BEACHES 2000

Report to the Governor

June 21, 1988

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Forward

Delaware's Environmental Legacy Program identified the phenomenon of beach migration as one of the most significant environmental problems we face in the coming decades. To address this issue, the Legacy Report recommended development of a comprehensive management plan which would outline for the Governor and Legislature the dimension and scope of the issues and problems involved, a recommended course of action, and an indication of costs to the citizens of the State in the years ahead.

The Beaches 2000 Planning Group was assembled, at the request of Governor Michael N. Castle, to prepare a report identifying the management measures required to address shoreline erosion along Delaware's Atlantic Coast over the next decade. The work of the Planning Group represents the initial development of state policy called for in the Environmental Legacy Report. As part of this effort, an Advisory Committee was created to maximize public input as formulation of recommendations occurred.

The dynamic nature of the coastline, the tremendous value of properties along the coast, and the economic value of the coastal tourism industry combine to create a natural resource management problem that is particularly difficult to address. Any course of action chosen to deal with the problem of construction on a migrating shoreline will, in all probability, carry a very high cost and require changes in land use practices, all of which was recognized in the Legacy Program.

This report represents the combined efforts of many individuals with particular experience and expertise in coastal communities and beach migration. The recommendations enclosed are made with the full realization of their impacts both fiscally and socially, and with the commitment that the practices and problems of human occupation on the edge of Delaware's ocean and bay coasts must be dealt with.

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Introduction

To fully understand the nature of beach erosion and shoreline migration, it is important to address the lack of understanding of these phenomena. To the majority of people, beach erosion is the process of nature destroying the sandy beach which exists between development and the water. When one digs a little deeper into the geologic nature of coastal land, it becomes evident that the perceived erosion problems are of little consequence without the benchmark of human development. The intensive development along the shore in the last several decades has been carried out on what is actually a temporary position of the shoreline. A lack of understanding though the middle of this century of the dynamic nature of the shore has resulted in a problem portrayed principally as beach erosion.

Attempts to halt erosion and migration have been necessitated by the proximity of structures to the ocean or bay. The problem of communities threatened with storm damage and loss of recreational beach is real and serious; however, the question must be asked, is the problem natural or man-made? Regardless of the actual cause, the problem of diminished beach due to the decreasing space between development and the water will require considerable planning and cost to counter now and into the future.

Beach erosion and shoreline migration are the product of two major forces -- storms and sea level rise. The position of the land/water interface is, at any given time, a product of water level (tide), sediment supply (sand), and wave size. During the calmer period of summer, the visible portion of the beach from the dune line to the water is very wide. When storms pass along the coast, sand is removed from the visible beach and deposited in the

relatively shallow nearshore zone. The amount of change in the beach profile is dependent on storm strength, storm duration, tide height, and pre-storm beach condition among other factors. In a matter of hours, a 100-foot wide beach can be reduced to nothing. The dramatic changes resulting from a single storm may take months or in some cases years for the coast to fully recover, if it indeed ever fully recovers. But for the most part storm induced change is temporary. The coastline undulates with the changes of wave energy. It is economically impractical to protect the coast against every conceivable storm, so this report does not directly address the emergency aspects of storm safety.

The other major force affecting the coastline is sea level rise. For the last approximately 14,000 years the ocean has been rising at varying rates pushing the point where land meets sea in a landward direction. The marshes and beaches that now make up the Delaware coast were once as far as 100 miles east of their current location. Over time the migration of the shoreline has proceeded with little concern shown by coastal inhabitants. In the last 50 years Delaware's coast has become a major summer recreation attraction. With the construction of buildings, roads, and other infrastructure, the persistent movement of the shoreline now presents problems which were not previously experienced.

Two geologic processes also contribute to shoreline movement: (1) the actual rise in ocean levels caused by a gradual melting of the polar ice caps and thermal expansion of the oceans, and (2) compaction of the sediments and subsidance of the earth's crust that cause the nearshore land surface and the ocean floor to sink. The combination of these two factors is leading to a gradual rise of the ocean and bay relative to Delaware's land area. Over the long term, a landward and upward movement of the barrier beaches has occurred.

As sea level rises, waves begin to attack the beach at a higher elevation causing increased shoreline erosion. At the same time, washover and blowing beach sands continue the process of dune formation. These processes occur slowly enough so that the dune's position relative to the shoreline is maintained. But the net result is a gradual landward and upward movement of the beach and dune line. To give some scale to this ongoing effect, sea level has risen approximately 440 feet during the past 12,000 to 14,000 years. Centuries ago the shoreline of Delaware lay seaward on the edge of the outer Atlantic Continental Shelf approximately 80 to 100 miles east of Rehoboth Beach.

The rate of rise and slope of the land determines how fast the shoreline migrates. Many scientists now agree that an increase in the rate of sea level rise and, hence, an increase in the rate of shoreline migration, will happen in the coming decades due to an increase in concentrations of carbon dioxide and other "greenhouse" gases in the atmosphere. There is debate over what the rate of acceleration will be, but at least a doubling of the last 100 year's rate can be reasonably expected over the next century. Geologic studies indicate that relative sea level rise in the middle Atlantic states is thirteen inches per century. This rate is more than double that of the past 2,000 years which was six inches per century.

A number of scientists have developed mathematical models to predict sea level rise based on the increasing concentration of gases. The results of one of these models is shown in Table 1 and indicates that sea level could rise by as little as 22 inches or as much as 136 inches by the year 2100.

TABLE 1

Estimated Sea Level Rise, 2000 - 2100, by Scenario (inches)

Year	Historical Extrapolation	Conservative Scenario	Mid-Range Scenario	High Scenario
2000	0.8 - 1.2	1.9	3.5 -- 5.2	6.7
2025	1.8 - 3.2	5.1	10.3 -- 15.5	21.6
2050	2.8 - 4.7	9.4	20.6 -- 30.9	45.9
2075	3.7 - 6.1	15.0	35.9 -- 53.9	83.7
2100	4.7 - 7.1	22.1	56.9 -- 85.3	135.8

Source: J. Hoffman, D. Keyes, and H. Titus, 1983, Projecting Future Sea Level Rise: Methodology, Estimates to the Year 2000, and Research Needs, 2nd rev. ed. U.S. GPO No. 055-000-00236-3, Washington, D.C.: Government Printing Office.

Neither of these extreme scenarios is likely to occur and sea level rise is expected to fall somewhere between the two mid-range positions (57 to 85 inches). However, such a rise represents an 8 to 18 fold increase over the average sea level rise experienced over the past 100 years. Even the conservative (unlikely) scenario represents a three to five fold increase over the historic rate. For each foot of vertical sea-level rise the shoreline tends to migrate about 300 feet laterally. When one considers the impact on coastal properties caused by the relatively low historic rate, it is disturbing to contemplate what the future holds for the entire natural system, which includes the inland bays, circulation in Delaware Bay, flooding in low lying areas, and saltwater intrusion in aquifers.

Treating Beach Erosion Problems

A review of the many of ways in which people have attempted to halt beach loss over time yields numerous examples of approaches that have failed or which merit little serious consideration. Responsible coastal managers

attempting to preserve beaches and provide property protection consider viable options to fall under three general categories: beach nourishment; shoreline hardening; and strategic retreat (planned obsolescence). Beach nourishment is the process of pumping or hauling of sand onto a beach to make it wider. The addition of new sand provides a wider buffer which will be eventually eroded but removes the immediate threat to structures too close to the water. Shoreline hardening is the construction of sea walls, bulkheads, revetments, break- waters, groins, and the like. These provide localized wave protection to man-made structures by stopping waves seaward of the structures or, in the case of groins, stabilize the beach by interrupting the littoral flow of sand along the shore. Strategic retreat is the removal of man-made structures from the water front as the coast migrates. The choice of which option is best suited to treat erosion of any particular beach is based upon several conditions. For instance, if the primary goal is to preserve the beach then either nourishment or strategic retreat are the desired options. But if property protection is the most important feature and the beach is viewed as providing little benefit, then a seawall may be the best plan. Given the geologic reality that shoreline migration is inevitable, any relatively short term solution will ultimately have to be abandoned for another plan.

At some point in the future, the economic justification for a particular course of action considered optimal today will change because the local shoreline has changed due to sea level rise. It is important to incorporate into any recommended course of action the need to identify what criteria will be used for recommending a shift in management policy. That which is recommended today may be impractical to maintain in 15 years.

Knowing when to change the way we manage our shorelines can be aided through the use of economic benefit/cost analysis. Under this approach the trigger for such a decision would come when it is no longer economically feasible to pursue a particular plan. This could come about when the shoreline has migrated or sea level has risen to the point where, from an economic perspective, the shore can no longer be held in a stationary position.

The fundamental advantage of retreat is not negative, but the very positive virtue of preserving the beaches, albeit in a different position. Systematic acknowledgement of the natural system also carries the merits of protecting life and minimizing economic impacts, both private and public.

Management Considerations for the Delaware Shoreline

The process of deciding the best way to treat the problem of beach loss in Delaware necessitates dividing the coast into distinct shoreline regions. The area of concern in this report is the shoreline from the Maryland/Delaware state line at Fenwick Island to Cape Henlopen. Geologically the coast is made up of a series of littoral or sand sharing cells. From Cape Henlopen to Indian River Inlet the sand is moving from the inlet toward the Cape. Sand is also moving northward toward Indian River Inlet from what is known as the nodal point. Sand is blocked by Indian River Inlet from any movement north. The littoral cell from the Inlet south to the nodal point includes all of the North Bethany area, Bethany Beach and probably South Bethany. Somewhere in the area from South Bethany to Fenwick Island there is a change in the net movement of sand. This nodal point marks the change from net northerly flow to net southerly flow. In Fenwick Island the net flow of sand is south toward Ocean City, Maryland.

Access

There are four characteristics which should be considered as part of any definition of meaningful public access to a beach area. Probably the most important characteristic is the availability of parking. Other characteristics, in no particular order, are the provision of rest rooms, changing facilities, and refreshments. Given the general structure of the Delaware shoreline, car transportation is necessary to get to the beach area; thus, parking space is, in general, a prerequisite to access the beach. Private communities exclude the general public by prohibiting them from using whatever parking space exists within the community. The lack of access for the public to the private community beaches means that the public will not be able to use enhanced beaches in such areas. Communities with parking permit systems are considered to provide more accessibility than those that prohibit parking. However, the obstacles posed to the public by such systems represent a real decrease in accessibility to these beach areas.

Management Options

The three major categories of response options have been listed above. Each has its own benefits and drawbacks. Beach nourishment rebuilds the beach width which provides a larger recreational area, increased storm protection and is aesthetically pleasing. It recreates a natural condition by adding sand to the littoral compartments described above. The sand-sharing nature of a beach eventually spreads the benefits of nourishment over a larger area than that in which the sand was initially applied.

But nourishment has drawbacks too, however. A large storm striking the coast after a nourishment job has been conducted could cause considerable loss of the sand just placed. Nourishment must also be repeated at regular intervals to maintain a static position of the coast. The frequency of renourishment ultimately determines the cost of nourishment as an option. The economics of nourishment favor treating long stretches of shoreline due to the high cost of mobilizing and demobilizing equipment for adding sand to the beach and the fact that longer nourishment projects increase the stability of newly expanded beach areas. In Delaware coastline development is separated by open park land, and public beach communities are often separated by private communities. It is difficult to plan a long shoreline project in Delaware. Another problem with any option for coastal stabilization is the necessity to time funding with State and Federal funding cycles. A problem which may quickly manifest itself may not be treatable until funding cycles can address the problem.

Hardening of the shoreline is the best protection from storms for the structures and upland behind them. Sea walls, such as the one in Galveston, Texas, can be built to withstand very large storms. But these structures provide little beach preservation quality. Their construction should be done only in areas where a beach is not a primary desire. Heavily urbanized coastal areas sometimes incorporate nourished beaches with a sea wall or bulkhead fronting the construction line for storm protection. The wave reflection from a sea wall or bulkhead can accelerate sand loss on the fronting beach however, and therefore the trade off must be weighed in the project planning process.

Groins on the other hand, although a form of hardening, have been successful at stabilizing the shore at Rehoboth Beach and, to a lesser degree, at Bethany Beach. When used in conjunction with beach nourishment, properly designed groins can be a particularly effective form of shore stabilization, providing that they are economically justified.

Strategic retreat will eventually become our only option in the long-term if sea level rises as predicted. As it becomes increasingly expensive to nourish the beaches, or the beach has disappeared in front of hard structure, moving structures off the beach may be the only way to preserve the beach and protect the remaining structures. Over a period of decades consecutive rows of structures parallel to the shore would be evacuated leaving an open beach seaward of remaining development. Although this deals realistically with the problem, a number of political, economic and social considerations stand in the way of making this a practical solution.

If strategic retreat were employed, one would have to determine where to move the houses. In some communities, ocean front lots support condominium buildings and hotels which either could not realistically be moved, or would be inappropriate located elsewhere.

Another problem relates to who pays the moving and land procurement costs. If strategic retreat was adopted as policy, the State may be compelled to underwrite a portion of such actions.

FINAL RECOMMENDATIONS

Over the last four months, the Beaches 2000 Planning Group, with assistance from its twenty member Advisory Committee, has worked to develop a comprehensive management plan for Delaware's Atlantic Coast beaches. At the direction of Governor Castle, the group has sought to formulate a plan in a timely and responsible fashion.

The product of this effort is a series of recommendations that touches on a wide variety of areas related to the management and protection of Delaware's ocean coastline. The intent of these recommendations is to guide state and local policy as well as private actions regarding our beaches, and ensure that this important natural resource and tourist attraction is available to Delawareans and out-of-state visitors in the years ahead.

Underlying the body of recommendations is the acknowledgement of the economic importance of Delaware's beaches to the state, Sussex County and coastal communities. The Beaches 2000 Planning Group has thus sought to put forward a ten-year action agenda reflecting this value. The series of recommendations also reflects the hard reality that Delaware's shoreline, like all shorelines, is a dynamic natural system that, slowly but inevitably, moves landward over time.

Over the course of the deliberations on the many issues reviewed, the Planning Group and its Advisory Committee found common ground in many areas and agreed to disagree in others. The reader is referred to the report's section on preliminary recommendations for a detailed review of this discussion.

What follows are the Final Recommendations from the Beaches 2000 Planning Group to the Governor and people of Delaware. These recommendations are based on the best technical information available and incorporate the concerns raised by individuals and communities closely tied to the state's shoreline.

I. Coastal storms of the recent past (Gloria and Charley) and the gradual rise of sea level in the future require that Delaware take increased action to protecting and, where required, restoring its Atlantic Coast shoreline. Given the fact that the state's twenty-four mile ocean shoreline is a patchwork of state parks, public beaches and private beach communities, prudent and cost-effective management can be achieved only by a comprehensive strategy that focuses on the entire coastline. The following actions are recommended to preserve the recreational value of Delaware's beaches into the year 2000:

1. Renourish the unincorporated and incorporated areas of Fenwick Island. Planning and engineering work should commence in state fiscal year 1989.
2. Renourish the area between and inclusive of Bethany Beach and South Bethany Beach. Planning and engineering work should commence in state fiscal year 1989.
3. Develop a beach erosion plan for the area of Rehoboth Beach and Dewey Beach and begin preliminary project investigation and planning in state fiscal year 1989. Implementation of the erosion plan should occur by state fiscal year 1993.

4. State-owned parkland along the Atlantic Coast should be managed so as to allow for natural movement of the shoreline.

5. Private communities adjacent or between public beaches scheduled for nourishment should be incorporated into such projects where feasible. The beach protection needs of other private communities should be assessed on a periodic basis and actions proposed as appropriate. State actions to nourish any private beach should be subject to the financial requirements outlined in this report.

II. Policy and funding decisions in coastal areas should better reflect the fact that these areas are part of a dynamic natural system subject to damage by coastal storms and gradual shoreline erosion. The following actions will help to achieve this objective:

1. As essential infrastructure for transportation and safety in high-risk zones are damaged, they should be rebuilt in a manner that recognizes the vulnerability of these areas to natural forces.

2. Priority should be given to examining the establishment of movable building set-backs that protect natural beaches and primary dunes and that prohibit new construction of permanent structures in threatened areas.

3. Establish in Delaware Code a requirement that when a change in ownership is recorded, a current plat will be filed showing the lot lines and location of structures on the property. Deed restrictions should note specific risks of building in high risk zones or threatened areas as identified by DNREC. A requirement

for developers, real estate agencies, and/or grantors marketing property to disclose in writing the risks of being in high hazard areas should be established in Code.

4. State, County and municipal governments should adopt zoning and land-use controls that discourage development in high-risk coastal areas as defined by Flood Insurance Rate Maps.
5. Prior to construction of any new oceanfront structure on public beach land administered by the Division of Parks and Recreation, that Division shall consider the annual average erosion rate for that section of coastline and place any structures far enough landward to allow for safe shoreline migration during the useful life of the structure.
6. State and local governments should increase efforts to educate the public about the nature of beaches, public and private property interests, and the economic consequences of beach management options.

III. Opportunities exist along undeveloped areas of Delaware's Atlantic and Bay coasts to guide development decisions in a manner that minimizes exposure to storm damage and erosion and maximizes environmental protection. The following will help achieve this goal:

1. The State should actively support measures before Congress that would provide additional federal funds for the acquisition of undeveloped areas to preserve natural features or recreational beaches important to the public.

2. The State should give increased emphasis on encouraging land owners in high risk zones to donate conservation easements or adopt uses compatible with preserving the natural beaches (e.g. fishing camps, some recreational uses, parks, etc.) through use of special favorable tax assessments.

IV. Implementation of the measures called for in Section I will require new management tools and funding techniques. The following actions are recommended to ensure that a fair and equitable policy is developed in these areas:

1. The State should proceed immediately to determine the costs of supplying sand to the nourishment projects recommended for the Fenwick Island and Bethany/South Bethany areas from both off-shore and inland sources. Environmental concerns must be addressed in any consideration of inland sources.

2. Benefit/cost analysis should be used as a management tool to help evaluate the relative benefits and costs of alternative strategies to address beach erosion (i.e., nourishment vs. hardening vs. retreat). The benefit/cost methodology developed as part of this project should be utilized, however, the methodology should be expanded to encompass the value of the Atlantic Coast beaches of public and private communities to local county and state economies.

3. As a guiding principle, the State should not undertake state funded beach erosion projects where total costs exceed total benefits.

4. It should be the state's policy that private beach communities that do not promote access to the general public should pay the full cost of any beach management project for that community.
5. Sussex County should establish a beach preservation tax district for the purpose of taxing non-municipal areas and contributing such funds toward authorized beach erosion projects. Private communities contributing to beach erosion projects as outlined in Recommendation 4 should not also be taxed through the beach preservation tax district.
6. Coastal communities having accessible public beaches should be required to contribute to authorized beach management projects at a level of between 50% and 75% of construction and maintenance costs. To be eligible for a maximum 50/50 cost share with the state, public beach communities must agree to participate, or adopt in local code where required, the actions called for in sections II, III and V of this report, and agree to maximize public access. Emphasis should be given to local requirements to discourage development in high-risk coastal areas. Communities that choose not to agree to the requirements outlined above should be eligible for funding at reduced levels.
7. A detailed plan of action outlining how the local and state cost-shares for the nourishment projects recommended in this report will be funded should be developed no later than November 1, 1988.

8. Additional funding and personnel should be made available to the Beach Preservation Section of DNREC in order to carry out the expansion of responsibilities and management of new programs recommended in this report.

V. Additional policy direction is required to address state action in the event of a major coastal storm and to guide our actions in the future as they relate to the impact of sea level rise. The following actions will help meet these needs:

1. A "Post Storm Plan" should be developed as part of the State's Comprehensive Beach Management Plan in order to give guidance to the Governor and the Legislature when a storm crisis should next occur. The Planning Group, with the assistance of the Advisory Committee, should draft a plan which would review post storm alternatives including nourishment needs and priorities, reconstruction limitations, land acquisition and State aid for disaster relief.

2. With the adoption of this report, implementation of the actions called for should proceed by the appropriate agencies. Follow-up actions will be required to update these recommendations on a periodic basis. This work should focus on the "Post Storm Plan" and the long-range strategy for the management of Delaware's shoreline. The consequences of long-term sea level rise should be featured prominently in long-range recommendations. The underlying

philosophy should be that as beach nourishment becomes increasingly cost prohibitive and our ability to defend existing development lines is lost, the State will adopt a policy of active strategic retreat as the management option of choice. A recommended "trigger mechanism" that begins the shift in state policy should be analyzed as part of this work. The timing of the shift in state policy should be such that the citizens of Delaware will have continued access to recreational beaches into the next century and that provision of these beaches will be done in a environmentally sound and cost-effective manner.

APPENDIX I

PRELIMINARY PLANNING GROUP RECOMMENDATIONS AND ADVISORY COMMITTEE COMMENTS

Considering the options available for beach preservation, and reviewing the need for short-term action at certain locations along Delaware's Atlantic coastline, the need for a plan of action emerges. What follows is a review of preliminary recommendations put forward by the Beaches 2000 Planning Group, with comments from the Beaches 2000 Advisory Committee.

Planning Group Recommendation 1 - A beach nourishment project should be undertaken for the incorporated and unincorporated areas of Fenwick Island. Planning and engineering work should commence on this project in state fiscal year 1989. The benefit/cost study conducted as part of this report indicates that nourishment of the area in question will produce economic benefits that exceed project costs. The project will entail placing sand on the beach area from the Maryland line through the entire length of Fenwick and tapering it into Fenwick Island State Park immediately north of the Fenwick town line. To minimize costs, the state should seek to conduct this project in coordination with the Phase II replenishment work planned for Ocean City, Maryland.

Because actual design dimensions cannot be determined until more detailed engineering and planning work is conducted, it is not possible to present specific yardage and cost estimates at this time. However, it is the opinion of the Planning Group that the final dimensions of the project must be determined on the basis of detailed engineering and planning work and the optimum benefit/cost ratio as determined by the methodology adopted in this report. Preliminary information considered by the Planning Group in developing this recommendation is outlined in Appendix II.

Advisory Committee Comments - The Advisory Committee unanimously approved the recommendation that beach nourishment be undertaken at Fenwick Island within the timeframe outlined. The Committee did not endorse, however, the language in the Planning Group recommendation related to the benefit/cost methodology.

Planning Group Recommendation 2 - A beach nourishment project should be undertaken for the area between and inclusive of Bethany Beach and South Bethany Beach. Planning and engineering work on this project should commence in state fiscal year 1989. The benefit/cost study conducted as part of this report indicates that nourishment of the area in question will produce economic benefits that exceed project costs. The project should span roughly 2.5 miles from the south end of South Bethany to the north end of Bethany, and include Middlesex Beach and Sea Colony.

Because actual design dimensions cannot be determined until more detailed engineering and planning work is conducted, it is not possible to present specific yardage and cost estimates at this time. However, it is the opinion of the planning group that the final dimensions of the project must be determined on the basis of detailed engineering and planning work and the optimum benefit/cost ratio as determined by the methodology adopted in this report. Preliminary information used in the determination of this recommendation by the Planning Group is outlined in Appendix II.

Advisory Committee Comments - The Advisory Committee unanimously approved the recommendation that beach nourishment be undertaken for the area between and inclusive of Bethany Beach and South Bethany Beach within the timeframe outlined. The Committee did not endorse, however, the language in the Planning Group recommendation related to the benefit/cost methodology.

Planning Group Recommendation 3 - Utilization of inland borrow sources should be strongly considered as an alternative in supplying sand to the beach nourishment projects outlined in Recommendations 1 and 2 should this method prove to be more cost-effective to the state. Environmental impacts, timeliness, and damage to affected roadways must all be included in the analysis of costs and benefits of this method. Study by the Delaware Geological Survey is in progress to determine the availability of inland borrow sources.

Advisory Committee Comments - The vote was 10/3/6 to accept the Planning Group Recommendation. The Advisory Committee emphasized strongly the need to focus on the environmental impacts created by potential use of inland sources. Concern was also expressed on the impact to roads in Sussex County.

Planning Group Recommendation 4 - A detailed plan outlining what actions will be taken to address beach erosion in the area of Rehoboth Beach and Dewey Beach should be developed by DNREC. Project investigation and preliminary planning should begin in state fiscal year 1989. At this time, the area in question is not currently considered as requiring immediate

attention. However, there has been sufficient beach loss in the recent past to warrant development of a plan of action to be implemented within four years. Preliminary information suggests that nourishment of the beaches in the Rehoboth and Dewey area is the management option of choice.

Advisory Committee Comments - Unanimous approval was expressed for language of recommendation as revised from preliminary Planning Group recommendation.

Planning Group Recommendation 5 - The benefit/cost methodology outlined in Appendix II of this report should be used to evaluate the total costs and benefits of undertaking beach management projects recommended in this report and for all future actions taken as part of a long-range strategic beach management plan for the Atlantic coast. Projects designed to address beach erosion that have total costs exceeding total benefits should not be undertaken with state funds.

Advisory Committee Comments - The Advisory Committee did not directly address the use of the benefit/cost methodology outlined in the report as part of a long-range strategic beach management plan. The Committee did vote 16/2/1 that the methodology referenced in recommendations 5 through 8 was flawed in that it failed to consider the state's interest in its important tourism industry. The Committee vote on recommendation language stating projects should be undertaken only if total benefits exceed total costs was 6/3/6.

Planning Group Recommendation 6 - The benefit/cost methodology outlined in Appendix II should be used as a basis for determining how the non-federal costs of any beach management project for the Atlantic Coast should be attributed to identified beneficiaries. State policy on this subject should reflect the philosophy that those who benefit financially from beach management projects should bear the costs of such projects in reasonable proportion to the benefits received.

Advisory Committee Comments - The Advisory Committee adopted the following motion by a vote of 16/2/1: "It is the view of the Advisory Committee that the benefit/cost methodology recommended by the Planning Group in recommendations 5, 6, 7, and 8 as reflected in Appendix II is flawed because it fails to consider the state's interest in its important tourism industry. Furthermore, the state has sole responsibility under the Beach Preservation Act (Title 7, Chapter 68) 'To enhance, preserve and protect' the beaches. The Advisory Committee believes the municipalities and the Sussex County should share in such costs and further believes a proper cost share of a minimum of 50% should be paid by the state, and the balance equitably shared between the County and the municipalities. This approach is consistent with policy adopted by the State in the past four years."

Planning Group Recommendation 7 - State financial contributions to any beach management project in the future should be based on the policy outlined in Recommendation 6. Increases in State and County revenues attributable to beach management projects should comprise the cost-shares from the respective

governments. State revenue streams to be considered in developing the State cost-share are outlined in Appendix II. It should be the state's policy that private beach communities that do not promote access to the general public should pay the full cost of any beach management project for that community.

Advisory Committee Comments - Advisory Committee objections to the benefit/cost methodology were again raised with discussion of this recommendation. The Advisory Committee unanimously agreed with the following: "It should be the state's policy that private beach communities that do not promote access to the general public should pay the full cost of any beach management project for that community."

Planning Group Recommendation 8 - A detailed plan of action outlining how the local and state cost shares for the nourishment projects recommended in this report will be funded should be developed no later than 90 days following delivery of this report to the Governor. The cost shares recommended in this report will require the funds at the local level be raised in a relatively short timeframe. To accomplish this objective in a timely fashion, a series of financing options should be developed with input from the State Budget Office and the Department of Finance, Sussex County, and the affected municipalities and private developments. The Planning Group recommends that strong consideration be given to establishing a "Beach Preservation District" encompassing, at a minimum, the Delaware shore south of

the Indian River Inlet. The purpose of the Beach Preservation District would be to implement the revenue raising measure(s) recommended in the financing plan called for in this report.

Advisory Committee Comments - The Committee unanimously adopted the following: "A detailed plan of action outlining how the local and state cost-shares for the nourishment projects recommended in this report will be funded should be developed no later than November 1, 1988. The Advisory Committee recommends that Sussex County establish a beach preservation tax district for the purpose of taxing non-municipal areas."

Planning Group Recommendation 9 - The State should actively support measures before Congress that would provide additional federal funds for the acquisition of undeveloped areas to preserve natural features or recreational beaches important to the public.

Advisory Committee Comments - The Committee unanimously agreed with this recommendation.

Planning Group Recommendation 10 - The State should support efforts to discontinue federally backed insurance programs that encourage new development and substantial rebuilding in high risk zones. Federal flood insurance rates for existing structures should reflect the actual degree of risk such construction is exposed to. Funding of such insurance programs should be borne by protected property owners. The use of insurance receipts or disaster payments should be conditioned on rebuilding outside high risk zones in coastal areas. High risk zones are defined as all V zones as found on Flood Insurance Rate Maps prepared by the Federal Emergency Management Agency.

Advisory Committee Comments - The Advisory Committee disagreed with this recommendation by a vote of 5/6/4.

Planning Group Recommendation 11 - Equate the costs of roads and other public works (aside from those constructed for the purpose of beach preservation) that lie within high risk zones more closely with those who benefit from this infrastructure. State funds for the repair of this infrastructure resulting from coastal storms should be discontinued or dramatically reduced. Essential infrastructure for transportation and safety should be rebuilt in a manner that recognizes the dynamic nature of the shoreline.

Advisory Committee Comments - The Advisory Committee recommended the following substitute language for recommendation 11 by a unanimous vote: "As essential infrastructure for transportation and safety in high-risk zones are damaged, they will be rebuilt in a manner that recognizes the dynamic nature of the shoreline."

Planning Group Recommendation 12 - Give increased emphasis on encouraging land owners in high risk zones to donate conservation easements or adopt uses compatible with preserving the natural beaches (e.g. fishing camps, some recreational uses, parks, etc.) through use of special favorable tax assessments. Protection of shorefront areas should be given greater emphasis in Delaware's Outdoor Recreation Program.

Advisory Committee Comments - The Committee agreed with the recommendation by a vote of 16/0/2.

Planning Group Recommendation 13 - Examine the establishment of movable building set-backs that protect natural beaches and primary dunes and that prohibit new construction of permanent structures in threatened areas. Where short-term changes in beaches create new beach areas, the state should prohibit building on such newly accreted land.

Advisory Committee Comments - The Committee agreed with this recommendation by a vote of 16/0/2.

Planning Group Recommendation 14 - Establish in Delaware Code a requirement that when a change in ownership is recorded, a current plat will be filed showing the lot lines and location of structures on the property. Deed restrictions should note specific risks of building in high risk zones or threatened areas as identified by DNREC. A requirement for developers, real estate agencies, and/or grantors marketing property to disclose in writing the risks of being in high-risk coastal areas should be established in Code.

Advisory Committee Comments - The Committee agreed with the language of the above recommendation as modified.

Planning Group Recommendation 15 - Require any applicant for a permit to rebuild in a threatened area to waive the right to petition state government for public aid when future damage occurs. Existing law should be amended to provide that no state officer or agency shall approve any financial assistance for construction or rehabilitation in a high risk zone for the purpose of replacing, rebuilding, or restoring a structure which has been damaged or destroyed by a coastal storm.

Advisory Committee Comments - The Committee disagreed with this recommendation by a vote of 5/3/5.

Planning Group Recommendation 16 - State, County and municipal governments should adopt zoning and land-use controls that discourage development in high-risk coastal areas as defined by Flood Insurance Rate Maps.

Advisory Committee Comments - The Committee unanimously agreed with the language of this recommendation as modified above.

Planning Group Recommendation 17 - State and local governments should increase efforts to educate the public about the nature of beaches, public and and private property interests, and the economic consequences of beach management options. Additional research to understand the effects of sea level rise on Delaware's shoreline development is also important. The Delaware Geological Survey should be given the lead to monitor and research the status of the shoreline and the processes acting upon it.

Advisory Committee Comments - The Committee unanimously agreed with this recommendation.

Planning Group Recommendation 18 - Prior to construction of any new oceanfront structure on public beach land administered by the Division of Parks and Recreation, that Division shall consider the annual average erosion rate for that section of coastline and place any structures far enough landward to allow for safe shoreline migration during the useful life of the

structure. If beach migration in any of the parks threatens an existing structure, remedial action should be based on the economics of structural protection or beach stabilization versus relocation or reconstruction of the structure.

Advisory Committee Comments - The Committee unanimously agreed with this recommendation.

Planning Group Recommendation 19 - A "Post Storm Plan" should be developed as part of the State's Comprehensive Beach Management Plan in order to give guidance to the Governor and the Legislature when a storm crisis should next occur. The Planning Group, with the assistance of the Advisory Committee, should draft a plan which would review post storm alternatives including nourishment needs and priorities, reconstruction limitations, land acquisition and State aid for disaster relief.

Advisory Committee Comments - The Committee unanimously agreed with this recommendation.

Planning Group Recommendation 20 - Additional funding and personnel should be made available to the Beach Preservation Section of DNREC in order to carry out the expansion of responsibilities and management of new programs recommended in this report. While management responsibilities have grown for the Section as growth has occurred along the shoreline, the size of the Section has remained relatively unchanged since its inception in 1973. Additional personnel will be required to ensure that enforcement, processing of permit applications, dune and beach maintenance, and new planning and management responsibilities can be conducted in a timely fashion.

Advisory Committee Comments - The Committee unanimously agreed with this recommendation. The Committee expressed to need to ensure that priority be given to securing adequate personnel to manage the planning, engineering, construction and management requirements of the nourishment projects recommended in this report.

Planning Group Recommendation 21 - With the adoption of this report, implementation of the actions called for should proceed by the appropriate agencies. Follow-up actions will be required to update these recommendations on a periodic basis. This work should focus on the "Post Storm Plan" and the long-range strategy for the management of Delaware's shoreline. The consequences of long-term sea level rise should be featured prominently in long-range recommendations. The underlying philosophy should be that as beach nourishment becomes increasingly cost prohibitive and our ability to defend existing development lines is lost, the State will adopt a policy of active strategic retreat as the management option of choice. A recommended "trigger mechanism" that begins the shift in state policy should be analyzed as part of this work. The timing of the shift in state policy should be such that the citizens of Delaware will have continued access to recreational beaches into the next century and that provision of these beaches will be done in a environmentally sound and cost-effective manner.

Advisory Committee Comments - The Committee unanimously agreed with this recommendation.

APPENDIX II

METHODOLOGY

In this appendix we outline the methodology for estimating 1) the direct benefits and costs of beach nourishment and 2) the expenditure-impact effects stemming from a beach nourishment project.

In broad terms the direct benefits and costs of a project are those effects that are immediately attributable to the project. In the case of beach nourishment to create a wider beach, the direct benefits are the recreational gains enjoyed by users of the beach and the enhanced property protection enjoyed by residential, commercial, and governmental owners of property near the beach. The direct costs are those associated directly with obtaining and placing sand on the beach. These include the outlays to the dredging or hauling contractors; they also include the cost of road damage (in the case of the hauling option), congestion costs if any (also in the case of the hauling option), and environmental costs.

The expenditure-impact effects arise from the changes in economic activity within the state that stem from the project. For instance, if beach nourishment eventually attracts more people from other states to Delaware beaches, expenditures they make while in Delaware will benefit residents of the state, thus representing a form of expenditure-impact benefit. Further, if the project is financed in part by new taxes on out-of-state residents (e.g., higher property taxes on beachfront property owners, many of whom live in other states), that represents an implicit increase in the resources available to state residents, and would be counted as an expenditure-impact benefit.

These distinctions are somewhat arbitrary, arising mainly from the separate analytical approaches often required for estimating the two types of effects. In the end, whether a benefit or a cost arises "directly" from the project or from the project's expenditure impact may be unimportant.

The appropriate methodology for investigating the economic implications of any project is a "with-without" methodology. What we are striving for is a set of quantitative estimates that will allow some comparisons between what would happen <u>with</u> the beach nourishment project and what would happen <u>without</u> it.

DIRECT BENEFITS AND COSTS

I. DIRECT BENEFITS

Beach nourishment creates three types of direct benefits: 1) protection and enhancement of property values (both residential and commercial); 2) recreational gains from a wider beach; and 3) protection of public assets (e.g., roads, sewer lines).

The principal groups receiving one or more of these direct benefits are 1) residential property owners; 2) commercial interests; 3) beach users; 4) the state government; 5) the county government; and 6) municipal governments.

A. Residential Property Values

Beachfront Property Owners: In many instances, beach nourishment will raise property values along the beachfront, because the properties would then provide access to an improved beach and because the properties are better protected from the effects of erosion and storm damage. This is particularly the case if the properties are seriously threatened, as in South Bethany. The direct benefit of this is the estimated increase in property values that beach nourishment would occasion. It appears that property values comparisons between various beach communities, combined with the judgments of realtors will allow us to estimate the short-term increase in property values from a wider beach.

In addition, a wider beach protects the property and delays the time when the property begins to suffer losses in value because of erosion. That is, increasing the width of the beach changes the time profile of the value of the beachfront property. The change in the time profile is likely to be highly uncertain; we will rely largely upon simulations to establish a range of reasonable values for this benefit.

Other Beach Area Residential Property Owners: In principle, the foregoing comments apply to properties located near, but not on, the beach. However, our current discussions with realtors and an investigation of property value profiles suggest that properties off the beachfront will experience either no gains or relatively small gains in value from the added protection provided by beach nourishment.

County and Local Governments: Property value benefits may be captured in some small part by county or local governments, through property taxes. At the county level, property taxes would be affected--in the absence of a

general reassessment--only if erosion causes a drop in the market value of properties, leading to a request for downward reassessment of the value of the property for tax purposes. An increase in market values from beach nourishment would not lead to higher county taxes, in the absence of a general reassessment. Local property taxes may behave differently; we still need to investigate these.

B. Commercial Property Values

Beachfront Commercial Property Owners: Hotels/motels stand to gain in value from a wider beach for essentially the same reasons that beachfront residences do. Immediate access to an improved beach is presumably something for which renters will pay higher rents; this means higher profits and thus higher property values for hotels/motels on the beachfront. In addition, beachfront hotels/motels may enjoy some significant added protection from erosion and storm damage, thereby enhancing their value.

The direct benefits for other commercial interests along the beachfront arise from the greater protection a wider beach provides. For property values to reflect this, the added protection would have to be significant. Since there are no commercial properties in the most seriously threatened areas (south of the inlet), we expect that this direct benefit will be negligible. (If a wider beach attracts more business for commercial enterprises along a beachfront, that is classified as an "expenditure impact" benefit and is discussed in a subsequent section.)

Other Beach Area Commercial Property Owners: Hotels/motels relatively close to a widened beach may gain in property value for the reasons described above. Protection benefits for all commercial properties off the beachfront should be negligible.

The only community south of the inlet with commercial interests likely to experience significant direct benefits appears to be Bethany Beach.

County and Local Governments: Just as with gains in residential properties, some of the gains in commercial property values may be captured by property tax authorities.

State Government: The state would benefit from higher lodging rates--part of the source of higher property values for hotels/motels--through the 6 percent public accommodations tax. It would also benefit from increased business and personal income taxes, arising from higher lodging rates. These effects are surely relatively minor, given the nature of the communities under investigation.

(The state would also benefit, for example, from higher gross receipts tax revenues in the event that wider beaches stimulated more business; that type of effect is an "expenditure impact" effect, which is considered in a subsequent section.)

C. Recreational Gains

The groups receiving direct benefits in this form are the beach users. People value a wider beach because it provides more space on days when crowding is a potential problem. Presumably, on days when the beach is uncrowded, the advantages of a wider beach are negligible, if not zero, except in the most serious erosion cases (like South Bethany). Valuing these gains requires a forecast of beach use with and without the project, and an estimate of the value beach users place on wider beaches (that is, on less congestion). Estimate of maximum beach use will be based upon estimates of beach capacity with and without the project. Criteria for estimating beach capacity are provided in various Corps of Engineers reports and in the latest Delaware State Comprehensive Outdoor Recreation Plan. Various Corps of Engineers reports, and some papers in the professional literature, provide some rough guidance to selecting reasonable values for the user benefit from wider beaches.

On private and quasi-private beaches, crowding is not perceived to be a problem. Thus, no recreational benefits will be attached to the placement of sand on such beaches as Middlesex. Sea Colony could be an exception to this, given the density of the population there.

To some extent, the user benefits from improved beaches are captured by landlords and motel/hotel owners in the form of higher rents. Thus, there is the possibility of some double counting arising in connection with this component of benefits.

D. Protection of Public Property

The direct benefit here is the avoided damage that continued erosion eventually implies for public property, such as sewers, underground cables, boardwalks, bulkheads, and even roads. The public property at risk from gradual erosion in the short-to-intermediate period appear to belong to the county or local governments.

II. DIRECT COSTS

The principal direct cost of a beach nourishment project is the outlay that must be made to one or more contractors for placing sand on a beach (either through dredging or hauling). We refer to this as the "contract cost" of the project. In addition, a beach nourishment project that relies on hauling may cause road damage, especially to secondary roads. Other costs, which we are not planning to estimate, are congestion costs caused by the hauling option, and environmental costs, which are likely to be associated with both the dredging and hauling options.

A. Contract Cost of the Project

Measuring these costs is relatively straightforward. It involves obtaining estimates of the number of cubic yards needed for the project and the average cost per cubic yard, including the costs of extraction, delivery, and spreading. We are relying on DNREC for these estimates.

B. Damage to Roads

If the project relies upon inland borrow pits for the sand, that will require many thousands of trips by large heavy trucks. Heavy truck traffic on secondary roads can cause serious damage; even on primary roads like Route 1 some damage is possible. The Delaware DOT has promised us some estimates of the amount of damage caused by heavy truck traffic.

C. Congestion Costs

Again, if the project relies upon the hauling option, there may be significant congestion costs created by the truck traffic. However, if the work is done in the off-season, congestion costs may be minimal. Presently, we do not intend to estimate this cost.

D. Environmental Costs

Either option can create environmental costs. Inland borrow pits could be left in an unsightly, perhaps even unsafe, way. Offshore dredging may create problems for bottom dwelling species. While we recognize these potential costs, we do not plan to quantify them.

EXPENDITURE IMPACT EFFECTS

Expenditure impact effects are created by net additional, in-state expenditures which are made because a nourishment

project is undertaken. The following explains the methodology for measuring three types of impact expenditures: project, construction, and visitor. Table A-1 summarizes this methodology and follows the organization used below.

I.A. **Total Project Expenditures**

This is the nominal cost of the nourishment project. For dredging it would consist of the price of the contract with the dredging firm and any costs to state and local governments which are part of the nourishment project. If an on-shore source of sand is used, the total cost would include the price of the hauling contract, including extraction costs, and the cost of moving the sand after it has been dumped on the beach.

B. **Portion of Total Project Expenditures which is spent out of state**

Any portion of the project expenditures which are not made in Delaware will not produce an expenditure impact in Delaware and therefore must be subtracted out. This adjustment is likely to apply only to dredging expenditures where in-state expenditures are likely to be limited to those for supplies, such as fuel, and those generated by the wage payments to workers who spend part or all of their incomes in Delaware.

C. **Reduction in other state project expenditures**

To the extent that a nourishment project preempts other state and local government expenditures, nourishment expenditures do not represent a net increment in expenditures in Delaware. For example, if the state's budget allocation for highway improvement is trimmed back by the amount of the State's share of nourishment costs, in order to fit the nourishment project into the State budget, then the net nourishment expenditure impact is reduced by the amount of the cutback.

D. **Reduction in expenditures by Delaware taxpayers resulting from taxation for a nourishment project**

To the extent that the nourishment project is financed by additional taxes at either the state or local level, these additional tax payments will leave Delaware residents with less income to spend in Delaware. The net nourishment expenditure impact is thus reduced accordingly. This adjustment does <u>not</u> have to be made for those addition nourishment taxes which fall on nonresidents.

TABLE A-1

SUMMARY OF EXPENDITURE IMPACT EFFECTS

I. Project Expenditures	
A. Total Project Expenditures	+
B. Portion of I.A. which is spent out of state	-
C. Reduction in other state project expenditures	-
D. Reduction in expenditures by DE taxpayers resulting from taxation for project	-
E. Required increase in other state expenditures because of the project	-
F. Net in-state project expenditure impact	(+ or -)
II. Construction Expenditures (residential and nonresidential)	
A. Additional construction in areas near project	+
B. Portion of II.A. which represents a shifting of construction from other DE beach areas	-
C. Net Increase in DE construction expenditures	+
III. Visitor Expenditures	
A. Additional expenditures by daytrippers and overnighters to the project areas	+
B. Portion of III.A. which reflect a shifting of visitors from other DE beach areas	-
C. Net Increase in DE visitor expenditures	+
IV. Total Impact Expenditures (I.,II.,III.)	(+ or -)
V. Total Expenditure Impact Effect: Total Impact Expenditures (IV.) plus Multiplier Induced Impact Expenditures	
A. Impact on State Income	(+ or -)
B. Impact on Tax Revenues	(+ or -)

E. Required increase in other state expenditures because of the nourishment project

State and local governments may have to make additional expenditures as a result of project related activity. In this regard the principal effect is likely to be the increase in road maintenance required by sand hauling road damage.

F. Net in-state project expenditure impact

Net in-state project expenditures as a fraction of Total Project Expenditures (I.A.) is likely to be greater for sand hauling than for dredging. The portion of the total project expenditure spent out of state is likely to be substantially greater for dredging. Note that if I.C., I.D., and I.E. are large enough, the expenditure impact of a dredging project could be negative.

II.A. Additional Construction Expenditures in areas near the beach nourishment (residential and nonresidential)

Beach nourishment will increase the incentive to improve and upgrade properties in nearby areas. This will occur both because the value of beach use increases and because of better property protection.

B. Portion of Additional Construction which represents a shifting of construction away from other Delaware beach areas

To the extent that nourishment in particular areas shifts the location of beach area construction, the total additional construction in particular areas does not represent a net increase in construction expenditures in Delaware.

C. Net Increase in Delaware Construction Expenditures

This represents the net in-state construction expenditure impact of beach nourishment.

III.A. Additional Expenditures by Daytrip and Overnight Visitors to the nourished areas

Beach visitors spend money on such things as food, lodging, and entertainment.

B. Portion of Visitor Expenditures which reflect a shifting of visitors from other Delaware beach areas

To the extent that nourishment in particular areas shifts the location of total beach area visits, the total additional visitor expenditures in particular areas does not represent a net increase in expenditures in Delaware.

C. Net Increase in Delaware Visitor Expenditures

This represents the net in-state visitor expenditure impact of beach nourishment.

IV. Total Impact Expenditures from I., II., and III.

This summation could be negative since I. could be negative.

V. Total Expenditure Impact Effect: Total Impact Expenditures (IV.) plus Multiplier Induced Impact Expenditures

The total expenditure impact effect on the Delaware economy goes beyond the summation of expenditures represented by IV. because these expenditures in turn lead to additional purchases by Delaware firms, some of which are directed to other in-State establishments. These multiplier induced expenditures are also part of the expenditure impact effect of nourishment.

This full expenditure impact effect will be divided between Private Sector Expenditures (A.) and Tax Revenues (B.).

State taxes to be taken into account in the development of State cost-share for beach management projects.

Individual Income Tax

Corporation Income Tax

Motor Vehicle and Fuel Tax

Business and Occupation Gross Receipts

Cigarette Taxes

Alcoholic Beverage Tax

Insurance Taxes

Real Estate Taxes

Public Utilities

Lottery

Public Accommodations

FENWICK ISLAND STUDY AREA The Planning Group recommends initiation of a beach nourishment project in this area on the basis of preliminary information that suggests the costs for initial nourishment will range from $900,000 to $4.2 million for sand pumped from an off-shore source. Expected benefits for a project at the lower end of this cost scale, plus the cost of periodic replenishment over a ten year period, are estimated at approximately $4.4 million. Estimated benefits to beachfront property owners (defined as protection and enhancement of property values) are approximately $3.6 million. Suggested local cost share for the replenished area is approximately $2.77 million, or approximately 92% of total project costs.

BETHANY/SOUTH BETHANY STUDY AREA The Planning Group recommends initiation of a beach nourishment project in this area on the basis of preliminary information that suggests the costs for nourishment from off-shore sand sources are estimated to range between $4 million to $7.2 million. Estimated benefits from a project at the upper of end of this scale, plus periodic beach nourishment over a ten year period, total $15 million. Estimated benefits (defined here as protection and enhancement of property values) to beachfront property owners are approximately $12.7 million. Suggested local cost share for the project is $6.49 million. Broken down by community, it is recommended that Bethany Beach contribute $2.15 million, Sea Colony and Middlesex contribute $2.3 million, and South Bethany contribute $2.77 million of project costs. On a percentage basis, Bethany Beach should contribute 83%, Sea colony and Middlesex should contribute 100% and South Bethany Contribute 89% of project costs.

APPENDIX III

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