Part 4

9. SUMMARY

Key findings from the California Beach Restoration Study are presented in the following sections.

The Public Beach Restoration Program

1. ***Program Funding (Fiscal Year 2000-2001):*** The state budget for fiscal year 2000-2001 included $10 million for grants to be administered by the California Department of Boating and Waterways. This expenditure represents a substantial funding increase over prior years.

2. ***Allocation of Funds:*** Funds were allocated to 16 beach projects. The majority of the program budget was used for beach nourishment, including several cost-shared projects with the Corps of Engineers. The remaining funds were used for additional studies and research into erosion control and California coastal processes (Figure 9.1).

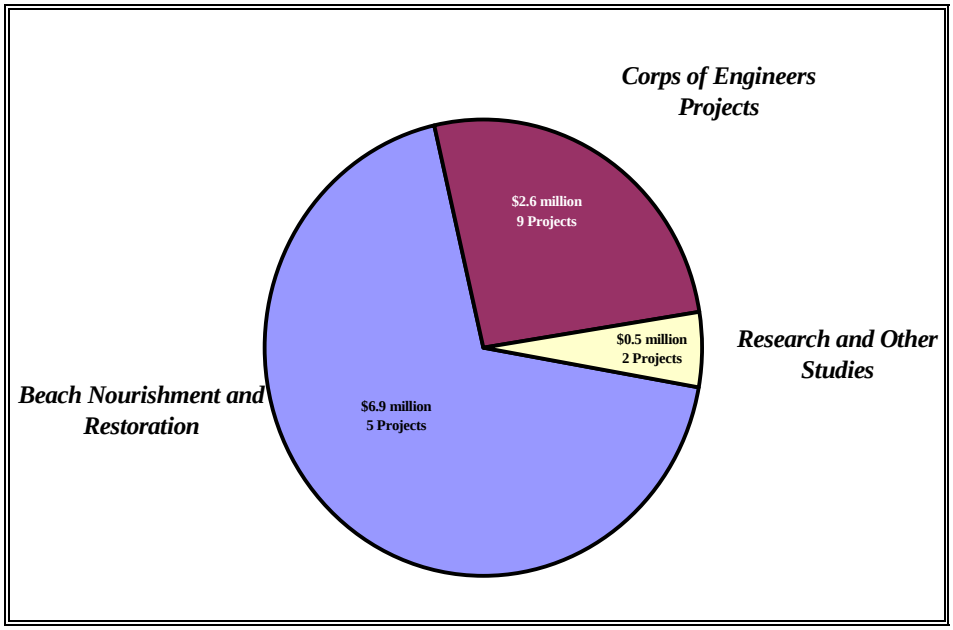

Figure 9.1. Allocation of Public Beach Restoration Program Funds (FY 2000-01)

3. *Future Needs*: The Department of Boating and Waterways has estimated that the State of California needs to invest $120 million in one-time beach nourishment costs and $27 million in annual beach maintenance costs. This investment will restore and maintain 24 miles of heavily-used beaches. Through cost-sharing partnerships with the U.S. Army Corps of Engineers, federal funding for these shoreline projects could reduce the state's costs to $42 million (65% reduction) and $13.5 million (50% reduction) for restoration and maintenance, respectively.

The Value of California's Beaches

1. ***Beach Attendance:*** Over two-thirds of Californians visit the beach each year. California's beaches experienced an estimated 659 million visitor-days in 2001, more than twice as many as the visitor-days at all U.S. National Parks combined. Of the state's top ten recreational destinations in 1991, three were beaches.

2. ***Spending on Beach Trips:*** Visitors to California beaches spent over $61 billion in 2001; approximately 36% of this total was spent by visitors from out of state.

3. ***Tax Revenues:*** California's beaches generate over $15 billion in tax revenue (excluding social insurance). Table 9.1 provides estimates for local, state, and federal tax revenue.

Table 9.1 Estimated Taxes Derived from Beach Spending

Government	Estimated Tax Generated	Percentage of Total Taxes Generated
Federal	$8.1 billion	53.4%
California State	$4.6 billion	30.5%
County	$1.2 billion	8.1%
City	$1.2 billion	8.1%
Total	**$15.2 billion**	100.0%

4. ***Value of Beach Nourishment Projects:*** Thirty-one beach nourishment projects have been evaluated for the state. Over twenty of these projects provide benefits exceeding the costs of completion. Over ten projects have benefits more than 10 times the cost of building/maintaining these projects. Failure to maintain the current infrastructure of California's beaches will lead to hundreds of millions of dollars in lost recreational and tourism revenues to the State of California.

5. ***Economic Impacts of Beach Erosion:*** Many of California's beaches are already overcrowded and, in some cases, beach erosion is making a bad situation worse. A study of north San Diego County's beaches, where erosion is a significant problem, estimated that without maintenance the state could lose $2.8 billion in direct spending and over $1 billion in taxes due to lost tourism at eroded beaches. The cost of maintaining these beaches is far less than the benefits generated. Given the current state of crowding and limited freshwater recreation activities in Southern California, most tourists would not be able to find a comparable alternative to a day at the beach.

Effectiveness of the Program

Judging by the success of prior nourishment projects conducted in California, the projects funded by the Public Beach Restoration Program offer the potential for significant improvement of the state's beaches. A brief summary of historical beach nourishment projects in California is provided below.

***Deterministic Nourishment*:** Deterministic beach nourishment projects are those that are undertaken for the primary purposes of replenishing beaches and protecting the coast. Typical motivations for such projects include mitigating the adverse effects of coastal structures and compensating for the lack of natural sediment supply from rivers and streams caused by dams and debris basins. Representative projects are:

- *Planned Regional Beach Nourishment in Orange County* - Scheduled periodic nourishment at Surfside-Sunset Beach and nourishment with sand retention devices at Newport Beach have placed nearly 18 million cubic yards of sand on northern Orange County beaches. The majority of this material has remained in the littoral system, and beach widths in the region have increased at an average rate exceeding 4 ft/yr.
- *Sand Backpassing at Peninsula Beach* - The City of Long Beach has performed sand backpassing since 1994 to alleviate chronic erosion at Peninsula Beach. Much of the program's success is due to the relatively modest construction costs, typically less than $1.50 per cubic yard.
- *Sand Bypasssing at Santa Barbara Harbor* - Sand bypassing has been conducted at Santa Barbara Harbor since 1933 to compensate for impeding the natural alongshore flow of sediment. Severe downcoast erosion was mitigated following program implementation.

***Opportunistic Nourishment*:** Opportunistic beach nourishment projects are those that are undertaken when beach-quality sand becomes available from projects unrelated to beach replenishment or coastal protection. 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 is often more cost effective to place the excavated material on nearby beaches than to dispose of it inland or offshore. Representative projects are:

- *Santa Monica Bay* - Over 31 million cubic yards of sand have been placed on Santa Monica Bay beaches since the 1930's. More than 90% of this material was opportunistic sand, which became available from construction and dredging activities. The cumulative effect of these independent projects was the creation of wide, sandy beaches in an area that was once sediment starved.

- *West Newport Nearshore Mound* - In 1992, 1.3 million cubic yards of beach quality sand were placed in a nearshore mound off the coast of Newport Beach. All of the material was opportunistic sand, derived from a flood control project in the nearby Santa Ana River. The shoreline advanced seaward as sand from the mound migrated landward under the influence of waves and currents.

Natural Sediment Supply

While beach nourishment is one way to increase the volume of sand on California's beaches, it is important also to consider increasing the natural supply of sediment to the shoreline. The primary source of natural sediment supply to the beach is discharge from rivers and streams. Bluff erosion is also a source of beach sand along much of the coast. Human activities have significantly affected both of these sand sources through the construction of dams, debris basins, hard channelization of stream beds, and seawalls and revetments along coastal bluffs.

In order to discuss ways to increase natural sediment supply to the coast, it is necessary to quantify the sediment volumes provided through each supply process and to assess the impact of human activities on this system.

Fluvial Sediment Supply and Reduction:

- Rivers are estimated to provide 70 to 90% of the beach-sized material to the coast.
- Over 480 major dams (under the jurisdiction of the Department of Water Resources' Division of Safety of Dams) have been built in California's coastal watersheds (excluding areas draining to San Francisco Bay).
- Coastal dams, built primarily for water supply, irrigation, and flood control, impact 38% (over 16,000 mi^2) of the state's coastal watershed area and impound 26% of the average annual beach-size sediment provided by streams.
- Southern California, from Point Conception to San Diego, is the region most highly impacted by dams, with 6 of 7 major littoral cells receiving two-thirds or less of the historical fluvial sediment supply.
- In Southern California each year, more than 1.5 million cubic yards of sand-size material are impounded behind dams and within debris basins. If sand were removed from behind just twelve dams, identified in this report, then the increase in local sand budgets would be substantial. If sand were bypassed around these dams at the same rate as long-term average sand deposition in the reservoirs created by the dams, then bypassing could offset 40% of the sediment deficit in these Southern California littoral cells.
- Material from channelized streams may constitute a significant portion of the sediment budget.

Bluff Sediment Supply and Reduction

- The great majority of the coast of California consists of actively eroding sea cliffs. More specifically, 13% of the coastline is high-relief, steep mountains that contribute a negligible amount of sand to the littoral budget, and 59% of the coastline is low-relief (less than 300 ft) wave-cut bluffs or terraces which, when eroded, will produce a greater percent of sand sized material than the high-relief, mountainous coastline.
- Approximately 102 miles of the state's coastline (10%) are presently armored; 58 miles (57%) of this armor lines coastal lowlands and dunes while the remaining 44 miles (43%) of armor protect sea cliffs.

Cell-Specific Analyses

- To assess the direct impact of human intervention on littoral sediment contributions, two littoral cells were chosen for detailed investigation. The Oceanside and Santa Barbara cells were selected for littoral cell-specific sand budget analyses, including the pre-development budget and the extent of human impact on the budgets.

Table 9.2. Sediment Inputs to the Oceanside and Santa Barbara Littoral Cells

Oceanside Littoral Cell			
Inputs	**Natural (cy/yr)**	**Actual (cy/yr)**	**Reduction in supply (cy/yr)**
Rivers	286,500 44.7%	132,500 27.9%	154,500 53.8%
Bluff Erosion	67,300 10.5%	54,900 11.6%	12,400 18.4%
Gullies/Terraces	287,000 44.8%	287,000 60.5%	0 0.0%
Total Littoral Input	640,800 100.0%	474,400 100.0%	166,400 26.0%
Santa Barbara Littoral Cell			
Inputs	**Natural (cy/yr)**	**Actual (cy/yr)**	**Reduction in supply (cy/yr)**
Rivers	3,642,773 99.6%	2,167,000 99.5%	1,475,773 40.5%
Bluff Erosion	14,028 0.4%	11,312 0.5%	2,716 19.3%
Total Littoral Input	3,656,801 100.0%	2,178,312 100.0%	1,478,489 40.4%

Santa Barbara Cell

- Historically, streams contributed approximately 3,643,000 yds^3/yr, or 99.6% of all the sand to the Santa Barbara littoral cell. Dam construction has reduced this by 40.5% to ~2,167,000 yds^3/yr.
- Cliff and bluff erosion under natural conditions contributed only 0.4%, or ~14,000 yds^3/yr, which has been reduced 19.3% to ~11,300 yds^3/yr through the armoring of 11 miles or 14% of the bluffs in the cell.
- Human activity has reduced the overall sand supply to the Santa Barbara cell by 40.4% or 1,478,000 yds^3/yr.
- The lack of any systematic reduction in the sand dredged from the three major harbors in the Santa Barbara cell strongly suggests that there has not been a significant reduction in the volume of littoral sand moving through the cell over the past 30 to 40 years.

Oceanside Cell

- Streams in the Oceanside cell historically contributed 286,500 yds^3/yr, or 44.7%, of the naturally-supplied sand to the littoral cell. Dam construction has reduced this by 53.8% to 132,500 yds^3/yr.
- Cliff and bluff erosion under natural conditions contributed ~67,300 yds^3/yr or 10.5% of the natural littoral budget. Although the armoring of seven miles or 20% of the cliffs of the cell has reduced the sand contribution by 18.4%, the relative contribution of bluff erosion to the littoral budget has increased slightly to ~11.6% due to a greater reduction in sand supply from the streams of the cell.
- Erosion of the uplifted marine terraces and gully expansion historically and presently contribute the remaining sand in the natural sediment budget, 287,000 yds^3/yr, or 60.5% of the present littoral budget.