U.S. Army Corps of Engineers®

THE CORPS OF ENGINEERS AND SHORE PROTECTION

- *History*
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NATIONAL SHORELINE MANAGEMENT STUDY

IWR REPORT 03-NSMS-1

MAY 2003

National Shoreline Management Study

The National Shoreline Management Study, authorized in the Water Resources Development Act of 1999 under Section 215c, presents an opportunity to examine the status of the Nation's shoreline for the first time in 30 years. Results from the study will provide a basis for Federal actions regarding shoreline management for the foreseeable future. The study will provide a technical basis and analytical information useful in developing recommendations regarding shoreline management, including a systems approach to sand management, and roles for Federal and non-Federal participation in shoreline management.

The study will:

- summarize information about the shoreline changes (erosion and accretion) available from existing data sources and examine the causes and economic and environmental affects;
- identify and describe the Federal, state and local government programs and resources related to shore restoration and nourishment; and,
- explore ideas concerning a systems approach to sand management.

The assessment of the nation's shorelines will take into account the regional diversity of geology, geomorphology, oceanography, ecology, commerce, and development patterns.

The study will be undertaken through collaborative efforts with other agencies. Information and products will be scoped, developed, and reviewed by national technical and policy committees involving multiple agencies. The National Study team will also solicit input from other interested parties and in developing study recommendations.

The U.S. Army Corps of Engineers' Institute for Water Resources (IWR) is managing the study working closely with the Engineer Research and Development Center Coastal and Hydraulics Laboratory and Corps field experts. National technical and policy committees, which include other agency experts, will be assembled as integral components of the study.

For further information on the National Shoreline Management Study, contact any of the following:

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Or go to the study website at: http://www.iwr.usace.army.mil/iwr/services/shoremanag.htm/ The website provides reports to date and study progress along with topical links to other related studies and relevant agency programs.

A limited number of reports are available and may be ordered by writing Arlene Nurthen, IWR Publications, at the above Institute for Water Resources address, by e-mail at: Arlene.nurthen@usace.army.mil, or by fax 703-488-8171.

THE CORPS OF ENGINEERS AND SHORE PROTECTION

History • Projects • Costs

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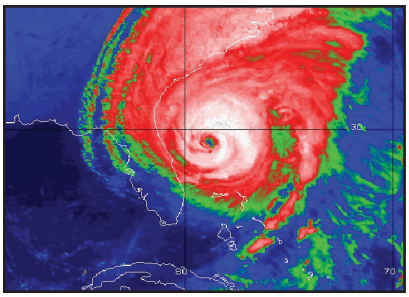
STORMS



LEGISLATION

PROJECTS

Before Nourishment

After Nourishment

Preface

This report is prepared as a product of the National Shoreline Management Study (NSMS). The NSMS was authorized by Section 215(c) of the Water Resources Development Act of 1999. The inspiration for the portion of this reprt on the history of the Corps shore protection program stems from effort undertaken on an earlier Institute for Water Resource report: "Shoreline Protection and Beach Erosion Control Study, Final Report: An Analysis of the U.S. Army Corps of Engineers Shore Protection Program," IWR Report 96-PS-1, June 1996. That study was undertaken in response to a directive from the Office of Management and Budget. One aspect of the 1996 report touched on the development of the Federal interest in shore protection and how that interest was influenced by tropical storms. This report expands that portion of the 1996 report by providing more detail on all aspects of the development of the shoreline protection program; storm events, laws, executive directives, significant milestones in coastal management and finally approaches and projects.

As the history portion of the report was under preparation, the Director of Civil Works sent out a data call to update certain portions of the 1996 report by developing a current list of U.S. Army Corps of Engineers shoreline protection studies and projects and the cost of completed projects. The results of this data call are incorporated in this report by providing the current list of the Corps major coastline protection studies and projects, actual construction costs of the program and those actual construction costs adjusted to September 2002 prices.

Acknowledgements

This report was developed by Ted Hillyer of the Planning and Policy Studies Division of the Institute for Water Resources (IWR). Chief of the Divison is Eugene Stakhiv. The Director of IWR is Robert Pietrowsky. Direct supervision and support for this effort was provided by Robert Brumbaugh of IWR, the Project Manager of the NSMS. Headquarters comments were provided by Harry Shoudy of the Planning and Policy Division, Directorate of Civil Works. Mr. Shoudy provided not only supportive comments but also headquarters oversight and direction. Additional review comments were provided by Lynn Martin and Ken Orth of IWR, Andrew Morang of the Coastal and Hydraulics Laboratory of the Engineer Research and Development Center, Anthony Ciorra of the New York District, David Schmidt of the Savannah District and Craig Conner of the San Francisco District. Special recognition is also given to David Schmidt (then in the Jacksonville District) who during development of IWR Report 96-PS-1, provided the original idea for the development of the approach taken in this report, i.e. projects follow legislation, which follow storms. Numerous Corps individuals from the divisons and districts with coastal responsibility provided the data necessary to update the Corps database of shoreline protection projects. These Corps employees are identified in Appendix B. The author wishes to thank each and everyone of them for their outstanding effort in response to the data call from the Director of Civil Works.

Executive Summary

This document provides both an annotated chronology of the U.S. Army Corps of Engineers (Corps) shore protection program during the 20th century and the current database of the Corps major shoreline protection projects. The chronology shows that projects follow legislation, which follow public demands after devastating coastal storms. With almost one-half of our population living in coastal counties and even more enjoying vacations at the shore, there has been Federal interest in protecting these areas from hurricanes and the effects of erosion. Corps shore protection projects are constructed only where public assess to the beach is assured, adequate parking is provided, and only after thorough studies have determined a positive benefit to cost ratio exists.

Between 1900 and 2000 there have been 81 major hurricanes resulting in over 14,000 deaths in the United States and actual damages of approximately $70 billion.

20th CENTURY SUMMARY	
Hurricanes	81
Deaths in the U.S.	Over 14,000
Damage	$70 billion
Legislation	24 major bills
Major Corps shore protection projects [1]	71
Miles of coast protected [1]	284
Actual cost to date of Corps projects [1]	$1.2 billion
[1] Through June 2002	

In response to these storms there have been 24 major authorization bills enacted by Congress and signed into law by the Administration. As a result of this legislation, since the first project in 1950, the Corps has constructed 71 specifically authorized shore protection projects that protect about 284 miles of the nations coastline. The 284 miles represents 10.5 percent of the nations 2,700 miles of critically eroding shoreline identified in the 1971 "National Shoreline Study." The majority of the projects are located on the Atlantic coast with the remaining distributed fairly evenly along the remainder of the coastal areas. Of the 71 completed projects, 45 (63%) are on the Atlantic coast, 11 (16%) along the Gulf of Mexico (mostly along the shores of Florida), 8 (11%) are on the shorelines of Lakes Ontario and Erie and 7 (10%) are on the Pacific coast. This database of Corps projects represents only those major shore protection projects that have been specifically authorized by Congress and enacted into law through a Water Resource Development Act or similar legislation.

TOTAL ACTUAL CONSTRUCTION COST, SHORE PROTECTION PROGRAM (1950-2002)	
TYPE OF MEASURE	TOTAL COST ($000)
Initial Beach Restoration	522,193
Periodic Nourishment	524,297
Structures	146,576
Emergency	22,095
TOTAL:	**1,215,161**

It does not include the numerous small projects authorized through the Continuing Authorities Program including those coastal projects related to navigation mitigation or environmental restoration. The total actual initial construction costs (initial beach restoration and structural costs) for these 71 specifically authorized projects is $668 million. When the actual periodic nourishment and emergency costs are included the total actual construction cost (at the time of construction, i.e. not updated) for the 71 projects is just over $1.2 billion. This $1.2 billion construction cost combines costs actually spent in 1950 with costs spent in 2002 and all years in between. While varying from project to project, the Federal share is approximately 60 percent of the total costs. Of this $1.2 billion, about 43 percent is attributed to initial beach restoration, another 43 percent to periodic nourishment, 12 percent to structures and 2 percent to emergency costs. In addition to the 71 constructed projects, the Corps also has an additional 10 under construction and another 70 in various stages of planning.

These actual costs were then updated to September 2002 prices by a combination of the Civil Works Construction Cost Index System (CWCCIS) and the Engineering News Record (ENR) Construction Cost Index. The CWCCIS was used whenever possible.

Since the CWCCIS only goes as far back as 1968, the ENR was used when necessary for older costs. For older projects that were in the 1996 Report, the already updated costs (to 1993) were utilized as a starting point for further updating to September 2002. The total cost of the program in current dollars is right at $2.4 billion.

The collected data indicate that as miles of coastal area protected by Corps shore protection projects increase, coastal damages due to hurricanes per mile of coastal project and damages from hurricanes per U.S. citizen both decrease.

A description of the major storms over the last 100 years, subsequent authorizations and the projects that followed those authorizations is woven together in this report through a written chronology. A schematic of this chronology is also provided.

CONSTRUCTION COSTS ADJUSTED TO SEPTEMBER 2002

TYPE OF MEASURE	COSTS ADJUSTED TO SEPTEMBER 2002 ($000)
Initial Beach Restoration	1,164,661
Periodic Nourishment	806,476
Structures	397,344
Emergency	33,116
TOTAL:	**2,401,597**

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INTRODUCTION

This document provides an annotated chronology of the U.S. Army Corps of Engineers (Corps) shore protection program during the 20th century including the current database of the Corps major shoreline protection projects. The chronology shows that projects follow legislation, which follow public demands after devastating coastal storms. Both cost sharing and engineering approaches affect this history. The distribution of costs between Federal and non-Federal interests and what costs are covered has changed over the years. In many cases the share of costs to be paid by the Federal government is influenced by political decisions based on budgetary constraints. Engineering approaches to shore protection have evolved over the years with additional understanding of coastal processes and technological advancements. The Corps looks for the most economically, environmentally sound and socially acceptable solutions to shore protection. In some cases, this will involve hard structures such as jetties or seawalls. In many other cases, a preferable approach is beach nourishment, the placement of sand along the beach. Beach nourishment can be an economical solution to a storm damage problem. During storms the sand acts as a buffer and protects the structures behind the beach. Storm waves move the sand offshore, causing the waves to also break further offshore and thus reducing the erosion threat at the shoreline. With almost one-half of our population living in coastal counties and even more enjoying vacations at the beach, there has been Federal interest in protecting these areas from hurricanes and the effects of erosion. Corps shore protection projects are constructed only where public assess to the beach is assured, adequate parking is provided, and only after thorough studies have determined a positive benefit to cost ratio exists.

A compendium of the authorizing legislation pertinent to the Corps Shore protection program is provided in Appendix A. The citations are limited to generic legislation and do not contain listings of the individual study and project authorizations.

A list of the worst hurricanes to hit the U.S. mainland in the 20th century is provided in Table 1. These data are provided by year and includes the category of storm, deaths and damages. Table 2 is a summary of this data by decade. It should be noted that damaging storms have also hit the Pacific coast of the United States. These storms are not, however, listed as "hurricanes" and detailed data similar to that presented for the Atlantic and Gulf coasts are not available. Literature does, however, show that 75 percent of the damaging storms along the coast of California have occurred in El Niño years. In this century, large El Niño storms occurred in 1941-42, 1957-58, 1972-73, 1982-83, 1986-87, 1991-92 and 1997-98. A definition of "El Niño is provided in Box 1.

BOX 1: Definition of El Niño

El Niño is a disruption of the ocean-atmosphere system in the tropical Pacific having important consequences for weather around the globe. In the United States, these consequences are increased rainfall in the southern tier of states and increased land and ocean temperatures. These conditions often result in damaging coastal storms along the Pacific.

In response to the storms and ensuing legislation, since the first project was constructed in 1950, the Corps has constructed 71 specifically authorized shore protection projects that protect about 284 miles of coastline. From data identified in the 1971 "National

Shoreline Study," the 284 miles represents 0.23 percent of the nations 84,240 miles or coastline and 10.5 percent of the nations 2,700 miles of critically eroding shoreline.

A list of the 71 projects in the order construction started and for which initial construction has been completed is provided in Table 3. Table 4 provides, by decade, a summary of the number of projects, initial construction cost and miles of shoreline protected. The costs shown are the total expenditures in actual dollars. While varying from project to project, the Federal share is approximately 60 percent of the total costs.

The majority of the projects are located on the Atlantic coast with the remaining distributed fairly evenly along the remainder of the coastal areas. Of the 71 completed projects, 45 (63%) are on the Atlantic coast, 11 (16%) along the Gulf of Mexico, 8 (11%) are on the shorelines of Lakes Ontario and Erie and 7 (10%) are on the Pacific coast. A description of the major storms over the last 100 years, subsequent authorizations and the projects that followed those authorizations is woven together in the following chronology. A schematic of this chronology is provided as Table 5.

As part of the preparation of this report, a survey of Corps coastal Divisions and Districts was undertaken to update the database of the Corps shore protection program. The request to the divisions and districts to provide this data is provided at Appendix B. The list of those individuals responding to this request and those identified as the points-of-contact is also provided in Appendix B.

The summary of the data collected is provided in Appendix C. This data shows that in addition to the 71 completed projects there are an additional 10 projects under construction and an additional 70 in various stages of planning and design. Cost spent to date on the 71 completed projects is about $1.215 billion. Of this amount, just less than 43 percent is for initial restoration, just over 43 percent is for periodic nourishment, 12 percent is for structures and about 2 percent has been spent for emergency measures. This construction cost of about $1.2 billion is in actual dollars spent. It combines dollars spent in 1950 with those spent in 2002 and all the years in between and is not on a common dollar basis. These costs were then updated to September 2002 price levels. This updating procedure resulted in a current cost of the program (September 2002 prices) of $2.4 billion.

This database of Corps projects represents only those major shore protection projects that have been specifically authorized by Congress and enacted into law through a Water Resource Development Act or similar legislation. It does not include the numerous small projects authorized through the Continuing Authorities Program including those coastal projects related to navigation mitigation or environmental restoration. Prior to enactment of the continuing authorities programs, several shore protection projects were specifically authorized which were small in size and cost. If a "Continuing Authority Program" had been in effect at that time, these projects would have been constructed under those authorities. There were a total of 26 of these types of projects constructed: 21 in the New England and five in Southern California. Total cost at the time of construction of these projects (between 1950 and 1960) was about $4.6 million or about $180,000 per project. The average Federal cost was about $67,000 per project. The average length of shoreline protected by these projects was about one-half mile. Future year efforts under the "National Shoreline Management Study" will attempt to include in the database these smaller projects including the projects constructed under the continuing authorities.

THE 20TH CENTURY

Prior to 1930

Interest in shore protection began in New York and New Jersey in the latter part of the 19th century and in the early decades of the 20th century. This stemmed primarily from two factors. The first was that these shorelines, being within easy reach of the burgeoning populations of New York City and Philadelphia, were the first to experience intense barrier island development. The second factor was that, during the period of 1915 to 1921, there was intense storm and hurricane activity. During this period, three hurricanes and four tropical storms passed within several hundred nautical miles of the coasts of New Jersey and New York. Although these were not land-falling storms, considerable beach erosion occurred as a result. Millions of dollars were spent in these states on uncoordinated and often totally inappropriate erosion control structures that often produced results that were minimally effective, and in some cases, counterproductive. It was soon realized that the efforts of individual property owners were incapable of coping with the problem of coastal erosion and that a broader-based approach was necessary.

In addition to the storms affecting the New York and New Jersey shorelines, there were eight major hurricanes that hit the Gulf of Mexico and Atlantic coasts between 1900 and 1928. The states of Mississippi, Alabama, Texas, Louisiana and Florida were severely impacted. In 1900 a hurricane inundated Galveston Island, TX with winds up to 120 mph and caused at least 8,000 deaths. A hurricane in 1919 hit the Florida Keys and was particularly severe with a barometric pressure of 27.37 inches. The storm caused between 100-400 deaths in the states of Florida and Texas. The storm of 1928 hit Lake Okeechobee, FL causing the lake to overflow into populated areas and caused close to 2,000 deaths.

In response to the increasing problems of coastal erosion, the New Jersey legislature, in 1922, appropriated money to form an engineering advisory board to study the changes taking place along the state's coastline. At about the same time, a Committee on Shoreline Studies was formed under the Division of Geology and Geography of the National Research Council in Washington, D.C. An outcome of the groups' activities in shore erosion matters was the formation of the American Shore and Beach Preservation Association (ASBPA). An early objective of this association was to persuade the states (as opposed to individuals and local communities) to accept responsibility for their beaches. However, in 1926, within a year of its formation, the association was lobbying to have the Federal government assume the function of unifying and coordinating the efforts of states with regard to shoreline erosion problems, thus advocating a regional rather than a localized approach to protection of the shoreline.

1930

The first Federal intervention in shore protection came in 1930. Public Law 71-520 (River and Harbor Act of 1930) authorized and directed the Chief of Engineers to cause investigations and studies to be made in cooperation with the appropriate agencies of various States on the Atlantic, Pacific, and Gulf coasts and on the Great Lakes, and the Territories, with a view of devising effective means of preventing erosion of the shores of the coastal and lake waters by waves and currents. Cost sharing was established at the discretion of the Corps. This law also established the Beach Erosion Board to act as a central agency to assemble data and provide engineering expertise regarding coastal protection. This board was a Corps of Engineers

team, consisting of four Corps Army officers and three civilians. In 1936, Congress adopted Public Law 74-834 (An Act for the Improvement and Protection of the Beaches along the Shores of the United States) which authorized assistance for construction – but not maintaining – coastal protection works where "federal interests" were involved. The Corps interpreted this to include only federal property, and little work was performed under this act.

During the 1930s, ten major hurricanes struck the coastal states: four along the Texas, Louisiana, Florida coasts; three just in Florida; two along the mid-Atlantic seaboard; and one in the New York-New England area. Two of these storms rank among the most severe in terms of loss of life in the Nation's history. The first of these was the "Labor Day" storm, which hit southern Florida in 1935 and caused 408 deaths. The second storm occurred in September 1938 and was one of the most devastating storms in New England history, resulting in 680-700 deaths in the Long Island, New York and southern New England area. The September 1938 storm was classified as a category 3 storm. Storm categories are historically identified through the Saffir-Simpson Hurricane Scale (see Box 2). This scale provides a rating of 1-5 based on the hurricane's present intensity. This is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the scale, as storm surge values are highly dependent on the slope of the continental shelf in the landfall region. Note that all winds are using the U.S. 1-minute average.

The Federal involvement in shore protection throughout the 1930s was essentially limited to cooperative analyses, planning studies and technical advisory services. These planning efforts were cost-shared between Federal and non-Federal interests.

1940 - 1944

With the onset of the Second World War, the involvement of the Corps of Engineers in shore protection studies virtually ended, as its resources were fully committed to the war effort. The period of 1940 to 1944 saw another five major hurricanes (one in the Gulf of Mexico and four along the Atlantic coast). These five storms caused another 122 deaths in Texas, Florida, Georgia and in North and South Carolina. In 1944 a category 3 hurricane passed off shore of Long Island, New York but still caused 46 deaths on land. While not as severe as the 1938 hurricane, it still did extensive damage to the barrier islands.

BOX 2: The SAFFIR/SIMPSON Hurricane Scale

Scale No. 1 - Winds of 74 to 95 miles per hour. Storm surge of 4 to 5 feet above normal. Low-lying coastal roads inundated, minor pier damage, some small craft exposed, anchorage torn from moorings.

Scale No. 2 - Winds of 96 to 110 miles per hour. Storm surge 6 to 8 feet above normal. Coastal roads and low-lying escape routes inland cut by rising water 2 to 4 hours prior to arrival of hurricane center. Considerable damage to piers. Marinas flooded. Evacuation of some shoreline and low-lying inland areas required.

Scale No. 3 - Winds of 111 to 130 miles per hour. Storm surge 9 to 12 feet above normal. Serious flooding at coast and many smaller structures near coast destroyed. Larger structures near coast damaged by battering waves and floating debris. Low-lying escape routes inland cut by rising water 3 to 5 hours before hurricane center arrives. Major erosion of beaches. Massive evacuation of all residences within 500 yards of shore possibly required, and of single-story residences on low ground within 2 miles of shore.

Scale No. 4 - Winds of 131 to 155 miles per hour. Storm surge 13 to 18 feet above normal. Flat terrain 10 feet or less above sea level flooded inland as far as 6 miles. Major damage to lower floors of structures near shore due to flooding and battering by waves and floating debris. Low-lying escape routes inland cut by rising water 3 to 5 hours before hurricane center arrives. Major erosion of beaches. Massive evacuation of all residences within 500 yards of shore possibly required and of single-story residences on low ground within 2 miles of shore.

Scale No. 5 - Winds greater than 155 miles per hour. Storm surge greater than 18 feet above normal. Major damage to lower floors of all structures less than 15 feet above sea level within 500 yards of shore. Low-lying escape routes inland cut by rising water 3 to 5 hours before hurricane center arrives. Massive evacuation of residential areas on low ground within 5 to 10 miles of shore possibly required.

1945 – 1950

In response to the disasters of the early 1940s Congress enacted three more laws. In 1945, Public Law 79-166 (Shore Protection Studies) established authority for the Beach Erosion Board to pursue a program of

general investigation and research and to publish technical papers. Public Law 79-526 (Flood Control Act of 1946) authorized emergency bank protection to prevent flood damage to highways, bridge approaches and public works (Section 14 Program). Public Law 79-727 (Federal Participation in the Cost of Protecting Publicly Owned Property) declared it to be the policy of the United States to assist in the construction but not the maintenance of in up to 1/3 of the total cost to protect publicly owned shores against erosion from waves and currents. From 1947 through 1950, eight more hurricanes hit the Gulf and lower Atlantic coasts. While none of these storms were major, a total of 64 lives were lost and damages ran into the hundreds of millions. One of these storms, in August 1949 crossed over Lake Okeechobee in Florida. Levees built by the Corps of Engineers after the 1928 hurricane prevented the lake from overflowing and casualties and extensive damages.

1950-1954

Public Law 81-516 (River and Harbor Act of 1950) and Public Law 83-780 (Flood Control Act of 1954) provided the first authorizations for shore protection studies and projects, when numerous were authorized. The 1954 Act, provided a separate heading for "BEACH EROSION."

In the late 1940s and early 1950s, the basic concept of shore protection evolved to a new approach. Rather than relying solely on the traditional coastal defense structures of the past, it was increasingly realized that, in many situations, results would be more cost-efficient and functionally successful if techniques were used which replicated the protective characteristics of natural beach and dune systems. In 1954 the Beach Erosion board published a technical manual "Shore Protection Planning and Design" to guide coastal engineering practices. Increasing attention during this period was given to beach nourishment as an alternative to the construction of hard structures and the Corps' Coastal Engineering Research Center, placed emphasis on the use of artificial beaches and dunes as economically efficient and highly effective dissipaters of wave energy. Other important considerations were the aesthetic and recreational values of artificially created beaches. It was also during this period that the Corps of Engineers first constructed specifically authorized shore projection projects.

During World War II, tropical cyclones were informally given women's names by U.S. Army Air Corp and Navy meteorologists (after their girl friends or wives) who were monitoring and forecasting tropical cyclones over the Pacific. From 1950 to 1952, tropical cyclones of the North Atlantic Ocean were identified by the phonetic alphabet (Able-Baker-Charlie-etc.), but in 1953 the U.S. Weather Bureau switched to women's names. In 1979, the U.S. National Weather Service switched to a list of names that also included men's names.

1955

Five major hurricanes occurred in 1954 and 1955 and caused the loss of 395 lives and flood and wave damage totaling more than $1 billion in the New England and mid-Atlantic area. In 1955 Congress enacted Public Law 84-71 (Hurricane Studies). This 1955 legislation was to have a far-reaching effect upon beach erosion control by directing concerned Federal agencies to develop shore protection measures. This legislation led to funding for the Department of Commerce to improve hurricane forecasting and warning services, and to authorizations for construction by the Corps of projects for hurricane protection. The Corps was directed to investigate Atlantic and Gulf shores of the United States to determine measures, which could be undertaken to reduce damages from hurricanes.

Also enacted in 1955 was Public Law 84-99 (Emergency Flood Control Work), which authorized the Chief of Engineers to provide emergency protection to threatened Federally authorized and constructed hurricane and shore protection works. It also established an emergency fund to repair or restore such works damaged or destroyed by wind, wave, or water action of other than an ordinary nature.

1956

Public Law 84-826 (Beach Nourishment) expanded the Federal role in shore protection. This law authorized Federal participation in the cost of works for protection and restoration of the shores of the United States, including private property if such protection is incidental to the protection of public owned shores, or if such protection would result in public benefits. It also provided for Federal assistance for periodic

nourishment on the same bases as new construction, for a period to be specified by the Chief of Engineers, when it would be the most suitable and economical remedial measure. The nourishment period recommended by the Chief of Engineers under the 1956 Act was usually 10 years, unless previous nourishment experienced at the site indicated that a longer period would be suitable and economical.

1958

Public Law 85-500 (River and Harbor and Flood Control Act of 1958) added provisions of local cooperation on three hurricane flood protection projects. This established an administrative precedent for cost sharing in hurricane projects. Non-Federal interests were required to assume 30 percent of total first costs, including the value of land, easements and rights of way, and operate and maintain the project. This law also authorized numerous coastal studies and projects along the east coast, in the Great Lakes and California.

1961

For the six-year period of 1956 through 1961, four more major hurricanes struck the Atlantic and Gulf coasts. One of these (*Donna* in 1960) impacted all east coast states from Florida to Maine. This storm caused 50 deaths, recorded wind gusts of 175-180 miles per hour and resulted in damages totaling close to $400 million. Hurricane *Carla* in 1961 caused 46 deaths in Texas and was the largest and most intense Gulf coast hurricane in many years. Following these storms, major legislation affecting the beach erosion control program was again enacted.

During the period from 1962 to 1969, there were six major land-falling hurricanes and one particularly severe northeast storm, the "Ash Wednesday" storm of 1962. The Ash Wednesday storm was particularly damaging. This storm lasted over five high tides and caused widespread damages to land forms as well as structures from New York to Florida. One of the hurricanes (*Betsy*) hit Louisiana in 1965 with 136 mile and hour winds and caused 75 deaths. In 1969, hurricane *Camille* entered land at Gulfport, Mississippi and before exiting at Virginia, caused 256 deaths. These storms were instrumental in the development of public opinion for a stronger federal role in protecting the coastal areas.

1962

Public Law 87-874 (River and Harbor and Flood Control Act of 1962) extended the Federal participation in the cost of constructing beach erosion and shore protection projects. The Federal share was increase to 50 percent when the beach is publicly owned or used, 70 percent for seashore parks and conservation areas when certain conditions of ownership and use of the beaches are met and 100 percent for Federally owned shores. It also increased the Federal share of study costs from 1/3 to 100 percent. Also authorized was authority for the Chief of Engineers to plan and construct small beach and shore protection projects without Congressional authorization (Section 103 Program). This provision was important in it provided programmatic authority. Prior to this, water resources developments recommended to the Congress in response to study authority could not be implemented without being specifically adopted in law. However, subject to specific limits on the allowable Federal expenditures, Congress delegated continuing authority to the Secretary of the Army acting thorough the Chief of Engineers for study, approval and construction of small shore protection projects. The cost limit set in this Act of $400,000 per project with an annual program limit of $3 million, has been increased over the years and, although not always fully funded in recent years, is now $3 million per project with a $30 million program limit. A number of shoreline studies and projects were also authorized in this law.

1963

As noted above, the 1962 Act changed the cost sharing on studies to 100 percent Federal. This, coupled with the great need to provide protection in areas damaged by the hurricanes of the 50s and early 60s, resulted in a large number of studies and subsequent project authorizations. Recognizing the increased need for additional engineering and scientific study in the area of shoreline protection and beach erosion control, in 1963, Congress established the Corps' Coastal Engineering Research Center through enactment of Public Law 88-172 (CERC Established). This act also abolished the Corps' Beach Erosion Board and transferred its review functions to the Board of Engineers for Rivers and Harbors.

1965

Public Law 89-72 (Federal Water Protection Recreation Act-Uniform Policies) specified those outdoor recreation benefits that could be attributed to a project shall be taken into account in determining the overall benefits of the projects (e.g., recreational use of beach fill, groins or other shore protection structures). This year saw one severe storm, hurricane *Betsy*, which hit Louisiana with 136 mile an hour winds and caused 75 deaths.

1968

Public Law 90-483 (River and Harbor and Flood Control Act of 1968). In Section 106 the Chief of Engineers was given responsibility for appraising, investigating, and studying the condition of the Nation's shorelines and for developing suitable means for protecting, restoring, and managing them so as to minimize erosion induced damages. This national study was completed in 1971 and was comprised of a series of 12 reports. The major findings of this national study are provided in Box 3. Section 111 of the 1968 Act, authorized investigation and construction of projects to prevent or mitigate shore damages resulting from Federal navigation works. The Federal share of cost is the same as the share of the implementation costs for the navigation project that caused the damages, but limited to $1 million per project (Section 111 Program has since been amended to limit Federal costs to $5 million per project).

In 1969, hurricane *Camille* entered at Gulfport, Mississippi, and before exiting Virginia, caused 256 deaths.

1970

Public Law 91-611 (River and Harbor and Flood Control Act of 1970) authorized discretionary modifications in Federal participation in cost sharing for hurricane protection projects. The law also increased the Federal share of costs of the Section 103 Program. Hurricane *Celia* hit Texas this year. This category 3 hurricane killed 11 people and produced damages of about $450 million.

BOX 3: 1971 National Shoreline Study, Summary of Findings

- The National shoreline Study finds 20,500 miles of the ocean and Great Lakes shores of the United States, Puerto Rico, and the Virgin Islands undergoing significant erosion. The Study further finds that action to halt significant erosion appears justified along 2,700 miles of critically eroding shore. This shoreline was classified as critical because the rate of erosion considered in conjunction with economic, industrial, recreational, agricultural, navigational, demographic, ecological and other relevant factors, indicates that action to halt such erosion may be justified. The cost of constructing suitable protective works for these shores is estimated to be $1.8 billion. The study suggests that priority attention should be given to 190 miles of shores where contined erosion is most likely to endanger life and public safety within the next 5 years. The cost of constructing protective works along these shores is estimated to be $240 million. About two-thirds of the area where erosion is a serious problem is privately owned and not eligible for Federal assistance under present law. The remaining 17,800 miles of significantly eroding shoreline is classified as non-critical.
- The shoreline is a vital part of the coastal zone; it is where the land and the people meet the sea. it is where tides, winds, and waves attack the land and it is where the land responds through the give and take of shifting beaches, rocky headlands, and offshore sandbars, coral reefs, and chains of barrier islands. The shore is complex and changing. Above all it is of critical importance and value to man.
- Shores and beaches serve a great variety of uses, respond to widely differing interest and needs, and concern all people.
- Shores and beaches are probably the most critical and valuable parts of the coastal zone. Shoreline land forms — rocky headlands, stable beaches, unspoiled salt marshes, bold shorelines — must strongly influence long range planning for land use in the coastal zone.
- The coastal zone is a uniquely valuable national asset. It is a magnet to living things. Nearly half of our population lives in counties that touch the sea or Great lakes. The heaviest population of fish in the sea, and essentially all marine vegetation, are concentrated in the coastal zone. The coastal zone is growing more rapidly in population and wealth than other parts of the Nation. In the past 10 years, 90 percent of the National population and growth was in the coastal States. The 30 coastal States have 75 percent of the Nation's population and 12 of the 13 largest cities.
- Shoreline management problems tend to be interwoven with coastal zone problems.

1972

Public Law 92-583 (Coastal Zone Management Act), established policy to preserve, protect, and develop the coastal zone while restoring and enhancing coastal resources. It required states to develop and implement management programs to achieve wise use of the land and water resources in the coastal zone, giving full consideration to ecological, cultural, historic and esthetic values, as well as compatible economic development. It also required all Federal agencies with activities directly affecting the coastal zone to assure that those activities or projects are consistent with the approved state program. This year, hurricane *Agnes* impacted the Atlantic coast from Florida to New York. This is one of the costliest natural disasters in U.S. history, with damages of about $2 billion. The storm caused devastating floods from North Carolina to New York and spawned many tornadoes.

1974

Public Law 93-251 (Water Resource Development Act of 1974 (WRDA 74)). Section 27 of WRDA 74 modified the definition of the emergency bank protection program (Section 14 of the FCA of 1946) to repair, restoration and modification of emergency streambank and shoreline protection works. Eligibility for this program was also extended to include churches, hospitals, schools and similar non-profit public services. This Section 27 also increased the Federal cost limits of the Section 14 Program. Section 54 of this act established the "Shoreline Erosion Control Act." This was a program to develop, demonstrate, and disseminate information about low cost means to prevent and control shoreline erosion. A comprehensive report on this demonstration program was submitted to Congress in June 1982. Section 55 authorized technical and engineering assistance to non–Federal public interests in developing structural and nonstructural methods of preventing damages attributable to shore and streambank erosion.

1976

Hurricane *Eloise* hit the northwestern coast of Florida in 1975, resulting in three deaths and damages of almost $500 million. In 1976, Public Law 94-587 (WRDA 76) was enacted. Section 145 of this law authorized the placement of beach quality sand obtained from dredging operations on adjacent beaches if requested by the interested state government and in the public interest, with the increased costs paid by local interest. Section 156 of the law authorized the Corps to extend Federal aid in periodic beach nourishment up to 15 years (from the original 10) from the date of initiation of construction and contained several authorizations for shoreline studies and projects.

1979

There were three major storms this year, *Claudette* in July, and *David* and *Frederic* in September. *Claudette,* while only a topical storm, hit Texas causing one death and $400 million in damages. *David* hit Florida and then went up the Atlantic coastline. The storm resulted in five deaths and damages totaling $320 million. The most severe, however, was hurricane *Frederic*, a category 3 storm that hit Alabama and Mississippi, causing damages of $2.3 billion and resulted in 11 deaths. These three storms in 1979 were followed by hurricane *Allen* in 1980, which hit the coast of Texas killing three and causing damages of $300 million.

1982

Public Law 97-348 (Coastal Barrier Resources Act) established a policy that those coastal barriers and their associated areas are to be protected by restricting Federal expenditures, which have the effect of encouraging development of coastal barriers (including islands, spits, tombolos, and bay barriers). Damage due to an El Niño event in the winter of 1982-1983 caused significant damage along the coast of California, causing damage to 3,000 homes and 900 businesses.

The period of 1983 to 1985 saw six major hurricanes. In 1983 *Alicia* impacted Texas with resulting damages of $2.0 billion and three deaths. In 1985 there were five storms, *Danny, Elena, Gloria, Juan* and *Kate* resulting in 37 deaths and damages of over $4 billion. Excluding Texas, these storms impacted all of the Gulf and Atlantic coast states.

1986

Public Law 99-662 (WRDA 86). Section 103 established hurricane and storm damage reduction as a project purpose (in lieu of beach erosion control) and required that the costs of constructing projects for beach erosion control must be assigned to recognized project purposes such as hurricane and storm damage reduction and/or recreation. It also established Federal cost sharing for hurricane and storm damage reduction for projects with public benefits at 65 percent and at 50 percent for separable recreation. Section 933 amended Public Law 94-587 to authorize 50 percent Federal cost sharing of the extra costs for using dredged sand from Federal navigation projects improvements and maintenance efforts for beach nourishment. In those cases where the additional costs for placement of the dredged material is not economically justified, the Corps may still perform the work if the state or political subdivision requests it and contributes 100 percent of the added cost of disposal. Section 934 extended the authority for the Chief of Engineers to provide periodic nourishment up to 50 years from the date of initiation of project construction. The law also increased the Federal share of costs of the Section 14, 103 and 111 Programs. The law contained a separate section "TITLE V-SHORELINE PROTECTION" that contained 23 separate provisions.

The year of 1986 was also the year in which the Office of Management through budgetary guidance prohibited the construction of "single purpose recreation projects." This meant that shore protection projects must be formulated for HSDR with no separable recreation costs. Therefore, any recreation benefits are considered incidental. Furthermore, more than 50 percent of the project justification must be HSDR benefits. In other words, greater than 50 percent of the cost of the project must be justified by HSDR benefits. Once this condition is met, there is no limit on the magnitude of incidental recreation benefits claimed.

1988

Public Law 100-676 (WRDA 88). Section 14 amended Public Law 99-662 to extend Federal flood plain management and flood insurance programs compliance requirements to sponsors of hurricane and storm damage reduction projects.

1990

Public Law 101-640 (WRDA 90). Section 309 directed the Secretary of the Army to report on the advisability of not participating in shore protection projects unless the state has established a management program which, includes restrictions on new development, provisions for the relocation of structures, and for assuring public access. (This report was never prepared).

1992

The period of 1989 to 1992 was one of the worst in terms of dollar damages in the history of the United States. There were only four major storms during this period, *Allison* and *Hugo* in 1989, *Bob* in 1991 and *Andrew* in 1992. These four storms, however, caused $35.5 billion in damages and resulted in at least 62 deaths. The two worst of these were *Hugo,* which hit the South Carolina area resulting in 21 deaths and $7.0 billion in damages, and *Andrew*, which hit Florida before impacting Louisiana resulting in 15 deaths and $26.5 billion in damages. While *Andrew* was extremely damaging, most all of the dollar damage was inland and not on the coast.

In 1992 Public Law 102-580 (WRDA 92) was enacted. Section 206 authorizes non-Federal interests to undertake authorized shoreline protection projects, subject to obtaining any permits required pursuant to Federal and State laws in advance of actual construction, subject to prior approval of the Secretary of the Army. Section 207 authorized political subdivisions of States to enter into agreements for disposal of dredged material on beaches and to consider, and to the maximum extent practicable, accommodate the schedule of the sponsor in providing its share of cost. Section 223 abolished the Board of Engineers for Rivers and Harbors with duties to be transferred to other elements as determined necessary.

There were no shoreline studies or projects authorized in 1992. Section 404 of WRDA 92, however, authorized a data collection and monitoring program of coastal processes for the Atlantic Coast of New York,

from Coney Island to Montauk Point, with a view toward providing information necessary to develop a program for addressing post storm actions and long-term shoreline erosion control. The objective of this program is to improve our understanding of the physical characteristics of the south shore of Long Island by obtaining and analyzing data on coastal processes directed at post-storm response and long-term shoreline erosion. The Atlantic Coast of New York Monitoring Program (ACNYPM), begun in 1995, is now complete. It is printed and bound as ERDC/CHL TR-02-16. Additional information can be found on the New York District web site at: http://www.nan.usace.army.mil/business/prjlinks/coastal/acnymp/index.htm

1993

In budgetary guidance, the Office of Management and Budget (OMB) requested the Army Corps of Engineers to conduct an analysis of the economic and environmental effectiveness of storm damage protection projects. OMB indicated the study should seek to compare and contrast the estimates of project benefits, costs, and environmental effects with current and projected conditions. The study should include a comparison of the anticipated and actual level of protection as well as an analysis of any induced development effects. In response to this directive a task force of Corps personnel and consultants was formed. The results were published in three documents.

- An initial phase was completed in January 1994 and published as Institute for Water Resources (IWR) Report 94-PS-1, "Shoreline Protection and Beach Erosion Control Study, Phase 1: Cost Comparison of Shoreline Protection Projects of the U.S. Army Corps of Engineers." The purpose of the first phase report was to provide early input to OMB regarding the scope and cost of the Civil Works shore protection program.
- The second document, developed by consultants, represented an assessment of the relation between Federal shore protection projects and potential induced development in coastal areas. The report was published in January 1995 as IWR Report 95-PS-1, "Shore Protection and Beach Erosion Control Study: Economic Effects of Induced Development in Corps-Protected Beachfront Communities." The research for this report was conducted in two stages. First, a model of the determinants of beachfront development was formulated based on economic theory. Second, three independent empirical tests were executed simultaneously in order to evaluate whether such theory actually reflected real world economic behavior. This report can be found at: http://www.iwr.usace.army.mil/iwr/pdf/95ps1.pdf. The conclusions of this report are presented in Box 4.

BOX 4: Economic Effects of Inducted Development, Conclusions from IWR Report 95-PS-1, 1995

1. There is no evidence that Corps shore protection projects induce development along the protected shoreline.
2. Residents of beachfront communities do not perceive the Corps as the sole source of protection for their erosion or storm damage problems, regardless of whether the corps is actually active in their beachfront community or not.
3. Awareness of the Corps among residents in beachfront communities decreases with wealth and increases with time of residence in the community. This implies that new residents, those economic agents who recently made the investment decision and are affecting the growth and pattern of development, did not explicitly take into account the presence of a Corps shore protection project as a part of their information or rationale used for selecting the location of their investment.
4. The existence of a Corps shore protection project is not statistically significant in generating changes in the pattern and growth of development in beachfront communities. Indeed, the significant variables are income and employment, indicators of aggregate economic activity. When the whole economy in a regional coastal area grows, the rate of development in the beachfront community grows as well, with or without a Federal shore protection project.
5. No significant effect is observed from Corps shore protection projects on the housing price appreciation rate differential between inland areas versus beachfront areas.

- The third and final report was published in 1996 as IWR Report 96-PS-1, "Shoreline Protection and Beach Erosion Control Study Final Report: An Analysis of the U.S. Army Corps of Engineers Shore

Protection Program." This report can be found at: http://www.iwr.usace.army.mil/iwr/pdf/96ps1.pdf. The conclusions of the 1996 report are presented in Box 5. The Administration never commented on this report, but OMB did give the Corps verbal approval to print the final document.

BOX 5: Shoreline Protection and Beach Erosion Control Study, conclusions from IWR Report 96-PS-1, 1996

1. **COMPARISON OF PROJECT COSTS**. From a cost performance standpoint, the shore protection program has been effectively managed, considering the highly variable environment, with total program costs being slightly less than estimated.
2. **COMPARISON OF SAND QUANTITIES.** From the standpoint of estimated sand volume emplacement, the shore protection program has performed well within acceptable limits, considering the highly variable and dynamic nature of coastal shorelines, with overall quantities being slightly more than estimated.
3. **BENEFIT ANALYSIS.** The major benefit of shore protection projects is the reduction of storm damages, with recreation benefits comprising a significant proportion of total benefits. Tracking actual benefits of shore protection projects is difficult. Historically, funding has not been provided to perform post-storm surveys of beach nourishment areas. Therefore, Corps districts have been unable to measure project performance of completed projects.
4. **ANALYSIS OF INDUCED DEVELOPMENT.** Corps projects appear to have no measurable effect on development, and it appears that Corps activity has little effect on the relocation and/or construction decision of developers, homeowners, or housing investors.
5. **LEVEL OF PROTECTION.** The Corps currently uses a number of approaches for developing design storm events. The selected approach is based on project scope, availability of data, and level or resources. Therefore, the term 'level of protection' is not appropriate for a short protection project; instead, a set of design storm events is used to evaluate the cost effectiveness of design alternatives. Projects are designed to perform under a continuum of different conditions.
6. **ENVIRONMENTAL EFFECTS.** Beach restoration and periodic nourishment is the most environmentally desirable shore protection alternative.

1995

There were two storms in 1994, *Alberto* and *Gordon* and one in 1995, *Opal*. While only tropical storms, *Alberto* and *Gordon* caused 39 deaths and damages of $900 million. *Opal*, a category 3 hurricane hit northwest Florida, caused nine deaths and damages of $3 billion. Because of budgetary constraints the President's budget recommended that all Federal participation in the construction of new shore protection projects be terminated. In report language accompanying the Energy and Water Development Appropriations Bill for Fiscal Year 1996, Congress rejects this proposal and approves funds for shore protection projects, which are not in accord with the President's policy recommendations. Nevertheless, the Administration directs the Corps district offices not to recommend new shoreline protection projects for the fiscal year 1997 budget.

1996

Public Law 104-303 (WRDA '96). Section 227 clarifies shore protection policy by stating it is Federal policy to promote shore protection projects and related research that encourage the protection, restoration, and enhancement of sandy beaches, including beach restoration and periodic nourishment. Section 227 also established a National Shoreline Erosion Control Development and Demonstration Program (subsequently funded in Fiscal Year 2002). Three projects were authorized in this law, Rehoboth Beach, DE and Brevard County and Lake Worth Inlet, FL. In addition, periodic nourishment was extended to a period of 50 years for eight projects. At that time the Administration continued to oppose new shoreline protection projects, but amended its proposal to permit case-by-case exceptions where the project does not involve long-term Federal commitments but does involve the protection of permanent structures that are not primarily related to a recreation purpose.

Two hurricanes hit the North Carolina coast in 1996, *Bertha* a category 2 storm, was followed a month later by *Fran* a category 3 storm which caused 34 deaths and resulted in $3.2 billion in damages. A Corps report, completed in 2000 compared areas in North Carolina hit by Hurricane *Fran* that were protected by Corps shore protection projects (Carolina Beach and Wrightsville Beach) and areas not protected by Corps shore protection

projects (Kure Beach and on Topsail Island, the three communities of Topsail Beach, Surf City and North Topsail Beach). A task force of Corps staff and consultants looked at the physical parameters of the storm (winds; storm surge and waves, which were modeled; and high water marks) as well as the offshore geology of the area to determine if these played a role in the storm's relative impact on the communities. Finally, an economic damage assessment was performed of the impacted areas, including the collection of demographic information. The study conclusions are provided in Box 6. The Corps report on Hurricane *Fran*, published as IWR Report 00-R-6, can be found at: http://www.iwr.usace.army.mil/iwr/pdf/HurricaneFranEffectsComms.pdf.

1998

The period of 1998 and 1999 saw five hurricanes. In 1998 *Bonnie* hit North Carolina caused three deaths and damages of $720 million, *Earl* hit the Florida, Georgia, South Carolina coasts, killing two and resulted in damages of $79 million and *Georges* hit the Gulf coastal states of Florida, Mississippi and Louisiana with only one death but damages of $1.155 billion. In late January and early February of 1998, the coast of California was hit by a series of powerful El Niño-influenced winter storms, causing 40 counties throughout the state, including most coastal counties, to be declared Federal national disaster areas.

1999

Public Law 106-53 (WRDA '99). Section 214 of the law increased the Federal limit of costs of the Section 111 program to $5 million and Section 226 increased the Federal limit of costs of the Section 103 program to $2 million.

Section 215(a) phased in a new cost-sharing formula for periodic shoreline nourishment, for both Congressionally authorized and Section 103 projects by changing the split from 65 percent Federal and 35 percent non-Federal to a 50:50 cost share. The amended cost sharing becomes effective for the periodic nourishment of projects authorized for construction after December 31, 1999.

Section 215(c) requires a Report on the Shores of the United States to be presented to Congress (initially funded in fiscal year 2002) and Section 215(d) requires the Secretary of the Army to establish a data bank containing data on the geophysical and climatological characteristics of the shores of the United States. The first funding for this study "The National Shoreline Management Study," was obtained in 2002.

Cost sharing for the disposal of dredged material on beaches (Section 145 of WRDA '86) as amended by Section 933 of WRDA '86 is further amended by Section 217(a) to lower the non- Federal share from 50 percent to 35 percent.

BOX 6: Hurricane *Fran*, Effects on Communities With and Without Shore Protection, Conclusions from IWR Report 00-R-6

1. The areas protected by Corps of Engineers shore protection projects received less damage as a percentage of total property value than did the unprotected areas.
2. While differences in physical storm parameters (winds, storm surge and waves) were observed across the study area, the differences were not large enough to explain the differences in damage. If anything, storm parameters showed the most severe part of the storm hit the protected Wrightsville Beach and the less severe part of the storm hit the unprotected areas of Topsail Island.
3. Offshore geology, which varies from the southern end (Kure Beach) to the northern end (Topsail Island), likely contributed to damages and lack of damages.
   - At the south end of Kure Beach is a Coquina rock outcrop that contributed to the highest of the highwater to be observed at this location and resulted in an increase in damages.
   - The areas with existing wide beaches and a frontal dune sysytem, either natural or man-made, experienced less storm damage.
4. Partnering with agencies such as the Federal Emergency Management Agency and the Federal Insurance Administration in collection damages data through post storm surveys and distinguishing between flooding and eroision damages would pay dividends.

Summary

Beach nourishment projects similar to the ones at Carolina Beach and Wrightsville Beach do reduce hurricane storm damages, which in turn, reduce Federal disaster recovery costs.

Section 226 increased the Federal limit of costs of the Section 103 program from $2 million to $3 million.

In this law, 11 shoreline projects were authorized for construction, but none obtained funding in subsequent appropriation legislation. Ten of these projects were in the Delaware/New Jersey area and one in Florida. In addition, 11-shoreline project related provisions and two projects (Indian River County, FL and Lido Key, Sarasota, FL) were reauthorized.

In 1999 there were two hurricanes, *Bret* in Texas and *Floyd* which impacted the Atlantic coast from North Carolina to New England, resulting in 56 deaths and damages of from $3 to $6 billion.

THE 21ST CENTURY

2000

The Administration continues to consider shore protection projects as a low budgetary priority. Congress, however, acts to authorize and appropriate funds for new shore protection studies and projects. The Corps conducts the studies and implements the projects as directed by Congress. The Administration's proposal for a 2000 WRDA contained no shoreline provisions.

2001

There was no authorization bill or severe storms this year. There were, however, two major Corps reports during the year that provided details on the shoreline protection program. One was related to a project (Atlantic Coast of New Jersey, Asbury Park to Manasquan) and the other to a study of shore protection benefits.

- Project Related Report. The Corps through the New York District and the State of New Jersey are presently engaged in an erosion control project to protect beaches along the northern coast of the state. The project, authorized by the River and Harbor Act of 1958, as amended, consists of a project 21 miles in length. The project provides for beach restoration and storm damage protection to the highly populated communities and infrastructure located along the area of the New Jersey shoreline, which was previously protected only by a seawall or eroded sections of beach. The project area consists of two sections, the northern section which extends 12 miles from Sea Bright to Ocean Township (Section I) and the southern section which extends 9 miles from Asbury Park south to Manasquan Inlet (Section II). In 1993, the Corps conducted a pilot study of the borrow and beach areas of this project to obtain the information needed to design the environmental monitoring for Section II. The pilot study characterized longshore variation in the abundance of intertidal infauna, characterized km-scale variation in the abundance of infauna within the borrow areas, and examined the effectiveness of various methods for sampling nearshore ichthyoplankton and juvenile fishes. Based on this information, the report recommended a monitoring plan for this reach (Section II) of the project. The New York District and the Waterways Experiment Station discussed these recommendations with resource agency representatives in March 1994, and the Biological Monitoring Plan was developed. A summary of the conclusions of the report is presented in Box 7. The final report on this monitoring program has been completed and can be found on the New York District web site at: htttp://www.nan.usace.army.mil/business/prjlinks/coastal/Asbury/index.htm

- Distribution of Shore Protection Benefits. The Office of Management and Budget (OMB) requested that the Corps review existing shore protection related literature and studies to identify information that might assist in making future budgetary and cost sharing decisions relating to the Corps' shore protection program. In their review of the report "The Distribution of Shore Protection Benefits: A Preliminary Examination," OMB expressed concern that the report does not provide an acceptable basis for policy-making, and that further studies are needed. While this report adds significantly to the limited professional literature on this important subject of how benefits from shore protection projects are distributed, it is a preliminary effort. As such, it does not represent an official position on the subject and may be

modified as the result of further studies. The Corps intends to conduct those further studies on this subject as part of the more comprehensive National Shoreline Management Study.

2002

The Administration's 2003 budget gives priority to ongoing studies, projects and programs that provide substantial benefits under the principal missions of the Civil Works program, which are commercial navigation, flood damage reduction (including coastal storm and hurricane damage reduction), and environmental restoration. While the budget includes no new shoreline protection projects, it treats projects to protect coastal structures from hurricane and storm damage on a par with other types of flood damage reduction projects. However, the Administration continues to be concerned about the appropriate level of non-Federal cost sharing for shore protection projects, and is considering proposing legislation to adjust Federal and non-Federal cost shares. Congress adjourned for the year before the proposed Water Resources Development of 2002 was finalized.

BOX 7: New York District's Biological Monitoring Program for the Atlantic Coast of New Jersey, Asbury Park to Manasquan Section Beach Erosion Control Project, Summary of Conclusions

1. **Intertical and Nearshore Benthos.** Beach nourishment resulted in short-term declines in abundance, biomass, and taxa richness. Recovery of intertidal assemblabes was complete within 2-6.5 months of the conclusion of filling. Differences in the rate of recovery were most likely due to differences in when nourishment was complete. Recovery rates are similar to those reported from other studies, particularly where the grain size of the fill material matched that of the beaches to be nourished.
2. **Ichthyoplankton.** There were no obvious differences between reference and nourished beaches based on an analysis of a number of parameters (surf zone ichthyoplankton abundance, size and species composition).
3. **Potential Fish Food Items Present in Ichthyoplankton Samples and on Rock Groins.** Sources of food items included both permanent and temporary members of the plankton, taxa dislodged from the bottom sediments, taxa washed off the rock groins, and a few originating on land and deposited by the winds (e.g., flying ants).
4. **Surf Zone Finfish.** Analysis of the post-nourishment monitoring did not reveal any long-term impacts to surf zone finfish distribution and abundance patterns. There was no sustained biological indicator, i.e., fish abundance or distribution pattern, that distinguishes nourished from non-nourished beach habitat.
5. **Surf Zone Fish Habits.** There were no indications of negative impacts related to beach nourishment for either kingfish or silversides based on the analyses of 'prey availability' parameters. The percentage of fish with filled stomachs did not differ for predator species, indicating that foraging success was comparable at the Reference and Beach Nourishment stations.
6. **Turbidity and Suspended Sediment Characterizations.** Effects of beach fill operations on short-term turbidity conditions appear to be limited to a relatively narrow swath of beachfront with a lateral extent on the order of several hundred meters. Dispersal of suspended sediments is prominent in the swash zone in the immediate vicinity of the operation, and can be traced into nearshore bottom waters.
7. **Offshore Borrow Area Benthos.** Abundance, biomass, and taxa richness recovered quickly after the first dredging operation with no detectable difference between dredged and undisturbed areas by the following spring. Abundance also recovered quickly after the 1999 dredging operation (BBA5), although both biomass and taxa richness were still reduced in May 2000. Species and biomass composition were altered in similar manners by each operation. Immediately after dredging the relative contribution of echinoderm biomass declined and the abundance of the spionid polychaete *Spiophanes bombyx* increased. Changes in biomass composition were longer lasting with the assemblage taking 1.5 to 2.5 years to return to undredged conditions.
8. **Offshore Borrow Area Finfish.** There was no substantive difference in species composition or catch-per-unit-effort among areas within any given collection period. Likewise, no dramatic change in assemblage structure or catch after dredging at any of the primarily on anemones, which were not common (as indicated in the benthic data) at any of the borrow area sites in 1997 or 1999 was observed.
9. **Offshore Borrow Fish Food Habits.** Analyses of stomach contents for both winter and summer flounder indicated no substantive change in the diet of either species. Analysis of trophic support for winter flounder indicated that this species continued to feed primarily on anemones, which were not common (as indicated in the benthic data) at any of the borrow areas.
10. **Recreational Fishing Surveys.** A total of 5,216 interviews of anglers were recorded to obtain information of fishing location, fishing duration, target species, creel success, fishing freguency, distance traveled to site, and money spent on the day's trip. These surveys were conducted before construction, during construction and after construction. A vast majority of the anglers (83%) believed that fishing was no worse after construction surveys when compared to during construction (75.7%) surveys.

HISTORY SUMMARY

Population and Damages

A summary of the population, shore protection projects and damages incurred for the seven decades where sufficient data are available to develop conclusions (the 1930s through the 1990s) are provided in Table 6. The table includes the term "coastal county." Coastal counties are defined as those counties, or county equivalents, having 15% of land within the coastal watershed, including the Great Lakes region. Of the 3,143 of these units nationwide, 762 (24%) are considered "coastal." While these coastal counties comprise only 17% of the contiguous United States land area, they contain approximately 55% of the population. According to the U.S. Bureau of the Census, the population in this area is expected to reach 165 million by the year 2015. Table 6 shows:

(1) Total United States and coastal populations,
(2) Actual damages due to hurricanes and those damages updated to 1995 dollars,
(3) Damages per United States coastal citizen in 1995 dollars,
(4) Accumulated miles of coastline protected by Corps projects,
(5) Damages per mile of coastline protected by Corps projects in 1995 dollars and
(6) Damages to coastal areas due to hurricanes per United States citizen in 1995 dollars.

Collected data seems to indicate that as the miles of coastal area protected by Corps shore protection projects increase, damages due to hurricanes per mile of coastal project and damages from hurricanes per U.S. citizen both decrease.

Cost sharing

In the 70 plus years since the Chief of Engineers was first authorized to conduct shore erosion studies, the share of costs to be picked up by the Federal Government has varied based on shore ownership and project purpose or benefit. The cost share also varies by type of action, i.e., study, initial construction, periodic nourishment, operation and maintenance or whether or not the use of dredged material is utilized. Corps of Engineers specifically authorized planning studies are conducted in two phases: reconnaissance and feasibility. The reconnaissance phase is conducted at full expense and the cost of the feasibility study is shared equally during the study between the Federal Government and the non-Federal sponsor. For the specific cost sharing policies for initial construction, periodic nourishment, operation and maintenance and the use of dredged material see Tables 7, 8 and 9.

PROJECTS AND COSTS

Call for Data

As part of the National Shoreline Management Study authorized in the Water Resources Development of 1999, a request for data was submitted to the Corps of Engineers Districts and Divisions with coastal responsibility. A copy of this 4 March 2002 request by the Director of Civil Woks is provided at Appendix B. These data built on the data collected and reported in the 1996 "Shoreline Protection and Beach Erosion Control Study, Final Report: An Analysis of the U.S. Army Corps of Engineers Shore Protection Program" (see Box 5 above). The Corps offices were requested to provide actual cost data for their coastal projects since the 1996 Report as well as a listing of all projects under construction and in the planning stages. The list of those individuals that responded to this request is also provided in Appendix B.

Projects

Provided in Appendix C is the current list of the studies and projects that comprise the Corps shore protection program. This database shows there are 71 completed projects, 10 projects under construction and an additional 70 in various stages of planning and design.

Actual Project Costs

Actual expenditures on the 71 large authorized and constructed shore protection projects are summarized in Box 8. These figures are cumulative for the period 1950 through June 2002 and are given in actual dollars. The summary presented in Box 8 lists the costs as reported in the 1996 Report (Old) and the additional costs expended since the 1996 Report (New). Note that in most cases, the costs listed in the 1996 Report (Old Costs) were actual costs through 1993. Total expenditures through 2001 are now calculated at just over $1.215 billion. These represent actual expenditures and are not updated to 2002 dollars. The major proportion (86 percent) of these expenditures was for beach restoration and periodic nourishment measures, with initial beach restoration accounting for just under 43 percent of the total costs, and periodic nourishment accounting for just over 43 percent of the total expenditures. Structural measures accounted for 12 percent of the costs, while only 2 percent of the costs were for emergency measures.

BOX 8: Total Actual Expenditures, Shore Protection Program (1950-2002)
(71 projects plus 2 extensions)

TYPE OF MEASURE	TOTAL COST ($000)		
	OLD [1]	NEW	TOTAL
Initial Beach Restoration	302,659	219,534	522,193
Periodic Nourishment	234,195	290,102	524,297
Structures	112,380	34,196	146,576
Emergency	15,841	6,254	22,095
TOTAL	**665,075**	**550,086**	**1,215,161**

The old costs do not exactly match the 1996 report as two projects have been deleted from the list: the Delaware Coast sand By Pass project because it is a Section 111 project and does not fit this study of specifically authorized projects the other project deleted from the list is the Virginia Key to Key Biscayne, FL project which was deauthorized in 1990.

Costs Adjusted to September 2002 Price Levels.

Methodology for Adjusting Costs

For the 1996 Shoreline Protection and Beach Erosion Control Study (1996 Report), adjusting to then current prices (1993) was accomplished by using two different criteria. For structural costs, the Engineering News Record (ENR) Construction Cost Index was used. In developing the 1996 Report the Task Force felt that the traditional (ENR price/cost index) method of adjustment to 1993 dollars did not adequately represent the cost changes in the dredging industry for beach nourishment projects. Beach nourishment costs were, therefore, adjusted on a project-specific basis in accordance with the prevailing 1993 cost of sand at the general project site. Those 1993 costs of sand were submitted for each project by the appropriate Corps office. For this 2002 study, however, the costs of sand were not developed and a different system had to be utilized. Costs for this report were updated by use of the Civil Works Construction Cost Index System (CWCCIS) as displayed in EM 1110-2-1304 revised 30 September 2002. For updating the cost of sand, "Feature 17, Beach Replenishment" was used. For updating structural costs, "Feature 10, Breakwater & Seawalls" was used. However, since the CWCCIS only goes as far back as fiscal year 1968, for costs prior to that time (when necessary) the ENR was utilized for the entire life of the project.

Project Categories

For this report there are three separate categories of projects that need to be updated to September 2002 prices:

Category 1. Projects displayed in the 1996 Report where no new expenditures have been made,

Category 2. Projects in the 1996 Report where there have been new expenditures since 1993 and

Category 3. New projects that were not listed in the 1996 Report.

For Category 1 projects, the data displayed in Table 4-5 of the 1996 Report were utilized as a starting point for all costs up to 1993. Those costs were then simply updated by the appropriate CWCCIS factor.

For Category 2 projects, the data displayed in Table 4-5 of the 1996 Report were utilized as a starting point for all costs up to 1993 and then the additional actual costs since that time were updated by the appropriate CWCCIS index.

For Category 3 projects, the actual costs were updated by the appropriate CWCCIS index.

Use of ENR Index

It was necessary to use the ENR for the following projects:

1. Wallis Sands State Beach, NH. 1996 Report did not have updated costs.
2. Winthrop Beach, MA. 1996 Report did not have updated costs.
3. Quincy Shore Beach, MA. 1996 Report did not have updated costs.
4. Prospect Beach, CT. 1996 Report did not have updated costs.
5. Seaside Park, CT. 1996 Report did not have updated costs.
6. Surfside/Sunset, CA. 1996 Report was in error in the distribution of costs between initial restoration and periodic nourishment.

Comparison of Indices

As displayed in Box 9, for the years that the CWCCIS has been available, there is not a great deal of difference in the three indices. However, based on the available information it was felt that the combination of indices provided the best method to update costs.

2002 Costs

The adjusted costs for each project, by project feature (initial restoration, periodic nourishment and emergency) are provided in Appendix C. The summary of these costs together with the actual costs as previously provided in Box 8 is provided in Box 10.

BOX 9: Update Factors

YEAR	UPDATE FACTOR TO SEPTEMBER 2002		
	(CWCCIS) SAND	(CWCCIS) STRUCTURES	ENR CONSTRUCTION COST INDEX
1970	4.57	4.62	4.77
1975	2.99	2.92	2.98
1980	2.06	1.96	2.04
1985	1.57	1.52	1.57
1990	1.36	1.30	1.39
1995	1.19	1.15	1.20
2002	1.00	1.00	1.00

BOX 10: Actual and Adjusted Costs

TYPE OF MEASURE	ACTUAL COSTS ($000)	ACTUAL COSTS ADJUSTED TO 2002 PRICES ($000)
Initial Restoration	522,193	1,164,661
Periodic Nourishment	524,297	806,476
Structures	146,576	397,344
Emergency	22,095	33,116
TOTAL	**1,215,161**	**2,401,597**

TABLE 1: MAJOR U.S. MAINLAND HURRICANES OF THE 20TH CENTURY, BY YEAR [1]

Date	Areas Most Affected	Category [2]	Deaths (US only)	Damage ($Millions) [3]
1900, Aug/Sept	TX (Galveston)	4	8,000**[4]**	5 to 50
1906,	Southeast FL	2	164	
1906,	MS, AL, Northwestern FL	3	134	
1909,	TX (Velasco)	3	41	
1909, Sept	LA (Grand Isle)	4	350	1 to 5
1910,	Southwest FL	3	30	
1915, Aug	TX and LA (Galveston)	4	275	
1915, Sept/Oct	Middle Gulf Coast	4	275	5 to 50
1916, June/July	MS to Northern FL		7	1 to 5
1918,	Southwestern LA	3	34	
1919, Sept	FL (Keys) and TX	4	100 to 400	5 to 50
1926, Sept	FL (Miami and Pensacola) and Al	4	243	Over 50
1928, Sept	FL (Lake Okeechobee)	4	1,836	5 to 50
1932, Aug	TX (Freeport)	4	40	5 to 50
1933, Aug	NC, VA and MD		0	5 to 50
1933, Aug/Sept	TX (Brownsville)	3	40	5 to 50
1933, Aug/Sept	FL, Jupiter Inlet		2	1 to 5
1933, Sept	NC		21	1 to 5
1934, June	LA		6	1 to 5
1934, July	FL and TX		11	1 to 5
1935, Aug/Sept	*Labor Day Storm*, FL	4	408	5 to 50
1935, Oct/Nov	Southern FL		5	5 to 50
1938, Sept	NY and Southern New England	3	600	306
1940, Aug	GA, NC and SC	2	50	1 to 5
1941, Sept	TX		4	5 to 50
1944, Sept	NC to New England	3	46	Over 50
1944, Oct	FL		18	Over 50
1945, Sept	FL, GA and SC		4	Over 50
1947, Sept	FL and Middle Gulf Coast	4	51	Over 50
1947, Oct	Southern FL, GA and SC		1	1 to 5
1948, Oct	Southern FL		0	5 to 50
1948, Sept	Southern FL		3	5 to 50
1949, Aug	FL, GA, SC and NC		2**[5]**	Over 50
1949, Sept/Oct	TX		2	5 to 50
1950, Sept	FL		2	1 to 5
1950, Oct	*King*, FL (Miami)		4	5 to 50
1954, Aug	*Carol,* NC to New England	3	60	461
1954, Sept	*Edna,* NJ to New England		21	5 to 50
1954, Oct	*Hazel,* SC and NC	4	95	281
1955, Aug	*Connie*, NC		25	Over 50
1955, Aug	*Diane,* NC to New England`	1	184	832
1955, Sept	*Ione,* NC		7	Over 50

Table 1: Major U.S. Mainland Hurricanes of the 20th Century, by Year *(Continued)*

Date	Areas Most Affected	Category [2]	Deaths (US only)	Damage ($Millions) [3]
1956, Sept	*Flossy*, LA to Northern FL		15	5 to 50
1957, June	*Audrey*, TX to AL	4	390	Over 50
1858, Sept	*Helene*, NC	3	0	10
1959, Sept/Oct	*Gracie*, SC	4	22	5 to 50
1960, Aug/Sep	*Donna*, FL to Maine	4	50	387
1961, Sept	*Carla*, TX	4	46	408
1964, Aug/Sept	*Cleo*, Southern FL and VA		0	200
1964, Aug/Sept	*Dora*, Northeastern FL and GA	2	5	250
1964, Sept/Oct	*Hilda*, LA	3	38	Over 50
1965, Aug/Sept	*Betsy*, Southern FL and LA	3	75	1,421
1967, Sept	*Beulah*, Southern FL		15	Over 50
1969, Aug	*Camille*, MS, LA and VA	5	256	1,421
1970, July/Aug	*Celia*, TX	3	11	453
1972, June	*Agnes*, FL to NY	1	122	2,100
1975, Sept	*Eloise*, Northwest FL	3		490
1979, July	*Claudette*, TX	TS **[6]**	1	400
1979, Sept	*David*, FL and Eastern United States	2	5	320
1979, Sept	*Frederic*, AL and MS	3	11	2,300
1980, Aug	*Allen*, TX	3	2	300
1983, Aug	*Alicia*, TX	3	21	2,000
1985, Aug	*Danny*, LA, AL and FL	1	3	50 to 100
1985, Aug/Sept	*Elena*, MS, AL and Northwest FL	3	4	1,250
1985, Sept	*Gloria*, Eastern United States	3	11	900
1985, Oct/Nov	*Juan*, LA	1	13	1,500
1985, Nov	*Kate*, FL (Keys to Northwestern area)	2	6	300
1989, June	*Allison*, North TX	TS	11	500
1989, Sept	*Hugo*, SC	4	21	7,000
1991, Aug	*Bob*, NC and Northeastern Coast	2	15	1,500
1992, Aug	*Andrew*, Southeast FL and Southeast LA	4	15	26,500
1994, June/July	*Alberto*, Northwest FL, GA and AL	TS	30	500
1994, Nov	*Gordon*, South and Central FL	TS	9	400
1995, Sept/Oct	*Opal*, Northwest FL	3	9	3,000
1996, July	*Bertha*, NC	2	3	270
1996, Sept	*Fran*, NC	3	34	3,200
1998, Aug	*Bonnie*, NC	3	3	720
1998, Aug/Sept	*Earl*, FL, GA, SC	1	2	79
1998, Sept	*Georges*, FL, MS and LS	4	1	1,155
1999, Aug	*Bret*, TX	4	0	60
1999, Sept	*Floyd*, NC to New England	2	56	3,000 to 6,000

For footnotes see next page.

Footnotes for Table 1

[1] Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service:

a. *"Some Devastating North Atlantic Hurricanes of the 20th Century,"* NOAA/PA 70025 (REV.), 1974. b. *"The Deadliest, Costliest, and Most Intense United States Hurricanes of this Century (and other frequently requested Hurricane facts)"* NOAA Technical Memorandum NWS TPC-1, February 1997.

c. www.nhc.noaa.gov/pastall.

[2] Saffir/Simpson Hurricane Scale.

[3] Actual, not adjusted.

[4] Deaths may have been as high as 10,000 to 12,000.

[5] Storm passed over Lake Okeechobee. Levees built by Corps of Engineers since 1928 prevented overflow and casualties.

[6] Tropical storm.

Table 2: Major U.S. Mainland Hurricanes of the 20th Century, Summary by Decade

Decade	Number of Hurricanes	Deaths (U.S. only)	Damage ($millions) (average of high and low estimate)
1900	5	8,689	31 **[1]**
1910	6	721 to 1,021	58 **[1]**
1920	2	2,079	Over 78
1930	10	1,133	456
1940	11	181	Over 596
1950	12	825	Over 1,845
1960	8	485	Over 4,187
1970	6	150	6,063
1980	9	92	13,825
1990	12	177	41,884 **[2]**
TOTAL	**81**	**14,532, to 14,832**	**Over 68,793**

Footnotes

[1] Most damage estimates not available.

[2] Includes hurricane *Andrew*, which hit Florida in 1992 with damages of $26.5 billion. The coastal damages due to this storm were minimal as most all damages were recorded inland due to high winds.

Table 3: Initial Construction Complete, Specifically Authorized Corps of Engineers Shore Protection Projects, by Year Construction Started

Year Initial Construction Started	State	Project Name	Type of Project [1]	Initial Construction Cost ($000)[2]	Miles Protected
1950	MA	Quincy Shore Beach	Combined	1,864	1.61
1952	MS	Harrison County	Combined	1,592	24.00
1956	MA	Winthrop Beach	Combined	530	0.76
	PA	Presque Isle	Combined	25,415	5.00
1957	CT	Prospect Beach	Combined	345	1.14
1958	CT	Seaside Park	BN	480	1.51
	FL	Palm Beach County – Lake Worth Inlet to South Lake Worth Inlet (sand transfer plant)	Structural	577	0.00
1959	CA	Channel Islands Harbor	Combined	6,078	0.95
1961	NC	Fort Macon	Combined	952	1.45
	CA	Oceanside	Combined	1,348	2.84
1962	CA	Ventura-Pierpoint Area	Combined	1,234	2.20
1963	TX	Galveston Seawall	Structural	9,335	3.09
1964	VA	Virginia Beach	BN	[3] 0	3.31
1965	NY	South Shore of Long Island, Fire Island to Montauk Point, Moriches to Shinnecock Reach	Combined	8,300	1.29
	NY	South Shore of Long Island, Fire Island to Montauk Point, Southampton to Beach Hampton	Structural	560	1.86
	NJ	Raritan and Sandy Hook Bay, Madison and Matawan Townships	Combined	1,314	2.97
	NC	Wrightsville Beach	BN	577	2.65
	NC	Carolina Beach and Vicinity	Combined	1,025	2.65
1966	NH	Hampton Beach	Combined	645	1.22
1968	NJ	Raritan and Sandy Hook Bay, Keansburg and East Keansburg	Structural	19,081	1.15
	CA	Coast of California, Point Mugu to San Pedro	Combined	2,448	2.23
1969	FL	Pinellas County – Treasure Island Segment	Combined	1,446	2.03
1970	FL	Broward County – Segment II	BN	1,759	11.60
1971	FL	Fort Pierce Beach	BN	621	1.30
1973	FL	Palm Beach County – Delray Beach Segment	BN	2,119	2.70
	CA	Surfside/Sunset	Combined	3,395	4.96
1974	NY	Atlantic Coast of Long Island, Fire Island Inlet & Shore Westerly to Jones Inlet	BN	13,150	3.41
	NY	Hamlin Beach State Park	Combined	2,378	0.80
1975	RI	Cliff Walk	Structural	1,361	3.41
	NY	Atlantic Coast of New York City, East Rockaway Inlet to Rockaway Inlet and Jamaica Bay	Combined	14,507	6.20
	GA	Tybee Island	Combined	4,111	2.58
	FL	Brevard County – Cape Canaveral	BN	1,026	2.80
	FL	Dade County	Combined	73,078	13.00
1977	OH	Lakeview Park Cooperative	Combined	1,674	0.28
1978	TX	Corpus Christi Beach	Combined	2,379	1.40

Table 3: Initial Construction Complete, Specifically Authorized Corps of Engineers Shore Protection Projects, by Year Construction Started *(continued)*

Year Initial Construction Started	State	Project Name	Type of Project [1]	Initial Construction Cost ($000)[2]	Miles Protected
1978	FL	Broward County – Segment III	BN	10,982	6.80
	FL	Duval County	BN	9,579	10.00
1980	NC	Fort Fisher	Structural	5,970	0.58
	FL	Pinellas County – Long Key Segment	Combined	1,738	0.53
1981	FL	Brevard County – Indialantic/Melbourne	BN	3,552	2.10
1983	NH	Wallis Sands State Park	Combined	501	0.15
	CT	Sherwood Island State Park	Combined	1,226	1.48
	OH	Point Place	Structural	14,122	3.22
1985	LA	Grand Isle and Vicinity	Combined	10,818	7.00
1988	FL	Palm Beach County – Boca Raton Segment	BN	3,547	1.45
1989	NJ	Cape May Inlet to Lower Township	Combined	11,809	3.60
	FL	Lee County – Captiva Island Segment	BN	6,418	4.70
1990	MD	Atlantic Coast of Maryland – Ocean City	Combined	37,529	8.90
1991	OH	Maumee Bay	Combined	2,302	0.99
1992	MA	Revere Beach	BN	3,015	2.46
	OH	Reno Beach	Structural	6,554	4.01
	NJ	Great Egg Harbor Inlet & Peck Beach	Combined	29,437	4.28
1993	SC	Folly Beach	Combined	10,946	5.34
	FL	Manatee County	BN	17,499	4.70
	FL	Pinellas County – Sand Key Segment	Combined	31,621	7.90
1994	NY	Atlantic Coast of NYC, Rockaway Inlet to Norton Point (Coney Island Area)	Combined	9,100	2.95
	IL	Casino Beach	Structural	3,922	0.57
	AK	Homer Spit Storm Damage Reduction	Structural	2,645	0.21
1995	SC	Myrtle Beach	BN	48,212	25.30
	FL	Palm Beach – Jupiter/Carlin	BN	4,787	1.10
	FL	Sarasota County – Venice Segment	BN	19,280	1.59
1996	NY	Fire Island Inlet to Montauk Point (Westhampton Interim)	Combined	19,249	4.06
	NC	Kure Beach	BN	14,550	3.41
	FL	Martin County	BN	11,639	3.75
	IN	Indiana Shoreline	BN	350	2.08
1997	NJ	Sandy Hook to Barnegat Inlet (Asbury Park to Manasquan)	Combined	43,448	9.00
	FL	Panama City Beaches	BN	21,223	16.29
	AK	Dillingham Snag Point	Structural	3,600	0.30
1998	FL	Palm Beach – Ocean Ridge Segment	BN	6,894	1.40
	AK	Homer Spit (extension)	Structural	5,846	0.76
2000	GA	Tybee Island (extension)	Combined	576	0.47
2001	NC	Ocean Isle, Brunswick Co. Beaches	BN	6,200	3.25
	FL	Brevard County – North Reach	BN	21,379	6.60
Program Totals		**71 projects (plus the extension of 2-projects)**		**$668,769**	**283.63**

For footnotes see next page.

Footnotes for Table 3

[1] Structural: A project with only a structural component.
BN: A project with only a beach nourishment component.
Combined. A project that contains both structural and beach nourishment components.

[2] Actual costs at time of construction. As these are initial costs, periodic nourishment and emergency costs are not included.

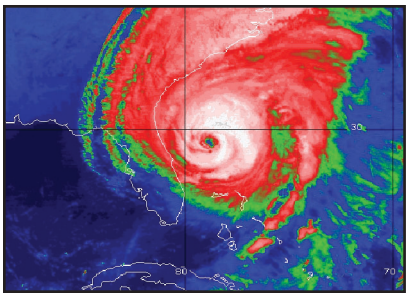
[3] There were no initial restoration costs for the Virginia Beach project. Periodic nourishment began in 1963 when 215 cubic yards were placed on the shoreline.

Source: U.S. Army Corps of Engineers Institute for Water Resources Report 96-PS-1, *and "Shoreline Protection and Beach Erosion Control Study Final Report,"* June 1996. The data of the 1996 report were updated to reflect a survey of districts in April-September 2002 as part of the National Shoreline Management Study.

Table 4: Initial Construction Complete, Specifically Authorized Corps of Engineers Shore Protection Projects, Summary by Decade

Decade (by year started)	Number of Projects Started	Cost ($000)	Length (miles)
1950	8	36,881	34.97
1960	14	48,265	30.94
1970	15	142,119	71.24
1980	10	59,701	24.81
1990	21 + 1 extension	353,648	111.35
2000-2002	2 + 1 extension	28,155	10.32
Total	**71 + 2 extensions**	**668,769**	**283.63**

STORMS



LEGISLATION

PROJECTS

Before Nourishment

After Nourishment

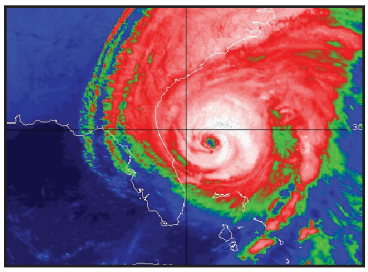
YEAR	1900 – 1929	1930 – 1939
STORM EVENTS 	About 50 hurricanes struck the U.S. mainland this period (13 of the major ones are listed in Table 1). Worst affected areas: Galveston TX (1900), over 8,000 deaths; the FL Keys (1919) with 100 to 400 deaths and L. Okeechobee, FL (1928) with 1,836 deaths. Over 11,000 deaths / Total damages unknown	10 major hurricanes: 4-TX, LA & FL; 3- FL only; 2- mid-Atlantic coast; and 1-NY/New England. The worst were the FL Labor Day storm (1935) killing 408 and a storm in 1938 killing 600 in NY and southern New England. 1,133 deaths / About $500 million in damages
CORPS COASTAL LEGISLATION	No Corps related Federal activity during this decade. The only legislation was by state legislatures.	PL 71-520 (1930) authorized Corps to conduct shore erosion studies in cooperation with cities, counties and states; cost sharing between Federal and non-Federal established (at Corps discretion) to be half of study costs. The Law also established the Beach Erosion Board. 1936 FCA Provided for Federal assistance in the construction but not maintenance of shore improvement and protection projects, on "Federal" property; authorized Beach Erosion Board to make investigations to determine the most suitable means of beach protection and restoration; and appropriate cost share to be borne by the Federal Gov.
SIGNIFICANT COASTAL MANAGEMENT MILESTONES	Corps: Corps' Board on Sand Movement and Beach Erosion replaced the National Research Council's Committee on Shoreline Studies. Non-Corps: - 1922, NJ legislature appropriated money to form an engineering advisory board. - Committee on Shoreline Studies formed under the Division of Geology and Geography of the National Research Council. - 1926, American Shore and Beach Preservation Association (ASBPA) established. - 1926, ASBPA lobbied for Federal govt. to assume function of unifying and coordinating state shoreline erosion management effort.	Corps: The Federal Government's role (to be carried out through the Corps of Engineers) in shore protection began in the 1930's in response to the growing recognition that haphazard and uncoordinated shore protection measures and poorly designed hard structures were ineffective, ugly, and damaging to the coastal environment. - Beach Erosion Board established by Congress in 1930 to act as a central agency to assemble data and provide engineering. expertise regarding coastal protection. - With the onset of WWII, involvement ended, with efforts committed to war effort.
CORPS APPROACHES AND PROJECTS	Corps: none Non-Corps: All shore projects planned, designed and constructed by non-Federal interests. - Dunes destroyed for hotels and boardwalks - Jetties and breakwaters built for Federal and non-Federal navigation purposes. - Recreation beaches built at Coney Island, NY and at Chicago. - In NJ millions of dollars spent on uncoordinated erosion control structures often produced minimally effective results, and, in some cases, were counterproductive.	Corps involvement limited to cooperative analyses, planning studies and technical advisory services.

Table 5A: Schematic History 1900-1959

1940	1949	1950	1959
11 major hurricanes: The worst were in 1944 when a storm hit the east coast from NC to New England resulting in 46 deaths and damage of over $50 million and in 1947 when FL and the middle Gulf coast suffered 51 lives lost and damages of over $50 million.		12 major hurricanes: one unnamed plus *King, Carol, Edna, Hazel, Connie, Diane, Ione, Flossy, Audrey, Helene*, and *Gracie*. These storms impacted all of the Gulf and Atlantic coast states. The worst storms were *Carol* (1954) and *Diane* (1955), both of which impacted NC to New England and *Audrey* (1957), which impacted the Gulf coast from TX to AL. These three storms caused 634 deaths.	
179 deaths	Damages over $500 million	823 deaths	Close to $2 billion in damages
PL 79-166 (1945) authorized the Beach Erosion Board to pursue a program of general investigation and research and to publish technical papers. PL 79-526 (1946) established the Section 14 Program. PL 79-727 (1946) established study cost sharing for construction but not maintenance.		PL 81-516 (1950) and PL 83-780 (1954) authorized beach erosion studies and projects. PL 84-71 (1955) directed Fed agencies to develop shore protection measures. PL 84-99 (1955) authorized emergency protection & funding to hurricane and shore protection works. PL 84-826 (1956) expanded the Federal shore protection role. PL 85-500 (1958) established construction cost sharing.	
Corps: Section 14 program provided funding for emergency bank protection without Congressional approval. -Federal participation in up to 1/3 of the cost of the study but not construction or maintenance of works to protect publicly owned shores authorized. - In late 1940s and early 1950s the value of the protective characteristics of dunes and beaches recognized.		Corps: First shoreline protection studies and projects authorized. - Corps directed to investigate Atlantic and Gulf shores to determine hurricane damage reduction measures. - Federal role in shore protection expanded to include construction and periodic nourishment for 10-years. - Non-Federal share of construction costs set at 30%. Non-Corps: - Commerce Dept. directed to improve hurricane forecasting and warning services. - 1956 National Flood Insurance Act authorized.	
While not a coastal shoreline protection project, the levees built by the Corps at L. Okeechobee following the 1928 hurricane prevented a 1949 storm at the lake from overflowing and again resulting in extensive casualties and damages.		First Federal (Corps) shore protection projects built. Construction started on 18 projects, eight of which were large projects. MA 2, PA 1, CT 2, FL 1, MS 1 and CA 1. - The largest was Harrison County, MS (1952) at 24.0 miles. - The most expensive were Presque Isle, PA (1956) at $25 million and Channel Island Harbor, CA at $6 million.	
		For the 8 projects, 35 miles of coastline protected at a total initial construction cost of $36.9 million.	

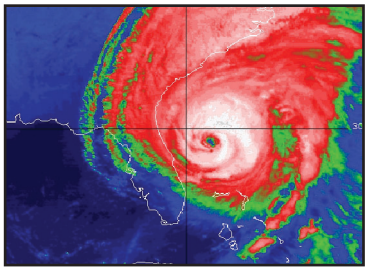
YEAR	1960 – 1969	1970 – 1979
STORM EVENTS 	8 major storms: *Donna, Carla, Cleo, Dora, Hilda, Betsy, Beulah* and *Camille.* These storms impacted the Gulf coast and FL and GA on the Atlantic seaboard. Camille (1969), a category 5 storm hit the Gulf coast in the LA-MS area and before exiting in VA caused 256 deaths and $1.4 billion in damages.	6 major storms: *Celia, Agnes, Eloise, Claudette, David,* and *Frederic. Agnes* (1972) was one of the most costly hurricanes in history impacting the Atlantic coast from FL to NY, causing 122 deaths and damages of $2.1 billion. In 1979 *Frederic* ravaged the AL-MS coastline, causing 11 deaths and $2.3 billion in damages.
	485 deaths; Over $4 billion in damages	150 deaths; $6 billion in damages
CORPS COASTAL LEGISLATION	PL 87-874 (1962) increased Federal cost share; Sec 103 program established. PL 88-172 (1963) established the Coastal Engineering Research Center (CERC). PL 89-72 (1965) permitted the inclusion of recreation benefits. PL 90-483 (1968) established the Section 111 program.	PL 91-611 (1970) modified cost sharing and increased Sections 103 & 111 funding limits. PL 92-583 (1972) Coastal Zone Management Act. PL 93-251 (WRDA 74) modified the Section 14 program. Section 54 established the Shoreline Erosion Control Demonstration Program. PL 94-587 (WRDA 76) Section 145 authorized the placement of beach quality sand.
SIGNIFICANT COASTAL MANAGEMENT MILESTONES	Corps: Fed share of construction increased to 50% for public beaches and increased Fed share of study costs to 100%. - Section 103 – design and construction of "small" beach and shore protection measures without Congressional authorization. - In 1963, CERC established to provide engineering and scientific expertise; Beach Erosion Board abolished; review functions transferred to Board of Engineering for Rivers and Harbors. - Use of outdoor recreation benefits attributed to a shore protection project authorized to be taken into account. - Section 111 – projects to prevent or mitigate damages resulting from Federal navigation works.	Corps: Discretionary modifications in Fed participation in cost sharing for hurricane protection projects authorized. - Emergency bank protection program (Sec 14) extended to cover shoreline protection works. - Technical and engineering assistance to non-Fed interests in development of structural and non-structural methods of preventing damages attributed to shore and streambank erosion auth. - Authorized placement of beach quality sand obtained from dredging operations on adjacent beaches if requested by states. - Federal aid in periodic beach nourishment extended up to 15 years. - National Shoreline Study to Congress. Non-Corps: Coastal Zone Management Act requires all Federal activities directly affecting the coastal zone to be consistent with approved state programs.
CORPS APPROACHES AND PROJECTS	Construction on 29 projects started, 14 of which were large projects: NH 1, NY 2, NJ 2, VA 1, NC 3, FL 1, TX 1 and CA 3 - The most expensive project was in NJ, with a cost about $19 million. - CERC pioneered use of artificial beaches and dunes. - One Florida project was deauthorized in 1990.	Construction started on 15 major projects: RI 1, NY 3, GA 1, FL 7, TX 1, OH 1 & CA 1. - Three long projects were constructed in FL: Dade Co., 13 miles; Broward Co. Segment II, 11.6 miles; and Duval Co., 10 miles. -The most expensive was the 1975 Dade County, FL project. With an initial construction cost of $72 million, this is the most expensive shore protection project ever built by the Corps.
	For the 14 projects, 31 miles of coastline protected at a total initial construction cost of $48.3 million.	71 miles of coastline protected at a total initial construction cost of $142.1 million.

Table 5B: Schematic History 1960-1999

1980	1989	1990	1999
9 major storms: *Allen, Alicia, Danny, Elena, Gloria, Juan, Kate, Allison* and *Hugo*. - *Hugo* (Sept. 1989) hit the Charleston, SC area and is the second most costly storm ever recorded in the US with damages estimated at $7.0 billion and there were 21 deaths attributed to the storm.		The decade of the 1990s was the most active decade of the 20th century, with 12 major storms hitting the US mainland: *Bob, Andrew, Alberto, Gordon, Opal, Bertha, Fran, Bonnie, Earl, Georges, Bret* and *Floyd*. While there were 6 storms that recorded damages of over $1 billion, *Andrew* (1992) will be remembered as the most damaging in history at $26.5 billion	
92 deaths	$14 billion in damages	177 deaths	$42 billion in damages
PL 97-348 (1982) Coastal Barrier Resources Act PL 99-662 (WRDA 86) made changes in cost sharing between Federal and non-Federal. PL 100-676 (1988) floodplain management compliance provision. - OMB prohibits single purpose recreation projects.		PL 102-580 (WRDA 92) permitted sponsors to undertake projects. -1995 President's budget recommended all Federal participation in new shore protection be terminated. PL 104-303 (WRDA 96) clarified shore policy. -1997 Administration directed the Corps not to construct new shore projects except on a case by case basis. PL 106-53 (WRDA 99) new cost sharing for periodic nourishment and dredged material on beaches authorized.	
Corps: WRDA 86 established storm damage reduction as a project purpose; periodic nourishment extended to 50-years; various cost sharing rules; auth. 50% Fed. cost of extra costs of using dredged sand from Fed. navigation projects for beach nourishment; and Fed shares of Section 14, 103 and 111 increased. - Not over 50% of benefits can be claimed for recreation at beach projects. Non-Corps: Coastal barriers and resources are to be protected by restricting Federal expenditures, which encourage development of coastal barriers. - Non-federal interests required to comply w/Federal floodplain management and FIA programs before construction of hurricane and storm damage reduction projects.		Corps: WRDA 92 – Sponsors can undertake shore projects subject to prior approval; political subdivisions of States can enter into agreements for disposal of dredged material on beaches and to accommodate, to the maximum extent practicable, the schedule of the sponsor in providing its share of cost; BERH abolished. WRDA96 - maintains Fed interest in shore and beach protection and restoration, including the use of periodic beach nourishment; National Shoreline Erosion Control Development & Demonstration Program established. -Administration continues to oppose new shoreline protection projects, but will permit case-by-case exceptions where the project does not involve the substantial replacement of sand but does involve the protection of permanent structures that are not primarily related to a recreation purpose.	
Constructed started on 10 major projects: NH 1, CT 1, NJ 1, NC 1, FL 4, LA 1, and OH 1. - The most expensive projects were: Point Place, OH at $14 million followed by Grand Isle, LA at $11 million. - The longest was Grand Isle at 7.0 miles.		Construction started on 22 major projects with an extension to 1 other: MA 1, NY 2, NJ 2, MD 1, NC 1, SC 2, FL 7, OH 2, IN 1, IL 1 and AK 3. - The longest and most expensive project was Myrtle Beach, SC at $48 million and 25.3 miles. Initial construction started in 1995 and was completed in 2001. The next most expensive project was at Ocean City, MD at $38 million and 8.9 miles.	
25 miles of coastline protected at a total initial construction cost of $59.7 million.		62 miles of coastline protected at a total initial construction cost of $247.3 million.	

Table 6: Summary of Population, Projects and Damages for the 20th Century

Item	DECADE						
	1930s	1940s	1950s	1960s	1970s	1980s	1990s
U.S. population in millions (average for decade)	128	137	165	191	215	235	265
U.S. coastal population in millions (average for decade)	67 **[1]**	71 **[1]**	86 **[1]**	100	120	135	145
Damages due to hurricanes (actual dollars)	$460 million	$600 million	$1.9 billion	$4.2 billion	$6.1 billion	$13.8 billion	$42 billion
Damages due to hurricanes in 1995 dollars **[2]**	12.8 billion	10.7 billion	15.7 billion	23.7 billion	15.1 billion	$18.0 billion	$42 billion $15.5 billion **[3]**
Accumulated miles of coast line protected by Corps projects **[4]**	0	0	35	66	137	162	273
1995 $ damages per mile of Corps project	No Corp projects	No Corps projects	$449 million	$359 million	$110 million	$111 million	$154 million $57 million **[3]**
1995 $ damages per U.S. citizen	$100	$78	$95	$124	$70	$77	$158 $58 **[3]**

Footnotes

[1] Approximate coastal population based on percent in the 1960s (52%).

[2] Updating by use of "Engineering News Record" Construction Cost Index.

[3] Total damages include both coastal and inland and a distinction between the two is unknown. For the 1990s, however, total damages of $42 billion include hurricane *Andrew*, which hit Florida in 1992 with damages of $26.5 billion. The coastal damages due to this storm were minimal as most damages were recorded inland due to high winds. Without hurricane *Andrew*, damages due to hurricanes in the 1990s would have been $15.5 billion and damages per mile of protected beach would have been $67 million and damage per U.S. citizen would have been $58.

[4] Miles are at end of decade.

Table 7: Shore Ownership and Levels of Federal Participation

Shore Ownership [1]	Project Purposes or Benefits	Maximum Level of Federal Participation: Construction [2]	Maximum Level of Federal Participation: Operation & Maintenance
Federally Owned **[3]**	HSDR on Developed Lands	100%	100%
	HSDR on Undeveloped Lands	100%	100%
	Recreation (Separable Costs) **[4]**	100%	100%
Publicly and Privately Owned (protection results in public benefits) **[5]**	HSDR on Developed Lands	65% **[6]**	0%
	HSDR on Undeveloped Lands		
	Public Lands	50%	0%
	Private Lands	0%	0%
	Recreation (Separable Costs) **[4]**	50%	0%
Privately Owned, (use limited to private interests)	HSDR on Developed Lands	0%	0%
	HSDR on Undeveloped Lands	0%	0%
	Recreation (Separable Costs) **[4]**	0%	0%

Footnotes:

[1] Cost sharing of shores owned by Native Americans depends upon the particular treaty provisions pertaining to the lands in question and will need to be examined in each instance.

[2] Periodic nourishment is considered "construction."

[3] Work to provide shore protection to lands under the jurisdiction of another Federal agency is accomplished only on a reimbursable basis, upon request from the agency. In the event protection has not been requested and such lands are within the study area, Civil Works funds may be used if including them in a project is more cost effective than excluding them. Protection of (non Civil Works) Department of the Army lands is accomplished with military funds, not Civil Works funds. If the lands are a minor part within the study area, Civil Works funds may be used if including them in a project is more cost effective than excluding them.

[4] Department of Army Policy precludes Civil Works funding of separable recreation measures at shore protection projects.

[5] Privately owned shores under public control (public access and public use), as through a sufficiently long-term lease assuring realization of public benefits throughout the economic life of the project.

[6] No separable costs assigned to recreation. For cost sharing of periodic nourishment for projects authorized for construction after 31 December 1999, see Table 8.

Table 8: Cost Sharing for Periodic Nourishment

Year that Nourishment is Performed		Federal Cost Share
All future nourishment for the authorized period of Federal cost sharing participation for projects authorized prior to 31 December 1999 and for projects where a District Engineer's Report has been completed and officially transmitted to higher authority for final approval by 31 December 1999.		Same as for initial construction unless there is a change in future conditions in the project area that would result in an adjustment in periodic nourishment cost sharing.
Future nourishment for all other projects authorized after 31 December 1999 are cost shared based on the year in which the nourishment is performed.	After 1 January 2001 but before 2 January 2002	40%
	After 1 January 2003 but before 2 January 2003	45%
	After 1 January 2003	50%

Table 9: Dredged Material on Beaches

Condition	Requirement	Federal Cost Share
Case 1	Placement of dredged material on the beach is the least costly acceptable means for disposal.	Cost sharing is the same as it is for the least costly way of doing the navigation project, i.e., it is the same as the purpose for which the disposal is being made.
Case 2	Placement of dredged material on a beach is more costly than the least costly alternative and: 1. It is requested by the state 2. The Secretary of the Army considers it in the public interest 3. The added cost of disposal is justified primarily by hurricane storm damage reduction benefits and recreation benefits.	Authorized by Section 145 of PL 94-587, amended by Section 933 of PL 99-662 and as amended by Section 217(a) of PL 106-56, the Federal share is 65% of the increased cost of disposal above the least cost acceptable disposal plan.

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APPENDIX A

Compendium of Authorizing Legislation Pertinent to The Corps of Engineers Shore Protection Program

1. PL 71-520, (3 July 1930) River and Harbor Act of 1930. Section 2 authorizes the Chief of Engineers to conduct shore erosion control studies in cooperation with appropriate agencies of various cities, counties, or states. Section 2 also established the Beach Erosion Board to act as a central agency to assemble data and provide engineering expertise regarding coastal protection.

2. PL 74-834, (1936) An Act for the Improvement and Protection of the Beaches along the Shores of the United States. Authorized the assistance for construction but not maintaining coastal protection works where "federal interests" were involved.

3. PL 79-166, (31 July 1945) An Act Authorizing General Shoreline Investigations at Federal Expense. This Act established authority for the Beach Erosion Board to pursue a program of general investigation and research and to publish technical papers.

4. PL 79-526, (24 July 1946) River and Harbor Act of 1946. Section 14 authorized emergency bank protection works to prevent flood damage to highways, bridge approaches and public works. Amended by PL 93-251 and PL 99-662.

5. PL 79-727, (13 August 1946) An Act Authorizing Federal Participation in the Cost of Protecting the Shores of Publicly Owned Property. This Act declared it to be Federal policy to assist in the construction but not the maintenance of in up to 1/3 of the total cost of projects to protect publicly owned shores against erosion from waves and currents. Amended by PL 84-826, PL 87-874, and PL 91-611.

6. PL 84-71, (15 June 1955). This legislation specifically authorized studies of the coastal and tidal areas of the eastern and southern U.S. with reference to areas where damages had occurred from hurricanes.

7. PL 84-99, (28 June 1955). This legislation authorized the Chief of Engineers to provide emergency protection to threatened Federally authorized and constructed hurricane and shore protection works. It also established an emergency fund to repair or restore such works damaged or destroyed by wind, wave, or water action of other than an ordinary nature.

8. PL 84-826, (28 July 1956). This legislation expanded the Federal role by authorizing Federal participation in the cost of works for protection and restoration of the shores of the United States, including private property if such protection is incidental to the protection of public-owned shores, or if such protection would result in public benefits. It also provides for Federal assistance for period nourishment on the same basis as new construction, for a period to be specified by the Chief of Engineers, when it would be the most suitable and economical remedial measure. Amended by Section 156, PL 94-587 and Section 934, PL 99-662.

9. PL 85-500, (3 July 1958) River and Harbor Act of 1958. Section 203 added provisions of local cooperation on three hurricane flood protection projects, which established an administrative precedent for cost sharing in hurricane projects. Non-Federal interests were required to assume 30 percent of total first costs, including the value of land, easements and rights of way, and operate and maintain the projects.

10. PL 87-874, (23 October 1962) River and Harbor Act of 1962.

    Shore Protection. Section 103 amended Section 3 of the Act approved 13 August 1946, as amended by the Act approved 28 July 1956 and indicated the extent of Federal participation in the cost of beach erosion and shore protection (50 percent of the construction cost when the beach is publicly owned or used, and 70 percent Federal participation for seashore parks and conservation areas when certain conditions of ownership and use of the beaches are met). Amended by Section 112, PL 91-611 and Section 915(e), PL 99-662.

    Small Beach Erosion Projects. Section 103 also authorized the Secretary of the Army acting through the Chief of Engineers, to plan and construct small beach and shore protection projects without specific Congressional authorization. Federal cost share was limited to $400,000 per project and $3 million program limit per fiscal year.

11. PL 88-172, (7 November 1963). Section 1 of this legislation abolished the Beach Erosion Board, transferred its review functions to the Board of Engineers for Rivers and Harbors and established the Coastal Engineering Research Center.

12. PL 89-72, (9 July 1965) The Federal Water Project Recreation Act of 1965. This Act required that planning of water resources projects consider opportunities for outdoor recreation and fish and wildlife enhancement. It specified that the outdoor recreation benefits that can be attributed to a project should be taken into account in determining the overall benefits of the project (e.g., recreational use of beach fill, groins or other shore protection structures).

13. PL 89-298, (27 October 1965). This legislative action allowed Federal contributions toward periodic nourishment.

14. PL 90-483, (13 August 1968) River and Harbor and Flood Control Act of 1968.

    Section 111. This section authorized investigation and construction of projects to prevent or mitigate shore damages resulting from Federal navigation works, at both public and privately owned shores along the coastal and Great Lakes shorelines. Cost is to be at full Federal expense, but limited to $1 million per project. Amended 17 November 1986 by Sections 915(f) and 940, PL 99-662, which, among other things, increased the limit on Federal, costs per project to $2 million for initial construction costs. There is no limit on in Federal participation in periodic nourishment costs.

    Section 215. This section authorized reimbursement (including credit against local cooperation requirements) for work performed by non-Federal public bodies after authorization of water resource development projects. Execution of a prior agreement with the Corps was required and reimbursement was not to exceed $1 million for any single project. Amended by Section 913 PL 99-662 and by Section 12, PL 100-676 to increase the limit on reimbursements per project. Project limit is now $3 million or one percent of the total project cost, whichever is greater; except that the amount of actual Federal reimbursement, including reductions in contributions, for such project may not exceed $5 million in any fiscal year.

15. PL 91-611, (31 December 1970) River and Harbor and Flood Control Act of 1970.

    Section 112. This section increased the limit on Federal costs for small beach erosion projects (Section 103 of PL 87-874) from $500,000 to $1 million. The annual authorization limit was also raised to $25,000,000. Limits have subsequently been raised further, most recently by PL 99-662 to $2 million per project and $30 million program limit per year.

    Section 208. This section authorized discretionary modifications in Federal participation in cost sharing for hurricane protection projects.

16. PL 92-583, (27 October 1972) The Coastal Zone Management Act of 1972. This Act required all Federal agencies with activities directly affecting the coastal zone, or with development projects within that zone, to assure that those activities or projects are consistent with the approved state program. The Coastal Zone Management Act Amendments of 1990 amended the CZMA of 1972. The 1990 Act amended the Federal consistency provisions (Section 307) by requiring all Federal agency activities, whether in or outside of the coastal zone, to be subject to the consistency requirements of Section 307(c) of the CZMA if they affect natural resources, land uses or water uses in the coastal zone.

17. PL 93-251, (7 March 1974) Water Resources Development Act of 1974.

    Section 27. This section raised the cost limits for emergency bank protection projects to $250,000 and program fiscal funding limit to $10 million per year. Project purpose was extended to cover construction, repair, restoration and modification of emergency streambank and shoreline protection works. Eligibility definition was extended to include churches, hospitals, schools and similar non-profit public services. Amended by Section 915 (c) of PL 99-662.

    Section 55. This section authorizes technical and engineering assistance to non-Federal public interests in developing structural and non-structural methods of preventing damages attributable to shore and streambank erosion.

18. PL 94-587, (22 October 1976) Water Resources Development Act of 1976.

    Section 145. This section authorized the placement of beach quality sand obtained from dredging operations on adjacent beaches if requested by the interested state government and in the public interest—with the increased costs paid by local interests. Amended by Section 933, PL 99-662, to lower the non–Federal share to 50 percent of the increased costs. This section was further amended by Section 207 of PL 102-580 to permit agreements for placement of fill on beaches to be with political subdivisions of a state and by Section 217(a) of PL 106-56 to further lower the non-Federal share to 35 percent of the increased costs.

    Section 156. This section authorizes the Corps to extend Federal aid in periodic beach nourishment up to 15 years from date of initiation of construction. Amended by Section 934 of PL 99-662 to allow for extension of up to 50 years.

19. PL 97-348, (18 October 1982) The Coastal Barrier Resources Act of 1982. This law established the policy that coastal barrier islands and their associated aquatic habitats are to be protected by restricting Federal expenditures, which encourage development on those coastal barrier islands. The Act also provides for a Coastal Barrier Resources System (the extent of which is defined by a set of maps approved by Congress on 30 September 1982), which identifies undeveloped coastal barriers within which Federal expenditures (including expenditures for flood insurance, roads, bridges, shoreline structures) may not be made. Specific exceptions to the expenditure prohibition include navigation, beach nourishment, and research works. The Act was amended in 1990. To ensure compliance with the Act, each Federal agency annually certifies compliance directly to the Senate and House Committees on Public Works and Transportation.

20. PL 99-662, (17 November 1986) Water Resources Development Act of 1986.

    Section 101(c). This section provides that costs of constructing projects or measures for the prevention or mitigation of erosion or shoaling damages attributable to Federal navigation works shall be shared in the same proportion as the cost sharing provisions applicable to the project causing such erosion or shoaling. The non-Federal interests for the project causing the erosion or shoaling shall agree to operate and maintain such measures.

    Section 103. Section 103(d) specifies that the costs of constructing projects for beach erosion control must be assigned to selected project purposes such as hurricane and storm damage reduction, and/or recreation. Cost sharing for these project purposes is specified in Section 103(c) (35 percent (non-Federal) for hurricane and storm damage prevention and 50 percent for separable recreation). However, all costs assigned to benefits to privately-owned shores (where use of such shores is limited to private interests), or to prevention of losses of private lands are a non-Federal responsibility. All cost assigned to protection of Federally owned shores are a Federal responsibility.

    Section 933. This section amended PL 94-587 to authorized 50 percent Federal cost sharing of the extra costs for using dredged sand from Federal navigation project improvements and maintenance efforts for beach nourishment.

21. PL 100-676, (17 November 1988) Water Resources Development Act of 1988. Section 14 of the Act requires non-Federal interests to agree to participate in and comply with applicable Federal flood plain management and flood insurance programs before construction of any hurricane and storm damage reduction project.

22. PL 101-640, (28 November 1990) Water Resources Development Act of 1990.

    Section 308 directs that the Secretary of the Army cannot consider for justifying new Federal project benefits from protecting specified new or substantially improved structures built in the flood plain after 1 July 1991.

Section 309 directs the Secretary of the Army to report within 1-year on the advisability of not participating in shoreline protection projects unless the state has established a management program which includes restrictions on new development, provisions for the relocation of structures, and for assuring public access. (This report was never prepared.)

23. Public Law 102-580, (31 October 1992) Water Resources Development Act of 1992.

    Section 206 authorizes non-Federal interests the authority to undertake shoreline protection projects on the coastline of the United States, subject to obtaining any permits required pursuant to Federal and State laws in advance of actual construction, and subject to prior approval of the Secretary of the Army.

    Section 207 modifies Section 145 of Public Law 94-587 to authorize political subdivisions of states to enter into agreements (with concurrence of States) for disposal of dredged material on beaches and to consider and to the maximum extent practicable, accommodate the schedule of the sponsor in providing its share of costs.

    Section 223 abolishes the Board of Engineers for Rivers and Harbors. Duties may be transferred to other elements as determined necessary.

24. Public Law 104-303, (12 October 1996) Water Resources Development Act of 1996.

    Section 207 directs that, in connection with carrying out navigation projects, the Secretary of the Army may select a disposal method that is not the least cost option if the incremental costs are reasonable in relation to the environmental benefits, including wetlands development and shoreline erosion control.

    Section 219 amends Section 1 of the 1946 Flood Control Act to increase Section 14 program limits to $15 million per year and 1 million per locality.

    Section 227 clarifies shore protection policy to maintain a Federal interest in shoreline and beach protection and restoration, including the use of periodic beach nourishment.

25. Public Law 106-53, (17 August 1999) Water Resources Development Act of 1999.

    Section 214 of the law increased the Federal limit of costs of the Section 111 program to $5 million.

    Section 215(a) phases in a new cost-sharing formula for periodic shoreline nourishment by changing the split from 65 percent Federal and 35 percent non-Federal to a 50/50 basis becoming effective for periodic nourishment of projects authorized for construction after December 31, 1999.

    Section 215(c) requires the Secretary of the Army to report to Congress, within 3-years, on the state of the shores of the United States.

    Section 215(d) requires the Secretary of the Army of establish a data bank containing data on the geophysical and climatological characteristics of the shores of the United States.

    Section 217(a) amended Section 145 of WRDA '76, as amended by Section 933 of WRDA '86 to change the cost sharing for the disposal of dredged material on beaches by lowering the non-Federal share from 50 percent to 35 percent.

    Section 226 increased the Federal limit of costs of the Section 103 program from $2 million to $3 million.

APPENDIX B

Request for Data

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CECW-PG 4 March 2002

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: National Shoreline Study - Update of the 1996 Shoreline Protection and Beach Erosion Control Study, Final Report

1. The National Shoreline Study was authorized by Section 215(c) of Public Law 106-503 (WRDA '99). The study shall report to Congress on the state of the shore of the United States. The specific task associated with this memorandum is to develop a current list of U.S. Army Corps of Engineers shoreline protection projects and studies and the cost of completed projects. This is to be accomplished by updating the 1996 Shoreline Protection and Beach Erosion Control Study (IWR Report 96-PS-1). This report can be found at: http://www.iwr.usace.army.mil/iwr/pdf/96ps1.pdf.

2. A list of projects from that report is enclosed as Table 1 (under construction), Table 2 (authorized/awaiting initiation of construction), and Table 3 (preconstruction engineering and design). Lists of studies are enclosed as Table 4 (feasibility) and Table 5 (reconnaissance). You are requested to update both the project and study tables to provide the current (31 December 2001) status. Also, add all completed or ongoing projects and studies that are not on the list. Please note that only Congressionally authorized projects and studies are to be included. Information is also needed on the actual expenditures by project. A list of the 56 constructed projects covered in the 1996 report is provided as Table 6. Updated costs of these 56 projects since October 1995 and all projects, which have been constructed since that time, must have a construction cost estimate in a form consistent with Table 4-2 of the 1996 report. Table 7 is enclosed as a worksheet for providing that information. We anticipate that this request is not significant in terms of time and effort, as it only requires a national updating of costs and projects/studies for the last six years by using existing district information.

3. The data should be provided by 1 April 2002 to the attention of CEIWR-PD, Ted Hillyer. Mr. Hillyer can by reached by Corps E-mail, phone at 703/428-6140 and fax at 703/428-6124. This memorandum is distributed to the Chiefs of Planning to focus the review effort. If Planning is not the appropriate element, request that you coordinate as necessary within your organization. In providing your response, also provide an appropriate point of contact and phone number.

FOR THE COMMANDER:

Encls

ROBERT H. GRIFFIN
Major General, USA
Director of Civil Works

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COMMANDER NORFOLK DISTRICT (CENAO-PL-P)
COMMANDER PHILADELPHIA DISTRICT (CENAP-EH-H)
COMMANDER PORTLAND DISTRICT (CENWP-PE-PF)
COMMANDER SEATTLE DISTRICT (CENWS-EN-PL)
COMMANDER ALASKA DISTRICT (CEPOA-EN-EIT)
COMMANDER HAWAII DISTRICT (CEPOH-ED-C)
COMMANDER CHARLESTON DISTRICT (CESAC-EN-PR)
COMMANDER JACKSONVILLE DISTRICT (CESAJ-PD-PC)
COMMANDER MOBILE DISTRICT (CESAM-PM-CM)
COMMANDER SAVANNAH DISTRICT (CESAS-PD-P)
COMMANDER WILMINGTON DISTRICT (CESAW-TS-PS)
COMMANDER LOS ANGLES DISTRICT (CESPL-PD-D)
COMMANDER SAN FRANCISCO DISTRICT (CESPN-PE)
COMMANDER GALVESTON DISTRICT (CESWG-PL)

CF:
DIRECTOR INSTITUTE FOR WATER RESOURCES (CEIWR-PD)

- Copy -

Response to Data Call to Update the 1996 Report		
Div/Dist	**Office Symbol**	**Name**
NAD		(none)
New England	CENAE-PP-P	Robert Byrne
New York	CENAN-PP-C	Anthony Ciorra
Philadelphia	CENAP-PL-PC	Lisa Vandergast
Baltimore	CENAB-PL	Patricia Coury
Norfolk	CENAO-PM-C	Jim Creighton
SAD	CESAD-ET-P	Gerald Melton
Wilmington	CESAW-EP-P	Bob Finch
Charleston	CESAC-PM-M	Lincoln Blake
Savannah	CESAS	David Schmidt
Jacksonville	CESAJ-EN-H	Tom Smith
Mobile	CESAM-PM-CP	Benny J. Smith
MVD		(none)
New Orleans	CEMVN	Marcia Demma
SWD	CESWD-CMP	Peter Shaw
Galveston	CESWG-PE-P	Richard Medina
GL&R	CELRD-CM-P	Harry Simpson
	CELRD-GL	Christopher Glanz
Buffalo	CELRB-PP-PQ	Lorraine Kwaczala
Chicago	CELRC-PM-M	Felicia Kirksey
Detroit	CELRE-HH-E	Phil Ross
NWD	CENWD-CM-P	Edwin Woodruff
SPD	CESPD-CM-O	George Domurat
Los Angeles	CESPL-ED-DC	Art Shak
San Francisco	CESPN-ET-P	Tom Kendall
POD	CEPOD-CW-PP	Linda Hihara-Endo
Alaska	CEPOA-EN-CW-PF	Patrick Fitzgerald

APPENDIX C

Database of Corps Shore Protection Studies and Projects

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A. Summary of Studies and Projects by Corps District (current as of April 2002)

District	Recon.	Feas.	PED	A/AIC	UC	Completed Projects
New England					1	9
New York	2	8	5	2	1	9
Philadelphia	1	3	5	6	4	2
Baltimore	1					1
Norfolk				1	1	1
Wilmington	1	2	1	2	0	6
Charleston		1				1
Savannah		1				2
Jacksonville		1	6		1	20
Mobile	1					2
New Orleans		1				1
Galveston		1				2
Buffalo						6
Chicago					1	2
Seattle					1	
San Francisco	1					
Los Angeles	7	7	1			5
Honolulu	1					
Alaska	1					2
National Totals	16	25	18	11	10	71

B. Projects in the Planning Stage or Under Construction (80)

(Scheduled (or actual if not progressed to next phase) completion date)

Reconnaissance Level (16)

New York	Marine Park Jamaica Bay, Plumb Beach , NY (to be determined)
	Lake Montauk, NY (Sep 02)
Philadelphia	Manasquan Inlet to Barnegat Inlet, NJ (May 02)
Baltimore	Chesapeake Bay Shoreline Erosion, MD, VA, DE, DC (Sep 04)
Wilmington	Dare County Beaches, NC (Jun 02)
Mobile	Baldwin County Shore Protection, AL (Apr 02)
San Francisco	Ocean Beach, CA (Jan 03)
Los Angeles	Pacific Coast shoreline, Carlsbad, CA (Apr 94)
	Oceanside Shoreline, CA (Sep 94)
	Malibu Coastal Area, CA (Jan 96)
	Silver Strand Shoreline, Imperial Beach, CA (Mar 95)
	City of Encinitas, CA (Sep 00)
	Peninsula Beach, CA (Feb 02)
	Solana/Encinitas Beach, CA (Jun 01)
Honolulu	Waikiki Erosion Control Study, Oahu, HI (May 02)
Alaska	Barrow Coastal Storm Damage Reduction, AK (02)

Feasibililty Level (25)

New York	Raritan and Sandy Hook Bays, NJ (recon. separated into 4 feasibilities)
	[1] Leornardo, NJ (Sep 04)
	[2] Union Beach, NJ (Nov 02)
	[3] Highlands, NJ (Nov 05)
	[4] Keyport, NJ (Nov 05)
	Montauk Point, NY (Jun 03)
	North Shore of Long Island, NY (recon. separated in 2 feasibilities)
	[1] Asharoken, NY (Mar 05)
	[2] Bayville, NY (Mar 05)
	South Shore of Staten Island, NY (Sep 04)
Philadelphia	Manasquan Inlet to Barnegat Inlet, NJ (FY 02)
	New Jersey Shore Protection-Hereford to Cape May, NJ (FY 05)
	New Jersey Alterative Long-Term Nourishment, NJ (FY 06)
Wilmington	Bogue Banks, NC (Jul 06)
	Surf City, Topsail Island, NC (Sep 10)
Charleston	Pawleys Island, SC (Jan 03)
Savannah	North Beach Tybee Island GA, (funding pending)
Jacksonville	Sarasota Co. – Lido Key, FL (Nov 02)
New Orleans	Grand Island, LA (Dec 02)
Galveston	Sabine Pass to Galveston Bay, TX (Aug. 04)
Los Angeles	Orange County Coast Beach, CA (Jun 02)
	Peninsula Beach, CA (Sep 02)
	San Clemente, CA (Sep 02)
	San Diego County, CA (Sep 02)
	San Gabriel to Newport Bay,CA (Sep 02)
	Santa Barbara/Ventura Counties, CA (Sep 02)
	Santa Monica Breakwater, CA (Nov 94)

Preconstruction Engineering and Design (18)

New York	Orchard Beach, NY (completed) (Project authorized under WRDA 96 has primarily recreation benefits and is inconsistent with Federal policies. Project construction will depend on a Congressional add.)
	Fire Island to Montauk Point, NY (Jun 06)
	Raritan Shoreline, NJ (Section 934 Study of Raritan and Sandy Hook Bays, Middlesex and Monmouth Counties) (May 03)
New York	Port Monmouth, NJ (May 04)
Philadelphia	Fenwick Island, DE (FY 03)
	Brigantine, NJ (FY 02)
	Barnegat Inlet to Little Egg Inlet, NJ (FY 02)
	Lower Cape May Meadows, NJ (FY 02)
	Great Egg Harbor Inlet to Townsends Inlet, NJ (FY 05)
Wilmington	Dare County Beaches (Bodie Island Portion), NC (Dec 02)
Jacksonville	Nassau County, FL (NA)
	Palm Beach – Lake Worth Sand Transfer Plant, FL (NA)
	Broward – Deerfield Beach (Segment I), FL (NA)
	Monroe – Smathers Beach, FL (NA)
	Lee – Gasparilla Island, FL (NA)
	Lee – Estero Island, FL (NA)
Los Angeles	Huntington Beach, Blufftop Park, CA (Sep 02

Authorized/Awaiting Initiation of Construction (11)

New York	Fire Island Inlet to Montauk Point, (West of Shinnecock), NY (Mar 03 construction completed)
	Atlantic Coast of Long Island, Jones Inlet to East Rockaway Inlet, Long Beach Island, NY (to be determined)
Philadelphia	Broadkill Beach, DE (completed FY 01)
	Port Mahon, DE (complete FY 00)
	Cape May Villas & Vicinity, NJ (competed FY 01)
	Pierces Point/Reeds Beach, NJ (completed FY 01)
	Oakwood Beach, DE (completed FY 01)
	Bethany Beach/S. Bethany Beach, DE (completed FY 01)
Norfolk	Sandbridge #2, VA
Wilmington	Brunswick County (Oak Island, Holden Beach, NC (completed, doing a GRR)
	West Onslow (Topsail Beach), NC (completed, doing a GRR)

Under Construction (completion date for initial construction) (10)

New England	Roughan's Point, MA (FY 03)
New York	Atlantic Coast of New Jersey, Sandy Hook to Barnegat Inlet (Reach 1, Sea Bright to Ocean Township), NJ (to be determined)
Philadelphia	Roosevelt Inlet/Lewes Beach, DE (FY 04)
	Rehoboth Beach/Dewey Beach, DE (FY 03)
	Absecon Island, NJ (FY 04)
	Townsends Inlet to Cape May Inlet, NJ (FY 05)
Norfolk	Virginia Beach, VA 1974 auth. (FY 03)
Jacksonville	Brevard County, South Reach, FL (FY03)
Chicago	Chicago Shoreline, IL, (05)
Seattle	Shoalwater Bay, WA (06) (project funded as a CG project but is really under design)

C. Projects with Initial Construction Completed (71)

Old numbers refer to the project number in the 1996 report.

* projects in italics refer to new projects since the 1996 report.

NORTH ATLANTIC DIVISION

New #	Old #	District	Project
1.	8.	New England	Wallis Sands State Beach, NH 1983
2.	7.		Hampton Beach, NH 1966
3.	6.		Winthrop Beach, MA 1956
4.	5.		Revere Beach, MA 1992
5.	4.		Quincy Shore Beach, MA 1950
6.	9.		Cliff Walk, RI 1975
7.	1.		Prospect Beach, CT 1957
8.	2.		Seaside Park, CT 1958
9.	3.		Sherwood Island State Park, CT 1983
10.	*	New York	*Rockaway Inlet to Norton Point (Coney Island Area), NY 1995*
11.	10.		E. Rockaway Inlet to Rockaway Inlet and Jamaica Bay, NY 1975
12.	11.		Atlantic Coast of Long Is. Fire Is. Inlet & Shore Westerly to Jones Inlet, NY 1974
13.	*		*Fire Island Inlet to Montauk Point (Westhampton Interim), NY 1997*
14.	12		Fire Is. to Montauk Pt. Moriches to Shinnecock Reach, NY 1965
15.	13.		Fire Is. Inlet to Montauk Point, Southampton to Beach Hampton, NY 1965
16.	14.		Raritan and Sandy Hook Bay, Madison and Matawan Townships, NJ 1965
17.	15.		Raritan Bay and Sandy Hook Bay, Keansburg and E. Keansburg, NJ 1968
18.	*		*Sandy Hook to Barnegat Inlet, Reach 2 (Asbury Park to Manasquan), NJ 2001*
19.	18.	Philadelphia	Great Egg Harbor Inlet and Peck Beach, NJ 1992
20.	17.		Cape May Inlet to Lower Township, NJ 1989
	16.		~~DE Coast Sand Bypass—Indian River 1986~~ (Deleted, Section 111)
21.	19.	Baltimore	Atlantic Coast of MD-Ocean City, MD 1995
22.	20.	Norfolk	Virginia Beach, VA (1962 auth.) 1964

SOUTH ATLANTIC DIVISION

New #	Old #	District	Project
23.	23	Wilmington	Fort Macon, NC 1961
24.	21.		Wrightsville Beach, NC 1965
25.	22.		Carolina Beach and Vicinity, NC 1965
26.	*		*Kure Beach, NC 1999*
27.	*		*Ft. Fisher, NC 1996*
28.	*		*Ocean Isle, Brunswick County Beaches, NC 2001*
29.	*	Charleston	*Myrtle Beach, SC 2002*
30.	24.	Savannah	Folly Beach, SC 1993
31.	25.		Tybee Island, GA 1975: *extension in 1997*

SOUTH ATLANTIC DIVISION *(CONTINUED)*

New #	Old #	District	Project
32.	32.	Jacksonville	Duval Co., FL 1978
33.	30.		Brevard Co. – Cape Canaveral, FL 1975
34	*		*Brevard Co. – North Reach, FL 2001*
35.	29.		Brevard Co. – Indialantic/Melbourne, FL 1981
36.	31.		Fort Pierce Beach, FL 1971
37.	*		*Martin County FL, 1996*
38.	*		*Palm Beach Co. – Jupiter/Carlin, FL 1995*
39.	40.		Palm Beach Co. – L. Worth Inlet to S. L. Worth Inlet, FL (sand transfer plant) 1958
40.	*		*Palm Beach Co. – Ocean Ridge, FL 1998*
41.	39.		Palm Beach Co. – Delray Beach Segment, FL 1973
42.	38.		Palm Beach Co. – Boca Raton Segment, FL 1988
43.	28.		Broward Co. – Segment 3, FL 1978
44.	27.		Broward Co. – Segment 2, FL 1970
45.	36.		Dade Co., FL 1975
-	35.		~~Virginia Key and Key Biscayne, FL 1969~~ (project deauthorized in 1990)
46.	37.		Lee Co. – Captiva Island Segment, FL 1989
47	*		*Sarasota Co. – Venice Segment, FL 1997*
48.	41.		Manatee Co., FL 1993
49.	34.		Pinellas Co. – Treasure Is. Segment, FL 1969
50.	33.		Pinellas Co. – Long Key Segment, FL 1980
51.	26.		Pinellas Co. – Sand Key Segment, FL 1993
52.	*	Mobile	*Panama City Beaches, FL 2002*
53.	42.		Harrison Co., MS 1952

OHER COASTAL DIVISIONS

New #	Old #	District	Project
54.	43.	New Orleans	Grand Isle and Vicinity, LA 1985
55.	45.	Galveston	Galveston Seawall, TX 1963
56.	44.		Corpus Christi Beach, TX 1978
57.	48.	Buffalo	Hamlin Beach State Park, NY 1974
58.	46.		Presque Isle, PA 1956
59.	47.		Lakeview Park Cooperative, OH 1977
60.	50.		Reno Beach, OH 1992
61.	49.		Point Place, OH 1983
62.	51.		Maumee Bay, OH 1991
63.	*	*Chicago*	*Indiana Shoreline, IN 1996*
64.	*		*Casino Beach, IL 1998*
65.	54.	Los Angeles	Channel Islands Harbor, CA 1959
66.	56.		Ventura-Pierpont Area, CA 1962
67.	52.		Surfside/Sunset, CA 1973
68.	55.		Coast of CA, Point Mugu to San Pedro, CA 1968
69.	53.		Oceanside, CA 1961
70.	*	*Alaska*	*Dillingham Snag Point, AK 1997*
71.	*		*Homer Spit, AK 1994: extension in 1998*

D. Actual Construction Cost, Division Summary (costs in ($000)

North Atlantic Division

Cost Item	Old [1]	New [2]	Total
Initial Beach Restoration	97,448	69,410	166,858
Periodic Nourishment	71,432	109,848	181,280
Structures	39,886	10,707	50,593
Emergency	4,645	2,135	6,780
Total **[3]**	213,411 [3a]	192,100	405,511

South Atlantic Division

Cost Item	Old	New	Total
Initial Beach Restoration	159,436	165,357	324,793
Periodic Nourishment	92,175	139,860	232,035
Structures	13,206	7,476	20,682
Emergency	6,035	4,119	10,154
Total	270,852 [3b]	316,812	587,664

Other Coastal Divisions

Cost Item	Old	New	Total
Initial Beach Restoration	45,775	-15,233 **[4]**	30,542
Periodic Nourishment	70,588	40,394	110,982
Structures	59,288	16,013	75,301
Emergency	5,161	0	5,161
Total	180,812	41,174	221,986

Total

Cost Item	Old	New	Total
Initial Beach Restoration	302,659	219,534	522,193
Periodic Nourishment	234,195	290,102	524,297
Structures	112,380	34,196	146,576
Emergency	15,841	6,254	22,095
Total	665,075 [3c]	550,086	1,215,161

Footnotes:

[1] Old costs are as reported in the 1996 Report (through 1993).

[2] Costs since 1993.

[3] 1996 Report total cost was $670,259. From this must be subtracted the two projects which have been deleted (DE Coast @ $2,777 (**[3a]**)) and (VA Key @ $2,407 (**[3b]**)), which results in a total cost of $665,075 (**[3c]**).

[4] Some costs listed as initial beach restoration in the 1996 Report for Surfside-Sunset were shifted to periodic nourishment.

E: Actual Expenditures by Project and Project Feature ($000)

Project [1]	Year Consturcted Initiated	Initial Beach Restoration	Periodic Nourishment	Structures	Emergency Costs	Total Costs
NORTH ATLANTIC DIVSION						
1. Wallis Sands State Beach, NH	1983	441	0	60	0	501
2. Hampton Beach, NH	1966	515	**[2]**	130	0	645
3. Winthrop Beach, MA	1956	344	**[2]**	186	0	530
4. Revere Beach, MA	1992	3,015	0	0	0	3,015
5. Quincy Shore Beach, MA	1950	1,305	**[2]**	559	0	1,864
6. Cliff Walk, RI	1975	0	0	1,361	0	1,361
7. Prospect Beach, CT	1975	283	**[2]**	62	0	345
8. Seaside Park, CT	1958	480	**[2]**	0	0	480
9. Sherwood Is. State Park, CT	1983	1,119	**[2]**	107	0	1,226
10. Rockaway Inlet to Norton Point (Coney Island Area), NY	1994	5,900	0	3,200	0	9,100
11. E. Rockaway Inlet to Rockaway Inlet and Jamaica Bay, NY	1975	12,825	59,229	1,682	1,750	75,486
12. Atlantic Coast of Long Is. Fire Is. Inlet & Shore Westerly to Jones Inlet, NY	1974	13,150	50,876	0	0	64,026
13. Fire Island Inlet to Montauk Point (Westhampton Interim), NY	1996	17,064	5,275	2,185	0	24,524
14. Fire Is. to Montauk Pt. Moriches to Shinnecock Reach, NY	1965	3,900	0	4,400	0	8,300
15. Fire Is. Inlet to Montauk Point, Southampton to Beach Hampton, NY	1965	0	0	560	0	560
16. Raritan and Sandy Hook Bay, Madison and Matawan Townships, NJ	1965	1,156	0	158	0	1,314
17. Raritan Bay and Sandy Hook Bay, Keansburg and E. Keansburg, NJ	1968	0	0	19,081	0	19,081
18. Sandy Hook to Barnegat Inlet, Reach 2 (Asbury Park to Manasquan), NJ	1997	38,131	0	5,317	0	43,448
19. Great Egg Harbor Inlet and Peck Beach, NJ	1992	27,184	20,856	2,253	0	50,293
20. Cape May Inlet to Lower Township, NJ	1989	8,441	13,077	3,368	2,135	27,021
21. Atlantic Coast of MD – Ocean City, MD 1995	1995	31,605	14,148	5,924	2,335	54,012
22. Virginia Beach, VA (1962 auth.)	1964	0	17,819	0	560	18,379
DIVISION TOTALS – CENAD	**22 projects**	**166,858**	**181,280**	**50,593**	**6,780**	**405,511**
SOUTH ATLANTIC DIVISION						
23. Fort Macon, NC	1961	46	0	906	0	952
24. Wrightsville Beach, NC	1965	577	8,644	0	760	9,981
25. Carolina Beach and Vicinity, NC	1964	983	23,664	42	1,769	26,458
26. Kure Beach, NC	1996	14,550	0	0	0	14,550
27. Ft. Fisher, NC	1980	0	0	5,970	0	5,970

E: Actual Expenditures by Project and Project Feature ($000) *(Continued)*

Project [1]	Year Consturcted Initiated	Initial Beach Restoration	Periodic Nourishment	Structures	Emergency Costs	Total Costs
SOUTH ATLANTIC DIVISION *(Continued)*						
28. Ocean Isle, Brunswick County Beaches, NC	2001	6,200	0	0	0	6,200
29. Myrtle Beach, SC	1995	48,212	0	0	0	48,212
30. Folly Beach, SC	1993	9,337	0	1,609	0	10,946
31. Tybee Island, GA *Tybee Island extension*	1975 2000	2,628	10,191	2,059	289	15,167
32. Duval Co., FL 1978	1978	9,579	24,870	0	0	34,449
33. Brevard Co. – Cape Canaveral, FL	1975	1,026	0	0	0	1,026
34. Brevard Co. – North Reach, FL	2001	21,379	0	0	0	21,379
35. Brevard Co.-Indialantic/Melbourne, FL	1981	3,552	0	0	0	3,552
36. Fort Pierce Beach, FL	1971	621	10,195	0	0	10,816
37. Martin County, FL	1996	11,639	4,976	0	0	16,615
38. Palm Beach Co. – Jupiter/Carlin, FL	1995	4,787	4,875	0	0	9,662
39. Palm Beach Co. – (58) L. Worth Inlet to S. L. Worth Inlet, FL (sand transfer plant)	1958	0	0	577	0	577
40. Palm Beach Co. – Ocean Ridge, FL	1998	6,894	0	0	0	6,894
41. Palm Beach Co. – Delray Beach Segment, FL	1973	2,119	10,525	0	0	12,644
42. Palm Beach Co. – Boca Raton Segment, FL	1988	3,547	2,867	0	0	6,414
43. Broward Co. – Segment 3, FL	1978	10,982	15,892	0	0	26,874
44. Broward Co. – Segment 2, FL	1970	1,759	9,988	0	0	11,747
45. Dade Co., FL	1975	67,281	6,833	5,797	4,119	134,030
46. Lee Co. – Captiva Island Segment, FL	1989	6,418	7,914	0	0	14,332
47. Sarasota Co. – Venice Segment, FL	1995	19,280	0	0	0	19,280
48. Manatee Co., FL	1993	17,499	0	0	0	17,499
49. Pinellas Co. – Treasure Is., FL	1969	595	1,776	851	3,217	6,439
50. Pinellas Co. – Long Key, FL	1980	803	10,361	935	0	12,099
51. Pinellas Co. – Sand Key, FL	1993	30,421	28,464	1,200	0	60,085
52. Panama City Beaches, FL	1997	21,223	0	0	0	21,223
53. Harrison Co., MS	1952	856	**[2]**	736	0	1,592
DIVISION TOTALS – CESAD	**31 projects**	**324,793**	**232,035**	**20,682**	**10,154**	**587,664**
OTHER COASTAL DIVISIONS						
54. Grand Isle and Vicinity, LA	1985	10,534	7,571	284	4,688	23,077
55. Galveston Seawall, TX	1963	0	0	9,335	0	9,335
56. Corpus Christi Beach, TX	1978	2,078	1,408	301	0	3,787
57. Hamlin Beach State Park, NY	1974	1,178	0	1,200	0	2,378
58. Presque Isle, PA	1956	5,695	30,853	19,723	0	56,268
59. Lakeview Park Cooperative, OH	1977	834	159	840	0	1,833

E: Actual Expenditures by Project and Project Feature ($000) *(Continued)*

Project [1]	Year Consturcted Initiated	Initial Beach Restoration	Periodic Nourishment	Structures	Emergency Costs	Total Costs
OTHER COASTAL DIVISIONS *(Continued)*						
60. Reno Beach, OH	1992	0	0	6,554	0	6,554
61. Point Place, OH	1983	0	0	14,122	0	14,122
62. Maumee Bay, OH	1991	1,517	0	785	0	2,302
63. Indiana Shoreline, IN	1996	350	7,890	0	0	8,240
64. Casino Beach, IL	1994	0	0	3,922	0	3,922
65. Channel Islands Harbor, CA	1959	2,642	34,205	3,436	0	40,283
66. Ventura-Pierpont Area, CA	1962	635	0	599	473	1,707
67. Surfside/Sunset, CA	1964	2,129	26,288	1,266	0	29,683
68. Coast of CA, Point Mugu to San Pedro, CA	1968	1,800	0	648	0	2,448
69. Oceanside, CA	1961	1,153	2,608	195	0	3,956
70. Dillingham Snag Point, AK	1997	0	0	3,600	0	3,600
71. Homer Spit, AK	1994	0	0	8,491	0	8,491
Homer Spit extension	1998					
DIVISION TOTALS – OTHERS	**18 projects**	**30,542**	**110,982**	**75,301**	**5,161**	**221,986**
TOTAL PROGRAM	**71 projects**	**522,193**	**524,297**	**146,576**	**22,095**	**1,215,161**

Footnotes:

[1] Projects in italics are new since the 1996 Report.

[2] Periodic nourishment costs for these projects are the responsibility of the local sponsor and records are not available.

F. Costs Adjusted to September 2002 Prices by Project and Project Feature ($000)

Project [1]	Year Consturcted Initiated	Initial Beach Restoration	Periodic Nourishment	Structures	Emergency Costs	Total Costs
NORTH ATLANTIC DIVISION						
1. Wallis Sands State Beach, NH	1983	759	0	362	0	1,121
2. Hampton Beach, NH	1966	1,906	[2]	848	0	2,754
3. Winthrop Beach, MA	1956	3,271	[2]	1,658	0	4,929
4. Revere Beach, MA	1992	7,538	0	0	0	7,538
5. Quincy Shore Beach, MA	1950	12,411	[2]	6,775	0	19,186
6. Cliff Walk, RI	1975	0	0	2,058	0	2,058
7. Prospect Beach, CT	1975	2,572	[2]	529	0	3,101
8. Seaside Park, CT	1958	4,162	[2]	0	0	4,162
9. Sherwood Is. State Park, CT	1983	1,271	[2]	162	0	1,433
10. Rockaway Inlet to Norton Point (Coney Island Area), NY	1994	7,021	0	3,776	0	10,797
11. E. Rockaway Inlet to Rockaway Inlet and Jamaica Bay, NY	1975	39,456	64,828	2,927	4,249	111,460
12. Atlantic Coast of Long Is. Fire Is. Inlet & Shore Westerly to Jones Inlet, NY	1974	30,561	56,668	0	0	87,229
13. Fire Island Inlet to Montauk Point (Westhampton Interim), NY	1996	19,496	5,489	2,404	0	27,389
14. Fire Is. to Montauk Pt. Moriches to Shinnecock Reach, NY	1965	11,250	0	24,163	0	35,413
15. Fire Is. Inlet to Montauk Point, Southampton to Beach Hampton, NY	1965	0	0	3,554	0	3,554
16. Raritan and Sandy Hook Bay, Madison and Matawan Townships, NJ	1965	7,430	0	974	0	8,404
17. Raritan Bay and Sandy Hook Bay, Keansburg and E. Keansburg, NJ	1968	0	0	96,277	0	96,277
18. Sandy Hook to Barnegat Inlet, Reach 2 (Asbury Park to Manasquan), NJ	1997	42,539	0	5,619	0	48,158
19. Great Egg Harbor Inlet and Peck Beach, NJ	1992	34,145	23,669	2,745	0	60,559
20. Cape May Inlet to Lower Township, NJ	1989	12,234	15,334	4,342	2,669	34,579
21. Atlantic Coast of MD – Ocean City, MD 1995	1995	50,192	13,915	7,542	2,438	74,087
22. Virginia Beach, VA (1962 auth.)	1964	39,831	0	0	2,711	42,542
DIVISION TOTALS – CENAD	**22 projects**	**328,045**	**179,903**	**166,715**	**12,067**	**686,730**
SOUTH ATLANTIC DIVISION						
23. Fort Macon, NC	1961	349	0	4,622	0	4,971
24. Wrightsville Beach, NC	1965	11,556	14,882	0	3,444	29,882
25. Carolina Beach and Vicinity, NC	1964	11,138	36,725	233	6,433	54,529
26. Kure Beach, NC	1996	16,373	0	0	0	16,373

F. Costs Adjusted to September 2002 Prices by Project and Project Feature ($000) *(Continued)*

Project [1]	Year Consturcted Initiated	Initial Beach Restoration	Periodic Nourishment	Structures	Emergency Costs	Total Costs
SOUTH ATLANTIC DIVISION *(Continued)*						
27. Ft. Fisher, NC	1980	0	0	7,151	0	7,151
28. Ocean Isle, Brunswick County Beaches, NC	2001	6,448	0	0	0	6,448
29. Myrtle Beach, SC	1995	53,789	0	0	0	53,789
30. Folly Beach, SC	1993	11,420	0	1,931	0	13,351
31. Tybee Island, GA	1975					
Tybee Island extension	2000	19,496	9,718	3,816	426	33,456
32. Duval Co., FL 1978	1978	46,979	65,718	0	0	112,697
33. Brevard Co. – Cape Canaveral, FL	1975	5,976	0	0	0	5,976
34. Brevard Co. – North Reach, FL	2001	26,724	0	0	0	26,724
35. Brevard Co. – Indialantic/Melbourne, FL	1981	7,639	0	0	0	7,639
36. Fort Pierce Beach, FL	1971	5,808	13,912	0	0	19,720
37. Martin County FL	1996	13,385	5,175	0	0	18,560
38. Palm Beach Co. – Jupiter/Carlin, FL	1995	5,697	5,411	0	0	11,108
39. Palm Beach Co. – (58) L. Worth Inlet to S. L. Worth Inlet, FL (sand transfer plant)	1958	0	0	4,687	0	4,687
40. Palm Beach Co. – Ocean Ridge, FL	1998	7,652	0	0	0	7,652
41. Palm Beach Co. – Delray Beach Segment, FL	1973	10,788	22,190	0	0	32,978
42. Palm Beach Co. – Boca Raton Segment, FL	1988	5,589	3,268	0	0	8,857
43. Broward Co. – Segment 3, FL	1978	61,981	30,749	0	0	92,730
44. Broward Co. – Segment 2, FL	1970	23,523	25,895	0	0	49,418
45. Dade Co., FL	1975	181,211	63,696	9,859	4,478	259,244
46. Lee Co. – Captiva Island Segment, FL	1989	14,346	8,785	0	0	23,131
47. Sarasota Co. – Venice Segment, FL	1995	22,396	0	0	0	22,396
48. Manatee Co., FL	1993	21,874	0	0	0	21,874
49. Pinellas Co. – Treasure Is., FL	1969	7,709	11,813	0	0	19,522
50. Pinellas Co. – Long Key, FL	1980	2,346	13,651	1,367	0	17,364
51. Pinellas Co. – Sand Key, FL	1993	50,704	30,457	1,732	0	82,893
52. Panama City Beaches, FL	1997	22,733	0 0	0	22,733	
53. Harrison Co., MS	1952	12,469	13,564	7,975	0	34,008
DIVISION TOTALS – CESAD	**31 projects**	**688,098**	**375,609**	**43,373**	**14,781**	**1,121,861**
OTHER COASTAL DIVISIONS						
54. Grand Isle and Vicinity, LA	1985	26,463	11,086	2,760	6,268	46,577
55. Galveston Seawall, TX	1963	0	0	63,852	0	63,852
56. Corpus Christi Beach, TX	1978	5,760	4,608	433	0	10,801
57. Hamlin Beach State Park, NY	1974	3,609	0	3,557	0	7,166

F. Costs Adjusted to September 2002 Prices by Project and Project Feature ($000) *(Continued)*

Project [1]	Year Consturcted Initiated	Initial Beach Restoration	Periodic Nourishment	Structures	Emergency Costs	Total Costs
SOUTH ATLANTIC DIVISION *(Continued)*						
58. Presque Isle, PA	1956	48,355	65,805	28,780	0	142,940
59. Lakeview Park Cooperative, OH	1977	1,326	166	2,016	0	3,508
60. Reno Beach, OH	1992	0	0	8,100	0	8,100
61. Point Place, OH	1983	0	0	21,353	0	21,353
62. Maumee Bay, OH	1991	2,010	0	998	0	3,008
63. Indiana Shoreline, IN	1996	438	8,690	0	0	9,128
64. Casino Beach, IL	1994	0	0	4,434	0	4,434
65. Channel Islands Harbor, CA	1959	23,450	113,280	25,936	0	162,666
66. Ventura – Pierpont Area, CA	1962	3,324	3,796	818	0	7,938
67. Surfside/Sunset, CA	1964	13,954	40,430	5,407	0	59,791
68. Coast of CA, Point Mugu to San Pedro, CA	1968	6,210	0	3,913	0	10,123
69. Oceanside, CA	1961	13,619	3,103	1,417	0	18,139
70. Dillingham Snag Point, AK	1997	0	0	3,960	0	3,960
71. Homer Spit, AK	1994					
Homer Spit extension	1998	0	0	9,522	0	9,522
DIVISION TOTALS – OTHERS	**18 projects**	**148,518**	**250,964**	**187,256**	**6,268**	**593,006**
TOTAL PROGRAM	**71 projects**	**1,164,661**	**806,476**	**397,344**	**33,116**	**2,401,597**

Footnotes:

[1] Projects in italics are new since the 1996 Report.

[2] Periodic nourishment costs for these projects are the responsibility of the local sponsor and records are not available.

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13. ABSTRACT (Maximum 200 words
This report discusses by year and summarizes by decade, major coastal storms, coastal legislation, significant coastal milestones and data on the ensuing U.S. Army Corps of Engineers projects since the start of the 20th century. The chronology shows that projects follow legislation, which follow public demands after devastating coastal storms. The report also defines the scope of the Corps' shore protection program over the period in terms of the number and types of protective measures, lineal distances of protected shorelines, actual costs and costs updated to September 2002. A listing of projects under construction and in the planning stages is also provided.

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