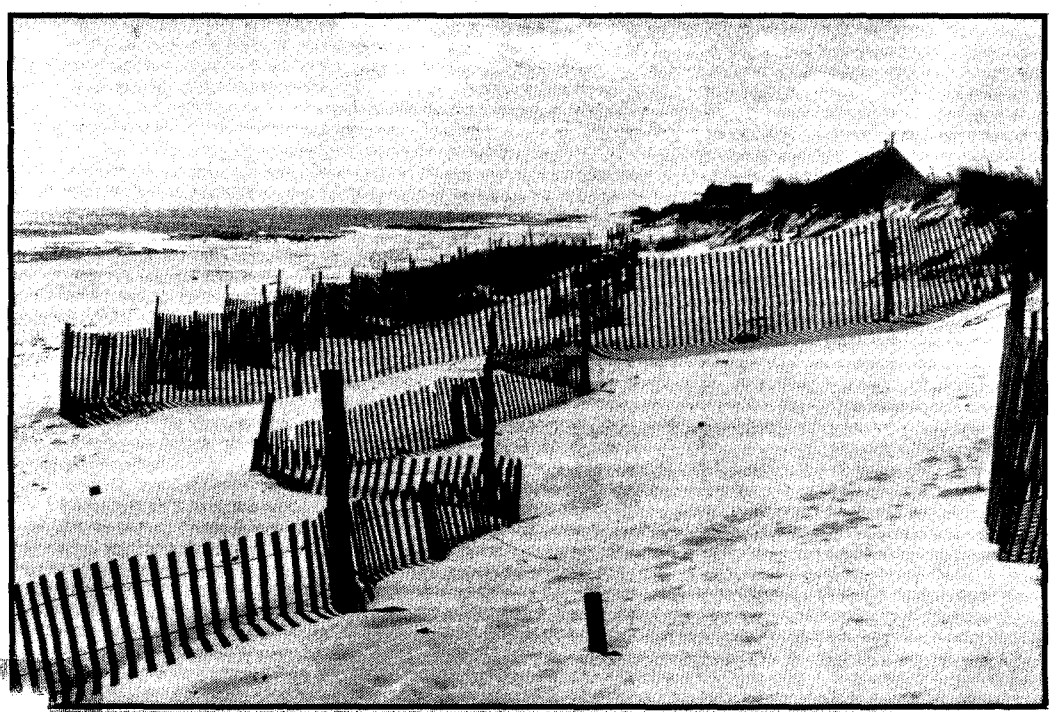
NEW JERSEY SHORE PROTECTION MASTER PLAN



STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF COASTAL RESOURCES

OCTOBER 1981

VOLUME I - THE PLAN

NEW JERSEY SHORE PROTECTION MASTER PLAN
VOLUME 1

THE PLAN

OCTOBER 1981

State of New Jersey

Brendan Byrne
Governor

Department of Environmental Protection
Jerry Fitzgerald English
Commissioner

Division of Coastal Resources
David N. Kinsey
Director

CN 401
Trenton, New Jersey 08625

Prepared With The Assistance Of:

Dames & Moore
6 Commerce Drive
Cranford, New Jersey 07016

Contract Number DBC-P168
Job Number 2422-013-10

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
OFFICE OF THE COMMISSIONER
P. O. BOX 1390
TRENTON, N. J. 08625
609-292-2885

October 1981

Dear Governor Byrne, Members of the Legislature, and Citizens of New Jersey:

The Jersey Shore is many things to many people: a place to live, a place to work and a place to visit. Sandy beaches, dunes, wetlands, jetties, fishing and amusement piers, inlets, bays, rivers, vacation houses, year-round residences, hotels, motels, and shops all make up the built and natural environment of the shore.

To protect these vital resources, the Department of Environmental Protection takes pride in presenting the first New Jersey Shore Protection Master Plan. This Plan, now adopted after more than two years of studies, workshops, and hearings, will guide five types of decisions and actions of the Department of Environmental Protection, and in particular the Division of Coastal Resources, to protect the shoreline.

First, the Plan will guide DEP's decisions on financial assistance for the construction, repair and maintenance of beaches, groins, jetties, seawalls, bulkheads, and dunes, investing prudently and rationally the funds available from the Beaches and Harbors Bond Fund of 1977, future bond issues, and other sources, including local government matching funds and federal reimbursement. Second, the Plan provides the framework for DEP's technical assistance on shore protection matters to local officials, citizens, and developers. Third, the Plan recognizes the important role of existing land use regulation by DEP and local governments in protecting sensitive beaches and dunes from inappropriate development. Fourth, the Plan will help DEP raise public awareness of the fragility of our barrier islands and the risks of coastal development. Fifth, the Plan defines DEP policy and provides the basis for the advocacy of proper management of shoreline processes.

The New Jersey Shore Protection Master Plan is presented in three volumes to facilitate its use. Volume I is the Plan itself. Volume II is the basis and background for the Plan, and contains useful reference materials and discussions of all the alternatives considered in developing the Plan. Volume III presents the public comments on the Draft Plan and the DEP responses to those helpful comments.

Life by the sea is exciting. Over the past 200 years, the people of New Jersey have extensively built up our shoreline. Some of these actions have led to disappearing beaches and property destruction during coastal storms. The Shore Protection Master Plan charts many steps that should be taken in coming years to protect the shoreline by working in closer harmony with the natural forces of the sea.

Sincerely,

JERRY FITZGERALD ENGLISH
Commissioner

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VOLUME 1

THE PLAN

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

VOLUME 1

LIST OF TABLES

VOLUME 1

LIST OF TABLES (Continued)

VOLUME 1

LIST OF FIGURES

VOLUME 1

LIST OF FIGURES (Continued)

VOLUME 1

LIST OF FIGURES (Continued)

VOLUME 2

BASIS AND BACKGROUND

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

VOLUME 3

COMMENTS AND RESPONSES ON THE DRAFT SHORE PROTECTION MASTER PLAN

TABLE OF CONTENTS

CHAPTER II

THE SHORE PROTECTION MASTER PLAN FOR NEW JERSEY

A. INTRODUCTION

This chapter presents a brief discussion of the selection of alternatives, the major findings, and the major component programs of the Shore Protection Master Plan. The summary of the major components of the plan is followed by specific recommendations including a reach-by-reach synopsis of the details of the preferred engineering plans.

1. Choices

There is a wide range of techniques that have been implemented at various levels of government, and by individual, private shorefront property owners to adjust to coastal erosion processes. These alternative techniques are shaped by the often conflicting objectives or priorities that exist among the various potential initiators of shore protection alternatives.

Historically, shore protection alternatives have been directed toward protecting the sizable public and private investment in development that has occurred along New Jersey's ocean shore. This development has resulted in the evolution of an economically important recreational and tourism industry that yields significant public and private economic and social benefits.

More recently, emerging Federal and State shore protection policies have questioned the wisdom of unregulated development of the oceanshore — and in particular — the barrier islands. It has been increasingly recognized that considerable subsidized flood insurance and shore protection costs are associated with intensive development of hazardous shorefront areas, and on barrier islands in particular. In addition, it has become increasingly clear that there are strong societal and environmental benefits to be gained by maintaining or restoring (to the extent practicable) the natural dynamic processes controlling shore erosion and barrier island migration.

These two conflicting philosophies have engendered the development of two basic approaches to shore protection. On the one hand are the engineering techniques and concepts (structural and nonstructural), designed primarily to reduce the direct, adverse effects of erosion on shorefront property by controlling or mitigating the natural forces that cause the erosion. On the other hand are the non-engineering approaches which seek to either avoid future erosion losses through land management programs, or to lessen or eliminate the direct social and economic costs and hardships incurred by shorefront property owners where erosion is occurring.

Sorensen and Mitchell (1975) have classified the alternative adjustments to coastal erosion into four major categories:

- Control and Protection Works (Engineering Alternatives)
- Land Use Management
- Warning Systems
- Public Relief, Rehabilitation, and Insurance Means

These four major categories are introduced and explained briefly below. Various alternative techniques and concepts under each of the major categories above are presented along with a discussion of the compatibility and interaction of alternatives in Volume 2, Chapter IV.

a. Control and Protection Works (Engineering Alternatives)

Engineering alternatives consist of structural and nonstructural measures of erosion control. Structural solutions used as a last resort to form a protective barrier against the encroaching sea typically include massive shore-parallel works such as seawalls, revetments, and bulkheads. Other structural approaches which are designed to slow the erosion by modifying the wave energy or littoral drift processes consist of breakwater, jetties, groins, artificial seaweed, and similar devices. Nonstructural works include beach nourishment projects, and dune and bluff stabilization using vegetative plantings and sand fencing.

The primary thrust of the engineering alternatives is one of maintaining a static shoreline to protect or enhance adjacent development. All of the structural approaches tend to be very expensive, and some tend to increase the rate of loss of the beach resource. Groins and jetties, while they slow the erosion at a particular location, may have the effect of increasing erosion on downdrift shoreline areas. Often as a result of this situation, continued control further along the coast is needed. Bulkheads, seawalls, and revetments tend to increase the reflective energy and turbulence along a shore and inhibit the natural beach recovery response to storms, resulting in accelerated losses of the fronting beach.

Although nonstructural measures such as dune stabilization and beach nourishment have been recognized for some time, it was not until the late 1950s, after extensive research, that they were considered seriously. Recently, beach nourishment has become the most preferred Federal erosion control technique. However, the costs of nourishment are also very high, extensive losses are often experienced following nourishment projects, and continued maintenance or renourishment is required.

b. Land Management

The efforts to utilize land management programs as adjustments to the coastal erosion hazard must be viewed against a background of sustained population and investment growth in shore areas and of intense competition among resource users. Land management programs attempt to minimize potential losses by controlling development and investments in the erosion hazard zones. The emphasis here is to reduce the losses over the long term by recognizing the dynamics of the coastal system, adjusting man's activity to be compatible with it and not attempting to modify the natural system to maintain a static shoreline as in engineering works. Tools of land management include acquiring existing open space land areas and enacting and enforcing building codes, ordinances, or other land use regulations. Construction setback lines and regulations protecting the dune/beach system are the most commonly employed land management tools.

c. Warning Systems

Warning systems can be utilized to alert the occupants of potentially affected areas to the onset of erosion or flood hazards. Coastal erosion warnings are sometimes issued from the National Weather Service forecasting centers in conjunction with storm surge and high water warnings. Normally, there is little danger to

human life due to erosion hazards. The current emphasis of the warning system is related to the flooding hazard associated with major coastal storms. Without other contingency programs in place and ready to operate, there is little that can be done on short notice to prevent extensive erosional loss of beaches, dunes, and structures.

Warning systems can also encompass public education and public awareness programs. Under this approach, the public (i.e., shorefront property owners, potential investors, tourists, etc.) would be made more aware of the dangers associated with development in coastal erosion hazard and storm hazard areas. This could include estimates of the likelihood of future property loss from continuing erosion or major storms. It must be recognized that warning systems do not directly avoid property losses or decrease human suffering. However, they can be useful adjuncts in making people more amenable to other approaches.

d. Relief, Rehabilitation, and Insurance Measures

These programs provide a means of compensating victims of erosion by spreading the social costs. Most methods of spreading disaster losses are unavailable to persons affected by coastal erosion. Relief and rehabiliation aid can be allocated to an area after Presidential declaration of a major disaster. This provides for a range of aid including low interest loans (Office of Emergency Preparedness, 1972). Except when accompanied by other catastrophic storm events, most episodes of serious erosion have not resulted in Presidential declaration of a major disaster. Under the National Flood Insurance Program, insurance is available for erosion damages only for accelerated cases when waves or currents exceed anticipated cyclical levels.

Additional programs can also utilize incentives to encourage shorefront property owners to relocate in other areas. Public resources (e.g., low interest loans, grants, relocation assistance, etc.) could be made available to persons in the hopes of avoiding higher, future costs (disaster assistance expenses). In addition, the amount of insurance settlements could be predicated on rebuilding destroyed structures out of hazardous areas.

2. Selection of Alternatives for New Jersey

In the selection of the shore protection alternatives for New Jersey, all of the available shore protection techniques and concepts were considered. With consideration of Master Plan objectives, State and Federal shore protection policies, operative coastal processes, shoreline conditions, and the density of development along the shore, a comparative evaluation of selected practical engineering and land management alternatives was performed. The alternative evaluation, which is provided in Volume 2, Chapter V, addresses the following questions: What are the pros and cons of each approach? What is the actual cost of continuing to protect development adjacent to eroding shores? What are the benefits and who are the beneficiaries? What are the impacts on the socioeconomic system and on the natural ecosystem and resources? How might combinations of alternatives present opportunities for increased shore protection benefits?

Thus, the stage was set for decisions regarding which approach, or combination of approaches, should be the direction for the State in the years to come. Considering the evaluations and recommendations provided in the Draft Shore Protection Master Plan (Dames & Moore, September 1980), and written and public hearing comments on that document, the DEP adopts the findings and programs summarized in the following sections.

3. Findings

- Coastal resources are essential to the welfare, commerce, and prosperity of the people of the State.

- The coastal areas of the State, including beaches, dunes, and coastal bluffs adjacent shorefront areas, are subject to natural disasters of inundation (flooding) and to dynamic changes resulting in erosion and accretion.

- The beaches, dunes, and adjacent shorefront areas (uplands and coastal bluffs) provide valuable recreational, scenic, and protective functions, and are important habitats for wildlife and vegetation.

- Beaches, dunes, and coastal bluffs operate in equilibrium with and moderate the effects of flooding and shoreline dynamics by migrating in response to coastal processes and sea level rise.

- Development within these coastal hazard areas has resulted in destruction of valuable dune areas and increases in losses associated with the natural disasters of flooding and erosion.

- Attempts to prevent hazard losses and maintain a static shoreline by construction of costly engineering projects, especially shore-parallel structures such as bulkheads and seawalls, have resulted in losses and damage to the natural beach systems and related resources.

- Nonstructural engineering projects, such as beach nourishment, can provide some level of protection against erosion and storm-related effects.

- Beaches can be renourished to return recreational and protective functions and benefits, but only at high costs.

- There is no guarantee that major storms capable of destroying shore protection projects and development will not occur; correspondingly, the anticipated benefits which would justify such projects may not occur.

- The static shoreline concept related to coastal development requires that beach nourishment and structural maintenance be continued indefinitely if the beach resources and development in the coastal hazard zone are to be maintained.

- Land regulations of coastal hazard and sensitive areas can provide a long-term mechanism for effective mitigation of erosion losses; such regulation should be in place now, prior to the next major storm, to effectively guide the pattern of rebuilding.

- Land regulation will not help to reduce short-term losses to existing development in the coastal hazard areas.

- Programs to encourage relocation out of coastal hazard areas after destructive storms are needed.

- Due to the prohibitive costs and the potential for significant political and social disruption, acquisition of entire barrier islands or large tracts of

coastal high hazard areas is not feasible as a means of coastal hazard mitigation.

- o Limited pre-storm acquisition of undeveloped access areas, and selected post-storm acquisition of portions of the barrier islands, especially areas on the tips of islands adjacent to inlets, would be an appropriate supplement to land regulation. Acquisition would also provide increased levels of public access and natural recreational opportunities for beach use.

4. Summary of Plan Components

To accomplish the objectives outlined in Chapter I, this Shore Protection Master Plan has the following objectives:

- o Implementation of priority reach-level and selected local engineering programs;
- o Land use regulation in coastal hazard and resource areas (beaches and dunes);
- o Selective post-storm acquisition of portions of barrier islands;
- o Parallel Federal programs which would be supportive of State coastal management policies and functional in providing incentives and assistance for relocation especially after destructive storms.

Each of the adopted plan components of the Shore Protection Master Plan is described below in more detail. The preferred engineering programs are shown schematically on Figure II.A-1.

To alleviate the anticipated short-term losses associated with storms and erosion processes, priority nonstructural reach-level and selected non-reach engineering projects would be implemented. To maximize the potential for Federal cost sharing assistance and to ensure expenditure of State and local monies in an equitable manner, only those projects which are beneficial and affordable should be implemented.

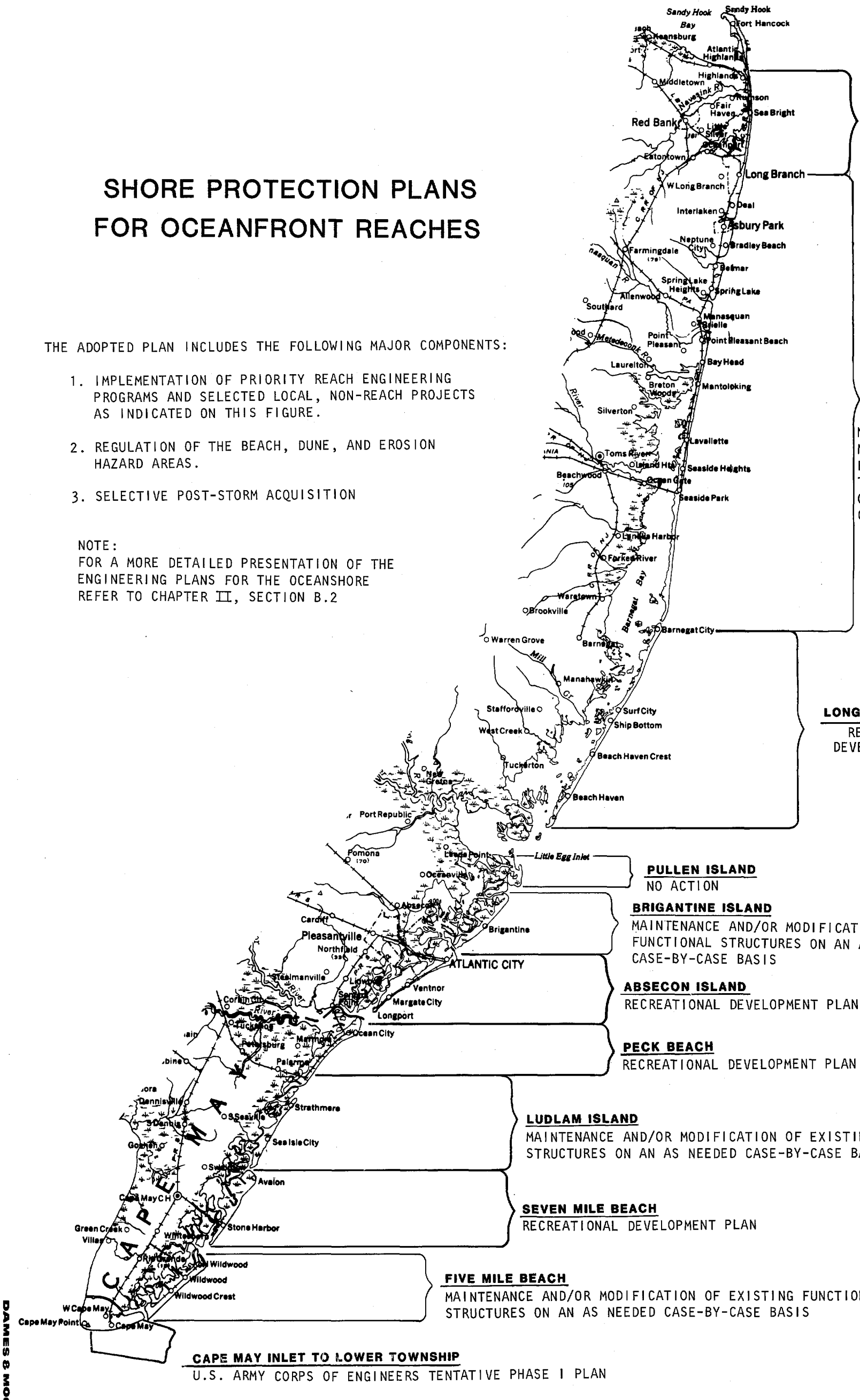
Shorefront regulations is primarily a local responsibility although the DEP does operate three regulatory programs which currently form the backbone of the State's existing Coastal Management Program. These are the coastal wetlands, coastal area facility, and waterfront development (riparian) permit programs. In accordance with its stated coastal management policies, the New Jersey Department of Environmental Protection, Division of Coastal Resources (DEP/DCR) is moving forward to develop land management tools for addressing the problem of shoreline erosion. To this end the DEP/DCR intends to work closely with coastal municipalities to develop workable regulatory legislation. Thus, a long-term component for mitigation of the shoreline erosion problem will be the use of coastal regulation to control development in the hazard and natural resource (beach and dune) areas. Under a plan inclusive of coastal regulation, as development in the hazard areas decreases over time, continued reliance on engineering projects will diminish and the cost associated with their construction and maintenance will decrease. A decrease in development in the coastal hazard strip along the shore, together with selected public acquisitions of the shorefront, will mitigate losses associated with shoreline erosion and will provide for increased levels of access to the beaches. While such regulation would provide the

SHORE PROTECTION PLANS FOR OCEANFRONT REACHES

THE ADOPTED PLAN INCLUDES THE FOLLOWING MAJOR COMPONENTS:

1. IMPLEMENTATION OF PRIORITY REACH ENGINEERING PROGRAMS AND SELECTED LOCAL, NON-REACH PROJECTS AS INDICATED ON THIS FIGURE.
2. REGULATION OF THE BEACH, DUNE, AND EROSION HAZARD AREAS.
3. SELECTIVE POST-STORM ACQUISITION

NOTE:
FOR A MORE DETAILED PRESENTATION OF THE ENGINEERING PLANS FOR THE OCEANSHORE REFER TO CHAPTER II, SECTION B.2



SANDY HOOK TO LONG BRANCH
MAINTENANCE PROGRAM

LONG BRANCH TO BARNEGAT INLET
MAINTENANCE AND/OR MODIFICATION OF EXISTING FUNCTIONAL STRUCTURES ON AN AS NEEDED CASE-BY-CASE BASIS

LONG BEACH ISLAND
RECREATIONAL DEVELOPMENT PLAN

PULLEN ISLAND
NO ACTION

BRIGANTINE ISLAND
MAINTENANCE AND/OR MODIFICATION OF EXISTING FUNCTIONAL STRUCTURES ON AN AS NEEDED CASE-BY-CASE BASIS

ABSECON ISLAND
RECREATIONAL DEVELOPMENT PLAN

PECK BEACH
RECREATIONAL DEVELOPMENT PLAN

LUDLAM ISLAND
MAINTENANCE AND/OR MODIFICATION OF EXISTING FUNCTIONAL STRUCTURES ON AN AS NEEDED CASE-BY-CASE BASIS

SEVEN MILE BEACH
RECREATIONAL DEVELOPMENT PLAN

FIVE MILE BEACH
MAINTENANCE AND/OR MODIFICATION OF EXISTING FUNCTIONAL STRUCTURES ON AN AS NEEDED CASE-BY-CASE BASIS

CAPE MAY INLET TO LOWER TOWNSHIP
U.S. ARMY CORPS OF ENGINEERS TENTATIVE PHASE I PLAN

DAMES & MOORE

FIGURE II.A-1

best immediate solution for sparsely developed coastal areas, given the heavily developed nature of the New Jersey shore, the implementation of shore protection engineering projects will continue to be an important component of the New Jersey Shore Protection Master Plan Program.

For maximum effectiveness of the Master Plan regulatory components discussed above, parallel and supportive Federal actions would also be appropriate. At a minimum, the State intends to support changes in existing Federal flood insurance and disaster assistance programs, and evolving barrier island legislation, to provide upgraded coastal construction standards, relocation incentives, and assistance for occupants of coastal high-hazard areas. However, it is unlikely that Federal relocation programs would be in place for some time, and even if in place, would probably not be used extensively, except in post-storm situations to assist property owners to rebuild in different, including further inland, locations.

A schematic representation of components of the plan and their interaction over a period of time is presented in Figure II.A-2. This schematic time interval is punctuated by a number of storms. As time proceeds, the losses suffered and the related threats to public health and welfare decrease. This reduction will be directly related to the extent of development in the hazard areas, which is controlled by:

- o The coastal regulation which would control new development and redevelopment on shorefront property in high hazard areas;
- o Acquisition of lands for public open space — natural areas, especially post-storm acquisition on portions of barrier islands; and
- o Voluntary relocations of businesses and residents to safer areas after destructive storms.

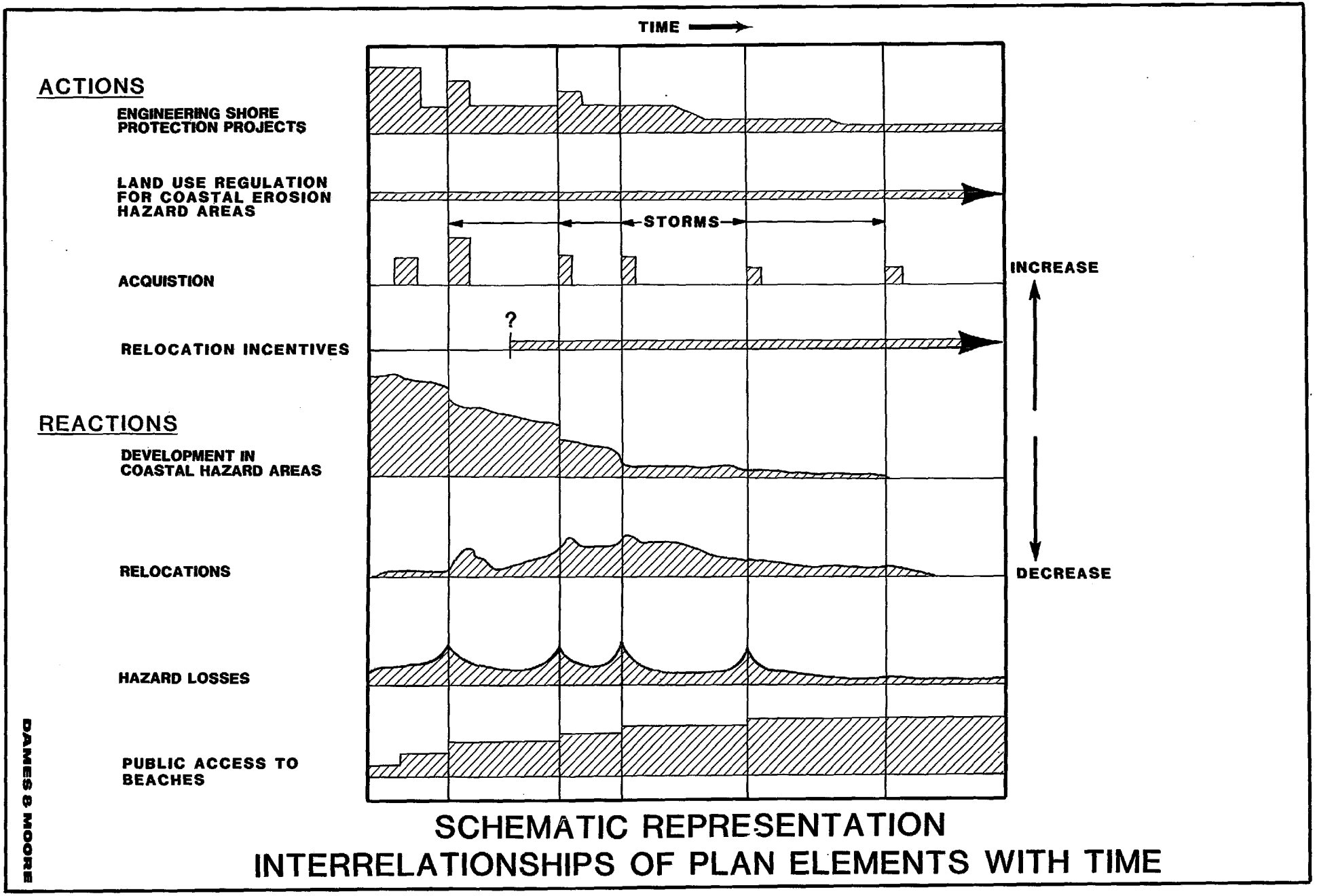
B. COASTAL ENGINEERING PROGRAMS

There are a wide range of engineering concepts and techniques that have been implemented at various levels of government, and by individual private shorefront property owners to reduce and direct natural forces which adversely affect shorefront property. Available engineering erosion control concepts and techniques are presented and discussed in detail in Volume 2, Section IV.B.

Historically, structural measures (including breakwaters, seawalls, groins, bulkheads, and revetments) and nonstructural methods (such as beach nourishment and dune stabilization) have been implemented to maintain a static shoreline to protect and enhance the sizable public and private investment in development that has occurred along New Jersey's ocean shore. This development has resulted in the evolution of an economically important recreational and tourism industry that yields significant public and private economic and social benefits.

However, the engineering alternatives have become increasingly more expensive and some of the structural methods have accelerated the rate of the loss of beach resources and adjacent shoreline areas, especially where they have been implemented on a piecemeal basis. In order to alleviate this problem the alternative reach engineering designs are proposed.

The principles and assumptions for design of the alternative engineering alternatives for New Jersey are set forth in the following sections.



SCHEMATIC REPRESENTATION
INTERRELATIONSHIPS OF PLAN ELEMENTS WITH TIME

FIGURE II.A-2

1. Engineering Principles and Assumptions

a. Rationale and Assumptions For Design

As discussed in Section I.B above, this study addresses the shore areas which are exposed to significant erosional forces and have had a history of erosion problems. In particular these areas include the Raritan Bay shore from Perth Amboy to Sandy Hook; the Atlantic Ocean shore from Sandy Hook to Cape May Point; the Delaware Bay shore from Cape May Point to Stow Creek; and the Delaware River from Stow Creek to Crosswicks Creek. Detailed consideration of engineering alternatives is provided for the ocean shores which, by comparison to river and backbay shores, have the most significant erosion problems. Where appropriate, development of the engineering plans is based on a regional (reach) approach, rather than the as needed, piecemeal solutions of the past.

The Corps of Engineers, in cooperation with the State, has developed a series of plans for comprehensive shore protection of the ocean beaches and inlets. These plans, which are discussed in Volume 2, Section VI.C., have received congressional authorization, but most are in the inactive category because of the inability of State and local government units to commit to the initial cost-sharing and maintenance responsibilities. In New Jersey, the general practice of the Corps of Engineers with regard to inlet stabilization has been to propose costly master jetties for navigation purposes; however, a few projects which do not involve major inlet stabilization costs have been completed. Three Federal shore protection projects have been completed on the New Jersey Coast — on Long Beach Island, at Atlantic City, and in the Keansburg area of the Raritan Bay shore.

The reach engineering conceptual designs that are developed and evaluated in the New Jersey Shore Protection Master Plan are alternatives to authorized Corps of Engineers shore protection plans for New Jersey which have been developed over the last 20 years. Considerations of inlet stabilization (including master jetty construction for navigational improvements and sand bypassing to prevent adverse effects on downdrift beaches), which is a component of the Corps of Engineers multipurpose projects, is not included in the Master Plan due to its high cost, predominance of navigation benefits, and the potential for adverse effects on adjacent shore areas.

For the reach engineering designs presented in this document, a uniform set of design criteria and assumptions has been applied. The design methodology for engineering protection of the New Jersey shoreline is based on four fundamental assumptions:

- The overall coastal processes of the State should not be altered.
- The "reach" concept should be employed in the application of engineering plans, where appropriate.
- Although the Master Plan engineering alternatives include consideration of storm erosion protection, flood control or protection measures are not addressed explicitly. The controlling measures and long-term effects of flooding and erosion are substantially different.
- Plans should be in accordance with the State's policies for shore protection as set forth in the New Jersey Coastal Management Program (NJDEP/NOAA, August 1980).

Thus, the erosion control solutions are created such that the overall coastal processes of the State are not significantly altered, since it is assumed that such an alteration would be detrimental.

The New Jersey Coastal Management Program emphasizes nonstructural solutions for shoreline protection. Structural solutions are only acceptable when nonstructural alternatives are incompatible with protection demands. Another important aspect of the State program requires that public and private resort-recreation developments adjacent to the shoreline provide for reasonable public access. Access takes the forms of visual and direct or indirect physical access; indirect physical access includes provision of parking, transportation, and support facilities. All shorelines protected with State or Federal funds must be accessible to all shorefront visitors on equal terms.

Although stated shore protection policies are primarily in favor of nonstructural engineering techniques, such as beach nourishment, the construction of new shore protection structures, such as jetties, groins, seawalls, and bulkheads, is conditionally acceptable if they meet the following specifications:

- The structure is essential to protect water-dependent facilities or heavily used public recreation beach areas from tidal waters or erosion, or to protect existing structures and infrastructure in developed shorefront areas from erosion.
- The structure is designed to eliminate or mitigate adverse impacts on the local shoreline sand supply.
- The structure will not create adverse shoreline sand movement conditions downdrift, including erosion or shoaling.
- The structure will cause minimum adverse impact to living marine resources.
- The structure is consistent with the State Shore Protection Master Plan conceptual engineering plans.
- If the proposed project requires filling of a water area it must also be consistent with the General Water Area Policy for filling as specified in The New Jersey Coastal Management Program (NJDEP/NOAA, August 1980.

The recommendation of this Master Plan is that existing and proposed shore protection policies be followed except for the following suggested modifications:

- It is recommended that shore-parallel structures — such as bulkheads, seawalls, and revetments — in areas characterized by sandy beaches, especially on ocean shores, be prohibited except for those recommended in the Shore Protection Master Plan as infilling to maintain the integrity of adjacent structures. These structures impede the natural migration and storm responses of sandy shores and result in significant increased losses of natural beach areas. The previous conditional policies for structural engineering techniques should apply to the remaining non-shore-parallel structures such as groins and jetties.

- Costly reach-level engineering programs should be implemented only if they are cost beneficial (benefit-to-cost ratio greater than one). The priority projects on the ocean reach level identified in this plan meet this criteria. However, other projects which will develop on a case-by-case basis — in the bay and inlet areas, for example —should also demonstrate a positive benefit-to-cost relationship prior to priority funding.

- Long-term, costly reach engineering projects, such as extensive beach fill and groin construction, should not be implemented as emergency projects.

Specific criteria have been established for this Master Plan to provide the necessary parameters for engineering planning and analysis. These criteria are generally consistent with the planning values used by the Corps of Engineers in its feasibility level studies. In later detailed studies, the design specifications would be subject to change depending on actual physical conditions (e.g., wave climate and beach width) at the site.

The following design criteria and assumptions were established with regard to the selected alternative engineering plans:

- A 50-year program life is assumed for economic evaluations.

- For storm erosion protection designs, beaches will have a 100-foot berm width on shoreline without groins and a 75-foot berm width on shoreline with functional groins (see Figure II.B-1).

- Recreational beaches shall be of sufficient surface area to provide a maximum of 100 square feet per person for recreational use. This value, as recommended in the State Comprehensive Outdoor Recreation Plan (SCORP), (NJDEP, 1977), is higher than the 75-square-feet-per-person criterion used by the Corps of Engineers in its design procedures.

- An average beach user turnover rate of 2.0 is assumed in the daily beach capacity estimates. This value is consistent with the Corps' estimating procedure.

- Beach berm and dry beach slope areas are used in the computation of recreational capacity.

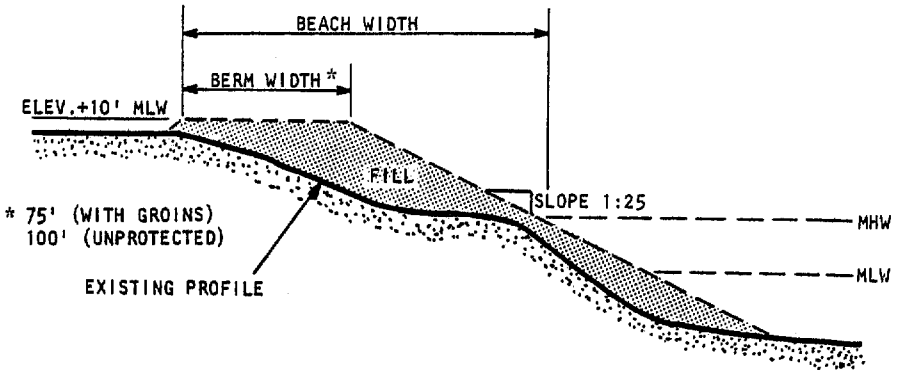
- Recreational beach shall only be added to an existing beach where there is public access.

- A nourished storm erosion protection beach shall have a slope paralleling the original beach profile and a berm elevation of 10 feet above Mean Low Water (MLW) (see Figure II.B-1).

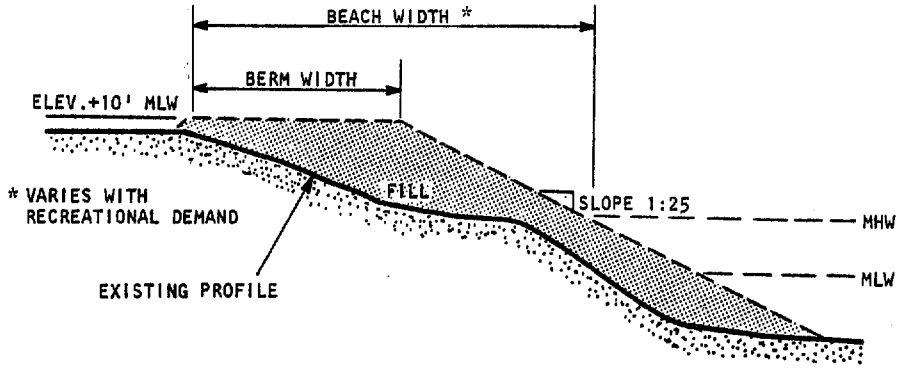
- Where recreational development designs require beach expansions to accommodate demand, final design berm elevations are planned at +10-foot MLW level to maintain a dry berm during normal high tide conditions.

- Dune maintenance and development are provided through a program of sand fence installation and dune grass planting. No newly constructed dune fields are planned for inclusion in beach fill design cross-sections.

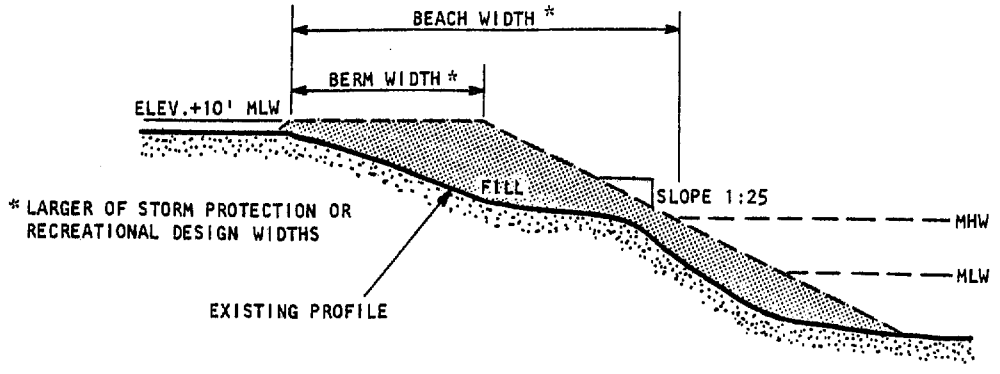
TYPICAL DESIGN BEACH PROFILES



STORM EROSION PROTECTION ALTERNATIVE



RECREATIONAL DEVELOPMENT ALTERNATIVE



COMBINATION ALTERNATIVE

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FIGURE II.B-1

- Normal structural maintenance costs are estimated by using a uniform series of annual payments which is equivalent to the cost of replacing a structure at the end of its 50-year economic life. This assumes that the structure is in excellent condition to start with, if not, initial repair (initial maintenance) costs are added to the project.

- Estimates of initial structural maintenance (repair) costs for each reach are taken from a State study entitled Shore Protection Structures, Public Access and Evaluation (NJDEP, Office of Shore Protection, January 1977). Cost estimates provided in that study have been upgraded to 1980 dollars for inclusion in the Master Plan.

In addition to the specific criteria identified above, several assumptions were necessary to substitute for unknown or inadequate data. These assumptions include oceanographic, demographic, economic, and environmental data as summarized below:

- Offshore sand sources identified by the U.S. Army Coastal Engineering Research Center have grain size distributions which are compatible with the native beach sands.

- A nourishment overfill factor of 1.3, typical of suitable beach fill materials, is used — based on the assumption that adequate quantities of such borrow material are available.

- Coastal processes in each reach will not be significantly altered naturally or by man except as recommended in the Master Plan.

- Well-designed groin fields reduce erosion rates by approximately 25 percent. The effectiveness of existing groin fields may vary from this estimate due to various local factors.

- A rate of return of 9 percent is used in the economic analysis.

- Recreational beach demand data are assumed to be valid as extrapolated to the year 2030, based on SCORP data (NJDEP, 1977) and Corps of Engineers Planning documents, and carrying-capacity estimates for major access routes to reaches.

- Recreational demands can be adequately met by providing a beach capacity based on a mean between the projected average and peak daily beach use estimates.

- Recreational beach demand can be satisfied by incremental increases in capacity at approximately 10-year intervals, resulting in a step function increase in capacity from the existing levels to those projected for the future.

- Dredging contracts can be let with sufficient volumes to attract dredging contractors in a competitive situation. One million cubic yards is assumed to represent a minimum size for an attractive project. Smaller projects in adjacent reaches may be combined to meet this guideline. Minor adjustments in the schedules for renourishment and berm expansion can also be made so that these two beachfill steps are concurrent.

- o Adequate dredging equipment will be available to economically obtain sand from offshore sources.

b. Alternative Reach Engineering Plans

Five alternative reach engineering plans have been developed and evaluated for application to the New Jersey ocean shoreline:

- o Storm Erosion Protection
- o Recreational Development
- o Combination Storm Erosion Protection and Recreational Development
- o Limited Shoreline Restoration
- o Maintenance Program.

These alternatives represent a range of engineering objectives for erosion control — from a comprehensive program which maximizes erosion protection and recreational benefits to a minimum program of maintenance of existing structures. In each of the engineering concepts, specific actions are recommended so as to achieve the design objective in a cost-effective and efficient manner. Economic evaluations were performed in the selection of competing technical options. An expanded discussion of assumptions and concepts for each of the alternatives discussed below is provided in Volume 2, Section VI.A.2.

(1) Storm Erosion Protection. This alternative concept has as its objective the protection of property and community infrastructure from probable erosion damage following a major storm. Flood protection design is not provided by this alternative. Beach berms are raised to elevations which provide a dry beach under normal high tide and wave runup conditions. Dunes are not added to provide flooding and overwash protection, but maintenance and continued development of existing dunes are provided through a program of beach grass planting and sand fence installation.

For the purposes of this study, the design storm has been selected from the historical record and has an approximate recurrence interval of 50 years. Stabilization is accomplished through nonstructural techniques (beach fill, dune maintenance, etc.) to the maximum practical extent in accordance with New Jersey Coastal Management Program policies. Structural shore protection plans are only conditionally acceptable under this program; they are appropriate and essential along certain heavily urbanized portions of the New Jersey coast. Structural measures including seawalls, bulkheads, breakwaters, and groins are specified only when nonstructural approaches are infeasible or impractical.

Both structural and nonstructural techniques are applied so as to provide a buffer of sufficient resistance to limit erosion losses of public/private property or infrastructure during a design storm. Generally, exposed beaches with berm widths of 100 feet and groin-protected beaches with berm widths of 75 feet represent suitable means of erosion protection under such conditions. The limited use of seawalls and bulkheads (as infilling) satisfies this protection requirement in areas that are heavily developed.

The storm erosion protection alternative also provides for the maintenance of the erosion buffer. Beach nourishment at periodic intervals is provided to replace erosion losses so that the full protective benefit of the design berm is preserved during the planning period; additionally, the use of beach fill also provides recreational beach benefits. Maintenance of existing functional shore protection structures and modifica-

tion of those structures that are functionally deficient are also included as considerations in this alternative.

(2) Recreational Development. This alternative concept has as its objective the satisfaction of projected recreational demand. The primary means of achieving this goal is through use of beach fill, with a minimum amount of structural stabilization. This approach allows the use of a phased recreational development plan, wherein beach widths are periodically expanded to meet recreational demand. Opportunities are thus provided during the 50-year planning period to adjust the planned beach expansion to meet actual recreational demand. Maintenance of beach widths, through periodic nourishment and maintenance of functional structures, is also provided under this alternative.

Specific locations within reaches for the development of recreational beach areas are chosen with appropriate consideration of convenient public access. Areas with public ownership of beach area and riparian lands and with convenient access to the beach and parking and support facilities are given preference.

Figure II.B-2 represents a schematic of design beach capacity for a typical recreational reach plan. Average and peak day demands show increases over time, while the existing beach capacity decreases through loss of sand by erosion. The plan provides for periodic beach width expansion over time. This avoids present day expenditures of funds for beach facilities which may not be fully used for another 30 to 40 years. In the example, an initial beach fill increases the beach area to generally satisfy the design beach demand during the first 10-year period. This beach width is then generally maintained at the same level through periodic nourishment. If required, further increases in beach width would occur at approximately 10-year intervals. The spacing of expansions at such intervals provides sufficient time to monitor the performance of the beach fill and the growth of recreational demand. Opportunities are thus provided to readjust beach expansion plans throughout the planning period. Nourishment schedules and volumes can also be adjusted so that nourishment and expansion operations can be conducted simultaneously. This generally provides a fill volume of adequate size to attract bidding interest.

(3) Combination Storm Erosion Protection and Recreational Development. This alternative has the objective of providing the full benefits of both storm erosion protection and recreational development, as described above. The design which results in the wider beach at a particular location controls under the combination alternative. The design can also change through the planning period. For example, a storm erosion protection plan can be the controlling design during the initial years of a project; as recreation demand grows, the beach may reach a point where the storm beach provides insufficient recreational capacity. Then the design would shift to a recreational design and periodic beach expansions would be provided.

(4) Limited Restoration. This alternative is provided to create a level of storm erosion protection or recreation beyond that obtainable from a minimum maintenance program, but less than the full benefits provided by the other alternatives discussed above. The emphasis of the limited restoration alternative is on nonstructural solutions.

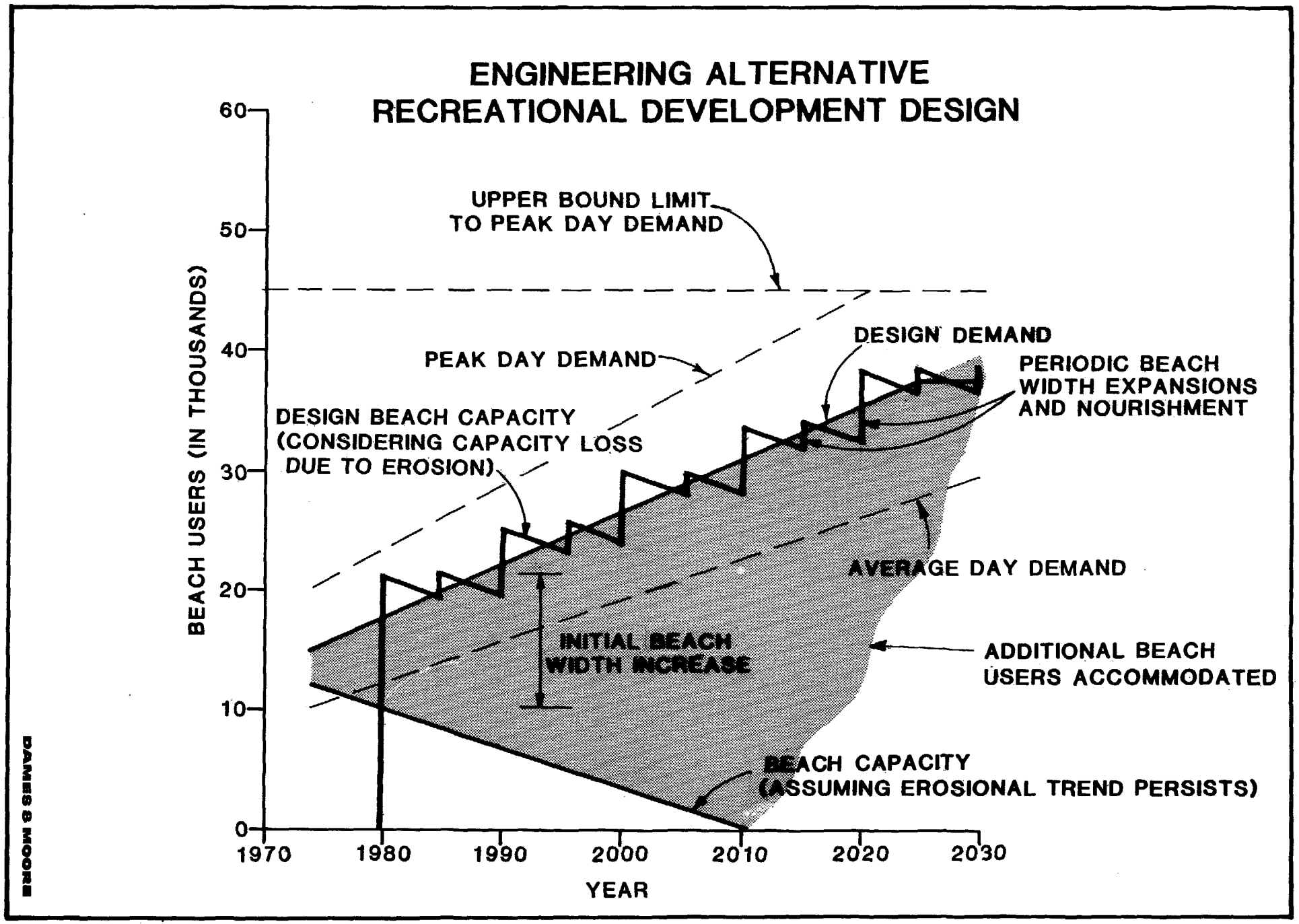

ENGINEERING ALTERNATIVE
RECREATIONAL DEVELOPMENT DESIGN
UPPER BOUND LIMIT
TO PEAK DAY DEMAND
PEAK DAY DEMAND
DESIGN DEMAND
PERIODIC BEACH
WIDTH EXPANSIONS
AND NOURISHMENT
DESIGN BEACH CAPACITY
(CONSIDERING CAPACITY LOSS
DUE TO EROSION)
AVERAGE DAY DEMAND
INITIAL BEACH
WIDTH INCREASE
ADDITIONAL BEACH
USERS ACCOMMODATED
BEACH CAPACITY
(ASSUMING EROSIONAL TREND PERSISTS)
BEACH USERS (IN THOUSANDS)
60
50
40
30
20
10
0
1970
1980
1990
2000
2010
2020
2030
YEAR
DAMES & MOORE

FIGURE II.B-2

In keeping with the reach concept, the objective of the limited restoration program is to stabilize the critically eroding areas of a reach by bringing the rate of erosion to the same level as other areas of the reach. This is primarily accomplished through restoration of the beach width along with periodic maintenance of the beach. Special consideration is given to the protection of public lands and infrastructure.

(5) Maintenance Program. This alternative represents a program of structural repair and maintenance. The primary objectives are to prevent existing shore protection structures from losing their functional and structural integrity and to provide nourishment material to compensate for that which is eroded during severe storms. In other words, beach renourishment is applied only as a reactionary effort rather than as preventive maintenance. The structural maintenance is performed on a preventive basis. The cost estimates for this program include the maintenance costs for structures only. No costs are included for post-storm restoration of the beach berm due to the unpredictable magnitude and frequency of storm damage.

c. Alternative Reach Engineering Plans Evaluated for New Jersey

Summary descriptions of the engineering alternatives for all reaches are provided in Table II.B-1. Included are the major components of each alternative, such as beach fill, groin construction, and dune stabilization. A full discussion and schematic representation of reach alternatives is provided in Volume 2, Chapter VI.

The alternative reach engineering plans presented here and in Volume 2, Chapter VI, and the reach specific priority engineering projects recommended below, comprise the comprehensive plan (Phase I) of the State's Shore Protection Program. Overall the Program includes four phases:

Phase I — Comprehensive State-wide Plan
Phase II — Individual Reach Design
Phase III — Local Government Coordination
Phase IV — Reach Construction

A summary of the estimated costs of the alternatives for the oceanfront reaches (Reaches 2 through 14) is provided in Table II.B-2. Detailed cost estimates are developed in Volume 2, Chapter VI. Specific reach-wide costs have not been prepared for Raritan Bay, Delaware Bay, or Delaware River (Reaches 1, 15, and 16) or for inlet, backbay, or tidal tributary shores. Erosion problems and operative coastal processes tend to be more localized along these reaches. The lower energy environment also allows for a relaxing of the requirement for strict reach-wide planning, as applicable on oceanfront reaches. The best shoreline protection approach for these areas is the planning and execution of local cost-effective projects in response to specific needs. Full consideration of low-cost erosion control measures is also appropriate. Projects following this approach have been planned by both the Corps of Engineers and the State; such projects are consistent with this Master Plan provided that their economic feasibility can be demonstrated. Recent Corps studies (USACOE, Philadelphia District, 1978) developed plans for erosion damage centers along the Delaware Bay shore, but they were found to be economically unjustified and therefore inconsistent with this Master Plan. Projects currently under consideration in this area by the State are presented along with their costs in Volume 2, Chapter VI. A similar discussion of problems, projects, and costs for other areas — including inlets, backbays, and tributary waterways — is also provided in Volume 2, Chapter VI.

TABLE II.B-1

SUMMARY OF ALTERNATIVE ENGINEERING PLANS

Reach	(1) Storm Erosion Protection	(2) Recreational Development	(3) Combination Program	(4) Limited Restoration	(5) Maintenance
1) Raritan Bay	o Local projects along the reach to be designed on a case by case basis. Projects can be large enough to consider beach fill. Smaller projects would consist of structural approaches such as groins, etc.	o Maintenance of existing recreational beaches plus limited recreational development. Evaluations to be done on a case by case basis	o Local projects developed on a case by case basis	o Storm erosion protection design controls on a case by case basis	o Maintenance of existing functional structures o Post storm berm repair
2) Sandy Hook to Long Branch	o 900' seawall extension o Beach nourishment at 10 year intervals o Maintenance of existing functional structures	o Recreational beach on about 1/3 of reach o Periodic berm expansion for recreational demand o Beach nourishment at 10 year intervals o Groin construction and modification o Maintenance of existing functional structures	o Simple combination of Alternatives 1 and 2	o Maintenance of existing functional structures o Beach nourishment at 10 year intervals	o Maintenance of existing functional structures o Post-storm berm repair
3) Long Branch to Shark River Inlet	o 75' berm at North Long Branch and south of Deal o Bulkhead additions in central part of reach o Beach nourishment at 5 year intervals o Maintenance of existing functional structures o Groin construction/ modifications	o No initial beach fill is required o Periodic berm expansion for recreational demand o Beach nourishment at 5 year intervals o Maintenance of existing functional structures o Groin modifications	o Initial beach fill for storm protection requirements o Beach nourishment at 5 year intervals o Bulkhead additions in central third of reach o Periodic berm expansion o Groin modifications o Maintenance of existing functional structures	o Initial beach fill at north and south thirds of reach to 75' berm o Beach nourishment at 5 year intervals o Groin modifications o Maintenance of existing functional structures	o Maintenance of existing functional structures o Post storm berm repair
4) Shark River Inlet to Manasquan Inlet	o 75' berm along entire reach o Beach nourishment at 5 year intervals o Maintenance of existing functional structures o Groin modifications	o Existing beach if maintained will satisfy the recreational demand throughout the entire planning period o Beach nourishment at 5 year intervals o Maintenance of existing functional structures o Groin modifications	o Initial fill to storm protection design o Beach nourishment at 5 year intervals o Maintenance of existing functional structures o Groin modifications	o Initial fill to storm protection design o Beach nourishment at 5 year intervals o Maintenance of existing functional structures o Groin modifications	o Maintenance of existing functional structures o Post-storm berm repair

TABLE II.B-1 (Continued)

Reach	(1) Storm Erosion Protection	(2) Recreational Development	(3) Combination Program	(4) Limited Restoration	(5) Maintenance
5) Manasquan Inlet to Mantoloking	o 75' berm along the groin-protected area and 100' berm elsewhere o Beach nourishment at 10 year intervals o Maintenance of existing functional structures o Dune maintenance	o Existing beach if maintained will satisfy the recreational demand throughout the entire planning period o Beach nourishment at 10 year intervals o Maintenance of existing functional structures o Dune maintenance	o Storm erosion protection alternative design applies here	o Beach fill to 75' at Bayhead o Beach nourishment at 10 year intervals o Maintenance of existing functional structures o Dune maintenance	o Maintenance of existing functional structures o Dune maintenance o Post storm berm repair
6) Mantoloking to Barnegat Inlet	o 75' berm along the groin-protected area and 100' berm elsewhere o Beach nourishment at 7 year intervals o Maintenance of existing functional structures o Dune maintenance	o Existing beach if maintained will satisfy the recreational demand throughout the entire planning period o Beach nourishment at 7 year intervals o Maintenance of existing functional structures o Dune maintenance	o Storm erosion protection alternative design applies here	o Beach fill to 75' at Lavalette o Beach nourishment at 7 year intervals o Maintenance of existing functional structures o Dune maintenance	o Maintenance of existing functional structures o Dune maintenance o Post storm berm repair
7) Long Beach Island	o 75' berm along the entire length of the reach o Beach nourishment at 8 year intervals o Dune maintenance o Maintenance of existing functional structures	o Existing beach if maintained will satisfy the recreational demand throughout the entire planning period o Beach nourishment at 8 year intervals o Maintenance of existing functional structures o Dune maintenance	o Initial fill for storm erosion protection. Storm berm satisfies recreation demand to 2030 o Beach nourishment at 8 year intervals o Maintenance of existing functional structures o Dune maintenance	o Beach fill to 75' berm width at Long Beach Twp. (Holgate) o Beach nourishment at 8 year intervals o Maintenance of existing functional structures o Dune maintenance	o Maintenance of existing functional structures o Dune maintenance o Post storm berm repair
8) Brigantine Island	o 75' berm along the developed northern groin protected area and 100' berm for the southern portion of the reach 10 year intervals o Beach nourishment at o Dune maintenance	o Existing beach if maintained will satisfy the recreational demand through the entire planning period o Maintenance of existing functional structures o Maintenance of existing functional structures o Dune maintenance	o Initial fill for storm erosion protection. This berm width more than satisfies recreational demand to 2030 o Beach nourishment at 10 year intervals o Maintenance of existing functional structures o Dune maintenance	o Beach fill to 75' berm width at northern half of developed section o Beach nourishment at o Beach nourishment at 10 year intervals functional structures o Dune maintenance	o Maintenance of existing functional structures o Dune maintenance o Post storm berm repair 10 year intervals o Maintenance of existing
9) Absecon Island	o 75' berm in groin field at northern end of island, 100' berm elsewhere o Beach nourishment at 3 year intervals o Maintenance of existing functional structures	o Initial fill to 400' recreational berm width in Atlantic City; tapered to 150' at Jackson Street; 150' elsewhere o Beach nourishment at 3 year intervals o Maintenance of existing functional structures	o Recreational development alternative design applies here	o Beach fill to 100' berm width at Longport o Beach nourishment at 3 year interval o Maintenance of existing functional structures	o Maintenance of existing functional structures o Post storm berm repair

TABLE II.B-1 (Continued)

Reach	(1) Storm Erosion Protection	(2) Recreational Development	(3) Combination Program	(4) Limited Restoration	(5) Maintenance
10) Peck Beach	o Initial fill to 75' width in northern groin field, 100' width elsewhere o Beach nourishment at 5 year intervals o Maintenance of existing functional structures o Dune maintenance o Groin construction/modification	o Initial fill for recreational beach at northern end of island o Periodic berm expansion o Beach nourishment at 5 year intervals o Maintenance of existing functional structures o Dune maintenance	o Initial fill for storm protection design o Periodic beach expansions for recreation at northern public access area o Beach nourishment at 5 year intervals o Maintenance of existing functional structures o Dune maintenance	o Initial fill to storm berm design at northern portion of island o Beach nourishment at o Periodic berm expansion at o Maintenance of existing functional structures o Dune maintenance	o Maintenance of existing functional structures o Dune maintenance o Post storm berm repair 5 year intervals
11) Ludlam Island	o Initial fill to 75' width in the Sea Isle City groin field with 100' width elsewhere o Groin field extension to south end of island o Beach nourishment at 3 year intervals o Maintenance of existing functional structures o Dune maintenance	o Existing beach if maintained will satisfy the recreational demand through the entire entire planning period o Beach nourishment at 3 year intervals o Dune maintenance o Maintenance of existing functional structures	o Initial fill for storm protection design o Beach nourishment at 3 year intervals o Dune maintenance o Maintenance of existing functional structures	o Initial fill to storm protection design for Strathmere and northern portion of Sea Isle City o Beach nourishment at 3 year intervals o Dune maintenance o Maintenance of existing functional structures	o Maintenance of existing functional structures o Dune maintenance o Post storm berm repair
12) Seven Mile Beach	o Initial fill to 75' in Stone Harbor groin field, 100' width elsewhere o Beach nourishment at 10 year intervals o Maintenance of existing functional structures o Dune maintenance	o No initial fill is required o Periodic berm expansion o Beach nourishment at 10 year intervals o Maintenance of existing functional structures o Dune maintenance	o Initial fill to storm protection design o Beach nourishment at 10 year intervals o Maintenance of existing functional structures o Dune maintenance	o Initial fill to 75' wide berm in Stone Harbor groin field o Beach nourishment at 10 year intervals o Maintenance of existing functional structures o Dune maintenance	o Maintenance of existing functional structures o Dune maintenance o Post storm berm repair
13) Five Mile Beach	o Initial fill to minimum of 100' berm width o Beach nourishment at the end of the 50 year period o Maintenance of existing functional structures o Dune maintenance	o Existing beach if maintained will satisfy the recreational demand throughout the entire planning period o Beach nourishment at the end of the 50 year period o Maintenance of existing functional structures o Dune maintenance	o Initial fill for storm protection design o Beach nourishment at the end of the 50 year period o Maintenance of existing functional structures o Dune maintenance	o Initial fill to 100' wide berm at Wildwood Crest area o Beach nourishment at the end of the 50 year period o Maintenance of existing functional structures o Dune maintenance	o Maintenance of existing functional structures o Dune maintenance o Post storm berm repair

TABLE II.B-1 (Continued)

Reach	(1) Storm Erosion Protection	(2) Recreational Development	(3) Combination Program	(4) Limited Restoration	(5) Maintenance
14) Cape May Inlet to Cape May Point	o 75' berm width at Cape May City and Cape May Point groin fields, 100' berm width elsewhere o Modification of structures in Lower Township and at northern portion of the reach to stabilize beach by equilibrium crenulate-shaped bays o Beach nourishment at 3 year intervals o Maintenance of existing functional structures o Dune maintenance	o Initial fill for recreational beach at Cape May City and Cape May Point o Periodic berm expansion o Beach nourishment at 3 year intervals o Maintenance of existing functional structures o Dune maintenance o Modification of structures in Lower Township and at northern portion of the reach to stabilize beach	o Storm erosion protection alternative design applies here	o Initial fill to 75' berm width Cape May City and Cape May Point groin fields o Beach nourishment at 3 year intervals o Maintenance of existing functional structures o Dune maintenance o Modification of structures in Lower Township and at northern portion of the reach to stabilize beach	o Maintenance of existing functional structures o Dune maintenance o Post storm berm repair
15) and 16) Delaware Bay and River	o Local projects to be designed on a case by case basis. Projects predominantly of a structural nature (bulkheading, etc.)	o Insufficient demand to justify any actions to develop recreational beach area any time during the planning period	o Storm erosion protection program controls on a case by case basis as justified	o Engineering programs on a case by case basis as justified	o Maintenance of existing functional structures on a case by case basis as justified
Backbay and Tributary Waterway Shores	o Local projects to be designed on a case by case basis. Projects predominantly of a structural nature (bulkheading, etc.)	o Insufficient demand to justify any actions to develop recreational beach area any time during the planning period	o Storm erosion protection program controls on a case by case basis as justified	o Engineering programs on a case by case basis as justified	o Maintenance of existing functional structures on a case by case basis as justified
Inlets	o Projects predominantly of a structural nature such as jetty construction, revetment and bulkhead construction, and groin stabilization of inlet shores, to be designed on a case by case basis for the following inlets: Shark River, Barnegat, Absecon, Great Egg Harbor, Townsends, and Hereford o Maintenance of the existing functional inlet structures on a case by case basis as justified o For the following inlets, no action is proposed and shores will be left in their natural state. They include Beach Haven, Little Egg, and Brigantine Inlets	o None	o None	o Maintenance program controls	o Maintenance of existing functional inlet structures on a case by case basis as justified o For the following inlets, no action is proposed and shores will be left in their natural state. They include Beach Haven, Little Egg, and Brigantine Inlets

TABLE II.B-2

SUMMARY OF ESTIMATED COST FOR

ALTERNATIVE ENGINEERING PLANS FOR OCEANFRONT REACHES

Reach No.	Reach Name	Alternatives*	Estimated** Total Present Worth Cost (in million dollars)	Initial Cost** (in million dollars)	Annual Cost (in million dollars)
2	Sandy Hook to Long Branch	(1)	10.402	5.509	0.446
		(2)	23.689	15.912	0.386
		(3)	26.187	17.712	0.449
		(4)	8.578	3.709	0.444
		(5)	4.482	3.709	0.071
3	Long Branch to Shark River Inlet	(1)	41.272	32.399	0.810
		(2)	21.495	11.270	0.933
		(3)	40.232	31.010	0.841
		(4)	28.837	19.891	0.816
		(5)	11.883	11.170	0.065
4	Shark River Inlet to Manasquan Inlet	(1)	29.876	20.286	0.875
		(2)	13.164	3.574	0.875
		(3)	29.876	20.286	0.875
		(4)	29.876	20.286	0.875
		(5)	3.598	3.424	0.016
5	Manasquan Inlet to Mantoloking	(1)	12.401	8.658	0.341
		(2)	4.271	0.528	0.341
		(3)	12.401	8.658	0.341
		(4)	7.357	3.614	0.341
		(5)	0.602	0.528	0.007
6	Mantoloking to Barnegat Inlet	(1)	21.750	14.588	0.653
		(2)	7.870	0.708	0.653
		(3)	21.750	14.588	0.653
		(4)	12.725	5.563	0.653
		(5)	0.944	0.708	0.021
7	Long Beach Island	(1)	28.496	20.813	0.701
		(2)	11.321	3.638	0.701
		(3)	28.496	20.813	0.701
		(4)	14.153	6.470	0.701
		(5)	5.149	3.638	0.138
8	Brigantine Island	(1)	13.297	9.373	0.358
		(2)	4.649	0.702	0.360
		(3)	13.297	9.373	0.358
		(4)	12.308	8.384	0.358
		(5)	0.980	0.702	0.025
9	Absecon Island	(1)	25.279	8.044	1.572
		(2)	28.741	11.506	1.572
		(3)	28.741	11.506	1.572
		(4)	23.018	5.687	1.581
		(5)	3.487	3.302	0.017
10	Peck Beach	(1)	30.708	19.523	1.020
		(2)	17.573	3.447	1.289
		(3)	30.504	17.203	1.213
		(4)	21.617	10.368	1.026
		(5)	1.007	0.653	0.032
11	Ludlam Island	(1)	42.409	22.248	1.839
		(2)	20.687	0.501	1.841
		(3)	42.409	22.248	1.839
		(4)	28.511	8.381	1.836
		(5)	0.795	0.501	0.027
12	Seven Mile Beach	(1)	18.724	14.402	0.394
		(2)	7.711	0.700	0.640
		(3)	18.724	14.402	0.394
		(4)	12.963	8.641	0.394
		(5)	0.959	0.700	0.024
13	Five Mile Beach	(1)	4.150	3.945	0.019
		(2)	0.973	0.752	0.020
		(3)	4.150	3.945	0.019
		(4)	3.244	3.039	0.019
		(5)	0.911	0.752	0.014
14	Cape May Inlet to Cape May Point	(1)	35.837	15.888	1.820
		(2)	31.740	9.808	1.820
		(3)	35.837	15.888	1.820
		(4)	34.263	14.314	1.820
		(5)	1.497	1.004	0.045

*Alternative engineering plans are: (1) Storm Erosion Protection; (2) Recreational Development; (3) Combination of Storm Protection and Recreational Development; (4) Limited Restoration; and (5) Maintenance Program.

**Cost estimate details are provided for all alternatives in Volume 2, Chapter VI.

d. Priority Analysis of Alternative Engineering Plans

(1) Summary of Methodology. Three primary factors were considered in the selection of priority engineering projects:

- o The relative ranking of reach alternative plans based on the non-incremental benefit-to-cost ratios.
- o Total costs.
- o Existing maintenance commitments to completed Federal projects.

The benefit-to-cost ratio for a given alternative was derived from four input parameters – engineering costs, public service costs, recreational benefits, and property protection benefits. For each reach, this ratio was computed for the five engineering plans.

All costs and benefits are expressed in present worth values with a rate of return of 9 percent for the 50-year planning period. A present worth value accounts for the effect of time on a future economic activity. The time value of money (opportunity to use funds during the intervening period in an alternative manner) is recognized. The future benefits or costs are converted to equivalent present day dollars by discounting at a given rate of return. The priority analysis used the net present worth approach as opposed to an average annualized value approach. It was felt that the net present worth approach was more applicable to the uneven temporal distribution of the benefits and costs observed in this analysis (i.e., low annual benefits occur early in the planning period, and large annual benefits occur later in the planning period).

(2) Cost-Benefit Analysis for Alternative Reach Plans. The cost-benefit analysis involves determination of a non-incremental benefit-to-cost ratio for each of the five alternative engineering plans for each of the oceanfront reaches. Figure II.B-3 illustrates the procedures involved. A brief explanation of the four input parameters is presented below; a more detailed discussion is provided in Volume 2, Chapter VII. The costs and benefits for each oceanfront reach alternative are summarized in Table II.B-3.

(a) Engineering Costs. Engineering costs are expressed in present worth values, including component costs pertaining to each alternative plan. Typical items are initial beach fill, periodic berm width expansion, beach nourishment and structural maintenance. These components are required to achieve a specific level of protection or development throughout the project design life.

(b) Public Service Costs. Public service costs are an estimate of the demands generated by beach users on a local area for recreation-related services (lifeguards, beach maintenance, etc.) and for additional infrastructure capacity. This estimate was computed on a per capita basis to take into account the additional public services costs that would be incurred by the communities within a reach as a result of the additional beach users anticipated. The total cost was calculated in present value dollars to be comparable to other costs and benefits. The per capita public service cost was estimated to be $1.00 per beach user.

(c) Recreational Benefits. Recreational benefits, expressed in present worth values, represent the benefits from an increase in visitors to the beach as a result of additional beach areas being provided for recreational use. The recreational benefit was estimated using a unit opportunity cost figure of $2.00 per additional beach user accommodated.

FIGURE II.B-3

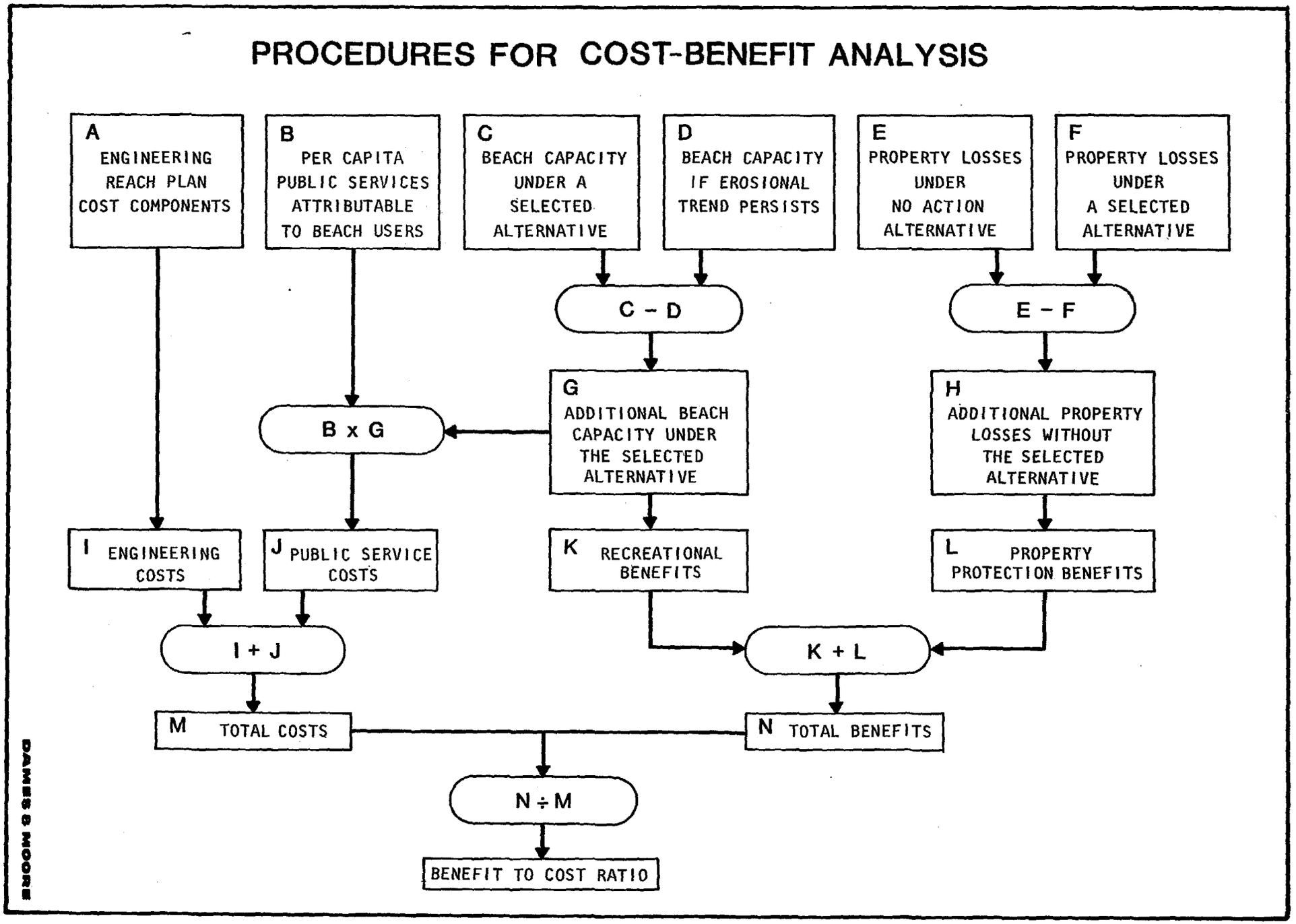

PROCEDURES FOR COST-BENEFIT ANALYSIS
A ENGINEERING REACH PLAN COST COMPONENTS
B PER CAPITA PUBLIC SERVICES ATTRIBUTABLE TO BEACH USERS
C BEACH CAPACITY UNDER A SELECTED ALTERNATIVE
D BEACH CAPACITY IF EROSIONAL TREND PERSISTS
E PROPERTY LOSSES UNDER NO ACTION ALTERNATIVE
F PROPERTY LOSSES UNDER A SELECTED ALTERNATIVE
C - D
E - F
G ADDITIONAL BEACH CAPACITY UNDER THE SELECTED ALTERNATIVE
H ADDITIONAL PROPERTY LOSSES WITHOUT THE SELECTED ALTERNATIVE
B x G
I ENGINEERING COSTS
J PUBLIC SERVICE COSTS
K RECREATIONAL BENEFITS
L PROPERTY PROTECTION BENEFITS
I + J
K + L
M TOTAL COSTS
N TOTAL BENEFITS
N ÷ M
BENEFIT TO COST RATIO
DAMES & MOORE

TABLE II.B-3

COST-BENEFIT ANALYSIS FOR OCEANFRONT REACHES (2-14)[a]

Reach No.	Reach Name	Erosion Control Alternatives[b]	Engineering Cost (in million dollars)	Public Service Cost (in million dollars)	Recreational Benefits (in million dollars)	Property Protection (in million dollars)	Benefit/ Cost Ratio	Relative[c] Rank
2	Sandy Hook to Long Branch	(1)	10.402	5.081	10.163	7.280	1.13	13
		(2)	23.689	9.709	19.418	7.209	0.80	18
		(3)	26.187	9.709	19.418	7.280	0.74	22
		(4)	8.578	5.081	10.163	7.209	1.27	9
		(5)	4.482	0	0	6.755	1.51	3
3	Long Branch to Shark River Inlet	(1)	41.272	10.384	20.769	4.383	0.49	30
		(2)	21.495	4.140	8.280	4.360	0.49	29
		(3)	40.232	10.477	20.954	4.383	0.50	27
		(4)	28.837	6.932	13.864	4.383	0.51	26
		(5)	11.883	0	0	1.579	0.13	43
4	Shark River Inlet to Manasquan Inlet	(1)	29.876	7.502	15.004	2.481	0.47	32
		(2)	13.164	5.234	10.468	2.479	0.70	23
		(3)	29.876	7.502	15.004	2.487	0.47	32
		(4)	29.876	7.502	15.004	2.487	0.47	32
		(5)	3.598	0	0	0.566	0.16	41
5	Manasquan Inlet to Mantoloking	(1)	12.401	0.374	0.749	2.161	0.23	39
		(2)	4.271	0.374	0.749	2.161	0.63	25
		(3)	12.401	0.374	0.749	2.161	0.23	39
		(4)	7.357	0.374	0.749	2.161	0.38	35
		(5)	0.602	0	0	0.050	0.08	47
6	Mantoloking to Barnegat Inlet	(1)	21.750	0.203	0.406	2.704	0.14	42
		(2)	7.870	0.203	0.406	2.697	0.38	36
		(3)	21.750	0.203	0.406	2.704	0.14	42
		(4)	12.725	0.203	0.406	2.697	0.24	37
		(5)	0.944	0	0	0.100	0.10	44
7	Long Beach Island	(1)	28.496	4.306	8.612	6.894	0.47	31
		(2)	11.321	3.905	7.810	6.894	0.96	15
		(3)	28.496	4.306	8.612	6.894	0.47	31
		(4)	14.153	4.047	8.094	6.894	0.82	17
		(5)	5.149	0	0	1.183	0.23	38
8	Brigantine Island	(1)	13.297	0.257	0.515	0.352	0.06	49
		(2)	4.649	0.257	0.515	0.352	0.17	40
		(3)	13.297	0.257	0.515	0.352	0.06	49
		(4)	12.308	0.257	0.515	0.352	0.07	48
		(5)	0.980	0	0	0.035	0.04	50
9	Absecon Island	(1)	25.279	50.456	100.911	2.328	1.36	8
		(2)	28.741	71.165	142.330	2.328	1.45	4
		(3)	28.741	71.165	142.330	2.328	1.45	4
		(4)	23.018	26.698	53.397	2.328	1.12	14
		(5)	3.487	0	0	0	0	54
10	Peck Beach	(1)	30.708	43.898	87.696	17.925	1.41	6
		(2)	17.573	42.431	84.861	17.198	1.70	1
		(3)	30.504	43.867	87.734	17.925	1.42	5
		(4)	21.617	43.184	86.367	17.193	1.60	2
		(5)	1.007	0	0	1.187	1.18	11
11	Ludlam Island	(1)	42.409	8.460	16.921	8.584	0.50	28
		(2)	20.687	8.460	16.921	8.584	0.88	16
		(3)	42.409	8.460	16.921	8.584	0.50	28
		(4)	28.511	8.460	16.921	8.584	0.69	24
		(5)	0.795	0	0	0.349	0.44	33
12	Seven Mile Beach	(1)	18.724	24.448	48.896	0.514	1.14	12
		(2)	7.711	16.097	32.193	0.402	1.37	7
		(3)	18.724	24.448	48.896	0.514	1.14	12
		(4)	12.963	21.974	43.949	0.402	1.27	10
		(5)	0.959	0	0	0.092	0.10	45
13	Five Mile Beach	(1)	4.150	0.052	0.103	0	0.02	52
		(2)	0.973	0.052	0.103	0	0.10	46
		(3)	4.150	0.052	0.103	0	0.02	52
		(4)	3.244	0.052	0.103	0	0.03	51
		(5)	0.911	0	0	0	0	53
14	Cape May Inlet to Cape May Point	(1)	35.837	22.196	44.393	0.754	0.78	21
		(2)	31.740	20.324	40.648	0.754	0.80	19
		(3)	35.837	22.196	44.393	0.754	0.78	21
		(4)	34.263	22.196	44.393	0.754	0.80	20
		(5)	1.497	0	0	0.571	0.38	34

Note: See text for cost-benefit methodology discussion.

(a) All estimated costs and benefits are expressed in present worth values.

(b) Alternative engineering plans are: (1) Storm Erosion Protection; (2) Recreational Development; (3) Combination of Storm Protection and Recreational Development; (4) Limited Restoration; and (5) Maintenance Program

(c) For alternatives with identical benefit/cost ratios, the one with the lower total cost was given priority over the others.

(d) Property Protection Benefits. Property protection benefits, expressed in present worth values, represent the benefits achieved under an engineering alternative plan in prevention of property loss associated with storm erosion and long-term erosional damages. The benefits credited to an engineering plan include the values of probable losses to commercial and residential lands and structures (including commercial and residential buildings, boardwalks, roads, and utilities) that could occur if no action is taken. The present worth property protection benefits are derived from cognizance of the capability of a beach area to retard the occurrence of erosional and storm damages. Since the beach area forms the first line of protection against erosion, damages would occur earlier in the property zone areas fronted by a narrow beach than in those areas protected by a wide beach.

2. Adopted Engineering Plans.

a. Adopted Priority List for the Ocean Shore

Priority recommendation for reach engineering projects is primarily dependent on the benefit-to-cost (B/C) ratios. Component present worth costs and benefits for the alternative engineering plans for oceanfront reaches are presented in Table II.B-3. Table II.B-4 shows the relative ranking for all five engineering alternatives in the 13 oceanfront reaches. Engineering projects which are the most cost beneficial in each reach are presented in ranked order in Table II.B-5.

From Table II.B-5, those altenative projects which are clearly the most cost beneficial include:

- Peck Beach, Recreational (1.70 B/C ratio)
- Sandy Hook to Long Branch, Maintenance (1.51 B/C ratio)
- Absecon Island, Recreational (1.44 B/C ratio)
- Seven Mile Beach, Recreational (1.37 B/C ratio).

A reach project that was marginally cost beneficial was:

- Long Beach Island, Recreational (0.96 B/C ratio)

The remaining reach projects are not clearly cost beneficial.

In setting priorities, consideration was also given to maintenance of completed Federal projects. State and local governments have executed assurances that the completed Federal projects will be maintained throughout their 50-year economic lives. Honoring of these contractual assurances is essential to prevent forfeiture of future Federal funds for water resources projects. The completed Federal projects are located in the Keansburg area along the Raritan Bayshore (Reach 1), in Long Beach Island (Reach 7), and on Absecon Island (Reach 9).

One of the advantages of Federal participation in shore protection projects is that the Corps can restore the beach to project levels if it is destroyed by a major storm. This added "insurance" would apply to the completed Federal Long Beach Island and Atlantic City projects only if the State maintains those projects. Since the proposed Master Plan alternatives for Long Beach Island and Absecon Island (Atlantic City) would provide for the required maintenance necessary to satisfy the Corps agreements for these projects, the added "insurance" provided by this plan is an additional "benefit." Thus, based on this consideration, the Long Beach Island recreational

TABLE II.B-4

RELATIVE RANKING OF REACH ENGINEERING PROJECTS BY BENEFIT/COST RATIO ALL REACH ENGINEERING ALTERNATIVES FOR OCEANFRONT REACHES

Relative Rank	Reach and Alternative**	Benefits* Cost Ratio
1	Peck Beach (10) - Recreational Development	1.70
2	Peck Beach (10) - Limited Restoration	1.60
3	Sandy Hook to Long Branch (2) - Maintenance Program	1.51
4	Absecon Island (9) - Recreational Development or Combination Alternative	1.45
5	Peck Beach (10) - Storm Erosion Protection	1.41
6	Peck Beach (10) - Combination Alternative	1.42
7	Seven Mile Beach (12) - Recreational Development	1.37
8	Absecon Island (9) - Storm Erosion Protection	1.36
9	Sandy Hook to Long Branch (2) - Limited Program	1.27
10	Seven Mile Beach (12) - Limited Restoration	1.27
11	Peck Beach (10) - Maintenance Program	1.18
12	Seven Mile Beach (12) - Storm Erosion Protection or Combination Alternative	1.14
13	Sandy Hook to Long Branch (2) - Storm Erosion Protection	1.13
14	Absecon Island (9) - Limited Restoration	1.12
15	Long Beach Island (7) - Recreational Development	0.96
16	Ludlam Island (11) - Recreational Development	0.88
17	Long Beach Island (7) - Limited Restoration	0.82
18	Sandy Hook to Long Branch (2) - Recreational Development	0.80
19	Cape May Inlet to Cape May Point (14) - Recreational Development	0.80
20	Cape May Inlet to Cape May Point (14) - Limited Restoration	0.80
21	Cape May Inlet to Cape May Point (14) - Storm Erosion Protection or Combination Alternative	0.78
22	Sandy Hook to Long Beach (2) - Combination Alternative	0.74
23	Shark River Manasquan Inlet (2) - Recreational Development	0.70
24	Ludlam Island (11) - Limited Restoration	0.69
25	Manasquan Inlet to Mantoloking (5) - Recreational Development	0.63
26	Long Branch to Shark River Inlet (3) - Limited Restoration	0.51
27	Long Branch to Shark River Inlet (3) - Combination Alternative	0.50
28	Ludlam Island (11) - Storm Erosion Protection or Combination Alternative	0.50
29	Long Branch to Shark River Inlet (3) - Recreational Development	0.49
30	Long Branch to Shark River Inlet (3) - Storm Erosion Protection	0.49
31	Long Beach Island (7) - Storm Erosion Protection or Combination Alternative	0.47
32	Shark River Inlet to Manasquan Inlet (4) - Storm Erosion Protection or Combination or Limited Restoration	0.47
33	Ludlam Island (11) - Maintenance Program	0.44
34	Cape May Inlet to Cape May Point (14) - Maintenance Program	0.38
35	Manasquan Inlet to Mantoloking (5) - Limited Restoration	0.38
36	Mantoloking to Barnegat Inlet (6) - Recreational Development	0.38
37	Mantoloking to Barnegat Inlet (6) - Limited Restoration	0.24
38	Long Beach Island (7) - Maintenance Program	0.23
39	Manasquan Inlet to Mantoloking (5) - Storm Erosion Protection or Combination Alternative	0.23
40	Brigantine Island (8) - Recreational Development	0.17
41	Shark River Inlet to Manasquan Inlet (4) - Maintenance Program	0.16
42	Mantoloking to Barnegat Inlet (6) - Storm Erosion Protection or Combination Alternative	0.14
43	Long Beach to Shark River Inlet (3) - Maintenance Program	0.13
44	Mantoloking to Barnegat Inlet (6) - Maintenance Program	0.10
45	Seven Mile Beach (12) - Maintenance Program	0.10
46	Five Mile Beach (13) - Recreational Development	0.10
47	Manasquan Inlet to Mantoloking (5) - Maintenance Program	0.08
48	Brigantine Island (8) - Limited Restoration	0.07
49	Brigantine Island (8) - Storm Erosion Protection or Combination Alternative	0.06
50	Brigantine Island (8) - Maintenance Program	0.04
51	Five Mile Beach (13) - Limited Restoration	0.03
52	Five Mile Beach (13) - Storm Erosion Protection or Combination Alternative	0.02
53	Five Mile Beach (13) - Maintenance Program	0
54	Absecon Island (9) - Maintenance Program	0

Note:

* For alternatives with identical benefit/cost ratios, the one with the lower total present worth cost was given priority over the others.

** The number in parentheses refers to the reach number.

TABLE II.B-5

RELATIVE PRIORITY RANKING BY BENEFIT/COST RATIO
HIGHEST RANKING ENGINEERING ALTERNATIVE FOR EACH REACH

Reach No.	Reach/Alternative	Relative Rank	Benefit/ Cost Ratio	Initial Cost (in million dollars)	Estimated Total Present Worth Cost (in million dollars)
10	Peck Beach Recreational Development	1	1.70	3.447	17.573
2	Sandy Hook to Long Branch Maintenance Program	2	1.51	3.709	4.482
9	Absecon Island Recreational Development or Combination	3	1.45	11.506	28.741
12	Seven Mile Beach Recreational Development	4	1.37	0.700	7.711
7	Long Beach Island Recreational Development	5	0.96	3.638	11.321
11	Ludlam Island Recreational Development	6	0.88	0.501	20.687
14	Cape May to Cape May Point Recreational Development	7	0.80	9.808	31.740
4	Shark River Inlet to Manasquan Inlet Recreational Development	8	0.70	3.574	13.164
5	Manasquan Inlet to Mantoloking Recreational Development	9	0.63	0.528	4.271
3	Long Branch to Shark River Inlet Limited Restoration	10	0.51	19.891	28.837
6	Mantoloking to Barnegat Recreational Development	11	0.38	0.708	7.870
8	Brigantine Island Recreational Development	12	0.17	0.702	4.649
13	Five Mile Beach Recreational Development	13	0.10	0.752	0.973

Notes:

1. Each of the nonmaintenance alternatives may include maintenance as a component, e.g., the total cost for the Peck Beach recreational development alternative includes $1.007 million of maintenance plus $16.566 million of additional costs above and beyond maintenance, for a total cost of $17.573 million. Details of cost estimates for each reach alternative are presented in Volume 2, Chapter VI.
2. In reaches where two, preferred, non-maintenance alternatives had identical benefit/cost ratios, the lower total present value cost among the two alternatives was entered in the table.

alternative has been added to the list of clearly beneficial projects. The Absecon Island plan is economically justifiable on its own, and its implementation avoids the violation of the assurances given on this project.

Based on the considerations above, the recommended priority reach engineering plans are those listed in Table II.B-6.

TABLE II.B-6

PRIORITY ENGINEERING REACH PLANS FOR THE OCEAN SHORE

Reach No.	Reach Name	Alternative
10	Peck Beach	Recreational Development
2	Sandy Hook to Long Branch	Maintenance Program
9	Absecon Island	Recreational Development
12	Seven Mile Beach	Recreational Development
7	Long Beach Island	Recreational Development

Maintenance of the Federal Keansburg area project is not explicitly included in the recommended priority list. Provision is made for its implementation in that the Raritan Bay projects are recommended pending evaluation on a case-by-case basis. The preservation of future Federal funding and the storm restoration "benefit" tend to favor this project.

b. Preferred Reach Engineering Plans

The following sections summarize the engineering recommendations for each of the 16 shoreline reaches as well as for inlets, backbays, and other shore areas. For reaches where alternative reach engineering alternatives were not found to be economically justified, general recommendations for less-than-reach projects have been provided. A discussion of the most cost beneficial of the reach-level alternatives evaluated has also been provided for these reaches. The DEP will consider implementation of these plans with available funds in the order of relative priority ranking provided in Table II.B-4.

The individual plans summarized here are presented in detail in Volume 2, Chapter VI. The assumptions and criteria used in development of engineering plans are presented above in Section II.B.1.

(1) The Plan For Reach 1 — Raritan Bay. It is recommended that a general program including maintenance of functional structures and recreational beaches be followed along the Raritan Bay Shore. Case-by-case evaluation of local nonstructural and structural projects will consider both the local needs to be served and the overall economic feasibility of these projects. Special consideration will be given to Old Bridge Township, Keansburg, and Middletown Township beach areas. These areas have

completed Federal shore protection projects. Their continued maintenance would satisfy assurances executed by the State and local governments regarding upkeep and would prevent the forfeiture of future Federal cost sharing for similar projects elsewhere.

(2) The Plan For Reach 2 - Sandy Hook to Long Branch. It is recommended that a program of maintenance of existing functional shore protection structures be followed in this reach. The Maintenance Program would include initial structural repairs to the seawall and functional groins to bring these structures up to a uniform level of repair. The initial maintenance cost estimate provided in Table II.B-7 is for repairs to 16 groins and about 2300 feet of seawall. Subsequently a program of periodic maintenance of the seawall and existing groins would be undertaken throughout the economic life of the program to ensure their integrity. Repair of future severe storm erosion damage to beach berms is also recommended.

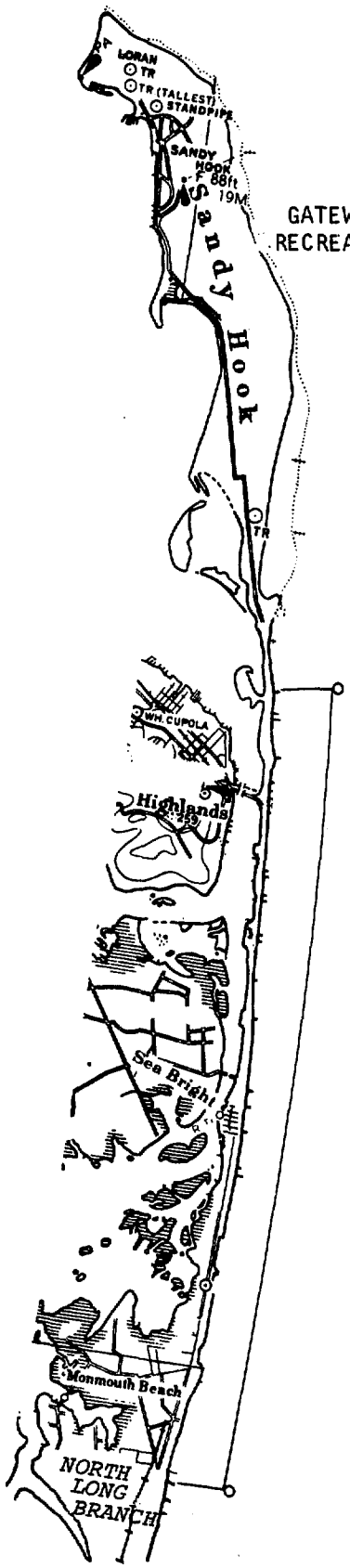
Initial structural repairs for Reach 2 are estimated to cost $3,709,000. The subsequent maintenance would average about $71,000 annually. No cost estimates are provided for the repair of storm damaged beaches because of the unpredictability of such occurrences. However, contingency funding would be made available to repair such damage when it occurs.

TABLE II.B-7

COST ESTIMATE SUMMARY
MAINTENANCE PROGRAM
REACH 2 - SANDY HOOK TO LONG BRANCH

Cost Components	Estimated Initial Costs	Estimated Present Worth Cost Totals
Initial Structural Maintenance		
o Repairs to 16 groins and 2300 L.F. of stone seawall	$ 3,709,000	$ 3,709,000
Maintenance of Existing Functional Structures		
o 24,250 L.F. of seawall		674,000
o 16 groins		99,000
TOTALS	$ 3,709,000	$ 4,482,000

The southern portion of Sandy Hook is critically eroding and there is an imminent threat of seawall failure and breaching of the island along the narrow neck of the Hook adjacent to Sea Bright. The plan for this reach does not provide a remedial engineering program for Sandy Hook because the area is Federally owned and under the administration of the National Park Service (see Figure II.B-4). The Maintenance Program recommended for Sea Bright and Monmouth Beach should not further aggravate the erosion problems at Sandy Hook.



REACH 2 - SANDY HOOK TO LONG BRANCH

NAUTICAL MILES

0 1 2 3

YARDS

1000 0 1000 2000 3000 4000

3000 0 3000 6000 9000 12000

FEET

RECOMMENDED PLAN

MAINTENANCE PROGRAM

MAINTENANCE OF THE EXISTING FUNCTIONAL STRUCTURES

DAMES & MOORE

FIGURE II.B-4

The recommended plan provides the badly needed repair and maintenance of the seawall. The program would keep the seawall in functional form during the planning period, but it is not a permanent solution. Without the provision of nourishment sands seaward of the wall, the offshore profile will continue to steepen. Localized failures of the wall during a future storm event are inevitable even with the maintenance provided under the recommended alternative. Analysis indicates that the wall will not be totally undermined during the 50-year planning period.

In the cost benefit analysis for the alternative engineering plans for Reach 2, three of the five alternatives evaluated were found to be clearly cost beneficial. The benefit/cost ratios (B/C ratio) and total present worth cost of these alternatives are as follows:

Maintenance Program	1.51	$4.5 million
Limited Restoration	1.27	$8.6 million
Storm Erosion Protection	1.13	$10.4 million

The Limited Restoration and Storm Erosion Protection alternatives include a provision for beach nourishment for stabilization of the erosion problem and the seawall deterioration. However, in accordance with the policy of implementing the most cost beneficial (highest priority) plan for each reach, the Maintenance Program is the preferred alternative for Reach 2. This also happens to be the lowest cost alternative for Reach 2.

Implementation of the Limited Restoration or Storm Erosion Protection alternatives would be more difficult for several key reasons.

- o The relative rank of these projects is substantially lower with respect to the priorities of all reach engineering plans (see Table II.B-4);
- o Since the total present worth cost of these alternatives is about double the cost of the Maintenance Program, the required local cost share would be twice as much; and
- o State and Federal policies allow cost sharing in beach restoration and improvement projects only where adequate public access is provided. Since the shorefront of Reach 2 municipalities of Seabright and Monmouth Beach are predominantly privately-owned and controlled, public access to most beaches is restricted. Unless current public access restriction are substantially reduced, State and Federal funding of the necessary beach nourishment programs would be unlikely.

Considering these factors and the fact that structural maintenance can be undertaken on a less-than-reach basis if necessary, the Maintenance Program is clearly the preferred alternative for Reach 2.

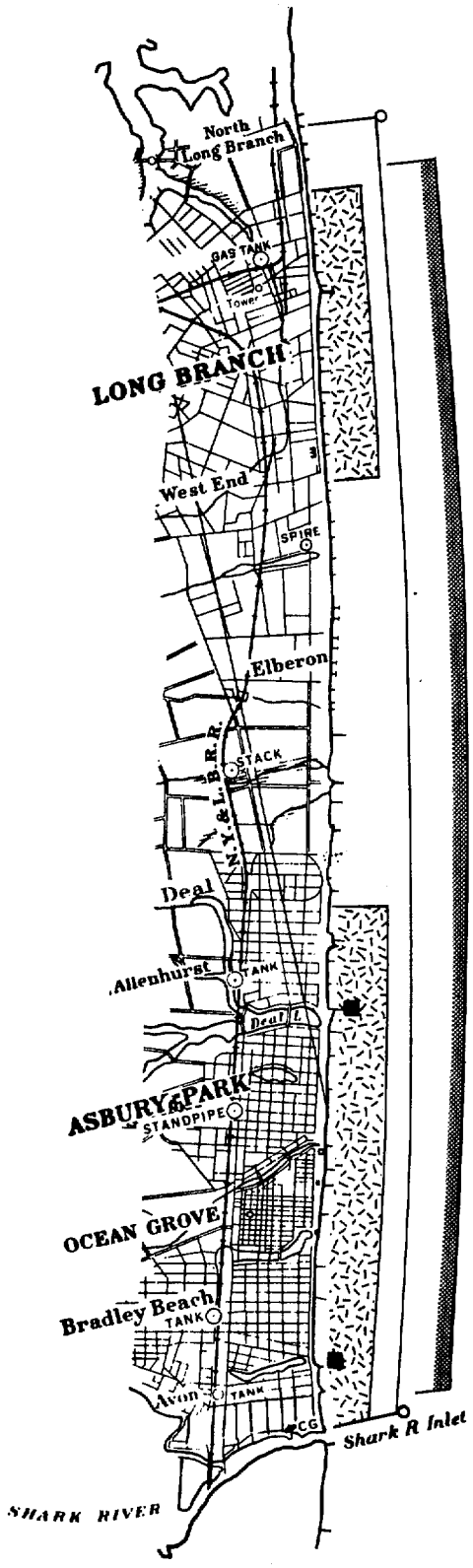
(3) The Plan For Reach 3 — Long Branch to Shark River Inlet. The priority analysis has shown that none of the reach-level engineering alternatives evaluated for Reach 3 are economically justifiable. Therefore, none of these engineering plans are recommended on a priority basis. It is, however, recommended that a limited program of maintenance and/or modification of existing functional shore protection structures be adopted to mitigate local erosion problems. Local projects are conditionally acceptable under this plan if they can be shown to adequately address the needs of the

area, they do not create adverse effects in adjacent shore areas, and can be shown to be economically feasible in case-by-case evaluations.

Modification of selected high profile groins which act as major littoral barriers would be appropriate to relieve local beach starvation effects. Consideration of sand bypassing across Shark River Inlet is also a possibility. However, this would provide only limited relief of beach erosion at the southern end of the reach. There is insufficient sand available for bypassing to adequately supply the entire reach. Consideration would also have to be given to potential adverse effects to the beach at Belmar, on the south side of the inlet.

Of the alternative reach engineering plans evaluated for Reach 3, the most cost beneficial plan was the Limited Restoration alternative. However, this alternative only has a benefit/cost ratio of 0.51. The components of the cost estimate and present worth cost totals are summarized in Table II.B-8. As illustrated in Figure II.B-5, the Limited Restoration alternative includes beach fills in public access areas in the northern and southern portions of the reach. Beach nourishment from offshore sources is provided at 5-year intervals for maintenance of beach width where required. The Limited Restoration plan also calls for notching, lowering, or otherwise modifying two groins (one located at the northern end of Avon (Sylvan Lake) and the other located south of Deal Lake) to relieve sand starvation effects on adjacent downdrift sand beaches. Initial maintenance of existing functional shore protection structures is provided to bring them up to a uniform level of repair throughout the reach. This work would include repair of 41 groins, approximately 4000 linear feet of timber bulkhead, and 450 linear feet of seawall. Periodic maintenance of all functional structures, including 64 groins, 1350 linear feet of shore seawall and more than 6000 linear feet of timber and steel bulkhead, is included to ensure their functional integrity throughout the economic life of the project.

The recommended minimum program of local maintenance and/or modification of existing functional shore protection structures on a case-by-case basis would be consistent with maintenance components of the Limited Restoration alternative for Reach 3.



N

REACH 3 - LONG BRANCH TO SHARK RIVER INLET

NAUTICAL MILES

0 1 2 3

YARDS

1000 0 1000 2000 3000 4000

3000 0 3000 6000 9000 12000

FEET

RECOMMENDED PLAN

MAINTENANCE AND/OR MODIFICATION OF EXISTING FUNCTIONAL STRUCTURES ON AN AS NEEDED, CASE-BY-CASE BASIS

MOST COST BENEFICIAL REACH ALTERNATIVE

LIMITED RESTORATION PROGRAM

MAINTENANCE OF THE EXISTING FUNCTIONAL STRUCTURES

PERIODIC BEACH NOURISHMENT

BEACH FILL TO A BERM WIDTH OF 75 FEET (BEACH WIDTH OF 215 FEET)

GROIN MODIFICATION

DAMES & MOORE

FIGURE II.B-5

TABLE II.B-8

COST ESTIMATE SUMMARY
LIMITED RESTORATION PROGRAM
REACH 3 - LONG BRANCH TO SHARK RIVER INLET

Cost Components	Estimated Initial Costs	Estimated Present Worth Cost Totals
Beach Fill		
o Beach fill in public access areas to 75' berm width (215' beach width) Initial fill: 1,192,000 cu. yd.	$ 8,621,000	$ 8,621,000
Beach Nourishment		
o 845,000 cu. yd. at 5-year intervals		8,430,000
Structural Modifications		
o Notching or lowering of 2 groins	100,000	100,000
Initial Structural Maintenance		
o Repairs to 41 groins, 4000 L.F. of timber bulkhead and 450 L.F. of seawall	11,170,000	11,170,000
Maintenance of Existing Functional Structures		
o 5700 L.F. of timber bulkhead in Long Branch		76,000
o 1350 L.F. of stone seawall in Deal		36,000
o 500 L.F. of steel bulkhead in Deal		7,000
o 64 groins		397,000
TOTALS	$ 19,891,000	$ 28,837,000

(4) The Plan For Reach 4 — Shark River Inlet to Manasquan Inlet. The priority analysis has shown that none of the reach-level engineering alternatives evaluated for Reach 4 are economically justifiable. Therefore, none of these engineering plans are recommended on a priority basis. It is, however, recommended that a limited program of maintenance and/or modification of shore protection structures be adopted to mitigate local erosion problems on an as needed basis. Local projects are conditionally acceptable under this plan if they can be shown to be cost effective in a case-by-case evaluation and that they will not create adverse effects in adjacent shore areas.

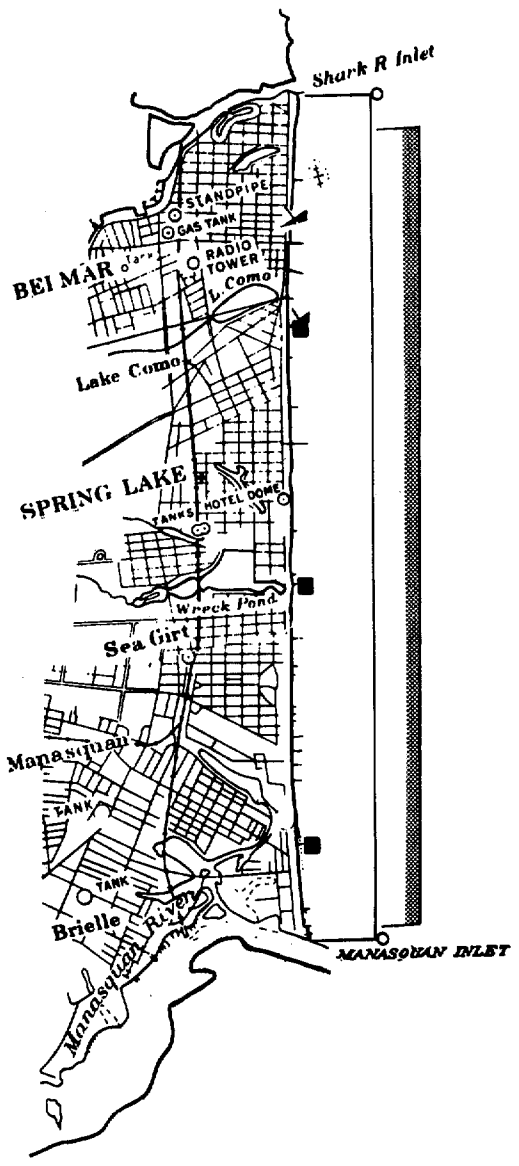
Modification of selected high profile groins, generally located at town limits, should be considered to mitigate local beach starvation effects. Consideration of sand bypassing across Manasquan Inlet is also a possibility. However, this would provide only limited relief of beach erosion at the southern end of the reach. There is insufficient sand available for bypassing to adequately supply the entire reach. Consideration would also have to be given to potential adverse effects to beaches south of the inlet. The Corps of Engineers, Philadelphia District is currently completing a detailed study of inlet bypassing alternatives at Manasquan Inlet. The results of that study were not available for inclusion in the Master Plan document.

Of the alternative engineering plans evaluated for Reach 4, the most cost beneficial plan was the Recreational Development alternative. This alternative has a benefit cost ratio of 0.70 and an estimated total present worth cost of about $13.2 million. The major components of the cost estimate for this alternative are provided in Table II.B-9. The alternative is illustrated schematically on Figure II.B-6.

TABLE II.B-9

COST ESTIMATE SUMMARY
RECREATIONAL DEVELOPMENT ALTERNATIVE
REACH 4 - SHARK RIVER INLET TO MANASQUAN INLET

Cost Components	Estimated Initial Costs	Estimated Present Worth Cost Totals
Beach Nourishment		
o 975,000 cu. yd. at 5-year intervals to maintain existing beach widths		$ 9,416,000
Structural Modification		
o Notching or lowering of 3 groins	$ 150,000	150,000
Initial Structural Maintenance		
o Repair to 23 groins	3,424,000	3,424,000
Maintenance of Existing Functional Structure		
o 28 groins		174,000
TOTALS	$ 3,574,000	$ 13,164,000



N

REACH 4 - SHARK RIVER INLET TO MANASQUAN INLET

NAUTICAL MILES

0 1 2 3

YARDS

1000 0 1000 2000 3000 4000

3000 0 3000 6000 9000 12000

FEET

RECOMMENDED PLAN

MAINTENANCE AND/OR MODIFICATION OF EXISTING FUNCTIONAL STRUCTURES ON AN AS NEEDED, CASE-BY-CASE BASIS

MOST COST BENEFICIAL REACH ALTERNATIVE

RECREATIONAL DEVELOPMENT

MAINTENANCE OF THE EXISTING FUNCTIONAL STRUCTURES

PERIODIC BEACH NOURISHMENT

GROIN MODIFICATION

DAMES & MOORE

FIGURE II.B-6

The present available beach area in Reach 4, if maintained, will meet the projected daily recreational beach use demands throughout the project life. Therefore, no initial beach fill would be required for this plan. The Recreational Development program includes beach nourishment at 5-year intervals from offshore sources to maintain the existing beach widths as required. The plan also calls for modification (i.e., notching or lowering) of three groins (located at the borough line of Sea Girt and Spring Lake (Brown Avenue), and at the northern end of Manasquan (south of Stockton Lake)), to relieve sand starvation effects on adjacent sand starved beaches. The plan provides for initial repair and periodic maintenance of existing functional groins.

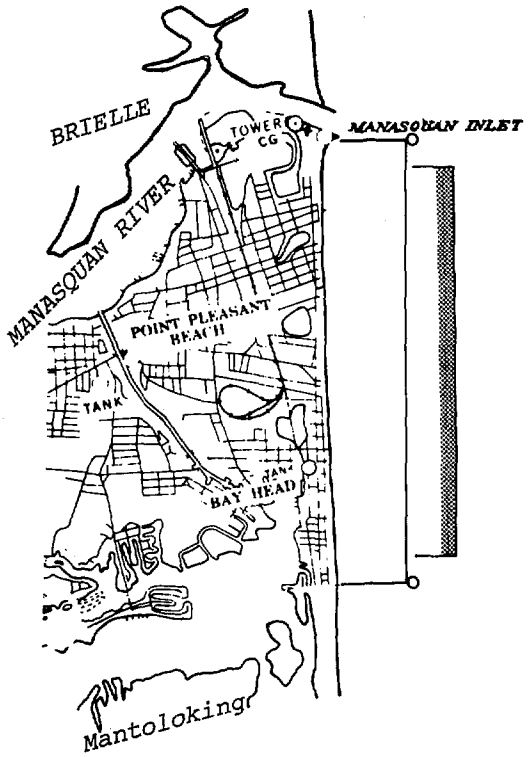
The recommended minimum program of structural maintenance and/or modification on an as needed basis would be consistent with the corresponding components of the Recreational Development alternative for Reach 4.

(5) The Plan For Reach 5 — Manasquan Inlet to Mantoloking. The priority analysis has shown that none of the reach-level engineering alternatives evaluated for Reach 5 are economically justifiable. Therefore, none of the these plans are recommended on a priority basis. It is, however, recommended that a program of local maintenance and/or modification of shore protection structures and dune maintenance be adopted to mitigate local erosion problems. Local projects are conditionally acceptable under this plan if they will not adversely affect adjacent shore areas and can be shown to be economically feasible in a case-by-case evaluation.

The Recreational Development program was found to be the most cost beneficial of the alternative reach engineering plans evaluated for Reach 5. This alternative has an estimated total present worth cost of $12.4 million; however, it only has a benefit/cost ratio of 0.63.

For Reach 5, the existing beach capacity, if maintained through periodic renourishment, will satisfy projected daily recreational beach use demand throughout the planning period. Therefore, no initial beach fill would be required under the Recreational Development plan. Periodic renourishment from offshore sand sources is recommended at 10-year intervals under the plan to maintain the existing beach widths as required. The Recreational Development alternative also includes initial structural repairs to two groins and placement of dune grass and sand fencing for dune maintenance. Periodic maintenance of existing functional groins and sand fencing are also provided. The components of the cost estimate for the Recreational Development plan are summarized in Figure II.B-7 and on Table II.B-10.

The minimum program of structural maintenance and/or modifications recommended for Reach 5 would be consistent with the maintenance component of the Recreational Development alternative.



REACH 5 - MANASQUAN INLET TO MANTOLOKING

NAUTICAL MILES

0 1 2 3

YARDS

1000 0 1000 2000 3000 4000

3000 0 3000 6000 9000 12000

FEET

RECOMMENDED PLAN

MAINTENANCE AND/OR MODIFICATION OF EXISTING FUNCTIONAL STRUCTURES ON AN AS NEEDED, CASE-BY-CASE BASIS

MOST COST BENEFICIAL REACH ALTERNATIVE

RECREATIONAL DEVELOPMENT

MAINTENANCE OF THE EXISTING FUNCTIONAL STRUCTURES AND DUNES

PERIODIC BEACH NOURISHMENT

DAMES & MOORE

FIGURE II.B-7

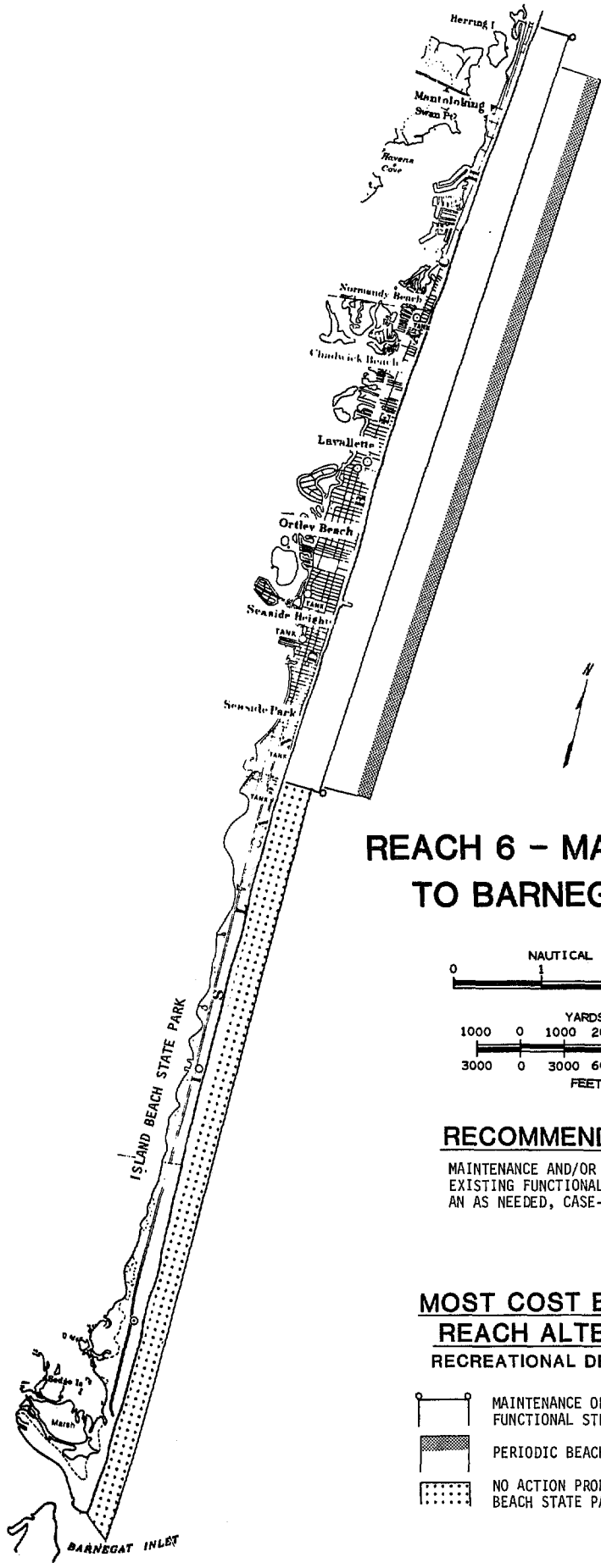
TABLE II.B-10

COST ESTIMATE SUMMARY
RECREATIONAL DEVELOPMENT ALTERNATIVE
REACH 5 - MANASQUAN INLET TO MANTOLOKING

Cost Components	Estimated Initial Costs	Estimated Present Worth Cost Totals
Beach Nourishment		
o 962,000 cu. yd. at 10-year intervals to maintain existing beach widths		$ 3,669,000
Initial Structural Maintenance		
o Repair to 2 groins	490,000	490,000
Maintenance of Existing Functional Structures		
o 6 groins		37,000
Dune Maintenance		
o Placement of dune grass (5 acres) and Sand Fencing (4000 L.F.), and replacement of sand fencing at 3-year intervals	38,000	75,000
TOTALS	$ 528,000	$ 4,271,000

(6) The Plan For Reach 6 — Mantoloking to Barnegat Inlet. The priority analysis has shown that none of the reach-level engineering alternatives evaluated for Reach 6 are economically justifiable. Therefore, none of the reach level plans are recommended on a priority basis. It is, however, recommended that a limited program of maintenance and/or modification of shore protection structures be adopted to mitigate local erosion problems. Local projects are conditionally acceptable under this plan if they can be shown to adequately address the needs of the area, they will not result in adverse effects in adjacent shore areas, and can be shown to be economically feasible in case-by-case evaluations. No action is proposed for Island Beach State Park at the southern half of the reach (see Figure II.B-8).

In the alternative analysis for Reach 6, the Recreational Development program was found to be the most cost beneficial of the reach engineering alternatives evaluated. The estimated total present worth cost for this alternative is $7.8 million; the benefit/cost ratio is 0.38. Since the existing beach area, if maintained through periodic renourishment, will satisfy the projected recreational beach demand during the 50-year planning period, no initial beach fill would be necessary under the Recreational Development alternative. Beach nourishment from offshore sand sources is provided at approximately 7-year intervals to maintain existing beaches in Reach 6 as required. The plan also allows for initial repairs to two groins at Lavallette, regular maintenance for the existing functional groin field in Lavallette, and dune maintenance through the planting of 20 acres of dune grass and placement and subsequent



REACH 6 – MANTOLOKING TO BARNEGAT INLET

NAUTICAL MILES
0 1 2 3

YARDS
1000 0 1000 2000 3000 4000

3000 0 3000 6000 9000 12000
FEET

RECOMMENDED PLAN

MAINTENANCE AND/OR MODIFICATION OF EXISTING FUNCTIONAL STRUCTURES ON AN AS NEEDED, CASE-BY-CASE BASIS

MOST COST BENEFICIAL REACH ALTERNATIVE

RECREATIONAL DEVELOPMENT

- MAINTENANCE OF DUNES AND EXISTING FUNCTIONAL STRUCTURES
- PERIODIC BEACH NOURISHMENT
- NO ACTION PROPOSED FOR ISLAND BEACH STATE PARK

DAMES & MOORE

FIGURE II.B-8

maintenance of about 19,600 linear feet of sand fence. Emergency repair to the beach berm is also recommended after the occurrence of significant storm damage. Estimated costs for the major components of the Recreational Development alternative are summarized in Table II.B-11.

The recommended limited program of maintenance on a case-by-case basis for Reach 6 would be consistent with the Recreational Development plan since it provides for the maintenance of existing structures called for in that plan.

TABLE II.B-11

COST ESTIMATE SUMMARY
RECREATIONAL DEVELOPMENT ALTERNATIVE
REACH 6 – MANTOLOKING TO BARNEGAT INLET

Cost Components	Estimated Initial Costs	Estimated Present Worth Cost Totals
Beach Nourishment		
o 1,138,000 cu. yd. at 7-year intervals to maintain existing beach widths		$ 6,926,000
Initial Structural Maintenance		
o Repair to 2 groins at Lavallette	$ 549,000	549,000
Maintenance of Existing Functional Structures		
o Lavallette – 9 groins		56,000
Dune Maintenance		
o Placement of dune grass (20 acres) and sand fencing (19,600 L.F.) and replacement of sand fencing at 3-year intervals	159,000	339,000
TOTALS	$ 708,000	$ 7,870,000

(7) The Plan For Reach 7 – Long Beach Island. It is recommended that the Recreational Development alternative be implemented in this reach. This program is nominally cost beneficial on its own merits (B/C ratio of 0.96). However, the plan satisfies the maintenance requirement which the State and local governments accepted at the completion of the Federal shore protection project on Long Beach Island. The estimated total present worth cost of the alternative is $11.3 million.

Almost all of Long Beach Island shoreline is ungranted. Public access and convenience features are also dispersed over the island so that no portion of the island is favored over another for the purpose of recreational development. The Recreational Development plan provides for maintenance of a recreational beach along the entire developed length of the island (Holgate unit of Brigantine Wildlife Refuge not included). The existing beach, with the provision of periodic beach nourishment from offshore sand sources, satisfies the projected recreational beach user demand for the 50-year planning period. Considering carrying capacity limitation estimates for Long Beach Island, only periodic beach maintenance is required to satisfy the estimated demands through the year 2025. The beach demand estimates and design capacities (in beach user days) and pertinent design beach width information for the recommended plan are provided in Table II.B-12. The major components of this alternative plan are shown schematically on Figure II.B-9.

TABLE II.B-12

REACH 7 – LONG BEACH ISLAND RECREATIONAL DEVELOPMENT PLAN
(Beach User Days (in thousands) And Design Beach Widths
Are Shown For Selected Years)

	1980	1990	2000	2010	2020	2030
Peak Day Daily Demand	260.3	297.0	333.7	370.4	407.5	425.4
Average Day Daily Demand	112.3	123.7	137.7	152.2	166.4	177.9
Daily Beach Capacity Without Plan	364.2	328.2	292.2	256.2	220.2	184.2
Daily Beach Capacity With Plan	364.2	364.2	364.2	364.2	364.2	364.2
Average Beach Width With Plan	186 ft.	186 ft.	186 ft.	186 ft.	186 ft.	186 ft.

Total Additional Beach User Days
Over 50-Year Period With Plan = 85,596.0

Periodic beach nourishment from offshore sand sources is recommended as the means of maintaining the existing beach width. An estimated 1,019,000 cubic yards of fill would be required, at approximately 8-year intervals, to accomplish this objective. Structural maintenance under this alternative consists of initial repair to about 15 groins in the existing groin field. Planting of beach grass and installation of sand fencing are also recommended. Regular maintenance of the groins and the dune fencing would be provided throughout the economic life of the project.

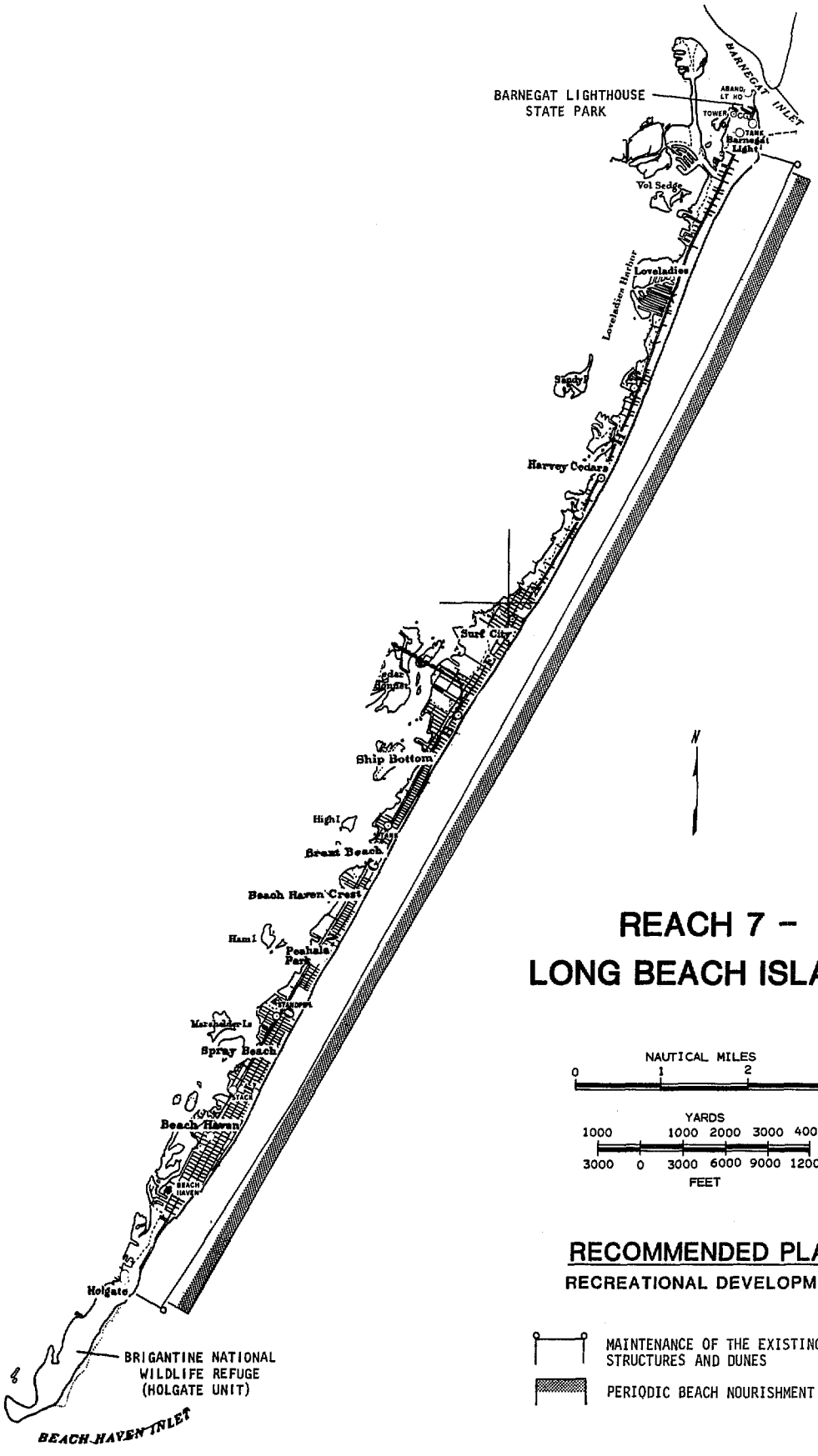

BARNEGAT LIGHTHOUSE STATE PARK
BARNEGAT INLET
Barnegat Light
Vol Sedge
Loveladies
Loveladies Harbor
Harvey Cedars
Surf City
Ship Bottom
High
Brant Beach
Beach Haven Crest
Ham
Peahala Park
Spray Beach
Beach Haven
Holgate
BRIGANTINE NATIONAL WILDLIFE REFUGE (HOLGATE UNIT)
BEACH HAVEN INLET
N
REACH 7 -
LONG BEACH ISLAND
NAUTICAL MILES
0 1 2 3
YARDS
1000 1000 2000 3000 4000
3000 0 3000 6000 9000 12000
FEET
RECOMMENDED PLAN
RECREATIONAL DEVELOPMENT
MAINTENANCE OF THE EXISTING FUNCTIONAL STRUCTURES AND DUNES
PERIODIC BEACH NOURISHMENT
DAMES & MOORE

FIGURE II.B-9

The initial cost of construction including the initial repair of functional structures, beach grass planting, and sand fence installation is $3,638,000. The subsequent annual maintenance including periodic beach nourishment would average about $701,000. The major components of this alternative plan are shown schematically in Figure II.B-9. Cost estimates of components and the total present worth cost of the recommended alternative are provided in Table II.B-13.

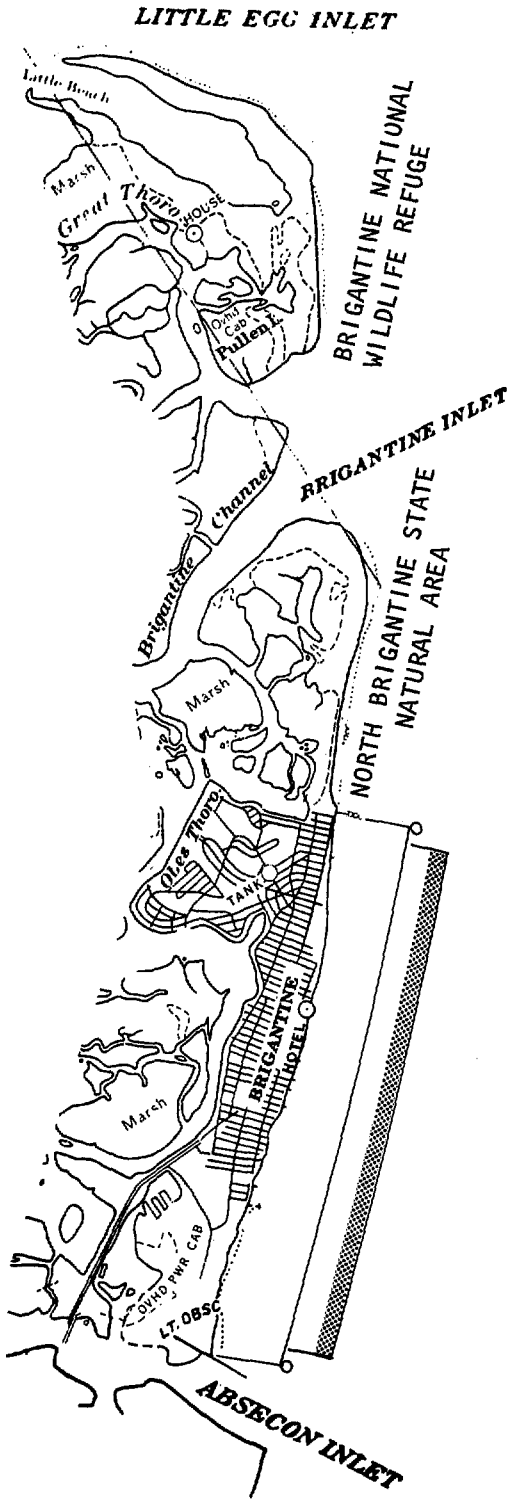
TABLE II.B-13

COST ESTIMATE SUMMARY
RECREATIONAL DEVELOPMENT ALTERNATIVE
REACH 7 - LONG BEACH ISLAND

Cost Components	Estimated Initial Costs	Estimated Present Worth Cost Totals
Beach Nourishment		
o 1,019,000 cu. yd. at 8-year intervals to maintain existing beach widths		$ 6,172,000
Initial Structural Repair		
o 15 groins	$ 2,214,000	2,214,000
Maintenance of Dunes and Existing Functional Structures		
o 98 existing groins		608,000
o Placement of about 220 acres of dune grass, 27,900 L.F. of sand fence and replacement of fence at 3-year intervals	1,424,000	2,327,000
TOTALS	$ 3,638,000	$ 11,321,000

(8) The Plan For Reach 8 — Pullen Island and Brigantine Island. No engineering plans are recommended for Pullen Island which is the last remaining undisturbed barrier island in New Jersey. Similarly, no action is proposed for the northern end of Brigantine which is occupied by the North Brigantine State Island Natural Area (see Figure II.B-10). For the remaining portion of Reach 8 the priority analysis indicates that none of the reach-level engineering alternatives evaluated for Reach 8 are economically justifiable. Therefore, none of these alternative engineering plans are recommended on a priority basis. It is, however, recommended that a limited program of maintenance of shore protection structures be adopted to mitigate local erosion problems. Local projects are conditionally acceptable under this plan if the they do not create adverse effects on adjacent shore areas and can be shown to be economically feasible in a case-by-case evaluation.

The Recreational Development program was found to be the most cost beneficial of the alternative engineering plans evaluated for Brigantine Island. This alternative has an estimated total present worth cost of $4.6 million, however, it only has a benefit/cost ratio of 0.17. A summary of the cost estimate for this plan is provided in Table II.B-14.



REACH 8 - LITTLE EGG INLET TO ABSECON INLET (PULLEN ISLAND AND BRIGANTINE ISLAND)

NAUTICAL MILES
0 1 2 3

YARDS
1000 0 1000 2000 3000 4000
3000 0 3000 6000 9000 12000
FEET

RECOMMENDED PLAN

MAINTENANCE OF EXISTING FUNCTIONAL STRUCTURES ON AN AS NEEDED, CASE-BY-CASE BASIS

MOST COST BENEFICIAL REACH ALTERNATIVE

RECREATIONAL DEVELOPMENT

MAINTENANCE OF THE EXISTING FUNCTIONAL STRUCTURES AND DUNES

PERIODIC BEACH NOURISHMENT

DAMES & MOORE

FIGURE II.B-10

TABLE II.B-14

COST ESTIMATE SUMMARY
RECREATIONAL DEVELOPMENT ALTERNATIVE
REACH 8 - BRIGANTINE ISLAND

Cost Components	Estimated Initial Costs	Estimated Present Worth Cost Totals
Beach Nourishment		
o 962,000 cu. yd. at 10-year intervals to maintain existing beach widths		$ 3,669,000
Initial Structural Maintenance		
o 5 groins and 360 L.F. of timber bulkheading	$ 439,000	439,000
Maintenance of Dunes and Existing Functional Structures		
o 8 existing groins		50,000
o Timber bulkheading (4,200 L.F.)		23,000
o Placement of about 38 acres of dune grass, 22,100 L.F. sand fence and replacement of fencing on 3-year intervals	263,000	468,000
TOTALS	$ 702,000	$ 4,649,000

The existing beach area between North 14th Street and 42nd Street, if maintained through periodic renourishment, will satisfy the projected recreational demand during the 50-year planning period. However, improved access and parking would be needed to take full advantage of the area.

Under the Recreational Development plan no initial beach fill would be required. An estimated 762,000 cubic yards of fill from offshore sources is provided at approximately 10-year intervals to renourish and maintain the existing beach width. The plan also allows for initial repairs to 5 groins and approximately 360 linear feet of bulkhead to bring these structures up to a uniform level of integrity throughout the reach. Periodic maintenance to existing functional structures (8 groins and 4200 linear feet of bulkhead) is recommended to ensure their integrity during the economic life of the program. Dune maintenance through the planting of 38 acres of dune grass and placement of and subsequent replacement of 22,100 linear feet of sand fence is also provided.

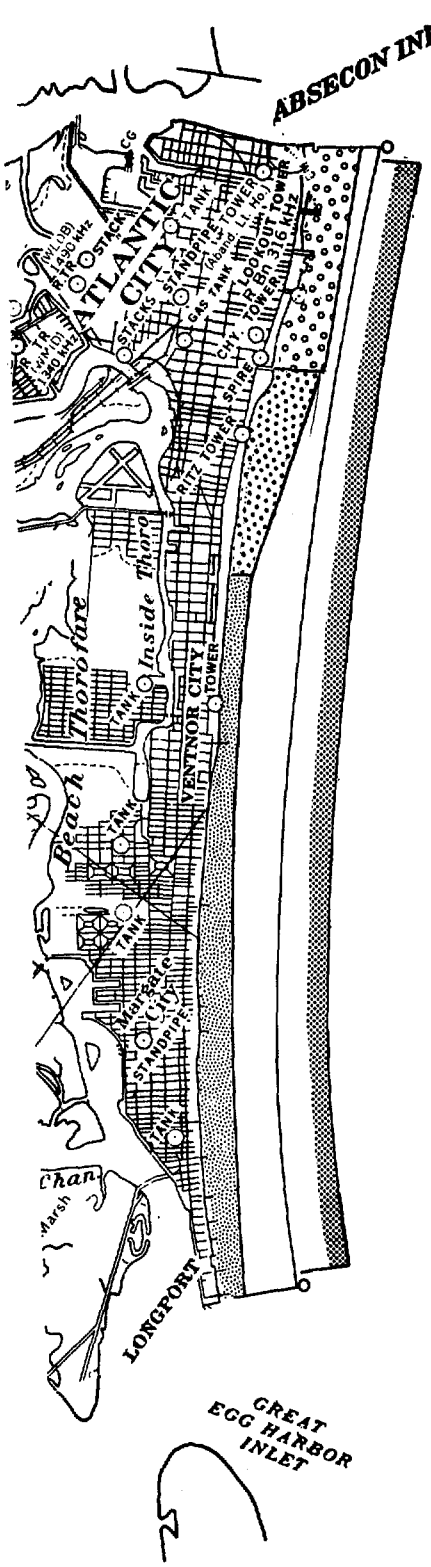
The recommended limited program of structural maintenance on a case-by-case basis for Reach 8 would be consistent with the Recreational Development design plan since it provides for the maintenance of existing structures called for in that plan.

(9) The Plan For Reach 9 — Absecon Island. It is recommended that the Recreational Development alternative be implemented for the Absecon Island Reach. This program has a cost/benefit ratio of 1.44 and an estimated total present worth cost of $29.4 million. The Recreational Development plan provides for an initial beach fill for a recreational beach with the dimensions illustrated schematically on Figure II.B-11. Estimated costs for the major components of the proposed plan are summarized in Table II.B-15.

TABLE II.B-15

COST ESTIMATE SUMMARY
RECREATIONAL DEVELOPMENT ALTERNATIVE
REACH 9 — ABSECON ISLAND

Cost Components	Estimated Initial Costs	Estimated Present Worth Cost Totals
Beach Fill		
o Initial fill in Atlantic City to 400' berm width (520' beach width), tapered to a 150' berm width (270' beach width) at Jackson St., 150' berm width elsewhere	$ 8,204,000	$ 8,204,000
Beach Nourishment		
o 975,000 cu. yd. at 3-year intervals		17,192,000
Initial Structural Maintenance		
o Initial repairs to 7 groins, 1950 L.F. of timber bulkhead, and 1550 L.F. of concrete seawall (at Longport)	3,302,000	3,302,000
Maintenance of Existing Functional Structures		
o 7 existing groins		43,000
TOTALS	$ 11,506,000	$ 28,741,000



REACH 9-ABSECON INLET TO GREAT EGG HARBOR INLET (ABSECON ISLAND)

NAUTICAL MILES
0 1 2 3

YARDS
1000 0 1000 2000 3000 4000
3000 0 3000 6000 9000 12000
FEET

RECOMMENDED PLAN

RECREATIONAL DEVELOPMENT

- MAINTENANCE OF THE EXISTING FUNCTIONAL STRUCTURES
- PERIODIC BEACH NOURISHMENT
- BEACH FILL TO 400 FOOT BERM WIDTH (520 FOOT BEACH WIDTH) FROM THE NORTHERN END OF THE REACH TO MISSOURI AVENUE
- BEACH FILL TAPERED FROM 400 FOOT BERM AT MISSOURI AVENUE TO 150 FOOT BERM AT JACKSON STREET
- BEACH FILL TO 150 FOOT BERM WIDTH (270 FOOT BEACH WIDTH)

DAMES & MOORE

FIGURE II.B-11

The Recreational Development plan evaluated in the Draft Shore Protection Master Plan provided for a wider initial beach and periodic beach expansions to accommodate projected recreational demand. Since the original design demand and beach width values for Absecon Island were considered to be anomalous as compared to other southern barrier island reaches, the Recreational Development beach design dimensions were reduced to minimize potential adverse impacts on the Absecon Inlet area. Under the modified plan, no periodic beach expansions are proposed after the proposed initial beach fill. As in the original plan, periodic beach nourishment, involving about 975,000 cubic yards of sand at 3-year intervals would be used to maintain the recreational beach throughout the economic life of the program. The beach demand estimates and capacity (in beach user days) of the design recreational beach are provided in Table II.B-16.

TABLE II.B-16

ABSECON ISLAND RECREATIONAL DEVELOPMENT PLAN
(Beach User Days (in thousands) Are Shown For Selected Years)

	1980	1990	2000	2010	2020	2030
Peak Day Daily Demand	375.5	427.2	478.9	530.6	582.3	634.0
Average Day Daily Demand	263.2	299.4	335.6	371.9	408.1	444.4
Daily Beach Capacity Without Plan	166.2	145.5	124.8	104.1	83.4	62.7
Daily Beach Capacity With Plan	298.1	298.1	298.1	298.1	298.1	298.1

Total Additional Beach User Days
Over 50-Year Period With Plan = 408,000

Structural maintenance under the proposed alternative includes initial repairs to 7 groins, approximately 1950 linear feet of bulkhead and 1550 linear feet of concrete seawall (in Longport). Regular maintenance of existing functional groins would also be provided throughout the 50-year planning period to ensure their functional integrity. The beach and structural maintenance provisions under the Recreational Development Plan for Reach 9 would also satisfy the conditions of assurances given by the State and Atlantic City to maintain the completed Federal shore protection project at Atlantic City.

As this document goes to press, the DEP has begun the Phase II - Individual Reach Design Planning for Reach 9. Components of this phase will include detailed engineering design plans for the reach, bid specifications, statements of compliance with this Shore Protection Master Plan and the Rules on Coastal Resource and Development Policies (NJDEP, DCR, June 1981). In addition, discussions have begun with the various municipal governments, specific permits, and statements of compliance.

(10) The Plan For Reach 10 — Peck Beach. It is recommended that the Recreational Development alternative be implemented for this reach. Public access and convenience features such as the boardwalk and nearshore parking facilities are concentrated along the northern portion of the island. In this section of the reach an initial recreational beach of 170 feet in total width would be developed between Morningside Road at Beach Boulevard to 21st Street using sand from offshore sources. At the southern end of the reach, the beach would be tapered to meet the existing beach which would be maintained for the remainder of the reach. Considering the carrying capacity limitations of the reach, the recreational beach development is planned to meet the demands at year 2010. Periodic expansion of the beach is planned at 10-year intervals to keep pace with the estimated growth in recreational demand. The last beach fill is planned at year 2010 for a total beach width of 360 feet. The beach demand estimates, design capacities (in beach user days), and pertinent design beach width information for the recommended plan are presented in Table II.B-17. The components of the cost estimate for the Recreational Development plan for Reach 10 are provided in Table II.B-18.

TABLE II.B-17

PECK BEACH RECREATIONAL DEVELOPMENT PLAN
(Beach User Days (in thousands) And Design Beach Widths Are Shown For Selected Years)

	1980	1990	2000	2010	2020	2030
Peak Day Daily Demand	103.4	117.6	131.9	146.1	146.1	146.1
Average Day Daily Demand	89.9	102.3	114.7	127.0	127.0	127.0
Daily Beach Capacity Without Plan	93.7	57.7	25.0	0	0	0
Daily Beach Capacity With Plan	103.4	116.7	130.0	143.3	143.3	143.3
Average Beach Width With Plan	170 ft.	223 ft.	286 ft.	360 ft.	360 ft.	360 ft.

Total Additional Beach User Days
Over 50-Year Period With Plan = 318,179.0

The initial beach fill of 314,000 cubic yards would cost an estimated $2.8 million. Because of the relatively small volume, this beach fill may have to be combined with other projects or with planned periodic nourishment for this reach in order to attract competitive bidding. Periodic nourishment for the entire reach is recommended in this alternative. This amounts to about 1,170,000 cubic yards at 5-year intervals from offshore sources. The beach would thus be maintained during the economic life of the project.

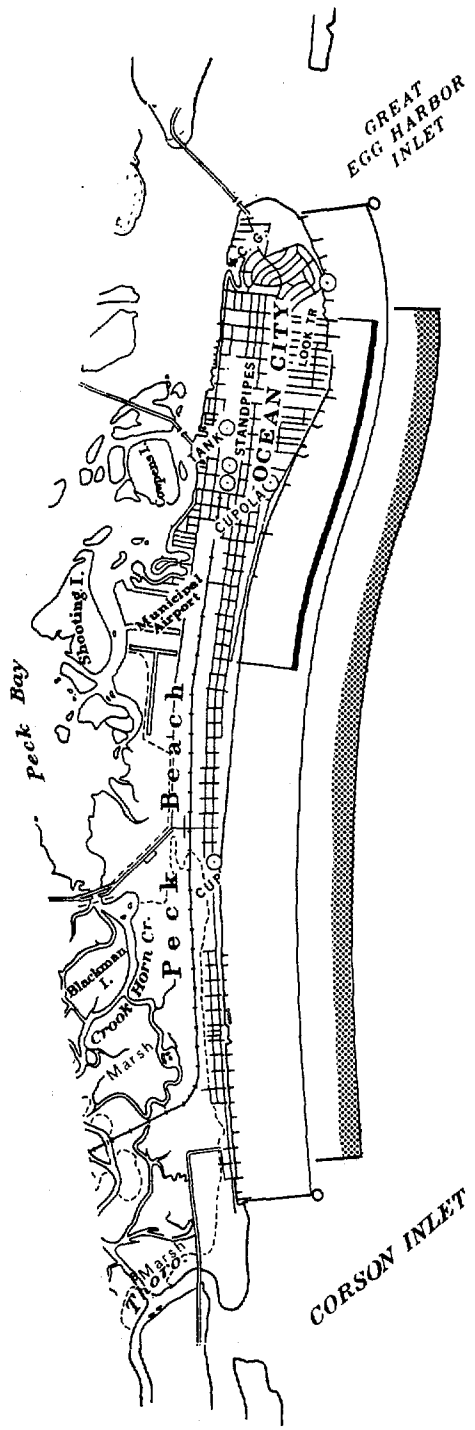
TABLE II.B-18

COST ESTIMATE SUMMARY
RECREATIONAL DEVELOPMENT ALTERNATIVE
REACH 10 - PECK BEACH

Cost Components	Estimated Initial Costs	Estimated Present Worth Cost Totals
Beach Fill		
o Initial fill at the northern end of island for a beach width of 170' (berm width approximately 8' at +10' MLW). In-place fill volume: 314,000 cu. yd.	$ 2,794,000	$ 2,794,000
o Periodic expansion in berm width in 10-year intervals (585,000 cu. yd. each expansion to year 2010) for a total beach width of 360' (berm width 180' at +10' MLW)		2,877,000
Beach Nourishment		
o 1,170,000 cu. yd. at 5-year intervals		10,895,000
Initial Structure Maintenance		
o Initial repairs to 3 groins and 1000' L.F. of timber bulkhead	433,000	433,000
Maintenance of Dune and Existing Structures		
o 20 groins and 12,000 L.F. of timber bulkhead		184,000
o Placement of about 32 acres of dune grass, 18,500 L.F. of sand fence and replacement of sand fence at 3-year intervals	220,000	390,000
TOTALS	$ 3,447,000	$ 17,573,000

Maintenance of functional structures would include initial repairs to 3 groins and about 1000 feet of timber bulkheading to bring these structures up to a uniform level of repair. Regular maintenance of existing shore protection structures is also provided to ensure their integrity during the 50-year planning period. Initial planting of 32 acres of dune grass and installation and maintenance of 18,500 linear feet of sand fencing is also included. The total estimated present worth cost of this plan is $17.6 million. Its features are presented schematically on Figure II.B-12.

As this document goes to press, the DEP has begun the Phase II - Individual Reach Design Planning for Reach 10. Components of this phase will include detailed engineering design plans for the reach, bid specifications, and statements of compliance with this Shore Protection Master Plan and the Rules on Coastal Resource and Development Policies (NJDEP, DCR, June 1981). In addition, discussions have begun with the various municipal governments, specific permits, and statements of compliance.



N

REACH 10 - GREAT EGG HARBOR INLET TO CORSON INLET (PECK BEACH)

NAUTICAL MILES
0 1 2 3

YARDS
1000 0 1000 2000 3000 4000
3000 0 3000 6000 9000 12000
FEET

RECOMMENDED PLAN

RECREATIONAL DEVELOPMENT

MAINTENANCE OF THE EXISTING FUNCTIONAL STRUCTURES AND DUNES

PERIODIC BEACH NOURISHMENT

INITIAL FILL FOR A BEACH WIDTH OF 170'(BERM WIDTH 8' AT +10 MLW) AND STEP INCREASE IN BEACH WIDTH TO 360 FEET BY 2010 (BERM WIDTH OF 180 FEET AT +10' MLW)

DAMES & MOORE

FIGURE II.B-12

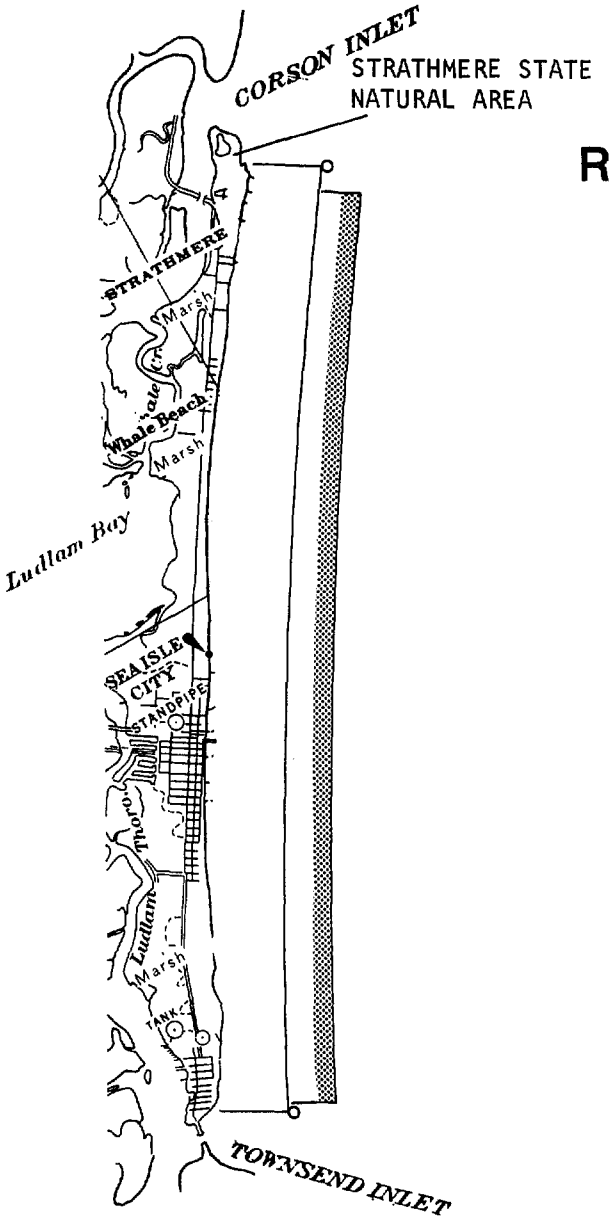
(11) The Plan For Reach 11 — Ludlam Island. The priority analysis indicates that none of the these engineering alternatives evaluated for this reach are economically justifiable. Therefore, none of the reach-level engineering plans are recommended. It is, however, recommended that a program of maintenance and/or modification of shore protection structures be adopted on an as needed basis to mitigate local erosion problems. Local projects are conditionally acceptable under this plan if they will not adversely affect adjacent shore areas and they can be shown to be economically justified in case-by-case evaluations.

In the alternative analysis for Reach 11, the Recreational Development progam was found to be the most cost beneficial of the reach engineering alternatives evaluated. The estimated total present worth cost for this program is $20.7 million and the benefit/cost ratio is 0.88. The plan is illustrated schematically on Figure II.B-13.

The Recreational Development plan calls for maintenance of a recreational beach along the entire reach. Since the present and projected beach use demand for Reach 11 would be satisfied if the existing beach area is maintained during the planning period, no initial beach fill would be necessary. Beach nourishment, involving approximately 1,170,000 cubic yards of sand from offshore sources at 3-year intervals, would be provided to maintain the existing beaches as required. The plan also allows for initial repairs to two groins and about 130 linear feet of timber bulkhead. Periodic maintenance of existing functional structures, including 18 groins and about 10,375 linear feet of bulkhead, is provided to ensure their integrity during the economic life of the project. Dune maintenance, including installation of about 12,800 linear feet of sand fence and 15 acres of dune vegetation, and sand fence replacement at 3-year intervals, would also be provided under the plan. The estimated costs for the major components of the Recreational Development plan are summarized in Table II.B-19.

The recommended limited program of case-by-case local maintenance for Reach 11 would be consistent with the Recreational Development plan since it provides the maintenance component called for under that plan.

As this document goes to press, the DEP has begun the Phase II - Individual Reach Design Planning for Reach 11. Components of this phase will include detailed engineering design plans for the reach, bid specifications, and statements of compliance with this Shore Protection Master Plan and the Rules on Coastal Resource and Development Policies (NJDEP, DCR, June 1981). In addition, discussions have begun with the various municipal governments, specific permits, and statements of compliance.



REACH 11- CORSONS INLET TO TOWNSEND INLET (LUDLAM ISLAND)

NAUTICAL MILES

0 1 2 3

YARDS

1000 0 1000 2000 3000 4000

3000 0 3000 6000 9000 12000

FEET

RECOMMENDED PLAN

MAINTENANCE OF EXISTING FUNCTIONAL STRUCTURES ON AN AS NEEDED, CASE-BY-CASE BASIS

MOST COST BENEFICIAL REACH ALTERNATIVE

RECREATIONAL DEVELOPMENT

MAINTENANCE OF THE EXISTING FUNCTIONAL STRUCTURES AND DUNES

PERIODIC BEACH NOURISHMENT

DAMES & MOORE

FIGURE II.B-13

TABLE II.B-19

COST ESTIMATE SUMMARY
RECREATIONAL DEVELOPMENT ALTERNATIVE
REACH 11 – LUDLAM ISLAND (CORSONS INLET TO TOWNSEND INLET)

Cost Components	Estimated Initial Costs	Estimated Present Worth Cost Totals
Beach Nourishment		
o 1,170,000 cu. yd. at 3-year intervals to maintain existing beach widths		$ 19,892,000
Initial Structure Maintenance		
o Repairs to 2 groins and about 130 feet of timber bulkhead	$ 389,000	389,000
Maintenance of Dunes and Existing Functional Structures		
o 18 existing groins		117,000
o 10,375 L.F. of timber bulkhead		56,000
o Placement of about 15 acres of dune grass, 12,800 L.F. of sand fence and replacement of sand fence at 3-year intervals	112,000	233,000
TOTALS	$ 501,000	$ 20,687,000

(12) The Plan For Reach 12 – Seven Mile Beach. It is recommended that the Recreational Development alternative be implemented in this reach. This alternative has a benefit/cost ratio of 1.37 and an estimated total present worth cost of $7.7 million.

A recreational beach is planned for the oceanfront beach. This alternative calls for beach fills along the reach segment starting in the vicinity of 25th Street in Avalon and extending to the terminal structure at 127th Street in Stone Harbor. No action is proposed at Stone Harbor Point, the undeveloped southern end of the reach. The beaches in this area would be maintained (nourished) via the southerly transport of sand from nourished beaches north of the terminal structure.

Consideration of reach carrying capacity limitations indicates that the recreational beach maintenance be planned to satisfy beach user demand through the year 2022. The beach recreational demand estimates, the design daily capacities, (in beach user days), and pertinent design beach width information are provided in Table II.B-20.

TABLE II.B-20

SEVEN MILE BEACH RECREATIONAL DEVELOPMENT PLAN
(Beach User Days (in thousands) And Design Beach Widths Are Shown For Selected Years)

	1980	1990	2000	2010	2020	2030
Peak Day Daily Demand	157.9	179.6	201.3	223.1	244.8	249.1
Average Day Daily Demand	90.3	102.7	115.1	127.4	139.8	142.4
Daily Beach Capacity Without Plan	131.5	108.9	86.3	63.7	41.1	18.5
Daily Beach Capacity With Plan	132.7	149.7	166.7	183.7	200.7	200.7
Average Beach Width With Plan	160 ft.	180 ft.	200 ft.	220 ft.	240 ft.	240 ft.

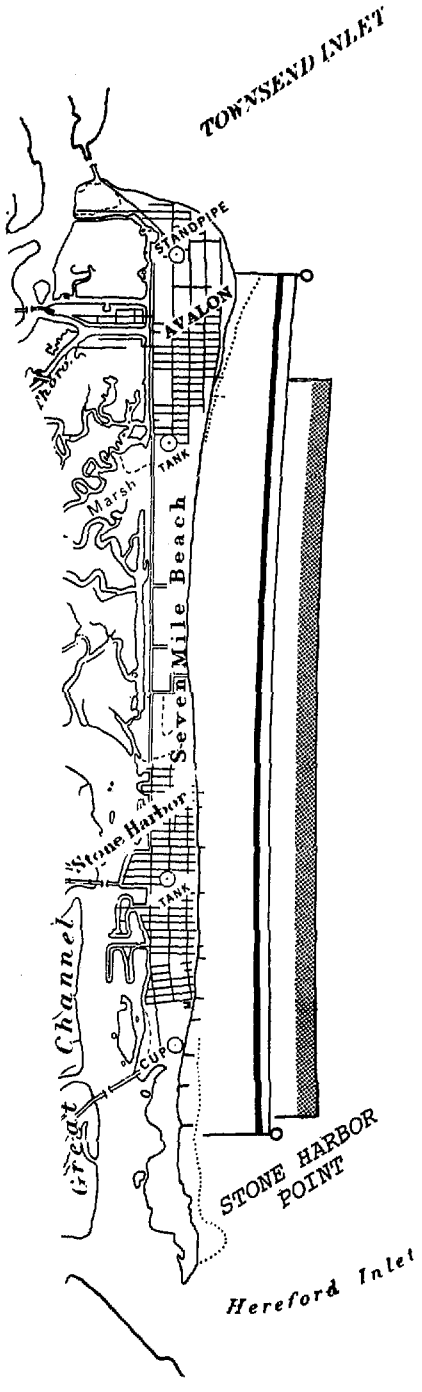
Total Additional Beach User Days
Over 50-Year Period With Plan = 238,190.0

The present beach demand for Reach 12 is satisfied by the existing available beach area. Periodic expansion in beach width is recommended to accommodate the growth in beach use demand over the 50-year planning period. Periodic beach expansions would require placement of 544,000 cubic yard fills on the beach during each interval. The last beach fill, planned for year 2020, would provide adequate beach area to satisfy the projected design daily capacity at year 2022. It is estimated that the carrying capacity of the transportation systems servicing Seven Mile Beach would constrain the recreational demands at that time.

Periodic nourishment is recommended to maintain the beaches at their design widths. Nourishment from offshore sand sources would involve placing 1,118,000 cubic yards at 10-year intervals. Periodic nourishment and expansions can be scheduled concurrently to provide more attractive project quantities for contract bidding.

Maintenance items under this alternative include initial repairs to one groin and approximately 620 linear feet of timber bulkheading. Periodic maintenance of functional shore protection structures, including 10 groins, 12,600 linear feet of timber bulkheading, and 800 linear feet of stone revetment is also provided to ensure their integrity throughout the economic life of the project. Dune maintenance, in the form of planting beach grass and sand fence installation, is also recommended for this reach.

The total estimated present worth cost of the Recreational Development plan is $7.7 million. The components of the plan are illustrated schematically on Figure II.B-14. A summary of the components of the cost estimate for the plan are provided in Table II.B-21.



N

REACH 12-TOWNSEND INLET TO HEREFORD INLET (SEVEN MILE BEACH)

NAUTICAL MILES
0 1 2 3

YARDS
1000 0 1000 2000 3000 4000
3000 0 3000 6000 9000 12000
FEET

RECOMMENDED PLAN

RECREATIONAL DEVELOPMENT

MAINTENANCE OF THE EXISTING FUNCTIONAL STRUCTURES AND DUNES

PERIODIC BEACH NOURISHMENT

STEP INCREASE IN BEACH WIDTH TO 240 FEET (60 FOOT BERM WIDTH AT ELEVATION +10'MLW) BY THE YEAR 2020

DAMES & MOORE

FIGURE II.B-14

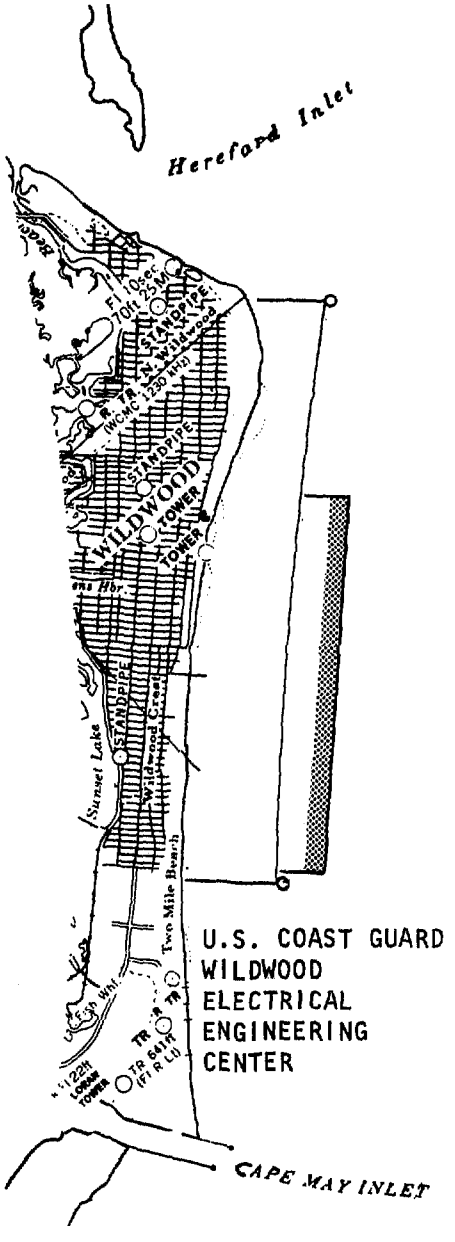
TABLE II.B-21

COST ESTIMATE SUMMARY
RECREATIONAL DEVELOPMENT ALTERNATIVE
REACH 12 - SEVEN MILE BEACH (TOWNSENDS INLET TO HEREFORD INLET)

Cost Components	Estimated Initial Costs	Estimated Present Worth Cost Totals
Beach Fill		
o No initial fill is required o Periodic beach expansion (544, 000 cu. yd. in 10-year intervals) to a total beach width of 240' by 2020 (total berm width of 60' at +10' MLW)		$ 2,689,000
Beach Nourishment		
o 1,118,000 cu. yd. at 10-year intervals		4,135,000
Initial Structural Maintenance		
o Repair of one groin and 620 L.F. of timber bulkhead	523,000	523,000
Maintenance of Dunes and Existing Functional Structures		
o 10 existing groins		62,000
o Placement of about 27 acres of dune grass, 13,300 L.F. of sand fence and replacement of sand fence at 3-year intervals	177,000	302,000
TOTALS	$ 700,000	$ 7,711,000

(13) The Plan For Reach 13 — Five Mile Beach. The priority analysis has shown that none of the reach-level engineering alternatives evaluated are economically justifiable. Therefore, none of these engineering plans are recommended on a priority basis. It is, however, recommended that a program of limited maintenance projects be adopted on an as needed basis. Local projects are conditionally acceptable under this plan if they will not adversely affect adjacent shore areas and they can be shown to be economically justifiable in case-by-case evaluations. As illustrated on Figure II.B-15, no action is proposed for the southern end of the reach, which is controlled by the U.S. Coast Guard.

The Recreational Development program was found to be the most cost-beneficial of the alternative reach engineering plans evaluated for Reach 13. This alternative has an estimated total present worth cost of $973,000. However, the plan only has a benefit/cost ratio of 0.10. A summary of the cost estimate for the Recreational plan is provided in Table II.B-22.



REACH 13 - HEREFORD INLET TO CAPE MAY INLET (FIVE MILE BEACH)

NAUTICAL MILES
0 1 2 3

YARDS
1000 0 1000 2000 3000 4000
3000 0 3000 6000 9000 12000

RECOMMENDED PLAN

MAINTENANCE OF EXISTING FUNCTIONAL STRUCTURES ON AN AS NEEDED, CASE-BY-CASE BASIS

MOST COST BENEFICIAL REACH ALTERNATIVE

RECREATIONAL DEVELOPMENT

MAINTENANCE OF THE EXISTING FUNCTIONAL STRUCTURES AND DUNES

BEACH NOURISHMENT AT THE END OF THE PLANNING PERIOD

DAMES & MOORE

FIGURE II.B-15

TABLE II.B-22

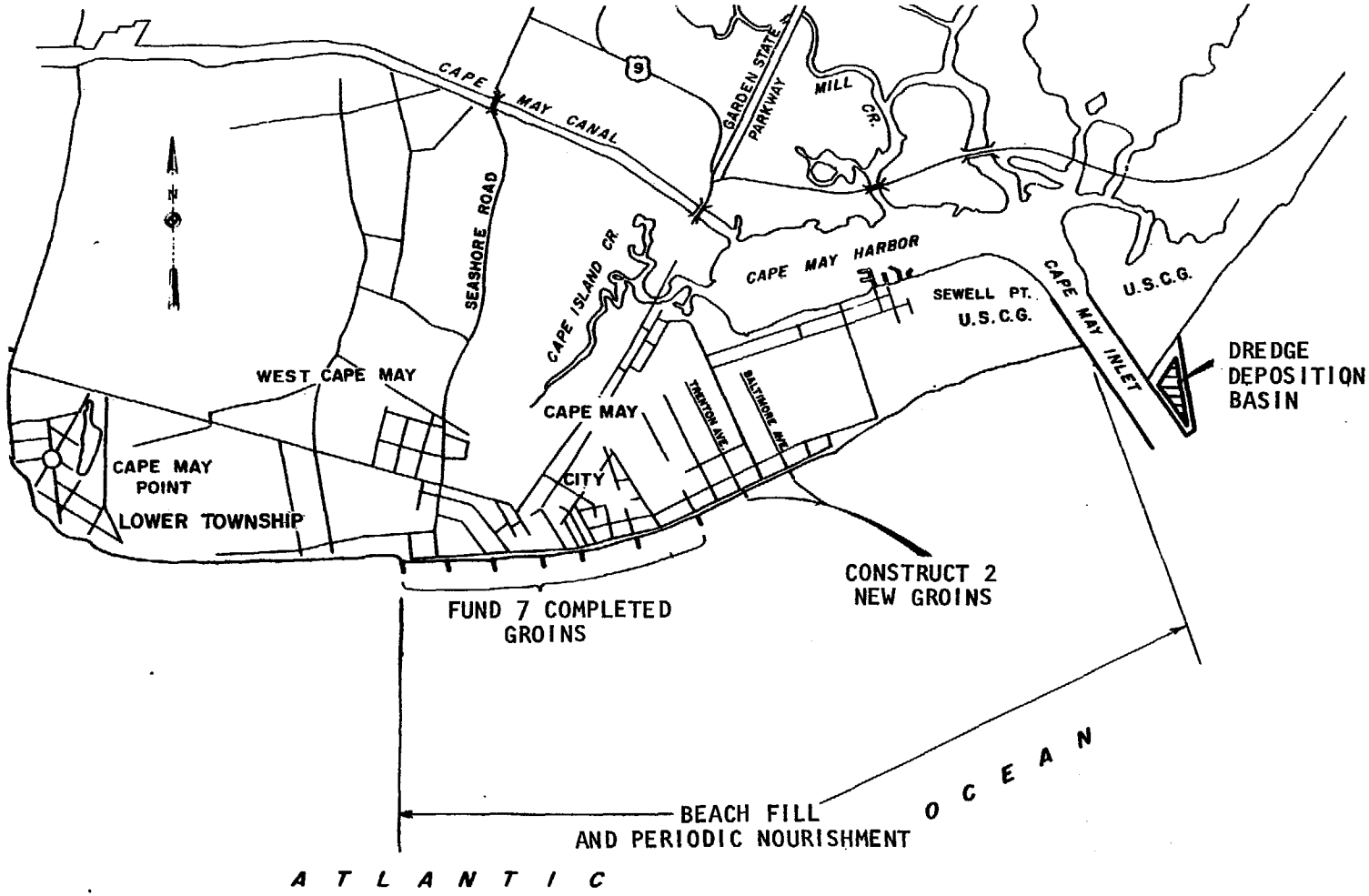
COST ESTIMATE SUMMARY
RECREATIONAL DEVELOPMENT ALTERNATIVE
REACH 13 - FIVE MILE BEACH (HEREFORD INLET TO CAPE MAY INLET)

Cost Components	Estimated Initial Costs	Estimated Present Worth Cost Totals
Beach Nourishment		
o 845,000 cu. yd. at the end of the 50-year planning period		$ 62,000
Initial Structural Maintenance		
o Repairs to 900 L.F. of timber bulkhead	$ 584,000	584,000
Maintenance of Dune and Existing Structures		
o 3,000 L.F. of timber bulkhead		16,000
o Placement of 24 acres of dune grass, 15,200 L.F. of sand fence and replacement of sand fence at 3-year intervals	168,000	311,000
TOTALS	$ 752,000	$ 973,000

For Five Mile Beach, the existing beach area is large enough to satisfy existing and projected demand until the year 2020. Therefore, no initial or periodic beach fill nourishment would be required for maintenance of the recreational beach. Beach loss rates and demand growth estimates indicate that beach nourishment may be required to maintain the beaches at the end of the 50-year planning period. It is estimated that selective filling of approximately 845,000 cubic yards from offshore sand sources would be adequate to maintain the beach width as required.

The plan allows for initial repair to approximately 900 linear feet of bulkhead to bring it up to a uniform level of repair. Subsequent periodic maintenance of 3000 linear feet of bulkhead is also provided to insure its integrity during the economic life of the project. For dune maintenance the plan calls for planting of 24 acres of dune grass, placement of about 15,200 linear feet of sand fencing, and replacement of sand fencing at 3-year intervals.

(14) The Plan For Reach 14 — Cape May Inlet to Cape May Point. The priority analysis has shown that none of the reach-level engineering alternatives evaluated for Reach 14 are economically justifiable. Therefore, none of these reach engineering plans are recommended on a priority basis. The engineering plan proposed by the Corps of Engineers (USACOE, Philadelphia District, 1980) will be adopted by the DEP for this reach. This plan, which is summarized schematically on Figure II.B-16, provides beach fill and nourishment, groin construction, and structural maintenance to mitigate the effects of sand starvation as a result of the construction of the Cape May Inlet jetties. The plan would be fully funded by the Federal government as mitigation



CAPE MAY INLET TO LOWER TOWNSHIP, NEW JERSEY
CORPS OF ENGINEERS
CURRENT TENTATIVELY SELECTED PLAN

SOURCE: USACOE, PHILADELPHIA DISTRICT, 1980

of damages caused by the Federal navigation project at the inlet. However, the entire reach is not covered by the Corps plan. Only the most serious conditions along Cape May City and the Coast Guard area at Sewell Point have been treated. In addition to the tentative Corps plan, a program of local maintenance of shore protection structures is recommended on an as needed basis at Cape May Point. Such local structural projects are conditionally acceptable if they will not adversely affect adjacent shore areas and can be shown to be economically justified in case-by-case evaluations.

(15) The Plan For Reach 15 — Delaware Bay. It is recommended that a general program of maintenance of functional structures be followed in this reach, with local projects selected for implementation on a case-by-case basis. The evaluation will consider both the local needs to be served, the potential of adverse impacts on adjacent shore areas and natural resources, and the overall economic feasibility of these projects. Previous alternative evaluations by the Corps of Engineers have not developed specific plans which satisify these criteria. The general plan provides the opportunity to implement and maintain cost justified structural and nonstructural shore protection works as needed.

(16) The Plan For Reach 16 — Delaware River. It is recommended that a program of construction and maintenance of shore parallel structures such as bulkheads and low-cost erosion control methods be followed to mitigate local erosion problems. Local projects will be selected for implementation on a case-by-case basis. In each case, the evaluation will consider both the local needs to be served, the potential for adverse physical and environmental impacts, and the economic feasibility of these projects.

c. Non-Reach Engineering Project Proposals

In the past, the DEP's Bureau of Coastal Engineering (previously the office of Shore Protection) made an annual determination of the shore protection needs for inlets, bays, backbays, and other tidal tributary waterways. Funding was based on the availability of financial and technical resources, as well as the urgency of the erosion problem.

Due to the diversity of physical processes along these shores, the reach concept of erosion control is not effective in these areas. Therefore, as discussed below, under the Shore Protection Master Plan, erosion control projects for these areas will be evaluated for implementation on a case-by-case, as needed basis with available funds. Evaluations will consider State coastal Management policies and objectives as well as economic feasibility.

(1) Inlet Shores. A general plan of inlet shore protection is proposed for evaluation and implementation on an as needed, case-by-case basis. Historically, erosion control methods for New Jersey coastal inlet shores have included construction of bulkheads, groins, revetments, and jetties, and beach fill programs. These types of projects are acceptable if they can be shown to be economically justifiable and will not cause adverse physical or environmental impacts on the inlet or adjacent shore areas.

No action is proposed for Beach Haven, Little Egg, and Brigantine, or Corson Inlets which will be left in their present natural condition. Maintenance of existing inlet shore protection structures, including jetties under State-law responsibility, will be considered on an as needed basis for Shark River, Absecon, Great Egg Harbor, Townsend, and Hereford Inlets. The structures on Manasquan, Barnegat, and Cape May Inlets are a Federal responsibility.

A detailed listing of inlet shore protection projects under consideration by the DEP is provided in Volume 2, Section VI.B.16.

(2) Bays, Backbays, and Tributary Waterway Shores. A general program of shore protection work using low cost structural and nonstructural techniques is recommended for bays, backbays, and tributary waterway shores to mitigate local erosion problems. Local projects are conditionally acceptable on a case-by-case basis if it can be shown that they are economically justifiable and will not result in adverse physical or environmental effects on adjacent shore areas.

3. Funding Options For Engineering Plans

The priority reach engineering projects and their related costs are provided in Table II.B-23. The table includes the initial project costs and subsequent annual costs for the first several years after implementation of each project, together with the 50-year project costs and average annual costs in 1980 dollars. This information will be used to evaluate the fiscal requirement of engineering program implementation.

The findings and assumptions related to the funding and implementation of engineering projects are summarized as follows:

- At present, about $15 million of the Beaches and Harbors Bond monies remains to cover the State's share of engineering projects costs;
- The DEP intends to set aside about one third of available shore protection funds for implementation of non-reach engineering programs and emergency shore protection projects on the ocean shore and shores of rivers, bays, and backbay areas. Thus $10 million is available for State cost sharing of priority reach-level projects and $5 million is available for non-reach and emergency projects;
- The recommended priority list of five reach projects (out of thirteen oceanfront reaches) calls for initial expenditures totalling $25.5 million and an estimated average annual expenditure of $4.3 million for the remainder of the 50-year project life. The cost of implementation of the most cost-beneficial reach projects for the remaining oceanfront reaches is $34.5 million initially and would average about $6.7 million annually for the remainder of the economic program life; and
- Due to the present uncertainties associated with the willingness or ability of reach municipalities to participate in the shore protection program, it is not known whether this list of priority projects will remain intact. For present planning purposes, however, it is assumed that the priority list will remain as shown.

TABLE II.B-23

ENGINEERING COSTS FOR PRIORITY REACHES
(thousands of 1980 dollars)

Reach/Project	Initial Cost[b]	Estimated Annual Costs[a] Year 1	Year 2	Year 3	Average[c]	50-Year Project Cost
Peck Beach Recreational Development	$ 3,447	$ 32	$ 32	$ 32	$ 1,289	$ 67,897
Sandy Hook to Long Branch Maintenance	3,709	71	71	71	71	7,259
Absecon Island Recreational Development	11,506	4	4	5,145	1,572	90,106
Seven Mile Beach Recreational Development	700	17	17	17	640	32,700
Long Beach Island Recreational Development	3,638	138	138	138	701	38,688
Cumulative Totals	$23,000	$23,262	$23,524	$28,927	$ 4,273	$236,650

(a) Annual costs for project maintenance during the first three years after program implementation are shown in columns labeled Year 1 to Year 3.

(b) Initial capital costs of construction.

(c) Average annual costs include all maintenance and improvement costs over the 50-year planning period. Initial construction costs are not included in the average annual costs.

In August 1981, DEP adjusted the municipal share of shore protection projects to be between 50% and 25%, depending upon whether the municipality is eligible for urban aid, whether an individual shore protection project is consistent with the respective Shore Protection Master Plan reach plan, whether it is undertaken by all municipalities within a reach, and whether adequate public access to beaches is provided by the municipality. This sliding scale has been requested by the State Legislature in the Appropriations Act (PL 1978 c.157). A more substantial reduction in the local cost share would require additional action by the Legislature. A bill now under consideration (A-1596) would change the current 50-50 cost sharing for shore protection programs to a 75-25 State-local share. This bill is strongly supported by the DEP.

Assuming no Federal participation and a 50-50 State-local municipality cost sharing:

- The combined funds of $20 million would be sufficient to cover the initial costs of four of the five priority oceanfront projects totalling $19.4 million;
- Approximately $10 million in combined funds would be available for implementation of local, non-reach projects and emergency projects;
- Although certain reach and non-reach projects could be initiated, monies are insufficient to completely cover the 50-year project cost for even the first priority project at Peck Beach; and
- Additional future bond monies will be required to complete the priority projects and to continue funding of non-reach and emergency projects on a case-by-case basis.

Assuming a 75-25 State-local cost sharing for shore protection projects as proposed under A-1596, then:

- The combined funds of $15 million would not be sufficient to cover the initial costs of the first three projects on the priority list (total initial cost $18.7 million);
- Approximately $7.5 million in combined funds would be available for implementation of local, non-reach projects and emergency projects;

Conversely, if there is Federal participation, other projects could move forward. However, because implementation of Federal cost-sharing participation is likely to take several years, if 75-25 percent cost sharing is enacted, initiation of all priority projects would not be possible until a second bond issue was passed.

As indicated in Table II.B-23, the average annual cost for implementing all five priority projects would be $4.3 million (1980 dollars). Although some variability can be expected in these expenditures due to their periodic nature (e.g., periodic beach nourishment), the $4.3 million amount can be used to estimate the additional bond monies required for plan implementation. If there is no Federal participation and 50-50 State-local cost sharing is assumed, a State funding requirement of about $2.15 million per year, or an $11 million (1980 dollars) bond issue every 5 years, would be required for maintenance during the economic life of the priority projects. If 75-25 State-local cost sharing is assumed, then State funding requirements for annual maintenance would be about $3.2 million or $16 million (1980 dollars) bond issue every 5 years.

The Department of Environmental Protection's annual Capital Improvement Plans since fiscal 1978 were reviewed to determine the funding of capital projects that utilized appropriations from existing bond issues, or which required the issuances of new bonds. The annual requests for such funds actually granted to DEP by the Commission on Capital Budgeting and Planning have ranged between $76 million and $93 million, and averaged $90 million per fiscal year. This excludes fiscal 1979 during which DEP received an unusually low bond appropriation of $18 million. Historically, requests for shore protection funds have averaged $1 million per year. The passage of the 1977 Beaches and Harbors Bond Act raised the funding level to about $4 million per year for 5 years. Thus, for a worst case situation where no Federal funding is available after depletion of the Bond funds, an annual funding level of about $2.2 million would be required to maintain the priority projects. This appears feasible within the recent trends of DEP's total budget and expenditures for shore protection.

Federal participation could further improve the feasibility of funding the engineering plans. As discussed in detail in Volume 2, Section III.C.1.a, Federal funding for engineering projects may range up to 70 percent, with a 30 percent non-Federal share for publicly owned non-Federal parks and conservation areas, or a 50-50 cost sharing for publicly owned non-Federal shores other than parks and conservation areas. The degree of Federal participation for privately-owned but publicly-used shores varies according to the ratio of public benefits to total benefits. Assuming a 50-50 Federal non-Federal cost sharing of the priority list plans, and a 50-50 State-municipal cost sharing, the required bond monies for the State would be about $5.5 million every 5 years. Federal cost sharing on the initial bond expenditures would equal about $12 million and could be applied as the State's share of the first-two 5-year maintenance bonds, so that new bond monies would not be required until about year 15 of the program. Thus, the feasibility of implementing the engineering plans is significantly increased if Federal cost sharing is involved.

Another advantage of Federal participation relates to the sharing of costs to replace unanticipated major loss of the design beach during a severe storm event. The cost associated with the engineering alternative for a reach may not represent the final total cost necessary to maintain the design beach over a designated period. Significant loss to the design beach, for instance, may occur due to the effects of one or more severe erosion events. The high capital expenditure associated with initial project implementation could be lost in this case. Thus, it is possible that such events would result in 50-year costs which are three or four times those estimated, with no related increase in benefits.

It may be possible to share the costs of unanticipated losses with the Federal Government through Corps of Engineers programs, thus lessening the financial impact on the State. This could occur if the Corps of Engineers participated in the Master Plan engineering projects. Assuming initial Federal participation, the Corps may, through its emergency shore protection program, restore and repair an existing Federally authorized shore engineering project following major storm damage. Although the cost-sharing in this case is not explicitly stated, the maximum Federal cost-share for such emergency protection could be 100 percent. Non-Federal interests are usually required to bear the costs of land, easements, rights of way, operation and maintenance, and relocation of utilities. If the project cost exceeds $1 million, Congressional approval is required prior to Federal assistance.

Federal cost participation in post-storm restoration may also occur even without initial Corps participation in the engineering project. As discussed in Volume 2, Section III.C.1.d, this can occur under the authority of the Disaster Relief Acts of 1970 and 1974, after a declaration of major disaster by the President. Such declarations are generally associated with storm events which are accompanied by high storm surge and resulting flooding damages. However, storm events which result in loss of the protective beaches, but which are not accompanied by widespread flooding damages, would not likely qualify as major disasters. In such cases, no Federal funding for restoring the storm losses would be available.

The limitation for Federal assistance, which stipulates that restoration of damaged beaches may not be extended beyond their historic shoreline (as determined from available survey data) unless required for protection of upland areas, could result in restored beaches which are not as wide as the design beaches provided under the Master Plan Program. In such cases, the total benefits anticipated for the 50-year period would not be realized.

Obviously then, from consideration of initial cost and emergency relief, the most appropriate course with regard to effective use of State funds is to solicit Federal participation in the Master Plan engineering program. There are two basic requirements for shore protection projects to be eligible for Federal assistance:

- The project must demonstrate positive net benefits; and
- Public ownership, public use, or substantial public benefits must be demonstrated.

The exact process of review and the additional Corps studies required to approve and quantify Federal cost sharing are not clear at present. It would appear that, in addition to review of the New Jersey Shore Protection Master Plan projects, detailed studies would be required as a part of the Corps pre-construction planning program, which includes the final engineering and design for the project, Congressional authorization for construction, and preparation of plans and specifications. These efforts could take 4 to 5 years to complete. The Corps' present shore protection program plans for the New Jersey oceanfront include flood protection, shore erosion control, and inlet stabilization including navigational improvements. The Master Plan includes shore erosion control only. However, the design considerations of the Master Plan are generally consistent with those of the Corps and the Master Plan emphasizes nonstructural approaches, as do the Corps plans. It appears that implementation of inlet stabilization may not be a requirement for Federal participation in this program.

Other potential factors which could contribute to delays in implementation of proposed engineering plans include:

- o Inability or reluctance of Federal, State, and local agencies to provide the necessary funds;
- o Requirements that public access be provided to beaches developed or improved with State or Federal funds; and
- o Inability to agree on State or Federal cost-sharing rules and maintenance responsibilities.

In a recent review of existing Federal policies related to a national coastal protection program, the former Heritage Conservation and Recreation Service in the U.S. Department of Interior (HCRS, January, 1980) proposed policy changes for progams related to disaster mitigation and recovery. The HCRS report suggested that the Corps of Engineers be encouraged to shift from engineering techniques toward cooperative land management and place added emphasis on the natural protective capabilities and ecological integrity of the wetlands, beaches, and dunes.

It is difficult to predict whether such policy changes will be implemented and, if implemented, what effect they may have on Federal participation in the engineering programs outlined in this Master Plan. If such policies are implemented, Corps approval of the engineering measures and Federal participation may be less likely. In light of these potential policy changes, the Master Plan may be a more acceptable plan since it does not include a structurally intense program such as inlet stabilization.

In addition to the potential funding problems discussed above, a number of additional problems may occur with respect to cost sharing between the State and local municipalities. These include the need for a determination of cost sharing between the municipalities within a reach, the ability of the municipalities to pay, and their willingness to participate given the requirement to provide public access and meet the other State requirements.

The following funding options will be adopted by the DEP:

- o The remaining $15 million Beaches and Harbors Bond monies will be used to initiate the priority reach projects and selected non-reach projects over the next few years;
- o The DEP will request Federal participation and early evaluation of feasibility of participation and related studies;
- o Plans will be developed to seek additional bond monies for completion of the program;
- o If Federal participation occurs, the DEP will apply Federal monies for previously completed projects to reduce future bond requirements.

C. LAND REGULATION

Shorefront land use regulation is primarily a local responsibility, and is exercised through zoning controls, sub-division approval, and construction review. The State's role in direct land use regulation is currently limited to the review of residential development with 25 or more dwelling units, and to certain types of commercial development under the Coastal Area Facility Review Act (CAFRA). The State also regulates industrial development under CAFRA, but of a type that is rarely undertaken in the areas addressed by this Plan. In addition, activities regulated under the Wetlands Act generally do not occur in ocean shorefront areas, and the Waterfront Development Law applies only to areas at or below mean high water at the shore. A bill now under consideration by the New Jersey Legislature would expand the State's regulatory role in the shorefront, but its passage is not being assumed for the purposes of this Master Plan (the bill is discussed below).

The most prevalent form of local shorefront control in New Jersey is an ordinance which establishes a fixed "construction line," seaward of which construction is prohibited. These ordinances are usually keyed to a fixed engineering line, which is usually determined with a reference to elevations above sea level or to the elevation of existing dunes. Ordinances of this type, many of which were developed following the storm of March 1962, are not intended so much to protect dune formations as to identify the point at which shorefront construction is no longer safe or economical. They are not "setback" ordinances in the ordinary sense, since they do not establish a setback footage.

The principal flaw in an ordinance of this type is that it fails to take natural processes into account. Construction lines are not periodically redelineated, and dune fields which were once entirely seaward of the building line often migrate landward until the building line runs along, or even seaward of, the dune crest. This leaves the municipality powerless to prevent construction on that portion of the dune landward of the line. Similarly, a dune may come into being on a vacant shorefront lot, but if the lot is landward of the building line, there is no basis for prohibiting its construction. Finally, such ordinances do not take erosion rates into account.

There are a number of land use measures which complement these construction setback ordinances, including ordinances which require shorefront property owners to maintain dunes on their property at a minimum elevation, often at their own cost.

Ordinances which are designated specifically to protect dunes, regardless of their location with respect to any line, are somewhat less prevalent in New Jersey, but they do exist. These ordinances define the term "dune," and then provide that no construction on or interference with the dune may be undertaken anywhere in the community, unless permitted by the municipality. Some ordinances define dunes as areas even where no dunes presently exist, so long as that area would be occupied by a dune if normal beach profile existed. Such ordinances are somewhat more effective than the "construction line" ordinances described above, although they clearly require diligence on the part of a municipality. They also raise technical and legal problems when it comes to defining a dune.

A variation on this type of ordinance is a measure that has been widely adopted in New Jersey, but whose viability has not yet been proven. In 1976, the Federal Emergency Management Agency (FEMA) modified the National Flood Insurance Program regulations by requiring municipalities which participate in the program

to establish minimum land use standards. The standards include minimum guidelines for protecting sand dunes, and are spelled out in published Federal regulations (24 CFR 1910.3(e)(8)). This provision requires that municipalities which encompass coastal high hazard areas, shall "prohibit man-made alteration to sand dunes which increase potential flood damage."

As part of its effort to implement this regulation, FEMA distributed a model ordinance which included the above quoted language. Almost every New Jersey shorefront community, in addition to submitting its existing ordinances in satisfaction of the minimum land use requirements, adopted the model ordinance as well. Almost every municipality, therefore, has a provision which prohibits man-made alterations to sand dunes which increase potential flood damage. At least one community, Ocean City, recently relied on this provision to prohibit the bulldozing of a sand dune and the construction of a house landward of its existing building line. This action has been upheld by the New Jersey Superior Court, Law Division, and is presently on appeal to the Appellate Division (Williams vs Ocean City, decision issued October 14, 1980).

A third method of shorefront regulation is to zone an area for beach, recreation and/or conservation purposes only, and to establish permitted uses in that zone which would prevent the destruction of sand dunes. This is a fairly common zoning measure in New Jersey, although the zone (variously referred to as a beach-dune or conservation-recreation zone) is generally limited to the actual beach area.

Finally, all shorefront communities have ordinances which establish certain construction performance standards for construction in or near beach and dune areas. Generally, these standards seek to insure the structural integrity of the building, rather than to avoid interference with natural beach processes.

All local shorefront land use measures are constrained by at least two factors: the intense level of existing development, and the legal problems posed by the "taking issue."

Existing development on almost all of New Jersey's barrier islands is of a degree that precludes a natural beach profile. A number of beaches support substantial primary dunes, but behind those dunes, in the area that would normally be occupied by secondary or tertiary dunes, stand homes. These structures not only interfere with natural beach processes, they also preclude the meaningful implementation of a rolling setback line, at least with respect to existing development. If the goal of such a setback is to keep development a safe distance from the sea, then a meaningful line can some day be established. But if the goal is to allow natural beach processes to take hold, or to regulate development prospectively, then the achievement of that goal will always be frustrated by the existing line of homes that would confront any migrating dunes. Of necessity therefore, even the most conservation oriented dune ordinances in New Jersey seek to protect and preserve a static dune line.

A second problem is the legal question of whether land use regulation so restricts the use of someone's land as to render it valueless, thereby constituting a "taking" without due process. A number of shorefront ordinances have successfully been challenged on this basis. Shorefront communities have responded to these challenges by inserting variance provisions in the ordinances which allow them to issue permits for construction seaward of a building line if it can be determined that construction will not jeopardize the public health, safety, or welfare.

As discussed at the beginning of this section, a bill now before the Legislature would give the State a direct role in the regulation of shorefront construction. A-2228, entitled the "Beach and Dune Protection Act," was introduced in November 1980. It requires every coastal municipality in Monmouth, Ocean, Atlantic, Cape May, Cumberland, and Middlesex (east of Cheesequake Creek) counties to prepare and adopt an ordinance for the regulation of land uses in beach and dune areas. The ordinances must comply with the bill's minimum standards for dune protection in order to be approved. DEP would be authorized to engage in direct regulation in those communities which fail to adopt such an ordinance. A similar bill, S-1636, was introduced in the State Senate in December 1980. These two bills were introduced after an initial more comprehensive legislative approach (A-1825) was withdrawn from the Assembly by its sponsor. That bill would have regulated construction in a wider area and prohibited reconstruction of buildings more than 50 percent destroyed by a coastal storm. (See Volume 2, Chapter XI.)

Thus, in accordance with its stated coastal management policies, the DEP is moving forward to develop land management tools for addressing the State's shoreline erosion problem.

D. LAND ACQUISITION

The acquisition of selected barrier island property can be one of the most cost-effective methods of shore protection, offering two simultaneous benefits: prevention of further development in an area that has proven to be prone to storm damage or to erosion, and facilitation of natural beach processes over a wider area, thereby affording greater protection to existing development.

There are, however, limited resources available for land acquisition. The State, through its Green Acres Administration, has since 1961 been assisting local and county governments to acquire open space tracts on a 50-50 matching basis. Green Acres funds are made available by bond issues, the most recent of which (1978) authorized the sale of $200 million in bonds. These funds are allocated on the basis of the 1977 New Jersey State Wide Comprehensive Outdoor Recreation Plan (SCORP), which serves as the State's principal recreational policy document.

As of July 1981, the Green Acres Program had funded the acquisition of approximately 140 acres of shorefront property in Monmouth, Ocean, and Cape May counties. The purpose of this program has been to gain control of the dry beach area for recreational purposes, but some parcels (4.5 acres in Beach Haven Borough and 4.6 acres in Long Beach Township) extend landward to the first road, and thereby encompass small dune fields. Acquisition of such parcels offers derivative shore protection benefits by preventing development on dunes, although this is not a SCORP criteria.

Federally-funded acquisition programs are almost nonexistent. Section 1362 of the National Flood Insurance Act of 1968 provides for the purchase of heavily storm damaged, high hazard properties by the Federal government. In fiscal year 1980, $5.4 million was appropriated for this voluntary program and was used for acquisition on Dauphin Island, Alabama and in Scituate, Massachusetts. However, it is unlikely that further funds will be available under Section 1362 in the future. The 97th Congress is considering legislation to create a national barrier island system, and to study the possible acquisition of units within that system. However, the legislation (H.R. 5981) is aimed at undeveloped barrier islands, and the only area in New Jersey for consideration within the system is Stone Harbor Point.

The Draft Shore Protection Master Plan (Dames & Moore, September 1980) examined possible acquisition strategies, and concluded that the purchase of property adjacent and parallel to the shore was not advisable (pg. VI-14). Instead, it recommended that barrier island tips, which are not already in Federal or State ownership, be given priority for post-storm acquisition.

The recommendation that areas parallel to the beach not be acquired was based in part on the assumption that a comprehensive state regulatory scheme encompassing that area would be in place. Since this is not the case, the State will, depending on the availability of funds, consider assisting local governments to acquire shorefront properties that have been heavily storm damaged, giving preference to shorefront areas maintained through engineering programs involving beach nourishment. Direct State land acquisition may also be considered, especially adjacent to existing DEP-managed parks and natural areas along the ocean. The purchase of such parcels would only be conducted on a post-storm basis since, as noted in the Draft Shore Protection Master Plan (pg. VI-13), the value of shorefront property is evenly divided between the value of the real estate and the value of the improvements thereon. Post-storm values, therefore, should be approximately one half of pre-storm values, assuming that the structures and other improvements on the site have been substantially or totally destroyed.

E. SUPPORTIVE FEDERAL PROGRAMS AND POLICIES

Numerous Federal programs and policies influence the degree and extent of shore protection, coastal development, and resource use. The most important programs include those administered by the U.S. Army Corps of Engineers and others dealing with National Flood Insurance and Federal Disaster Relief. A detailed discussion of each of these programs and the related policies are presented in Volume 2, Section III.D.

Other Federal programs relevant to coastal development and preservation include the following:

- Environmental Impact Statement Review Process
- Flood Plain Management and Wetlands Protection (Executive Orders 11988 and 11990)
- National Park System
- Soil Conservation
- Fish and Wildlife
- Air Quality
- Wastewater Treatment Facilities Grants
- Bridge and Highway Construction Programs and Permits
- Federal Surplus Property
- Interstate Land Sales
- Economic Development Administration Grants
- Urban Planning Assistance
- Federal Home Mortgage Insurance
- Mineral and Oil Exploration and Extraction
- Land and Water Conservation Fund Grants

These programs are also discussed in detail in Volume 2, Section III.D.

New direction in Federal polices on shore protection have recently been taken as a result of the President's first (May 1977) and second (August 1979) Environmental Messages. The first message identified the unique aspects of the barrier islands of the Gulf and Atlantic, and called for a review of existing and conflicting Federal policies that affect these ecosystems, and directed the Secretary of Interior — in consultation with the Secretary of Commerce, the Council on Environmental Quality (CEQ), and State and local officials in coastal areas — to develop a plan to protect the barrier islands from unwise use and development. The President's second message outlined three initiatives aimed at achieving comprehensive and wise management of the coastal zone:

- o Reauthorization of the Coastal Zone Management Act for 5 more years at current levels;
- o Development of new amendments to the Act which would establish a national coastal protection policy; and
- o Conducting a systematic review, by the Secretary of Commerce, of Federal programs that significantly affect coastal resources.

The objective is to provide a basis for specific recommendations to improve Federal actions affecting the coastal zone and develop additional legislation needed to achieve the national coastal management goals.

In January 1980, the Heritage Conservation and Recreation Service (HCRS), in conjunction with the National Park Service (NPS), the Fish and Wildlife Service (FWS), and CEQ published a Draft Environmental Impact Statement (DEIS) on Alternative Policies for Protecting the Barrier Islands. The Department of Interior, Office of Coastal Zone Management, is presently reviewing Federal policies related to a national coastal protection program called for in the President's second environmental message. The HCRS Draft EIS made several significant conclusions:

- o Barrier islands need special recognition;
- o Review of existing Federal authorities related to barrier islands reveals the need for a clear Federal barrier island policy;
- o Information on which to base the formulation of barrier island policy needs to be made available to planners and other public and private officials;
- o Private actions must continue to play a valuable role in barrier island protection. Private commitment ranges from large national and regional conservation organizations to small groups and concerned citizens;
- o The roles of the states and localities are the key to the success or failure of any barrier island protection effort; and
- o Federal programs and authorities have, in many ways, encouraged development of barrier islands, resulting in potential problems of public health and safety, increasing costs, and loss of important public benefits provided by unspoiled barrier islands.

Pursuant to the President's 1979 message, the Department of Commerce undertook a systematic review of Federal programs affecting the coastal zone. This study, the "Federal Coastal Program Review," was completed in early 1981, and reached similar conclusions to those arrived at in the HCRS Draft EIS.

More recently, legislation has been introduced in the 97th Congress (H.R. 3252 and S. 1018) to prohibit Federal construction aid and flood insurance for new development on undeveloped barrier islands and undeveloped portions of developed islands. The only area in New Jersey affected by this bill is Stone Harbor Point, which is already subject to limitations on development under the conditions of an issued CAFRA permit.

The availability of Federally subsidized flood insurance is the most significant Federal program affecting developed barrier islands. Actuarial rates (i.e., rates that attempt to measure the actual risk of storm damage) have recently been raised for structures in coastal high hazard areas, but a program to individually review and rate all new structures has been abandoned.

Disaster relief is also a significant Federal action in the coastal context, but no firm policy on post-storm assistance has yet been articulated.

The DEP intends to support existing and evolving Federal programs which are consistent with the State coastal management policies and functional in providing upgraded coastal construction standards and relocation incentives and assistance for occupants of coastal high-hazard areas.

CHAPTER III

CONCLUSION AND SUBSEQUENT ACTIONS

The implementation of the Shore Protection Master Plan will require a number of accompanying actions and studies by various levels of government.

A. SCIENTIFIC AND ENGINEERING STUDIES

The conceptual engineering studies presented in the Master Plan are equivalent to the U.S. Army Corps of Engineers pre-construction engineering feasibility studies. As such, they relied on existing published data, air photos, and field observations. Two additional levels of effort will be required prior to construction of priority engineering projects. They include:

- o Pre-construction reach specific studies; and
- o Final design

These pre-construction reach specific design studies will require current beach profile and littoral drift rate and direction data to more accurately estimate the actual volumes of sand required for implementation of selected engineering projects. Selection and sampling of offshore sources of sand will be required to evaluate the suitability of the sand for application on the design beaches.

In addition, refinements in recreational demand estimates will be required for the priority recreational development projects. Beach counts and the development of a reasonable beach usage reporting scheme will also be required to provide, and periodically update, a data base for decision making on design beaches. Site specific evaluations of beach berm elevations and widths will also be required in the refinement of selected limited restoration or storm erosion protection designs to meet the design objective.

Finally, DEP's Bureau of Coastal Engineering will cooperate with municipal engineers, to prepare detailed designs and cost estimates for priority projects utilizing data collected during the pre-construction reach design studies. If substantial modifications of conceptual Master Plan design plans occur, the project specific engineering plans will be evaluated with respect to economic justification.

B. LEGISLATION

While this Shore Protection Master Plan is designed for use under existing laws, it could more effectively help lessen the loss of property and lives and government expenditures from coastal storms and beach migration if the New Jersey Legislature enacted a law further restricting development upon the ocean. The proposed Beach and Dune Protection Act (A-2228, 1980) would require a State-local partnership to regulate new development on beaches and dunes. Another similar approach would be to incorporate dune and erosion hazard areas into a regulatory format by using a methodology such as the one recommended in Volume 2, Section V.A.2.b. To be most effective in regulating the pattern of development in coastal high hazard areas, regulatory legislation would need to be in place prior to the next major storm.

C. STATE-FEDERAL COORDINATION

Cost sharing for implementing the engineering alternatives will be sought through the Federal government. In particular, a determination of compatibility between selected engineering alternatives and U.S. Army Corps of Engineers funding criteria will be sought. This would enable the Federal government to provide up to half the total cost of an engineering reach plan in some instances. Priority engineering programs will be implemented even if Federal funds are not immediately forthcoming. If such funding becomes available in the future, the monies received will be applied retroactively to the engineering cost or they can be applied to cover additional engineering projects.

Funds for the land acquisition could also be sought at the Federal level, although the availability of funds is unlikely. These sources could include the Land and Water Conservation Fund Act of 1965, and Section 1362 of the National Flood Insurance Act of 1965, which provide grants to coastal states for land acquisition.

At the State level, additional funds will be obtained in one of two ways. One involves the passage of additional bond issues, similar to the 1977 Beaches and Harbors Bond Issue, to fund the implementation, and/or maintenance of the engineering alternatives. Second, additional Green Acres bond monies will be used for acquiring selected shorefront properties after storms.

D. STATE - LOCAL COORDINATION

The determination of local government participation in the implementation of recommended shore protection projects will be based on three considerations:

- o Willingness to participate;
- o Ability to participate in cost sharing; and
- o State-local aid agreements.

Local governments must first be willing to participate in proposed engineering projects. Even where affected municipalities are willing to participate, their fiscal and debt characteristics must indicate that they are capable of raising the necessary funds for sharing in the costs of initial construction and subsequent maintenance of engineering projects. Such a determination would focus on the size of the local tax base and the current debt levels carried by the affected municipalities. The New Jersey Department of Community Affairs is capable of making assessments of the ability to participate.

State-local aid agreements will be required before priority reach engineering plans are finalized and implemented. The aid agreements will specify the cost sharing responsibility of each of the municipalities within a reach. State cost sharing will be contingent on local governments meeting certain minimum requirements with regard to information disclosure, beach use/demand monitoring, and whether it has acceptable policies and other management techniques for beach access, beach/dune protection, and erosion hazard areas. The specific requirements, to be negotiated at the time that the aid agreement is prepared, will be based on consistency between municipal policies and programs and the policies of the New Jersey Coastal Management Program.

Where reach municipalities are not willing to participate in proposed engineering programs given the conditions set forth in the State-local aid agreement, or where municipalities are not able to participate in cost sharing, the State will consider the next reach on the priority list — and so on. Where the priority reach project is a maintenance program — as is the case for Reach 2 (Sandy Hook to Long Branch) — local participation and project construction may be addressed for individual municipalities within a reach. This is because the recommended maintenance programs, as defined in Chapter II, Section B.1.c, can usually be implemented at a local level without significant adverse effects on adjacent reach segments.

State-sponsored continued public education and training programs — including public participation workshops, meetings, and hearings — will continue to keep the public informed and aware of evolving shoreline management programs and policies. The Shore Protection Master Plan is an important part of the DEP's ongoing public awareness program.

E. CONTINGENCY PLANNING

Contingency planning will be undertaken to allow for preparedness for (1) emergency mitigation of severe erosion events (2) emergency evacuation for barrier islands and other coastal hazard areas and (3) post-disaster cleanup and recovery. For each of the planning regions identified in Volume 2, Chapter IX, contingency plans will be further analyzed and refined during implementation of the proposed Master Plan programs.

Where shore communities do not already have emergency evacuation plans for hazard areas, at a minimum, they should identify probable evacuation routes, evacuation time requirements, and specify the role and responsibilities of local officials in dealing with evacuation emergencies, coordinating with State and Federal disaster assistance agencies, and the public. Local post-disaster cleanup and recovery plans should, at a minimum, consider contingencies for restoration of basic utilities (e.g., electric, gas and water), razing and clearing of destroyed structures, and programs for supply of food and shelter. As discussed in Volume 2, Section III.C.1.d., the Federal Emergency Management Agency administers the Federal Disaster Relief Program which encourages states to develop plans, programs, and capabilities for disaster preparedness, prevention, and mitigation. The Federal Government has granted funds for the preparation and periodic updating of such plans and programs.

F. MONITORING PROGRAMS AND STUDIES

Since engineering programs will not provide permanent solutions for the New Jersey's shoreline erosion problems, it is important that induced physical and environmental shoreline changes be monitored continuously against the background of widely variable natural changes. As discussed in Chapter I, Section C.3.b, natural changes are seasonal (e.g., calm-storm beach cycles), long term (e.g., sea level effects), as well as related to irregular external influences (e.g., violent storm effects). It is also important to recognize and monitor important legal, economic, social, and political trends related to the implementation of Master Plan engineering and land management programs.

The following studies and monitoring programs will be adopted to ensure that the Shore Protection Master Plan is being implemented and functioning as intended.

- The shoreline migration rates will be monitored on a regular basis to maintain a consistent, uniform data base for future reference. This is best accomplished by utilizing annual or biannual aerial photographic coverage of the coast in conjunction with periodic beach profiling programs.

- Utilizing erosion data obtained from the monitoring program above, and data obtained from longshore current measurements, littoral drift rates and directions will be periodically reassessed. This information is an important component in shore protection engineering design.

- In reaches where engineering projects have been implemented, beach nourishment schedules and quantities will be periodically adjusted during the project life to accommodate shoreline migration trend fluctuations due to unanticipated variations in erosion and littoral drift rates.

- Beach user attendance will be monitored and compared with forecasted recreational beach demand in those reaches where the recreational engineering alternatives are implemented. This will enable the engineering design plans to be adjusted during the project life to accommodate actual demand. It will also allow more accurate, short-term forecasts of annual maintenance and periodic improvement costs. In addition, it will help reduce inefficient resource allocation by avoiding the creation of unnecessarily large beaches.

The following studies and monitoring programs will also be considered in conjunction with implementation of engineering and land management plans.

- Recording of property losses directly attributable to erosion impacts. This would allow an accurate assessment of the respective property protection benefits and costs that occur under the adoption of the selected plans, and any adjustment that might be required. Such recording could be done at the municipality level.

- Monitoring of coastal land use changes induced by land management programs to assess development density changes within a regulatory zone as well as in remaining sections of the affected municipalities.

- A survey of traffic conditions to determine how existing transportation links leading to shore areas are affecting access to the recreational beach on peak and average demand days.

With the publication of the Shore Protection Master Plan, the follow-up actions and studies discussed in previous sections of this chapter will be necessary for implementation of proposed engineering and land management programs. After implementation of the proposed programs, the State will be required to establish monitoring programs and studies to measure the effectiveness of the Master Plan and detect any induced direct or indirect physical, environmental, or socioeconomic effect. Monitoring will facilitate the implementation of corrective measures where they are found to be necessary.

Throughout the process of Master Plan implementation and monitoring, local and Federal participation and cooperation will be necessary if Plan objectives are to be met and if proposed programs are to function as intended.

G. CONCLUSION

The Shore Protection Master Plan is a major step in New Jersey's efforts to live and work, as well as to play, near the ocean. It attempts to match an analysis of current scientific knowledge, and a recognition of development patterns, social preferences, and economics with the legal and financial resources of government. The Plan will immediately be useful for shore protection decision-making, yet it is designed so that new information can be incorporated into it.

The Department of Environment Protection hopes that as people use this Plan, they will recognize the complex issues involved in shore protection and develop and suggest further improvements for New Jersey's shore protection program.

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