per cubic yard. In comparison, costs of beach nourishment operations involving inland sand sources typically range between $6 and $10/cy. Likewise, because hydraulic dredge operations are burdened by high mobilization charges, the unit cost of using that method for small nourishment programs is often in excess of $6/cy.

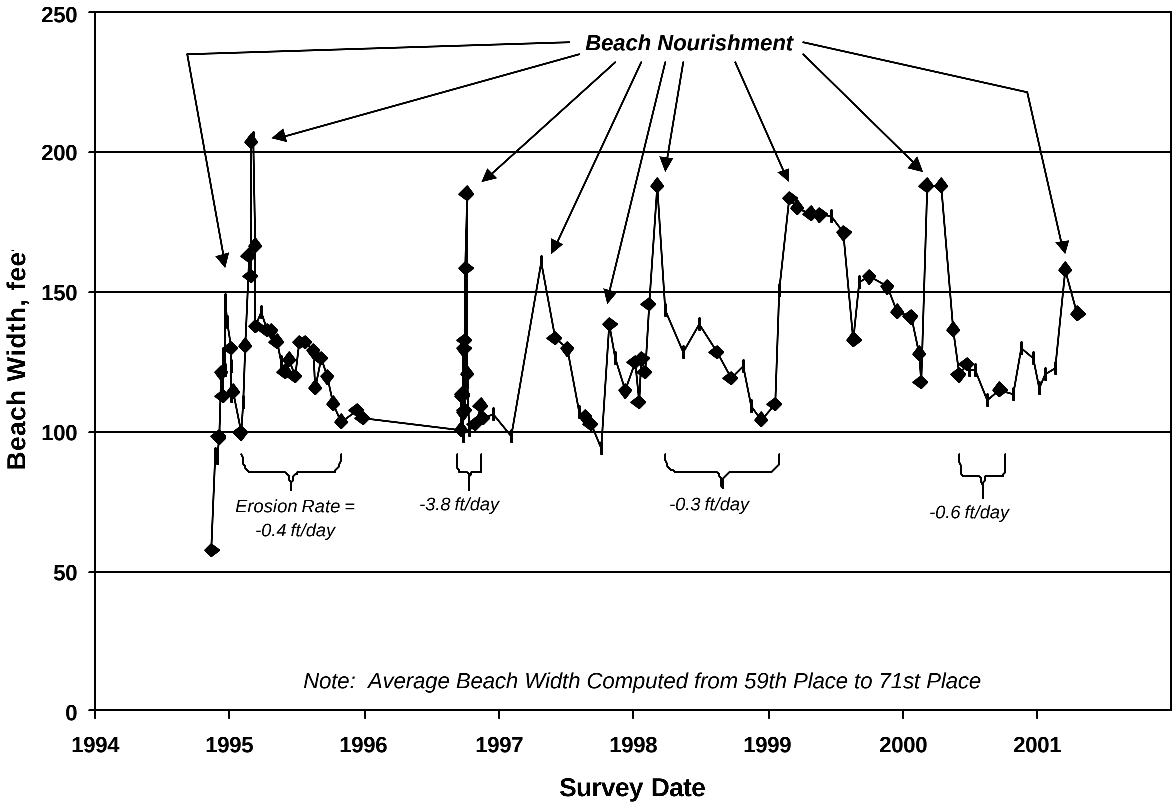

Figure 6.5 Beach width measured at Peninsula Beach, 1994-2001

6.2.3 Sand Bypassing at Santa Barbara Harbor

Sand bypassing has been conducted at Santa Barbara Harbor since 1933, longer than any other such operation in California. The nourishment method consists of transporting sand from the upcoast side of a sediment-blocking structure to the downdrift side to compensate for interrupting the natural downcoast flow of sand. The objective of the ongoing project at Santa Barbara is to maintain navigable depths within the harbor while providing beach sand for the downcoast shoreline.

Similar operations are conducted at most harbors along the coast that require periodic maintenance dredging. Examples include Santa Cruz Harbor in Northern California, and Ventura, Channel Islands/Pt. Hueneme, Marina del Rey, Oceanside, and Mission Bay in Southern California (Wiegel, 1994). Many of the harbors are designed with “sand traps” in an attempt to promote sediment accumulation in a controlled area and minimize shoaling in navigation channels. Most of the sand bypass operations conducted in California utilize mobile dredges to transport shoaled material from sand traps and harbor channels to the downcoast beaches.

Project History

Like the majority of ocean harbors in California, Santa Barbara Harbor was created by building large quarrystone structures in the nearshore zone. Construction of the facility began in 1927. The harbor was originally designed with a detached breakwater, which was intended to allow sand to pass along the shoreline relatively unimpeded. However, the harbor soon began to shoal, and the west end of the breakwater was connected to the shoreline in 1930.

East Beach, located immediately downdrift of the harbor, began to erode soon after completion of the breakwater. Shoreline recession of 500 ft to 600 ft was noted at some locations farther to the south (Peel in USACE, 1986). With the erosion problems progressing several miles downcoast, it became apparent that a sand bypassing program would be required to transport the sand that had accumulated at the harbor to the downcoast beaches. The first bypass operation was conducted in 1933, placing over 606,000 cubic yards of sand at East Beach. Since that time, bypassing has continued on a periodic basis, supplying downcoast nourishment material at an average annual rate of 350,000 cy/yr (Noble Consultants, 1989). Sand has been bypassed primarily from within the harbor and from a sand spit that forms off the eastern terminus of the breakwater.

Project Performance

Downcoast erosion was lessened following the implementation of the sand bypassing program at Santa Barbara Harbor. The shoreline advanced substantially at East Beach, which serves as the receiver site for the bypassed sand. Beach widths at this location have exceeded 300 ft during recent years (Hearon, 1997). East Beach and its amenities, including Stearns Wharf and a coastal path, are now valuable recreational and economic assets to Santa Barbara and surrounding communities.

Subsequent to nourishment, East Beach functions as a “feeder beach” as waves and currents transport the sand alongshore, nourishing the downcoast shoreline. The sand bypassed from the harbor has been sufficient to arrest severe erosion downcoast of East Beach; however, these beaches have never returned to pre-harbor conditions. The bypassing program essentially restored the littoral system to the pre-harbor status-quo, providing enough sand to avoid severe shoreline recession but insufficient quantities to rebuild the eroded beaches.

6.3 Opportunistic Beach Nourishment Projects

Opportunistic beach nourishment utilizes sand that was derived from projects whose primary motive was not beach replenishment. The majority of beach nourishment projects conducted in California have been opportunistic in nature. Projects have varied in size from a few thousand to several million cubic yards of material.

6.3.1 Opportunistic Nourishment in Santa Monica Bay

The majority of the wide, sandy beaches in Los Angeles County are directly attributable to beach nourishment. Most of the beach nourishment material has been "sand of opportunity", derived from navigation projects and the construction of coastal facilities.

Several opportunistic nourishment projects in California have been associated with the construction of harbor facilities. Over 7 million cubic yards of sand, which became available during the construction of Newport Harbor, were placed on nearby beaches between 1919 and 1935 (Coastal Frontiers, 1999). Similarly, the ill-fated Navy Homeporting project planned to nourish San Diego County beaches with 7 million cubic yards of sand derived from channel deepening operations in San Diego Harbor (SANDAG, 2000). Construction activities in support of coastal facilities, such as the San Onofre Nuclear Power Plant, also have provided material for beach nourishment (Flick, 1993).

Project History

Prior to significant human intervention in the early 1900's, Santa Monica Bay (Figure 6.6) was bordered by naturally narrow beaches. These conditions can be attributed to the paucity of natural sediment entering the littoral cell, high rates of alongshore sediment transport, and the fact that most of the sand moving along the shoreline eventually was lost down the Redondo Submarine Canyon. The result was beach widths typically ranging from 50 to 150 feet, similar to conditions that persist today in the Malibu area, where artificial nourishment has been minimal or nonexistent.

Beach nourishment in Santa Monica Bay began in 1938. As indicated in Table 6.2 and graphically in Figure 6.7, over 31 million cubic yards of sand have been placed on the region's beaches. More than 90% of this material was "sand of opportunity".

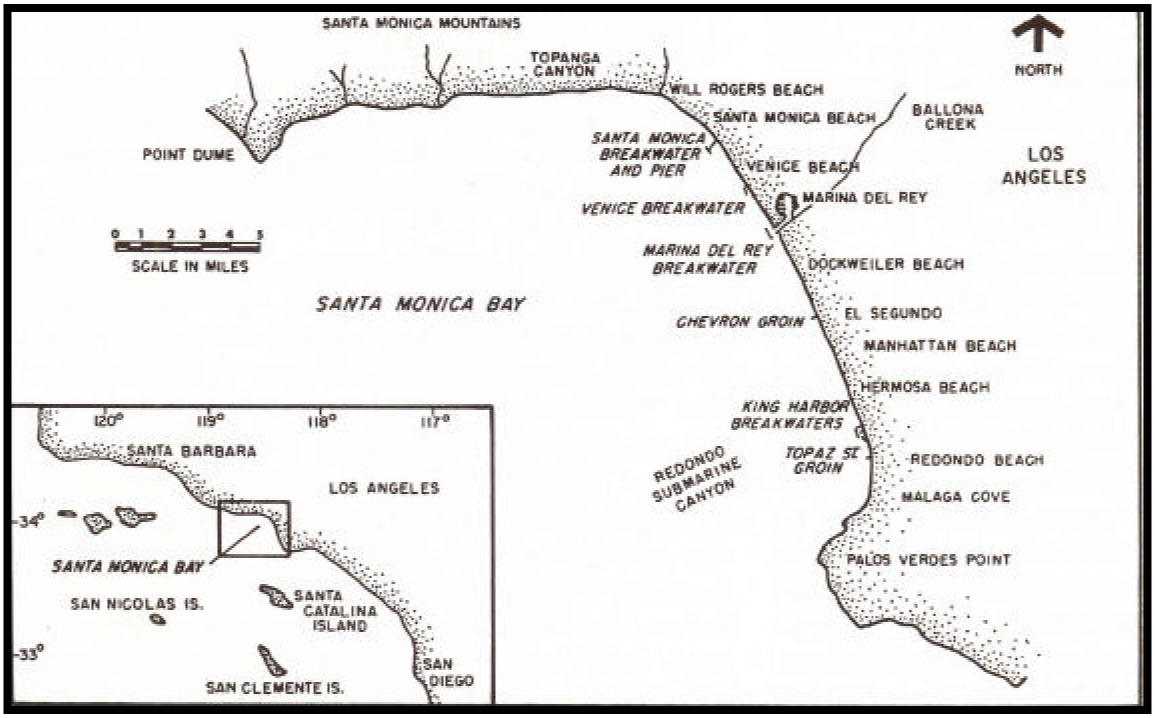

Figure 6.6 Santa Monica Bay location map

The Hyperion Sewage Treatment Facility site represents the single largest contributor of nourishment material to the Santa Monica Bay shoreline. Construction and subsequent expansion activities at the facility, located adjacent to Dockweiler Beach, supplied nearly 17 million cubic yards of dune sand for the beaches between Santa Monica and El Segundo from 1938 to 1989. The largest nourishment operation, conducted in 1947, provided 13.9 million cubic yards of sand to nourish 7 miles of shoreline at Dockweiler Beach.

The other principle source of opportunistic nourishment has been Marina del Rey. During construction of the harbor, between 1960 and 1963, over 10 million cubic yards of sediment were dredged from the small-craft basin and entrance channel and placed on Dockweiler Beach. This material contained a higher percentage of fine sediment than the relatively coarse material derived from the Hyperion project (Herron in USACE, 1986).

Coastal structures have been built along the Santa Monica Bay coastline since the late 1800's. By the 1960's, the large number of structures had effectively compartmentalized the shoreline between Topanga Canyon and Malaga Cove. This section of coast currently contains 5 shore-parallel breakwaters, 3 shore-perpendicular jetties, 19 groins, 5 revetments, and 6 open-pile piers (Coastal Frontiers, 1992). The major sediment-blocking structures are identified in Figure 6.6.

Table 6.2 Beach Nourishment in Santa Monica Bay

Date	Placement Site	Source	Classification	Quantity
1938	Dockweiler Beach	Hyperion	Opportunistic Nourishment	1,800,000 cy
1945	Venice Beach	Hyperion	Opportunistic Nourishment	150,000 cy
1947	Venice/Dockweiler	Hyperion	Opportunistic Nourishment	13,900,000 cy
1947	Redondo Beach	Onshore	Deterministic Nourishment	100,000 cy
1956	Dockweiler Beach	Scattergood	Opportunistic Nourishment	2,400,000 cy
1960-62	Dockweiler Beach	Marina del Rey	Opportunistic Nourishment	3,200,000 cy
1963	Dockweiler Beach	Marina del Rey	Opportunistic Nourishment	6,900,000 cy
1968-69	Redondo Beach	Offshore	Deterministic Nourishment	1,400,000 cy
1984	El Segundo	Offshore	Deterministic Nourishment	620,000 cy
1988	Dockweiler Beach	Hyperion	Opportunistic Nourishment	155,000 cy
1988-89	El Segundo	Hyperion	Opportunistic Nourishment	945,000 cy

Source: Coastal Frontiers, 1992

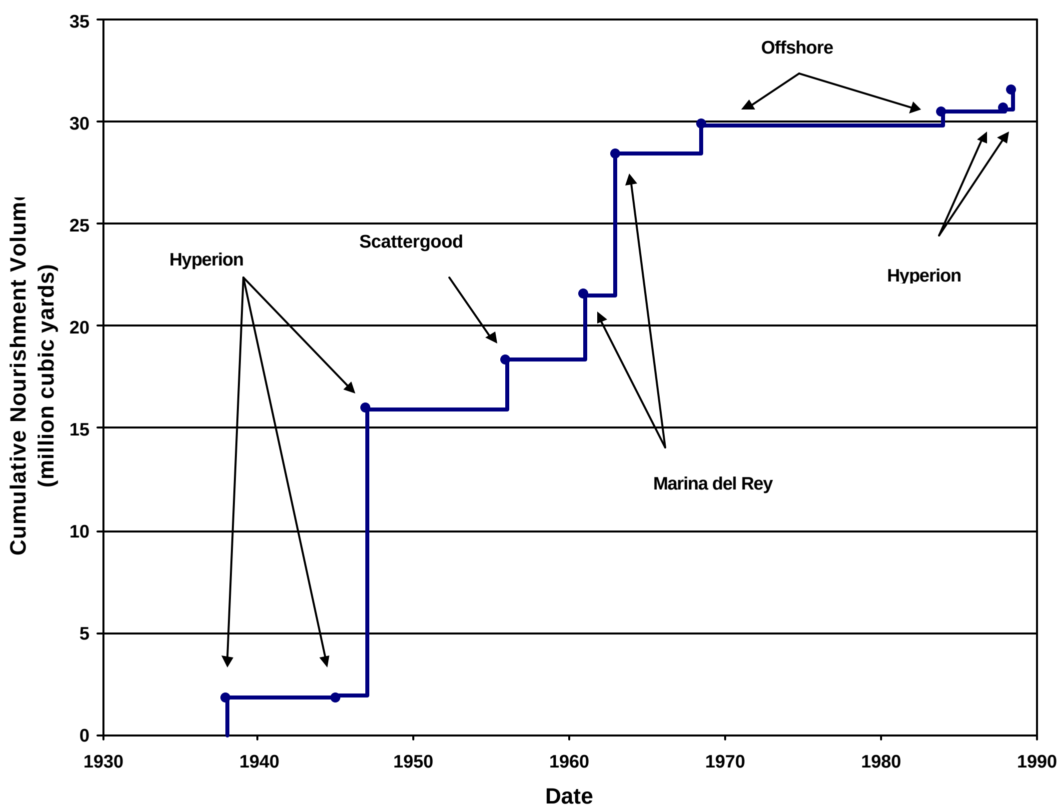

Figure 6.7 Cumulative nourishment for Santa Monica Bay beaches, 1938-1989

Project Performance

In contrast to the beach nourishment work performed in Orange County (Section 6.2.1), the projects discussed above were conducted in the absence of a regional shoreline plan. However, the cumulative effect of these independent projects was the creation of the wide, sandy beaches that draw over 50 million visitors per year to the Los Angeles County coast (Leidersdorf et al., 1993). In their natural condition, these beaches were incapable of supporting the recreational needs of the developing region, much less the demands of the present-day population.

The most substantial shoreline changes occurred in the southern and central portions of Santa Monica Bay, where beach nourishment was most prevalent. Santa Monica beaches are shown in Plate 6.8. A study commissioned by the Los Angeles County Department of Beaches and Harbors (Coastal Frontiers, 1992) found that the shoreline measured in 1990 was located well seaward of the 1935 position in all areas that received nourishment material. As shown in Table 6.3, the greatest shoreline advance relative to the 1935 baseline condition occurred at Dockweiler Beach, the beneficiary of the Hyperion and Marina del Rey opportunistic beach fills.

Plate 6.8 Wide, stable beaches at Santa Monica, 1993

Table 6.3 Average Beach Width Increases in Santa Monica Bay, 1935 - 1990

Location	Average Beach Width Increase
Santa Monica and Venice Beach	400 ft
Dockweiler Beach	500 ft
Manhattan and Hermosa Beach	250 ft
Redondo Beach	150 ft

Source: Leidersdorf et al., 1994

The magnitude of the shoreline changes is illustrated in Figure 6.8, which shows representative beach profiles in Venice Beach. The 55-year period of record encompasses all of the major beach nourishment operations conducted in Santa Monica Bay, accounting for nearly 31.6 million cubic yards of material. As a result of the 1947 Hyperion fill, the beach width and nearshore sediment volume increased dramatically by the time of the 1953 profile survey. Over the following 37-year period the beach remained remarkably stable, retaining most of the sand from the prior nourishment.

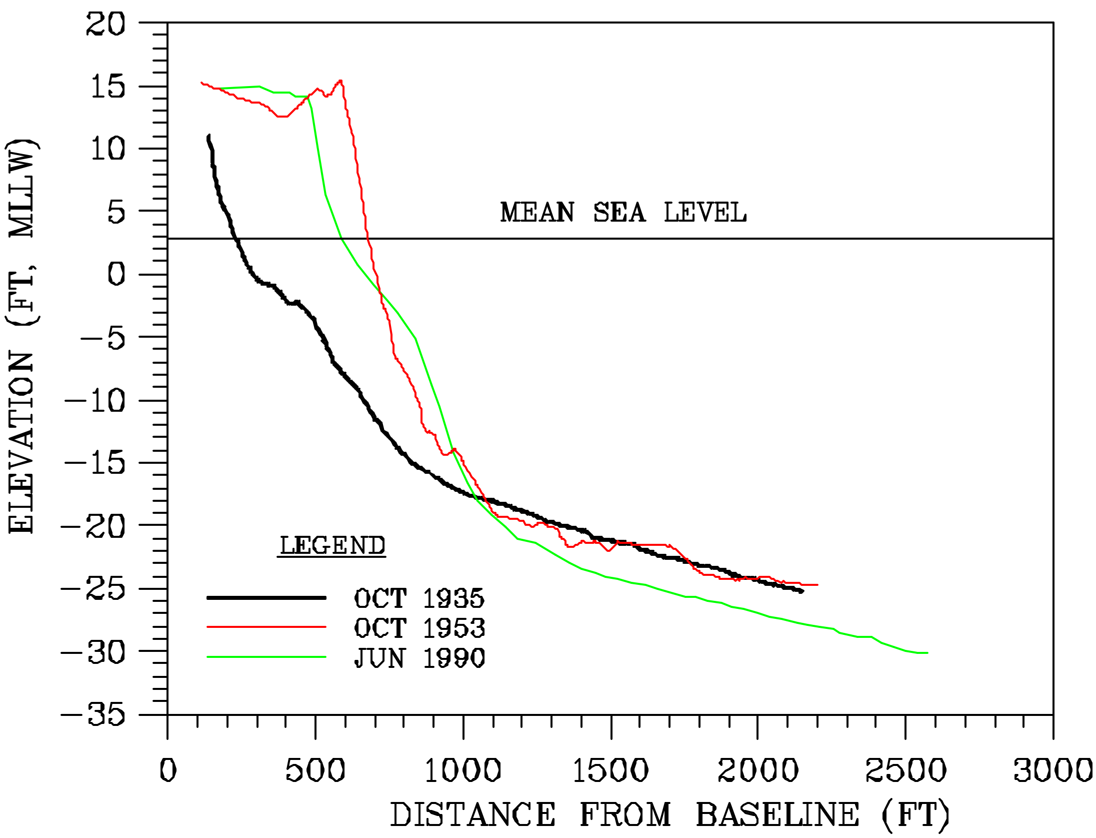

Figure 6.8 Representative beach profiles in Venice Beach

The stability of the beaches in Santa Monica Bay, and hence the longevity of the beach nourishment material, can be attributed partially to the structural compartmentalization of the shoreline. The numerous breakwaters, jetties and groins in the reach are extremely effective in limiting alongshore transport and retaining sand (Flick, 1993). In the absence of these structures, waves and currents would continue to move large quantities of sand downcoast and into the Redondo Submarine Canyon. Combined with the lack of natural sediment supply to the system, the extremely wide beaches in Santa Monica Bay would probably not be realized today without these artificial features.

6.3.2 West Newport Beach Nearshore Nourishment Project

In 1992, nearly 1.3 million cubic yards of beach quality sediment were placed in a nearshore sand bar off the coast of Newport Beach. All of the material was "sand of opportunity", derived from a flood control project in the nearby Santa Ana River.

The nearshore nourishment project at Newport Beach is representative of similar projects that have been conducted or are currently under consideration at other California locations. Material from maintenance dredging at San Diego Harbor has been used for nearshore nourishment off the coast of Imperial Beach (SANDAG, 2000). In Santa Barbara and Ventura Counties, nearshore sand placement is a major component of BEACON's proposed regional shoreline plan (BEACON, 2000).

Project History

The Lower Santa Ana River Flood Control Channel Expansion Project plan required the dredging and disposal of accumulated material in the river bed between the San Diego Freeway and the ocean outlet. A nourishment project was devised to reduce disposal costs and to take advantage of the large quantities of beach-grade sand. Operations were conducted between January and November 1992.

Nearly 1.3 million cubic yards of dredged material were deposited offshore of Newport Beach in water depths of 15 to 30 feet. The nourishment site (Figure 6.9), located southeast of the Santa Ana River mouth, was selected in hopes that the material would be contained between the Santa Ana River jetties and the West Newport groin field (Mesa, 1996).

Unlike traditional nourishment techniques, an immediate increase in beach width is not achieved with nearshore placement. To be effective, the material must be placed within the active portion of the littoral system. Beach widths increase gradually as the sand moves onshore under the influence of waves and currents.

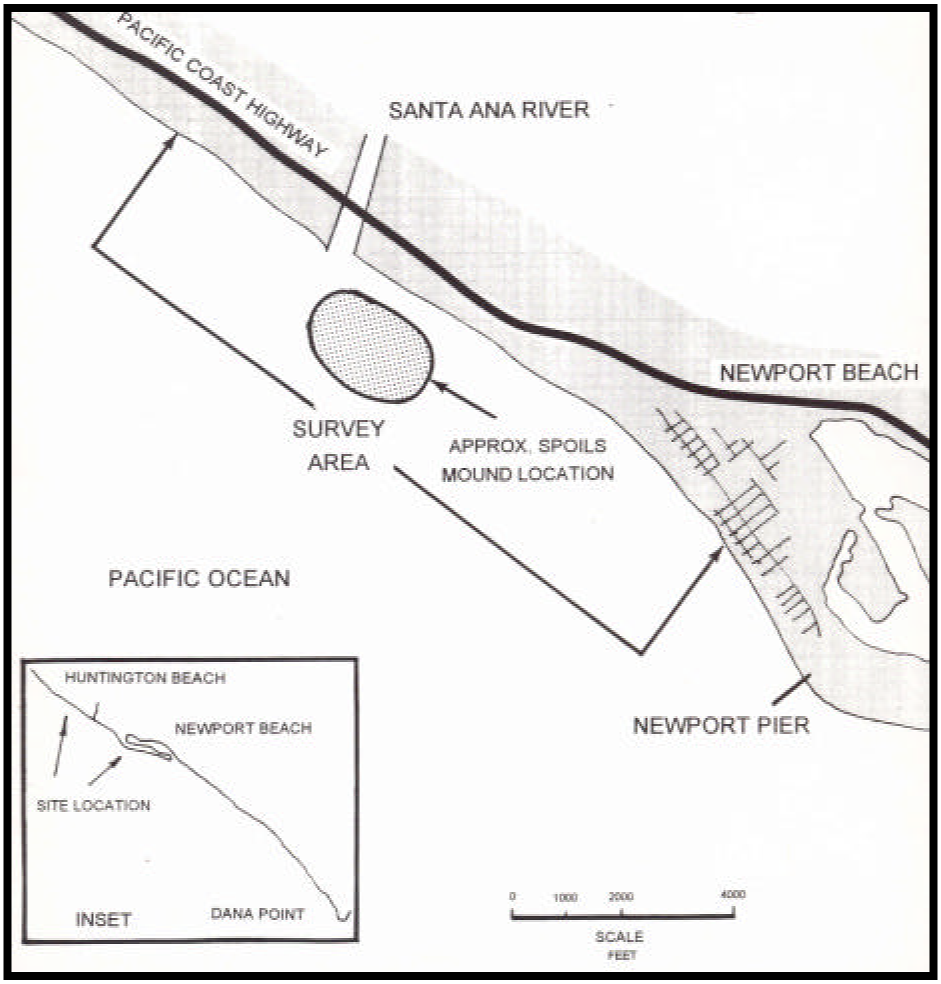

Figure 6.9 West Newport Beach Nearshore Nourishment Project location map

Project Performance

The nearshore nourishment sand bar progressively eroded and dispersed following placement. Survey results from the post-construction monitoring program, shown in Figure 6.10, indicate that material from the crest of the bar migrated landward in response to waves and currents. There was no definitive evidence to support offshore or alongshore migration of the mound (Mesa, 1996).

Beach widths measured in the vicinity of the project are shown in Figure 6.11. A pronounced trend of shoreline advance is evident during the five-year period (1992-1997) following project implementation. The shoreline changes reflect the onshore migration of sediment, as well as the wave sheltering effects of the sand bar. Similar increases at downcoast beaches were less evident.

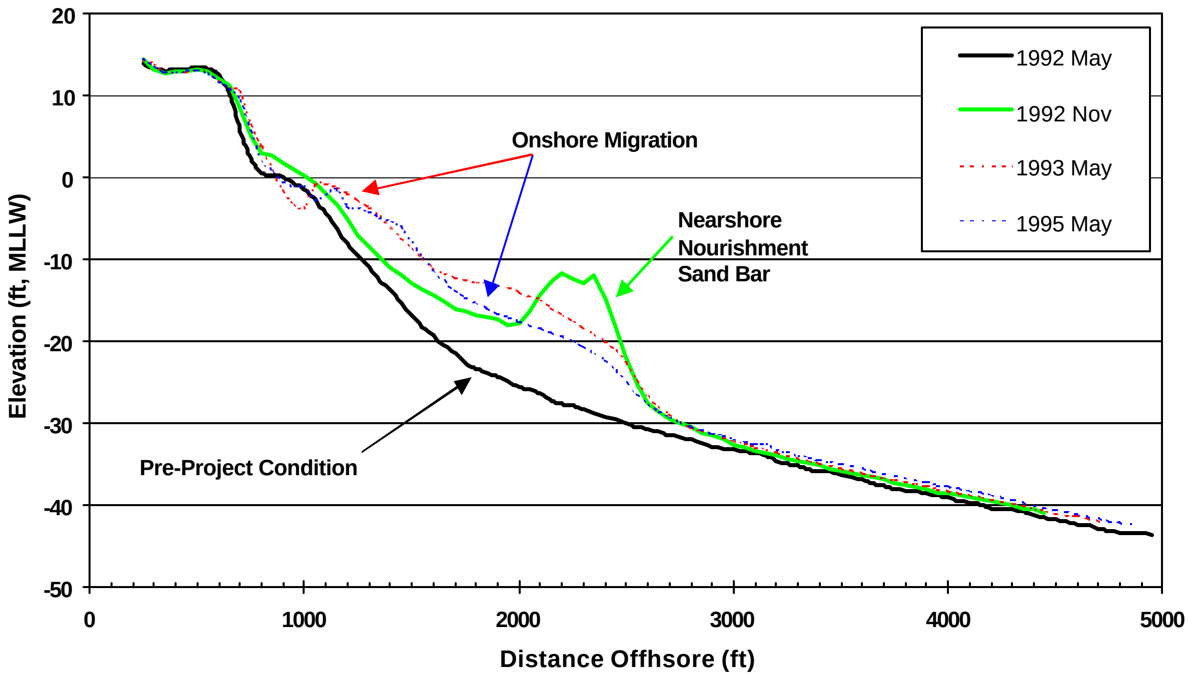

Figure 6.10 Beach profiles through West Newport nearshore mound

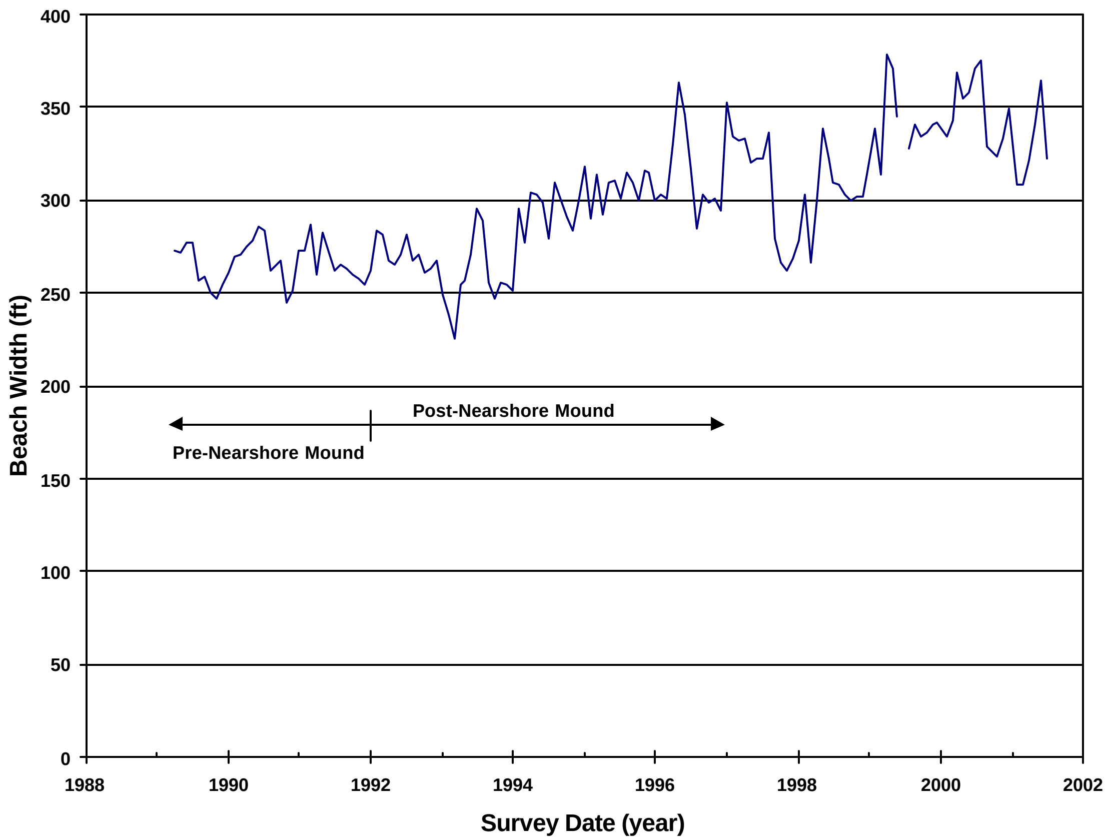

Figure 6.11 Beach width in vicinity of West Newport nearshore mound, 1989-2001

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