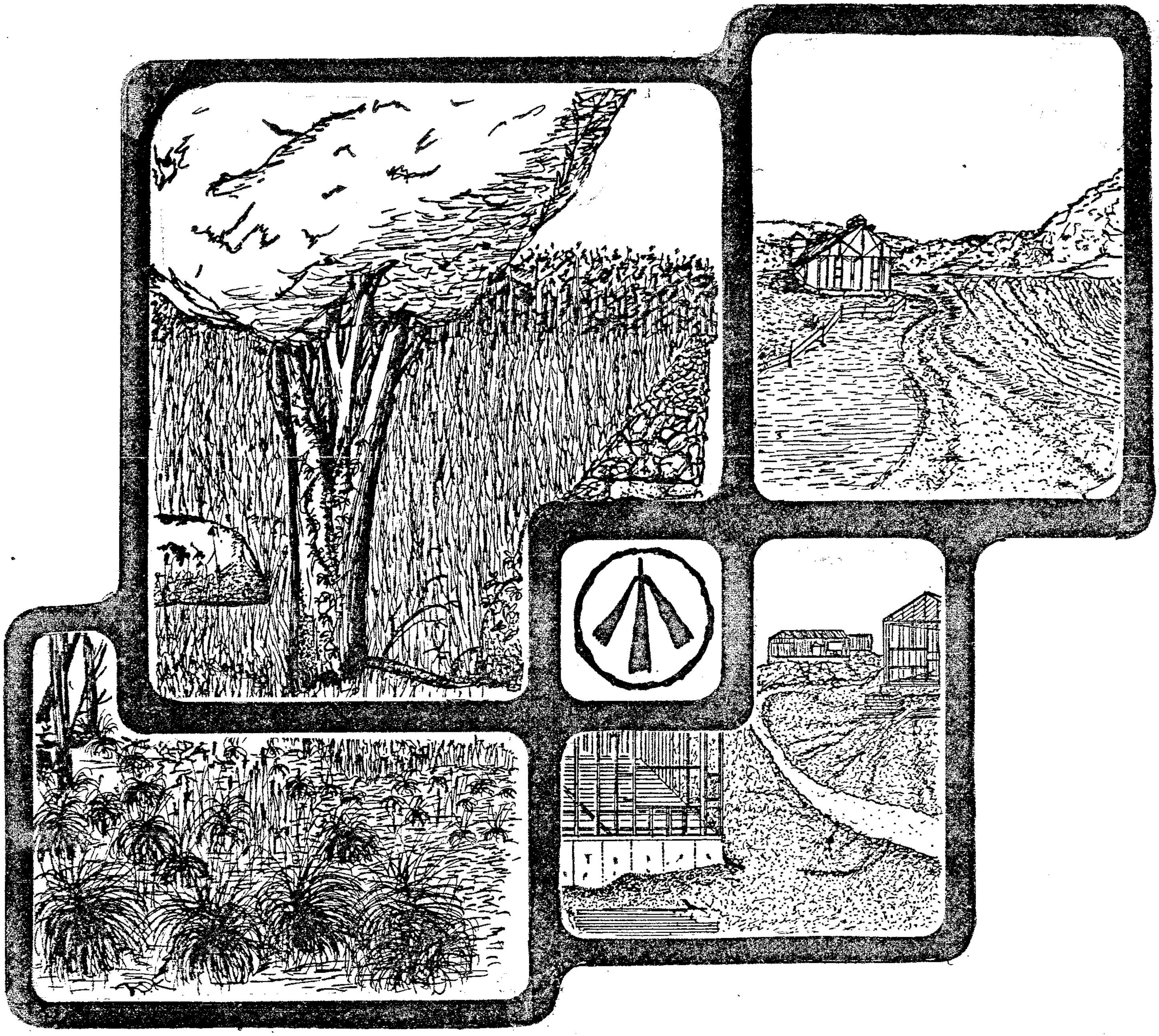
ENVIRONMENTAL REVIEW TEAM REPORT



PLEASURE BEACH
BRIDGEPORT, CT

KING'S MARK
RESOURCE CONSERVATION & DEVELOPMENT AREA

KING'S MARK ENVIRONMENTAL REVIEW TEAM REPORT

PLEASURE BEACH
BRIDGEPORT, CT
MAY 1984

King's Mark Resource Conservation and Development Area
Environmental Review Team
Sackett Hill Road
Warren,Connecticut 06754

ACKNOWLEDGMENTS

The King's Mark Environmental Review Team operates through the cooperative effort of a number of agencies and organizations including:

Federal Agencies
- U.S.D.A. Soil Conservation Service

State Agencies
- Department of Environmental Protection
- Department of Health
- University of Connecticut Cooperative Extension Service
- Department of Transportation

Local Groups and Agencies
- Litchfield County Soil and Water Conservation District
- New Haven County Soil and Water Conservation District
- Hartford County Soil and Water Conservation District
- Fairfield County Soil and Water Conservation District
- Northwestern Connecticut Regional Planning Agency
- Valley Regional Planning Agency
- Central Naugatuck Valley Regional Planning Agency
- Housatonic Valley Council of Elected Officials
- Southwestern Regional Planning Agency
- Greater Bridgeport Regional Planning Agency
- Regional Planning Agency of South Central Connecticut
- Central Connecticut Regional Planning Agency
- American Indian Archaeological Institute
- Housatonic Valley Association

x x x x x

FUNDING PROVIDED BY
State of Connecticut

POLICY DETERMINED BY
King's Mark Resource Conservation and Development, Inc.
Executive Committee Members

Victor Allan, Chairman, Bethlehem
Harold Feldman, Treasurer, Orange
Stephen Driver, Secretary, Redding
Leonard Assard, Bethlehem
Sam M. Chambliss, Ridgefield
David Hannon, Goshen
Irving Hart, New Hartford
Frederick Leavenworth, Woodbury
David Brooks, North Canaan
John Rabbe, East Hartford
Mrs. Julia Wasserman, Newtown
Donna Lindgren, Ansonia

STAFF ADMINISTRATION PROVIDED BY

Northwestern Connecticut Regional Planning Agency

Dorothy Westerhoff, Chairman
Charles A. Boster, Director
Richard Lynn, ERT Coordinator
Sandra Bausch, ERT Cartographer
Jamie Whitman, Secretary

TABLE OF CONTENTS

Page

a. INTRODUCTION.......... 1

I. DESCRIPTION OF THE ENVIRONMENT.......... 5

A. Geology and Marine Processes.......... 5

B. Landforms.......... 10

C. Soils.......... 12

D. Botanical Resources.......... 14

E. Wildlife.......... 19

II. MANAGEMENT CONSIDERATIONS AND ALTERNATIVES.......... 21

A. Dune Enhancement and Protection Plan.......... 21

B. Native Plants for Landscaping.......... 25

C. Shoreline Erosion Along Lewis Gut.......... 27

D. Wildlife Management.......... 27

E. Municipal Coastal Program.......... 28

F. Coastal Site Plan Review.......... 32

G. Fee Options.......... 33

H. Recreational and Educational Use.......... 33

APPENDIX I. SAVING THE AMERICAN BEACH: A POSITION PAPER BY CONCERNED COASTAL GEOLOGISTS

APPENDIX II. PLANT CHECKLIST

APPENDIX III. COASTAL POLICIES APPLICABLE TO PLEASURE BEACH REVITALIZATION

LIST OF FIGURES

a Land Use.......... 2

1 Location of Pleasure and Long Beaches.......... 6

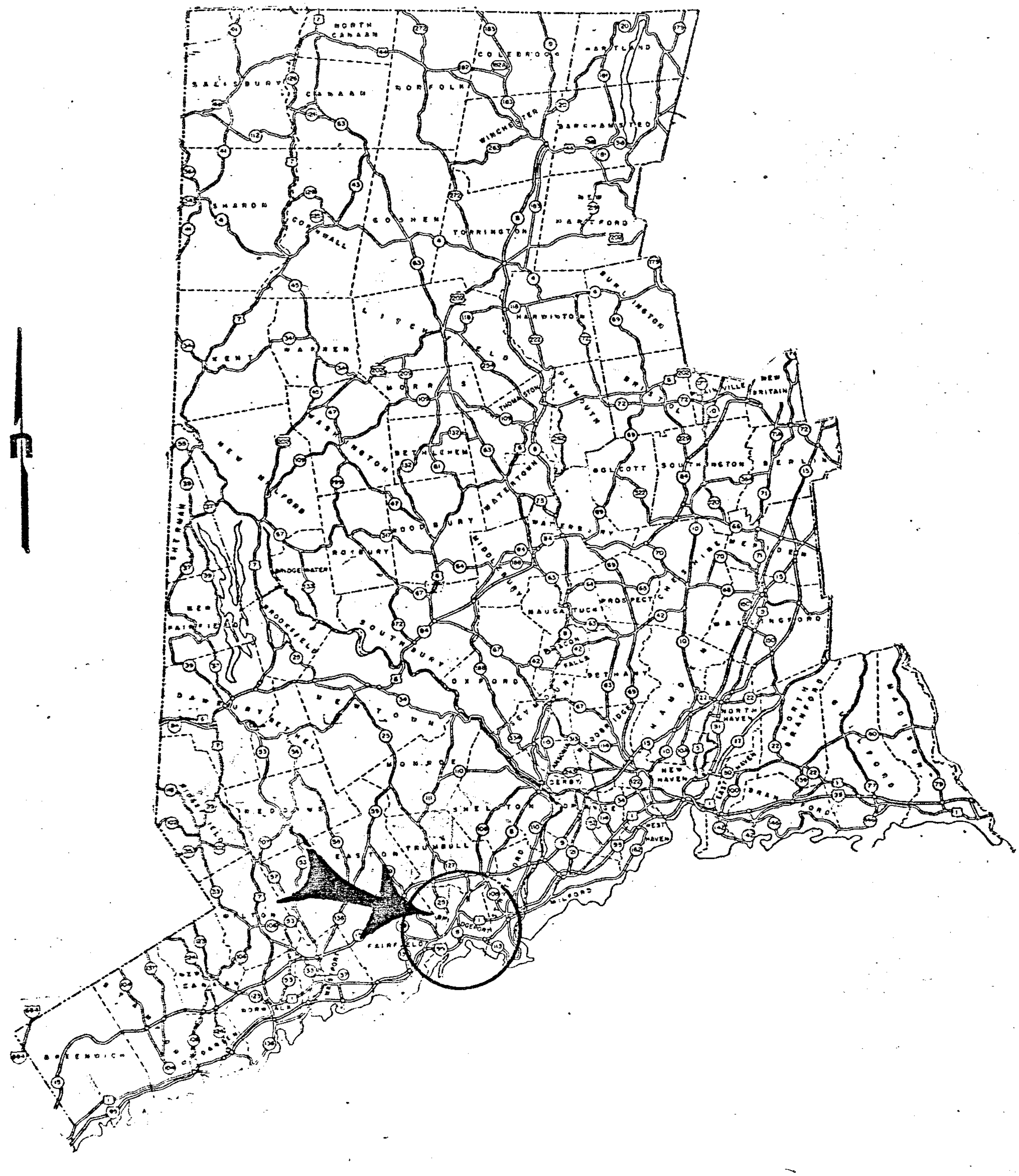
2 Sandy Outwash Plain in Site Vicinity.......... 7

3 Shoreline Changes 1835-1980.......... 9

4 Coastal Resources..........11

5 Dune Management Plan..........23

LOCATION OF STUDY SITE



Scale 1" = 10 miles

10 0 5 10 miles

ENVIRONMENTAL REVIEW TEAM REPORT

ON

PLEASURE BEACH

BRIDGEPORT, CT

a. INTRODUCTION

The preparation of this report on Pleasure Beach was requested by the Mayor of Bridgeport in cooperation with the Bridgeport Department of Parks.

Pleasure Beach is a ± 75 acre publicly owned parcel of land located off the coast of Bridgeport. Years ago, this land was developed for use as an amusement park. The amusement park was closed in the 1950's and little has been done to upgrade and maintain the park since that time. Today the land is used as a City Park with a beach, fishing pier, and several picnic areas. Also located on the site is the Polka Dot Playhouse Theatre, a number of miscellaneous buildings, and the WICC Radio transmission towers (see Figure a). Remnants of a number of amusement park rides are also observable on the site. Access to Pleasure Beach is available from the north via a ± 1000 foot bridge.

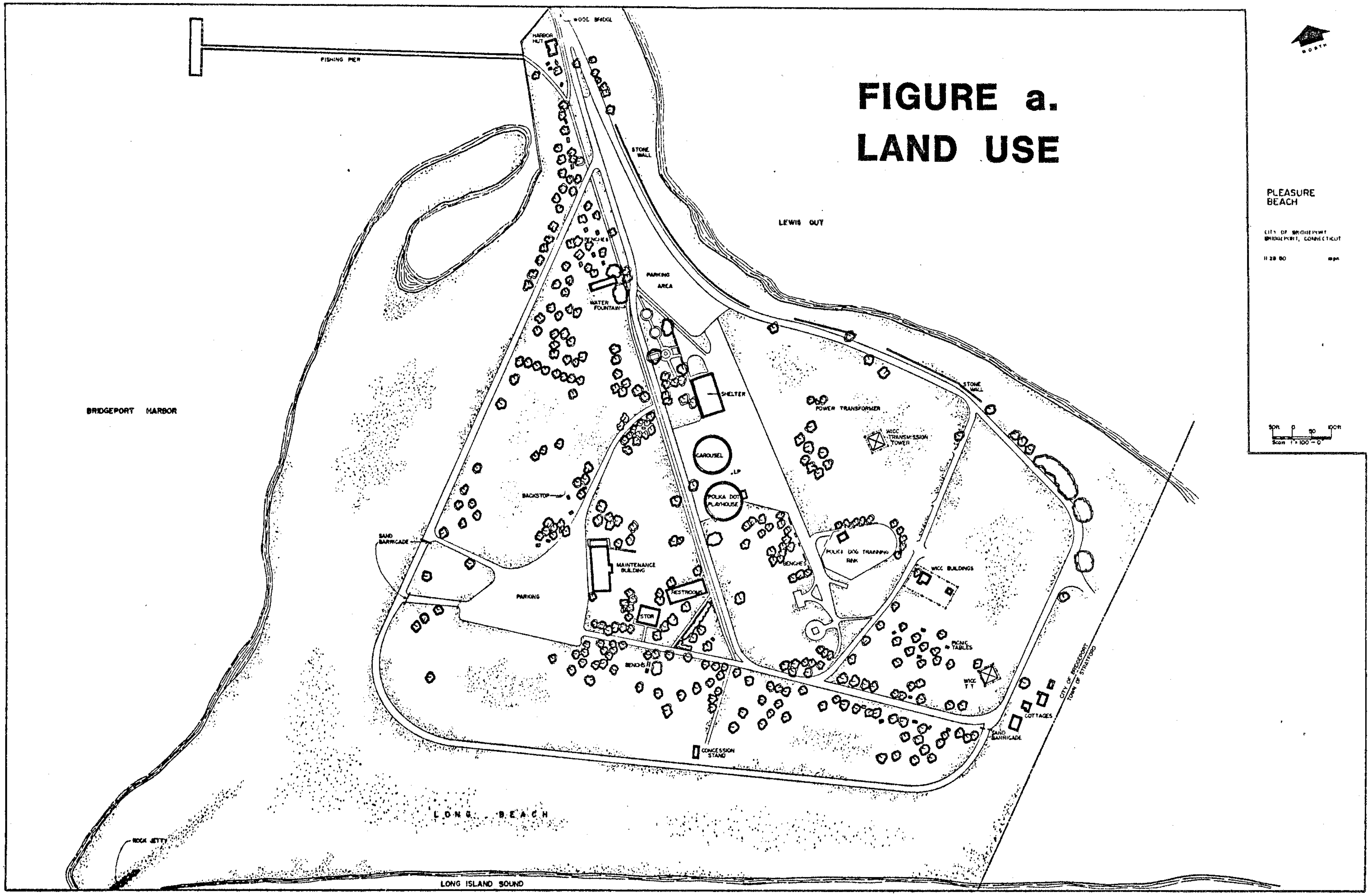
The City of Bridgeport is dedicated to improving the park at Pleasure Beach and has received an Urban Park and Recreation Rehabilitation Grant to upgrade the facilities at the site. The total amount of the federal portion received is $1,075,000. which will be supplemented by the State of Connecticut's share of $161,250. The project will assist in the "preservation of fragile environmental resources found in the park, and will also assist in meeting the increasing demand for beach, picnic, and recreational facilities in the area".

The following excerpt from the project grant application summarizes the proposed rehabilitation plans.

> *"In general, the project is designed to replace the deteriorated facilities at the park with safe, healthy, functional and attractive facilities. The basic elements, such as water, electricity and sewage will be upgraded to meet the health code and modernized. The recreational activities that will be restored at the Park include: softball field, horse shoe pits, bocci ball courts, volleyball courts, and tennis courts. The picnic groves on the island will be rehabilitated and the existing traffic patterns will be altered considerably with the removal of large portions of the existing roads and a new bathhouse pavilion will serve as the focal point in the Park. The Park will be oriented towards family activities and will be rehabilitated in such a way that all natural resources are preserved and enhanced".*

The City of Bridgeport has hired an engineering firm to design the project. To assist the City in guiding project design and protecting the site's natural resources, this ERT study was

FIGURE a.
LAND USE



note: this map reduced from original prepared by Cahn, Inc., 1983.

requested. Specifically, the ERT was requested to describe the natural resource base of Pleasure Beach and to analyze the environmental concerns which may impact, or be impacted by, the proposed project. Of particular concern is plant life, wildlife resources, dune management and shoreline erosion.

The King's Mark Executive Committee considered the City of Bridgeport's request, and approved the project for review by the Team.

The ERT met and field reviewed the site on November 17, 1983. Team members participating on the project included:

Norman Bender	Marine Economist	CT Cooperative Extension Service
Marc Beroz	Soil Scientist	U.S.D.A. Soil Conservation Service
Denise Rodosevich-Rollman	Coastal Planner	CT Department of Environmental Protection
Ron Rosza	Coastal Ecologist	CT Department of Environmental Protection
Lance Stewart	Marine Biologist	CT Cooperative Extension Service
David Thompson	District Conservationist	U.S.D.A. Soil Conservation Service
Timothy Visel	Marine Fisheries Specialist	CT Cooperative Extension Service
Frank Webb	Plant Materials Specialist	U.S.D.A. Soil Conservation Service

Prior to the review day, each team member was provided with a summary of the proposed project, a checklist of concerns to address and a topographic map of the area. During the ERT's field review, team members met with representatives from the City of Bridgeport and walked the property. Following the field review, individual reports were prepared by each team member and forwarded to the ERT Coordinator for compilation and editing into this final report.

This report presents the Team's findings. The report identifies the natural resource base of Pleasure Beach and discusses opportunities and limitations for the proposed land use. It is hoped the information contained in this report will assist the City of Bridgeport in making environmentally sound decisions.

The report is divided into two major sections. The first section identifies the natural resources of Pleasure Beach. The second section addresses various management considerations and alternatives.

If any additional information is required, please contact Richard Lynn (868-7342), Environmental Review Team Coordinator, King's Mark RC&D Area, Sackett Hill Road, Warren, Connecticut, 06754.

The ERT Coordinator would like to express his gratitude to the staff of the Connecticut DEP Coastal Area Management program for their invaluable assistance in the preparation of this report. In particular, the Coordinator would like to thank Ron Rosza, Denise Rodosevich-Rollman, and Jesse Arnold from the CAM office for their exemplary work in preparing the majority of the text and graphics for this report.

* * * * *

DESCRIPTION OF THE ENVIRONMENT

I. DESCRIPTION OF THE ENVIRONMENT

Pleasure Beach is located along the southern shore of Bridgeport at the western terminus of the Long Beach system (see Figure 1). Fastland (non-tidal upland) area embraces approximately 75 acres. Three coastal water bodies border upon Pleasure Beach namely Long Island Sound to the southwest, Bridgeport Harbor to the west and Lewis Gut to the northeast. The width varies between 1200' and 1800' and shoreline length totals approximately 1.3 miles.

The terrain is more or less level with elevations ranging between 6.7' and 10'. Elevations of 12' and 13' coincide with the location of dunes on the southern shore. The highest point is a mound of sand (dredged material) located adjacent to and west of the western access road.

Most of the historic park uses, introduced vegetation, lawns and parking lots are located within the confines of the road network. Seaward of especially the western and southern roads, there is no development and the vegetation is composed almost entirely of indigenous vegetation. The area between the southernmost road (presently closed to traffic) and the one immediately to the north, contains vegetation composed of mostly native vegetation and a few planted trees. Here also development is absent except for the concession stand.

Land uses include a number of historic buildings, roads, parking areas and two radio towers. Only a small percentage of fastland area has been displaced by buildings or paved surfaces.

A. Geology And Marine Processes

An extensive sandy outwash plain of glacial origin (see Figure 2) intersects the north shore of Long Island Sound between Milford and Fairfield. Through the centuries, marine processes have modified these deposits to the point that their shore areas include a series of sandy barrier beaches including but not limited to Fairfield Beach, Milford Point and the Long Beach-Pleasure Beach system.

Critical to the growth and the maintenance of any barrier beach is the long-term erosion of certain upland features called headlands. These are convex, seaward projecting upland features whose shoreline is composed of bluffs or seacliffs. The latter attests to the occurence of long-term erosion. Headlands are the principal source of the sediment which is instrumental to the nourishment of contiguous barrier beaches. In this instance, the headland or sediment source for the Long Beach-Pleasure Beach system is the Point No Point headland in Stratford. However, the critical role of this feature as a sand source has been temporarily interrupted by the placement of a seawall at Point No Point as a means of arresting erosion.

FIGURE 1

LOCATION OF PLEASURE AND LONG BEACHES

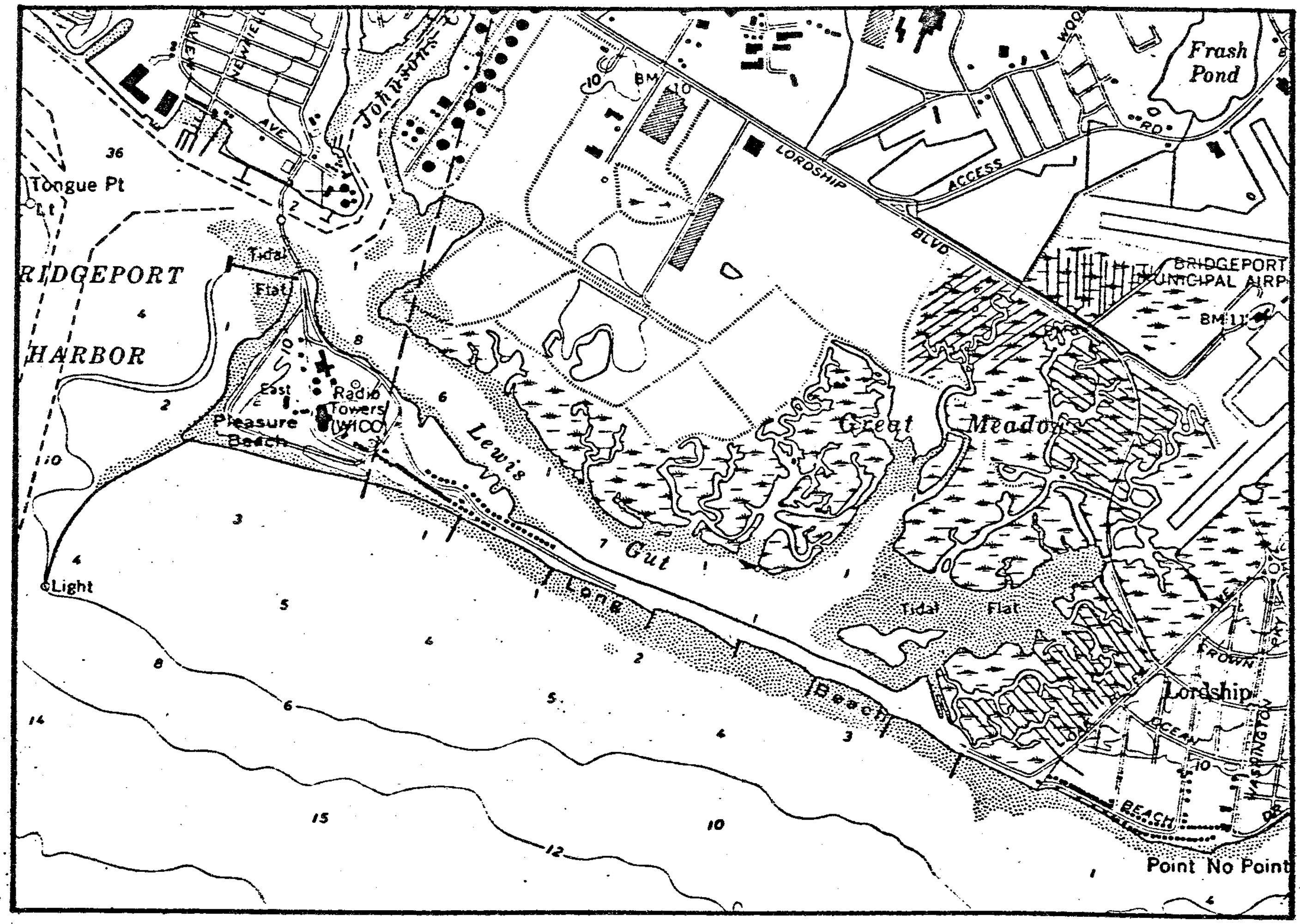
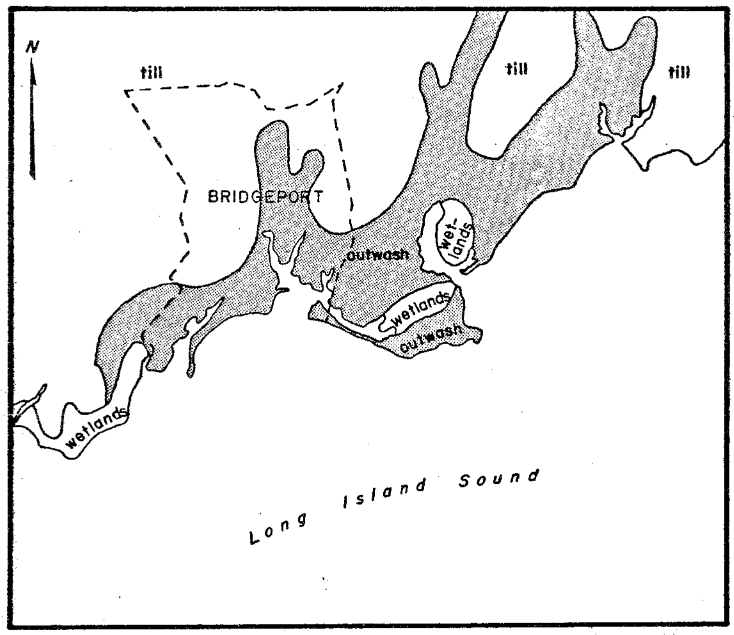


FIGURE 2
SANDY OUTWASH PLAIN IN SITE VICINITY



Generally, such erosion control structures are not cost effective (see Appendix I). In addition, they often result in significant environmental impacts both on-site and off-site. First, following the placement of the seawalls, the manner in which waves reflect off the seawall induces scouring of the seaward beach. This beach erodes more rapidly thereby subjecting the seawall to greater wave energies which tend to undermine the footings and lead to the collapse of the wall. At best, seawalls provide only temporary erosion control in such situations. Second, since the headland no longer functions as a source of sediment, the erosional rates of contiguous beaches is accelerated.

Sediment in the nearshore and intertidal zones adjacent to a beach will move both on-shore/off-shore (perpendicular to the shore) and along or parallel to the shore (longshore transport or drift). Collectively this movement of sediment by waves and currents is called littoral drift or transport. At any given time, as a function of wind and wave direction, sediment can move parallel to the shore in two directions, however, there is usually a net movement in only one direction. At Long Beach, the net longshore drift direction is from southeast to northwest. Evidence for this is the accumulation of sediment on the eastern (updrift) side of the groins on Long Beach. Here the sediment moving westward is intercepted by the groins and the beach builds (progrades) seaward. On the western side of these groins, the process of longshore drift continues but the sediment, trapped by the groin can no longer move downdrift to nourish the beach; thus sand is removed on the western (downdrift) side of the groin causing shoreline erosion. The groin at the western end of this beach system (i.e. at the western end of Pleasure Beach) has trapped sand on the updrift eastern side. This has not only reduced the sedimentation rates in Bridgeport Harbor but has caused the beach, in proximity to the groin, to prograde seaward as much as 1400' over the last 140 years. To the east, the rates decrease until the point of stability (erosion rates =accretion rates, see Figure 3) is reached.

Figure 3 illustrates the shoreline changes that have occurred at Pleasure Beach and portions of Long Beach since 1838. The construction of a breakwater, post 1838, contributed to limited progradation by 1883-1887. Since that time, the beach, particularly near the jetty, has continued to prograde seaward. A conspicuous feature that appears on this map is an inlet in the center of Long Beach. This inlet, opened by the 1938 hurricane, was subsequently filled by the Army Corps of Engineers. Inlets interrupt the longshore drift system and tend to trap sediment often in the form of deltas behind the beach. Such shoaling usually culminates in inlet closure. This seemingly catastrophic process of inlet formation increases the width of the beach and often provides substrate for tidal wetland development. It is through the

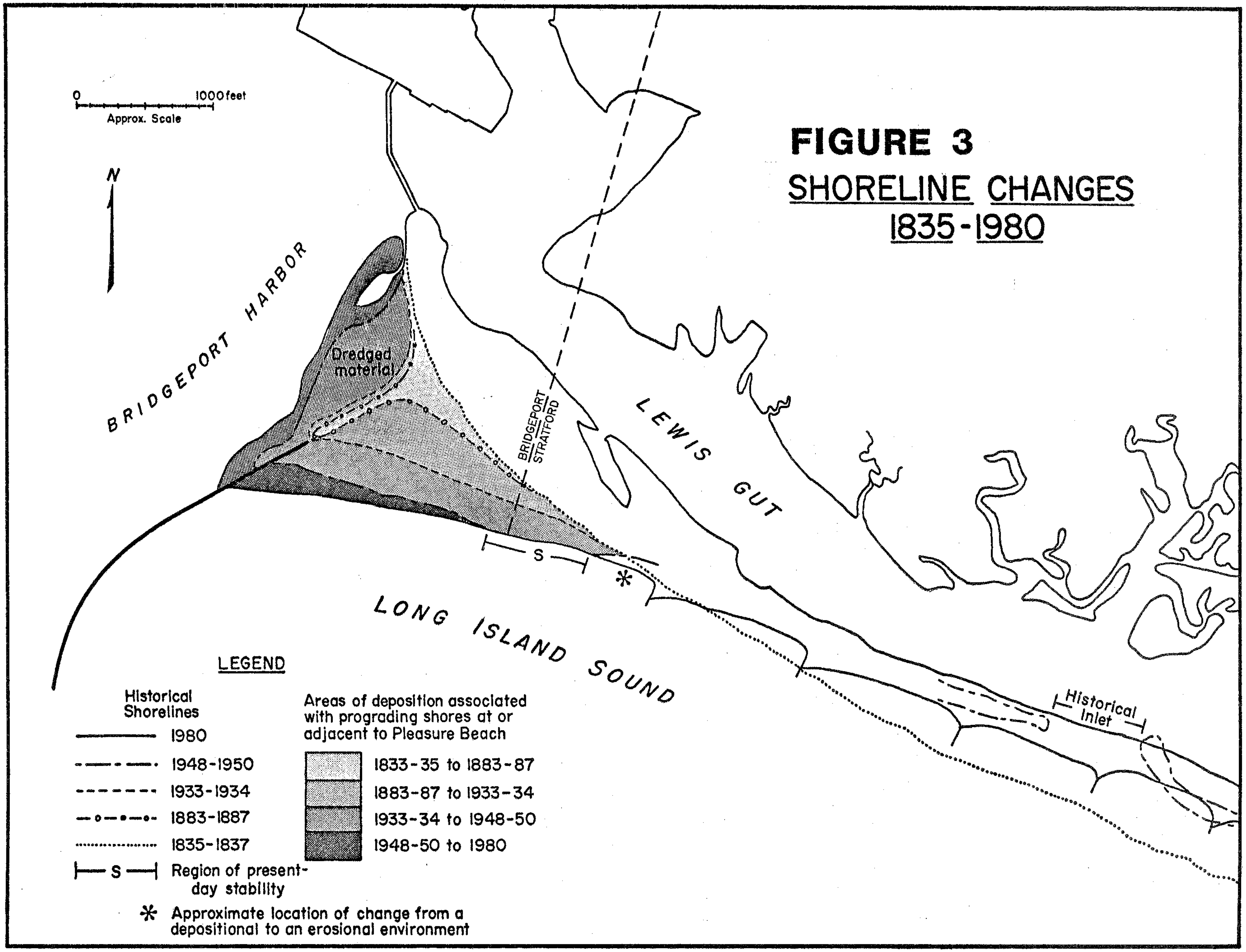


FIGURE 3
SHORELINE CHANGES
1835-1980
0
1000 feet
Approx. Scale
N
BRIDGEPORT HARBOR
Dredged material
BRIDGEPORT
STRATFORD
LEWIS GUT
LONG ISLAND SOUND
S
*
Historical Inlet
LEGEND
Historical Shorelines
1980
1948-1950
1933-1934
1883-1887
1835-1837
Region of present-day stability
Areas of deposition associated with prograding shores at or adjacent to Pleasure Beach
1833-35 to 1883-87
1883-87 to 1933-34
1933-34 to 1948-50
1948-50 to 1980
* Approximate location of change from a depositional to an erosional environment

processes of inlet formation and overwash (the movement of sand over the dune onto the landward side of the beach or into the adjacent bay) that barrier beaches avoid submergence and obliteration as a result of rising sea level. It is the natural and usually necessary tendency for beaches such as this to migrate landward. One type of evidence for this is the burial of salt marsh peat by overwash sands. Certain areas of beach and dune deposits on Long Beach are in fact underlain by old salt marsh peat.

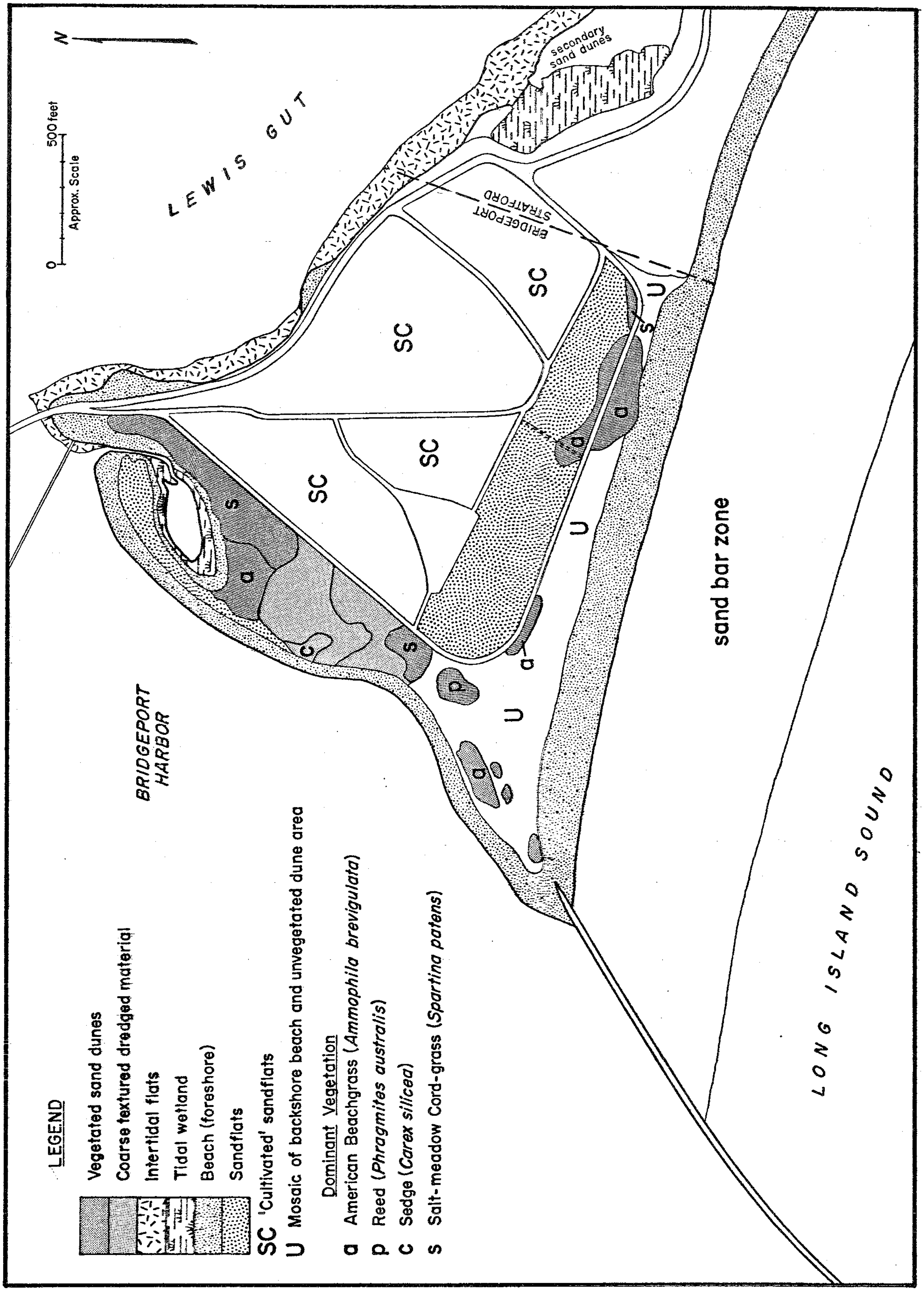
One final note regarding this defunct inlet is the historic anecdotal references by people living near the Stratford Meadows which indicate that the tides amplitude in Meadows/Lewis Gut increased following inlet formation. Prior to inlet formation, Lewis Gut was the primary inlet and source of tidal water. However, it is probably the case that Lewis Gut is too narrow to transmit tidal water into the marshes at a sufficiently rapid rate in order to attain the elevation of high tide as it exists in Long Island. Slack high tide in the embayment would occur only after the water in the Sound had ebbed and the levels between the two water bodies equilibrated. Obviously the creation of a second inlet culminated in the introduction of more water via two tidal passages at a faster rate so that the tides in the embayment were elevated. This translates into flooding of a greater area during normal and storm tides and the readjustment of wetland vegetation to a new flooding regime. Likewise when the inlet was closed, this process reversed itself. There have been proposals in recent years to construct a new inlet; the purpose of which would be to improve the circulation in the embayment. One should proceed cautiously with such an endeavor due to the above noted changes or adverse impacts that would ensue.

With the exception of Pleasure Beach, Long Beach has experienced long-term landward migration. To what extent the rates of migration or retreat have accelerated as the result of placement of a seawall at Point No Point or inlet formation are not known. Comparison of the 1948-1950 shoreline with the 1980 shoreline (as depicted on the Bridgeport orthophoto map) indicates that accretion is still occurring near the Pleasure Beach groin or breakwater and there is limited 'erosion' in a stretch of beach to either side of the boundary between Bridgeport and Stratford which is more or less stable (see Figure 3).

B. Landforms

Pleasure Beach contains a variety of geological features (see Figure 4) or landforms namely beach, sand dunes, sandflats, modified sand dune/sand flat, tidal wetlands and intertidal flats. The beach is technically that area which is subjected to tidal action, both on a daily basis and during extreme high tides of the year.

FIGURE 4
COASTAL RESOURCES



Beaches can be divided into the foreshore zone, which is the area between daily low and high tides and the backshore zone or area between high tides and extreme high tides. (The latter is usually coincidental to the seaward edge of the dune or the line where dune vegetation begins to grow). Substrate instability is greatest in the foreshore and decreases towards the backshore. This general instability of beach sand accounts for the absence of vegetation in the foreshore and the sparsity of vegetation in the upper backshore.

Sand dunes and sandflats are composed predominantly of aeolian (wind blown) sands. Beach sands (usually medium or finer textured) are transported by winds across the beach to a point beyond the influence of tidal action. Here debris and especially vegetation reduces the wind speed causing sediment to be deposited. Vegetation not only traps sediment but stabilizes the substrate. In time, at the more seaward locations, these deposits will continue to grow vertically and take the shape of a sand dune or in this case a sand dune ridge. Rates of sand accretion are usually maximal on the foreslope (seaward slope) of the dune and then diminish progressively inland. Landward of the sand dune ridges are the more or less flat areas of aeolion sand called sand flats. Here the substrate is more or less stable and sedimentation rates are low. For the sake of simplicity, the beach environment interior to these unmanaged resources is called the modified or cultivated sandflat environment which during the years has been leveled, mowed and built upon for recreational purposes.

C. <u>Soils</u>

Pleasure Beach is a barrier beach composed dominantly of medium sized sand grains (0.5-0.25 millimeters in diameter). This medium sand was deposited by wave action.

The soils on Pleasure Beach are sandy and show little pedogenic development. They have not been in place long enough to show the typical soil coloration or organic matter content characteristic of sandy soils from older deposits.

In spite of the soils' young age, there is a progression of soil characteristics that can be observed on Pleasure Beach. As one moves from Long Beach on the south side of the property toward the parking area adjacent to Lewis Gut, the soils show fewer signs of erosion.

Long Beach itself consists of the most recently deposited materials. These sand are reworked frequently by the waves and no soil development is observable here.

On the next landscape to the north are small dunes of one to three feet in height. These dunes are formed by wind action. They perform a natural function of trapping sands that have been blown off Long Beach. Again, no soil development is evident. These dunes should be further stabilized using adapted plant species and snow fence as discussed in a later section of this report.

Between the dunes and the east-west road immediately to the north is an area having spots of naturally occurring A horizons. These A horizons are surface layers 2 to 4 inches thick that are dark in color and loamy sand in texture. It took many years for these soils to develop A horizons. Where the A horizons are absent, they have been removed by wind erosion.

At one time this particular part of Pleasure Beach was relatively stable. It had a thicker vegetative cover which not only contributed organic matter to the soil but protected the soil surface from wind erosion. Apparently, this vegetative cover was disturbed and as a result much of this A horizon has been stripped off due to the strong southerly winds.

Wind erosion is less active inland from the dunes and beach. Therefore, the further north from the dunes one goes, the more prevalent the A horizons become. Remnants of A material can be found on the north side of trees even though the surrounding soils may not have any A horizons present. The spottiness of the A horizons in this area is indicative of wind erosion occurring primarily within the last 100 years.

The central part of Pleasure Beach is covered by 4 to 20 inches of fill material overlying naturally deposited sands. The composition of the fill varies considerably. Generally, the areas that were previously landscaped or used for picnic areas have had 4 to 6 inches of fine sandy loam topsoil spread over them. In the vicinity of the former structures that dotted this area, the surface material is composed of bricks, shingles and stones covered by 2 to 6 inches of fine sandy loam. Because of such variability in this central area, site specific recommendations cannot be made until a more definite development plan is available.

Pleasure Beach is subject to wave action around its periphery and strong wind action throughout. Erosion from these two processes is natural. Man has accelerated the rate of wind erosion but this is to be expected in such a fragile environment. Sand grains are going to be blown around. Therefore, the facilities at the beach should be planned accordingly. If tennis courts are constructed they should be located as far north and east as possible. This would help hold down the maintenance costs associated with constantly cleaning up the wind blown sand.

These sandy soils have extremely low fertility. Plantings of beach grasses, shrubs or trees should be fertilized at least yearly. None of the sites under consideration for plantings have a high salt content. Measured salt concentrations are <100 ppm.

At least 6 inches of topsoil should be spread over the areas planned for picnic areas and ballfields. The topsoil will provide better fertility and provides more drought resistance than the naturally occurring sands. These characteristics are important if these areas are to sustain long and continued use. An alternative to this is to use the sandy soils that are presently on the site, incorporate organic materials into the top 6 inches and irrigate as needed. This would require installing a sprinkler system in these high use areas.

D. Botanical Resources

As a result of their unique habitats, barrier beaches contain an assemblage of plants and animals not found anywhere else in the state. These ecosystems are relatively uncommon in Connecticut and are unevenly distributed across the coast in locations where the geologic composition provides an adequate sand supply to sustain a beach formation. Not only were barrier beaches an uncommon coastal resource in precolonial times, but the low wave energy climate associated with Long Island Sound reduces their areal extent, especially in regard to width. In addition, development for residential cottages and homes and recreational uses have further reduced the extent of natural sand dune and sandflat deposits to the point that these are rare habitat. It should therefore not be surprising that the associated biotic communities are rare today. Coastal sand beaches and dunes are classified by Dowhan and Craig (1976) as critical habitats. Critical habitats are defined as those habitats that rare species require for their survival. Many undeveloped barrier beaches contain or have the potential to contain a number of rare plants and animals.

The following section includes a brief description of the natural vegetation associated with the sand dune ridges, sandflats and tidal wetland in the park. Excluded is a treatment of the managed and landscaped area of the park which as a result of management (mowing, etc.) and land use (picnicing, trampling, etc.) usually will not contain important plant communities or rare species. Also separately described are the wildlife considerations.

1. Plant Communities

The beach, sand dune ridge and sandflat vegetation contain typical plant communities as described by Nichols (1920). Each of these will be discussed below:

a. Wrackline Community

This community develops on the upper portion of the beach and seaward of the toe of the dune ridge where tidal inundation is only intermittent. Tidal inundation occurs principally during the more stormy sedimentation on the beach environment. The perennial component of this plant is the subterranean root system called a rhizome. Rhizomes are capable of extensive lateral growth and at every joint or node, will propagate roots below and a shoot above. Beachgrass can thus rapidly colonize new areas through this means of reproduction. Also, each shoot is capable of rapid vertical growth which enables the plant to survive the constant burial by sand. Each vertical internode corresponds to the amount of vertical growth during the growing season and each new node can produce new shoots for the next growing season and lateral rhizomes. While Beachgrass is tolerant of salt spray and its toxic effect, the presence of salt spray is not a requisite environmental factor for its growth and maintenance. Beachgrass, and many of the native beach plants of the northeast, grows on the beach and dune environments of the Great Lakes where salt spray is not present.

The foreslope of dunes, due to the active deposition of sand, is virtually dominated by Beachgrass alone. This is where the vigor of Beachgrass is maximal. The principal associate in this habitat is Seaside Goldenrod (Solidago sempervirens).

As the substrate stability increases on the backslope and the dune intercepts some of the salt spray, species diversity increases although the vegetation is still dominated by Beachgrass. Associates here include Seaside Goldenrod, Pinweed (Lechea maritima), Evening Primrose (Oenothera parviflora), Sedge (Carex silicea) and Salt-meadow Cord-grass (Spartina patens). The latter is a grass that is not confined to salt marshes and frequently occurs on sand dunes and sandflats. Cord-grass, in the absence of flooding by saltwater, actually grows best on the better drained sand dune environments. Locally in the park, Salt-meadow Cord-grass is the dominant plant (see Figure 4).

c. Sandflat Community

In general, sandflat environments are restricted to the distal tips of barrier beaches in Connecticut where the beach is wide and youthful. On the older sections of the beach the long history of erosion and overwash has culminated in a simple landscape composed of only foreslopes and the gently sloping backslopes. Sandflat environments are therefore much rarer than the dune ridge environment and attain their optimal development in the Milford to Fairfield area.

The very low rates of sand accretion and hence, increased substrate stability of sandflats, culminates winter season and is rare to absent during the growing season. This narrow zone corresponds to what is frequently called the annual wrackline. Plant cover is exceedingly variable and can range from absence of vegetation to sparse or dense cover of herbs. The location of this community is also variable and changes from year to year, hence this community can be defined as an ephimeral type. The reason for this variablility is the occasional wave and tidal action which reworks and redistributes the substrate including any constituents, such as whole plants or the fruits or seeds of the plants. Some of these may be lost at sea or located on the more exposed sections of beach. The latter may germinate but will in time be destroyed by tidal action during the growing season. Only those seeds or fruits that find refuge on the uppermost zone of the backshore beach at the beginning of the growing season will survive if all other conditions for growth are suitable. As a result of recurrent wave action, no perennial plants survive on the beach proper.

The wrackline community therefore, is composed of salt-tolerant annuals which are capable of surviving on the harsh beach environment. Many of these are succulents (i.e. have fleshy stems or leaves or both) and store water in their tissues. In this manner, the uptake of toxic sea salts through the roots or deposits of the salts on the leaves can be diluted by the vast quantities of water in the tissues. The principal plants growing on the beach wrackline in the park are Saltwort (Salsola kali var. caroliniana), Sea Rocket (Cakile edentula), Common Clotbur (Xanthium strumarium) and Seabeach Goosefoot (probably Chenopodium macrocalycium). Saltwort, by far, is the most common wrackline plant.

b. Coastal Grassland Community

The sand dune ridges and to a lesser extent the exposed areas of sandflat, support a vegetation dominated by grasses. The term "grassland" aptly describes the physiognomy or structure of the vegetation. As noted earlier, the foredune slope is the most active sedimentary environment and is exposed to salt spray. Backslope areas are subjected to lower rates of sedimentation and the dune ridge affords some protection against the effect of salt spray; hence the character of the vegetation varies between the foreslope and backslope areas of the dune.

American Beachgrass (Ammophila breviligulata) is the dominant plant. It covers extensive areas of dunes and often forms pure to nearly pure colonies. This grass is uniquely adapted to areas of active in a markedly different vegetation than that which characterizes sand dune ridges. At Pleasure Beach the vegetation can be better described as forbland, that is dominated mostly by forbs (herbaceous plants) although grasses may be locally important. To the casual observer, the sandflat vegetation at the Park has a weedy appearance, but the majority of these plants are indigenous. The floristic composition of sandflat is as follows:

Tall Wormwood (Artemisia caudata)
Sand-Grass (Triplasis purpurea)
Sedge
Gray's Umbrella Sedge (Carex grayii)
Beach Pinweed
Purple Love-Grass (Eragrostis spectabilis)
Seaside Goldenrod
Little Bluestem (Schizachyrium scoparium var. littoralis)
Beachgrass

Tall wormwood and Pinweed are frequently dominant. Locally Beachgrass is an important and dominant plant. Individual plants on sandflats have a tendency to be widely dispersed thereby creating openings in the cover suitable for weeds to become established. Despite the historical uses at the Park, there are suprisingly few weeds in this habitat. Included here are Butter-and-Eggs (Linaria vulgaris), Mullein (Verbascum thapsus Drooping Brome-grass (Bromus tectorum), Crabgrass (Digitaria spp.)and Cichory (Cichorium intybus).

On the western shore of the park is a low hill (dredged material mound composed of coarse sands and gravel) that contains sandflat vegetation. The dominant plant on the western slope of this mound is the sedge, Carex silicea; which has a grass-like appearance. Also present are Pinweed, Seaside Goldenrod, scattered but stunted Reed (Phragmites australis), Little Bluestem, Purple Love-grass, Tall Wormwood, and Drooping Brome-grass. Due to the coarse and compact nature of this material, most of the area, especially the summit, is devoid of vegetation.

The sandflat vegetation associated with the coarse textured sandspit, near but south of the fishing pier is dominated by Sand-grass. Associates include Wild Rye (Elymus virginicus), Sea Rocket, Crabgrass and Clotbur.

The central area of the park, for all practical purposes, is sandflat habitat that is managed for non-indigenous vegetation namely lawn species and exotic trees and shrubs. Natural sandflat vegetation is restricted to those areas not mowed such as the fenced areas adjacent to certain buildings or under the radio towers. Undisturbed sandflat behind the cottages in Stratford adjacent to the park, support, in addition to the forbland vegetation, thickets of Beach Plum (Prunus maritima) and Bayberry (Myrica pensylvancia). Historically these probably grew in the park and are capable of growing there today.

d. Tidal Wetland Community

The principal tidal wetland in the park is found interior to the sandspit located near the fishing pier. Salt-marsh Cord-grass (Spartina alterniflora) forms a nearly pure zone which encircles the small tidal pond. At the base of this grass and in the pond grows Sea Lettuce (Ulva lactuca). Associated marine invertebrates include Blue Mussel (Mytilus edulis)and Mud snail (Ilyanassa obsoletus).

2. Rare Plants

Biologists involved with the conservation of rare and endangered species have found it necessary to be extremely cautious in the dissemination of the names and locations of rare species. Unfortunately rare species attract both curiosity seekers, and collectors. Even scientists with the best intentions of merely trying to photograph a population of rare species have been known to trample and alter the habitat of rare species and induce local extirpation. Therefore it has become a necessary policy of most rare and endangered species programs to not release such information except in rare instances where there is a documented need-to-know by any agency, conservation group or individual. If the recommendations in the accompanied sections are adhered to,(specifically the restoration of the sand dunes and subsequent protection of the dune and sandflat habitats), then protection of these plants will be assured. In a need-to- know situation by the Parks Department, it would be necessary to submit a letter or request and reasons for the request to the Data Manager of the Natural Diversity Data Base of the Natural Resources Center of the Department of Environmental Protection, 165 Capitol Avenue, Hartford, Connecticut, 06106.

Two plants were discovered at Pleasure Beach which are both rare at the state (Dowhen and Craig 1976; Mehrhoff 1978) and regional-New England (Crow et al. 1981) levels. Their critical habitat are the backslope of dune ridges and sandflats. Hence if the dune and sandflat systems at Pleasure Beach are protected and pedestrian access controlled via well-defined access trails or walkways, the species will be protected.

One of the plants grows within the confines of the chain-linked fence that surrounds the southeastern radio tower. This is sandflat habitat that is neither mowed nor trampled. It was probably the case that the installation of the tower disturbed the substrate and provided a suitable habitat for the invasion by natural species. The absence of mowing favors the maintenance of native vegetation over lawn species. One radio tower site is the principal habitat for this plant but it also occurs sporadically in other sandflat areas of the park.

3. Plant Checklist

A late fall survey is an inappropriate time to conduct a floristic survey of the park. Given the greater importance of the native vegetation versus the more ubiquitous introduced and planted vegetation, only the natural vegetation were surveyed. The results of this preliminary survey are reported in Appendix II. Nomenclature follows that of Dowhan (1979).

E. Wildlife

Beaches such as this are also the critical habitat for certain coastal wildlife, particularly birds. In recent years, the state rare colonial seabird, the Least Tern, has attempted to nest on the spit south of the fishing pier. Pedestrian traffic however has led to the failure of any nesting attempts and these birds will usually 'retreat' to safer environs such as Long Beach or Milford Point. As a result of historic disturbance of beaches, especially residential development and pedestrian traffic, there are currrently less than five, active and usually successful nesting sites. Least Terns nest on sandy beaches with sparse vegetation. The nest is comprised of a shallow depression in the sand and the average clutch size is two eggs. The eggs are cryptically colored thereby matching the color of the sand and camouflaging the eggs from predators. This inconspicuous nature of the eggs also makes them susceptible to trampling.

A second rare bird, a shorebird called the Piping Plover, may be nesting at the Park. There is no confirmation of nesting but the habitat is ideal for Piping Plovers. This bird commences nesting as early as April and encourages the young to seek shelter among the vegetation by June or early July.

A potential nesting rare bird which frequents open lawn and dune habitat is the Horned Lark. This species in recent years has been noted to breed in Stratford. The nest is a depression in the ground that is lined with grass and may be located on the lawn, sandflat or sandspit habitat that has some cover of low vegetation. The nest depression is sufficiently deep that young birds and eggs would be protected during lawn mowing operations. This bird should be searched for in the park.

The only other wildlife report of note is the occurrence of winter 'finches' such as Pine Siskins, Snow Bunting and Lapland Longspurs to name a few. Shorebirds frequent the tidal pool/wetland near the Stratford-Bridgeport line on the Lewis Gut side of the park. This is not a prime shorebird concentration area but within the limits of the Park, this is the best site at which to observe shorebirds.

MANAGEMENT CONSIDERATIONS AND ALTERNATIVES

II. MANAGEMENT CONSIDERATIONS AND ALTERNATIVES

The City of Bridgeport is not only interested in improving the quality of the recreational experience and facilities at Pleasure Beach but also in the enhancement and protection of the natural resources. Barrier beaches are obviously ideal locations for traditional types of coastal recreation but at the same time, are so rare that there is an need to protect certain facets of this resource and associated biota. These two competing needs create a dilemma for the manager. Management alternatives however do exist that could promote coastal recreation on the barrier beach and yet culminate in the protection of sensitive and critical ecosystem components, especially sand dunes, sandflats and wildlife.

Most barrier beaches in Connecticut are composed almost entirely of a narrow sand dune ridge and hence it would be impossible to construct recreational support facilities and parking areas without destroying the integrity of dunes and perhaps the entire beach system. However, Pleasure Beach, by virtue of the historic construction of a jetty, has artificially induced the beach to become exceptionally wide. Given this increased area, it is possible to accommodate appropriate structures and ancillary parking at a low density and still preserve the integrity of the beach. Careful site planning for these facilities including recreational uses and pedestrian traffic can culminate in the protection of the more important coastal resources. A variety of alternative plans to accommodate recreational uses and resource protection are possible here.

Listed and discussed below are some of the more important management-related issues and opportunities.

A. Dune Enhancement and Protection Plan

Normally, the term restoration is reserved for the reestablishment of a resource to its historic, pre-disturbed condition at a site where it formerly occurred. The historic dune system, prior to widening of the beach incidental to the construction of the jetty, were long ago destroyed and are no longer restorable. However, as the beach accumulated sand and grew seaward, the area where dunes have attempted to form also moved to more seaward location. The existing, albeit fragmentary dune areas today are youthful or incipient dunes. Therefore the term enhancement is more appropriate than the term restoration. The more interior sections of the park, if managed for any resource type, should be managed for the very rare sandflat habitat. Through a rather simple management procedure, a beneficial and continuous primary dune can be established through the protection of existing segments and the planting of appropriate vegetation between these segments. This will establish an area of important biologic, social and aesthetic value that was lost decades ago.

1. Primary Dune Enhancement Plan

The key to a successful dune enhancement program is the control of pedestrian traffic through the establishment of specified corridors which provide access to the beach through or over the dune. Uncontrolled pedestrian traffic culminates in the trampling of existing or planted dune vegetation which destablizes the dunes, accelerates wind erosion and precludes the growth of the dunes. Figure 5 illustrates a basic plan for dune management and enhancement. A limited number of pedestrian crossings are incorporated into this design. As noted earlier, each crossing is subject to wind erosion and potential wave damage and therefore the number of crossings should be kept to an absolute minimum. Ultimately, as the dune becomes established, the principal pedestrian crossings should be elevated using a simple elevated wooden walkway. Then the former crossings or gaps should be planted with Beachgrass. A limited number of crossings will also maximize the area of natural sandflat habitat and vegetation.

The seaward section of these pedestrian crossings that pass through the dune area should be angled in a SW-NE manner. This may afford interior areas protection against most wave attack and the only waves that can form with this orientation will originate between the breakwater and the beach. These waves will be of smaller size and lower energy than waves originating from southerly or southeasterly vectors. The southernmost road should be phased out; either removed or allowed to fill in with sand. Continuance of this reportedly non-essential accessway will merely serve to invite unwarranted pedestrian access across the dune and sandflat areas. Also, it is this very location where the dune is attempting to establish itself. The pedestrian corridors should be carefully demarcated with rails or snow (people) fence as shown (see Figure 5).

The seaward edge of existing sand dunes should be delimited by a row of snow (people) fence as a means of discouraging pedestrian access across these areas. Snow fence will also function to trap sand and add to the height and width of dunes.

The unvegetated areas of dune will require the use of snow fence and plantings of Beachgrass in order to foster and accelerate dune formation. Snow fence should be established parallel to the existing dunes in the gaps and at a position more or less coincidental to existing dune crests. Interior to this, a band of Beachgrass vegetation, approximately 15' to 25' wide should be planted. The reason for this planting design is that the combination of snow fence and vegetation will trap a significant volume of sand. Interior to this zone, sand accumulations will be

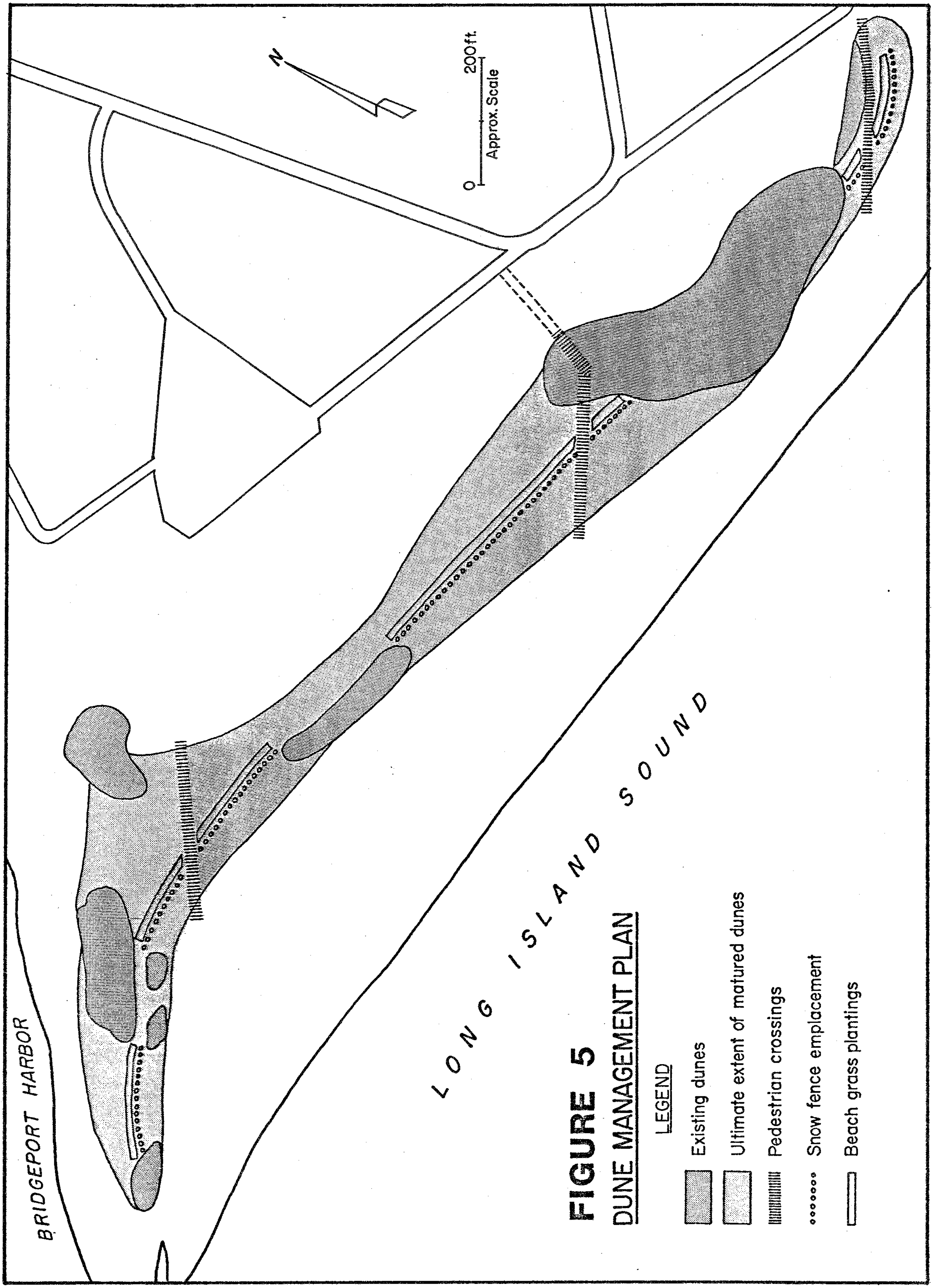


FIGURE 5

DUNE MANAGEMENT PLAN

considerably less. The dune will only grow in the direction of sand supply, namely seaward towards the beach. Placement of snow fence and dense plantings at more seaward locations will culminate in a very irregular or meandering dune line. The youngest dunes would then have their crests develop at more seaward locations and also be more vulnerable to wave erosion.

The initial planting scheme should consist of a gridwork with spacings of 12" or 18". A hole 7" to 9" deep is excavated and 3 culms of shoots or grass are planted into each hole. The hole is covered with sand and then packed firmly to eliminate any air spaces and reduce dessication. Plantings must occur during the months of March and April. Survival rates during the growing season are very low due to the shock of transplanting actively growing plants and subsequent establishment on the droughty dunes. Plantings are possible in fall when plants become dormant but this exposes these individuals to an excessively long period of harsh weather.

A less dense planting of Beachgrass seaward of the snow fence is possible and would serve to accelerate the rate of dune restoration. However, Beachgrass grows rapidly toward the source of sediment by sending out subterranean rhizomes, thus natural colonization and seaward extension of the Beachgrass will occur rapidly and without cultivation.

In successive years, new snow fence can be installed at more seaward locations to foster dune growth but more importantly to arrest unwanted trampling by pedestrian traffic. Signs stating "KEEP OFF THE DUNES" should be posted and routine patrols must be conducted if the dune restoration program is to be successful. Educational explanation signs concerning the restoration effort would be appropriate.

2. Source of Beachgrass

There are two sources of Beachgrass: (1) nurseries, or (2) the careful and selective thinning of existing Beachgrass vegetation. Two suppliers of Beachgrass are:

RR Beach Grass
Box 33
RD-1
Lewes, Delaware(302-645-2835)

Churches Greenhouse and Nursery
522 Seashore Road
Cape May, New Jersey (609-884-3927)

Thinning is a relatively simple procedure but should only be done with supervision. Healthy colonies located on the more protected backslopes of existing dunes are carefully thinned. Clusters of Beachgrass are excavated. Care must be taken to not create too large a disturbance of bare sand; otherwise wind action may cause significant erosion. This problem should be minimal if conducted in March or April, the period just prior to the onset of the growing season. The sand is shaken free from the clumps and then subdivided into lots, each lot containing 3 culms or plants. Dead culms, dead blades or underground stems that could interfere with planting should be removed. Culms may be clipped to a length of 18" above the base in order to reduce bulk and make planting easier. Culms should be kept cool and moist and planted as soon as possible following harvesting.

B. Native Plants for Landscaping

Native plants known to grow and thrive upon barrier beaches should be used to the fullest extent possible since they evidently possess the capacity to tolerate the harsh conditions present in this environment; namely nutrient poor soil and porous and dry sands, but most notably the detrimental effects of salt spray. Not only does the introduction of non-indigenous plants change the composition of the barrier island ecosystem but it could result in some becoming aggressive weeds which could displace desirable native vegetation or wildlife habitat. Examples of these are Russian Olive, Bush Honeysuckles and Tree-of-Heaven. The latter occassionally invades the dunes and its shade retards the growth of light-demanding grasses which prevent dune erosion. Landscaping should further be restricted to sandflat environments due to the importance of maintaining Beachgrass upon the dune habitat.

As noted earlier, between the dune area and the mowed lawn is an area of sandflat that supports typical, native sandflat vegetation dominated by herbs and grasses. Landscaping in this area should be discouraged so that this very rare plant community can be protected. Listed below are the primary species that should be used if additional landscaping is desired. These all possess desirable attributes with respect to wildlife habitat or food, and human useage other than serving simply as landscape plants.

Red Cedar (Juniperus virginiana) - Red Cedar is the only native evergreen in the Pine Family that posseses a strong degree of resistance to the toxic effects of salt spray. It is capable of growing to the size of low trees, and if planted in colonies, becomes ideal wildlife habitat particularly in the winter for winter birds such as Crossbills and Cedar Waxwings and roosting habitat for Owls such as Long Earred, Short Earred, and Saw-Whet Owls. Salt spray can actually induce the main shoot to branch in a manner not unlike deciduous trees. This culminates in an attractive, evergreen foliage.

Beach Plum (Prunus maritima) - Beach Plum is a native shrub that can grow as tall as 5' to 6'. As a member of the Cherry group, it produces an edible fruit, an especially large cherry or plum (size of a nickel or quarter) with an equally large pit. In the early spring it produces a magnificant floral display of white flowers. Between mid-August and the end of September, the fruits ripen. Not only are these fruits utilized by wildlife and birds but they make jelly or jam. No Beach Plums were observed at Pleasure Beach, however they do occur adjacent to this park and interior to the cottages. If a supplier of shrubs can not be located, the fruits can be collected from this neighboring area and experimentally planted.

Bayberry (Myrica pensylvanica) - Bayberry is a mid-sized shrub that rapidly spreads vegetatively and forms colonies. The foliage is attractive and scented. A bountiful supply of small, grayish-white, waxy fruits are produced in the late summer and persist into the fall. The fruits are relished by small birds and can be used to manufacture old fashioned bayberry candles.

Wild Black Cherry (Prunus serotina) - Wild Black Cherry is one of the primary forest species on high energy barrier beaches in the northeast and even grows in the shelter of the taller dune systems in Connecticut. At Greenwich Point Park, a shoreline park, a rather majestic forest of this cherry exists. It should be possible to cultivate Wild Black Cherry in the lee of buildings or at more landward locations. The fruits are edible and used by wildlife.

Juneberry or Shadbush (Amelanchier canadensis) - Juneberry, like Cherry, is a primary forest species on high energy barriers in the northeast and also grows in the lee of higher dune systems in Connecticut. It regenerates rapidly and has an attractive gray-striped bark. The fruits are edible and can be used to make jams or jellies. This too should be cultivated in the more sheltered locations.

Salt-spray Rose (Rosa rugosa) - This is not a native species but is one that has become naturalized and established on many coastal barriers. While it forms small colonies or shrub thickets it is usually not very aggressive in displacing native vegetation. It produces red or white showy flowers throughout the growing season and by late summer produces a large red fruit called a rose hip. These are edible and can be used to make jam. The rose hips also contain a high concentration of vitamin C and have been used as one of the principal sources of natural vitamin C.

Seaside Rose (Rosa virginiana) - This is a native rose which in the northeast is commonly observed in more protected sandflat areas of high energy barriers. It is rarely seen on barrier beaches in Connecticut; perhaps a function of the lack of extensive sandflats. It should prosper in sheltered locations on Pleasure Beach. Flowers vary in color from red to white and include an intermediate pink.

C. Shoreline Erosion Along Lewis Gut

Erosion by high velocity tidal currents along the Lewis Gut shoreline of the Park has undermined sections of a seawall. The most critical erosion problem is the area immediately east of the bridge. Not only has the wall been destroyed here but the road is being undercut. Restoration or replacement of the seawall here is probably a necessary erosion control measure in order to protect access to the beach.

Alternative erosion control measures exist however for the more easterly sections of the shoreline. Since the park is undergoing rehabilitation and redesign, it is appropriate to consider relocating the exit road to a more interior location thereby removing the future threat of erosion upon access (except at the entrance as noted above). The Lewis Gut shoreline could be regraded following the removal of the existing seawall, and wetland vegetation could prehaps be established as a means of reducing erosion rates. Since Pleasure Beach is still growing seaward, minor shoreline erosion along Lewis Gut should not be a major concern especially if structures or roads are not threatened. Alternatively, armoring the shore with riprap and use of marsh plants for stabilization could be pursued although at a higher cost. Generally the cost of riprap is considerably less than the costs for seawall construction.

D. Wildlife Management

At least one rare coastal bird has been noted to nest on Pleasure Beach. This is the colonial seabird, called the Least Tern.

Least Terns have recurrently attempted to nest on the small sandy spit near the fishing pier. Each attempt has been unsuccessful due to uncontrolled pedestrian traffic. The use of snow fence, signs and especially routine patrols could result in an establishment of a successful colony here. Presently the number of primary Least Tern colonies in

Connecticut number about 2 to 3 but all are threatened by pedestrian traffic. Since nesting starts in late May to early June, it would be important to install snow fence before this period.

A second rare bird may nest here. The small Piping Plover, a shorebird, nests on sandy beaches, dune areas and sandflats. These are not a colonial bird but may occur alongside Least Tern nests. The nest is a simple depression in the sand which is lined with shells. Each clutch usually contains four eggs. Nesting commences in April or early May.

A plan to enhance existing dunes and protect the sandflats and the sandspit near the fishing pier is of critical importance to the protection and perpetuation of these rare birds.

E. Municipal Coastal Program

Through the development of it's Municipal Coastal Program, the City of Bridgeport:(1) identified several issues pertinent to Pleasure Beach, (2) formulated goals and objectives to resolve the identified issues, and (3) adopted policies into the City's Master Plan for the recreational development of Pleasure Beach. Table 1 identifies these issues, goals and objectives, and policies. Inherent within the Municipal Coastal Program's treatment of Pleasure Beach is the recognition of its underutilization as an important recreational area, and its resource significance in an intensively developed urban area.

After reviewing the resources, access problem, and underutilization of Pleasure Beach, the City of Bridgeport adopted a park improvement policy for Pleasure Beach, predicated on the desire to revitalize the recreational use of the park, while protecting its natural resources. In support of this policy, the City's Planning Commission redesignated Pleasure Beach as a Parks, Open Space and Recreation district within the City's Master Plan, and recommended that the park's existing zoning designation of Light Industrial, be changed to a zone corresponding to its land use designation.

TABLE 1
Bridgeport Municipal
Coastal Program*

Issues	Goals & Objectives	Policies/Recommendations
.Encroachment on natural resources	.Protect and enhance coastal resources. .Develop a natural resource protection component within management plans for City parks...to promote their use as critical habitat for native and migratory bird species, for indigenous plant and animal species, and as major recreational/open space areas.	.Seek to improve the utilization of Bridgeport's parks and to improve the level of maintenance by studying the use of user fees to generate revenues for operation and maintenance, study feasibility of developing additional fee supported facilities such as additional marinas and boat launch facilities. Land use maps show areas designated for Park Improvement and designated area for Parks, Open Space, and Recreation, and for Parks Improvement.

TABLE 1 (cont.)

Issues	Goals and Objectives
• Lack of access due to overdevelopment	• Improve access to City parks • Emphasize Bridgeport's maritime role and history by encouraging tourism through development of a tourist attraction at the Union Dock area, such as a boat/tour ferry to Pleasure Beach. • Improve access to Pleasure Beach by improving Seaview Ave. or by developing an alternative route.
• Better utilization of public open space	• Develop comprehensive parks and open space plan • Support rehabilitation of Pleasure Beach, encouraging a broad base of ideas and support; recognize special character and setting of area and its value as a recreational resource.

TABLE 1 (cont.)

	•Protect and reserve the city-owned sandy beaches as bathing beaches.
•Shortage of public and private marina space and boat launching facilities	•Develop and manage recreational boating opportunities.
	•Investigate the development of a franchised marina at Pleasure Beach.

*Taken from Coastal Issues of Bridgeport, Connecticut, October, 1982, and A Coastal Plan for Bridgeport, Connecticut, Revisions to the Master Plan, November, 1982 prepared by Kasper Associates.

F. Coastal Site Plan Review

The proposed redevelopment of Pleasure Beach park is considered to be a municipal improvement and is therefore subject to the municipal referral process, specified in section 8-24 of the Connecticut General Statutes (C.G.S.). Because Pleasure Beach is within the coastal boundary, a coastal site plan review (in accordance with section 22a-105, through 22a-109 of the Connecticut Coastal Management Act), must be conducted by the City's Planning Commission along with its municipal referral review.

Generally, the coastal site plan review process for the revitalization of Pleasure Beach will require the Parks Department or Commission to complete a coastal site plan review application (available from the City Planning Department), which will include: 1) identification of the coastal resources on and continguous to Pleasure Beach, 2) a description of the entire project with appropriate site plans, 3) an assessment of the capability of the resources to accommodate the proposed use, 4) an evaluation of the potential benefical and adverse impacts of the redevelopment proposal, and 5) a description of the proposed methods to mitigate adverse effects on coastal resources. The Planning Commission will then review the application for consistency with the goals and policies of the Connecticut Coastal Management Act.

The policies applicable to the proposed revitalization of Pleasure Beach include the following coastal resource and coastal use policies:

Coastal Resource Policies:

- General Resources
- Beaches and Dunes
- Intertidal Flats
- Coastal Hazard Area
- Shellfish Concentration Areas
- Coastal Waters and Estuarine Embayments

Coastal Use Policies:

- General Development
- Water Dependent Uses
- Boating (if the final plan includes provision for boating)
- Sewer and Water Lines

The specific policies are detailed in Appendix 3 of this report.

Measures to preserve and protect the dunes and natural sandflats, the setback of recreational structures from the beach and dunes, and the elevation of these structures above the flood height in accordance with the Federal Flood Insurance Regulations, will probably lead to a favorable determination under the coastal site plan review criteria. For consistency with the sewer and water line policies of the Connecticut Coastal Management Act, the design capacity of such lines should be restricted to the size necessary for recreational use only. In addition, it should be noted that if any activity is proposed below mean high tide, that appropriate permits will have to be obtained from the Water Resources Unit of the State Department of Environmental Protection.

G. Fee Options

Important to the success of Pleasure Beach Park, beyond its initial improvements, will be the City of Bridgeport's ability to operate and maintain the Park. Presently, the City charges only a non-resident admission fee which goes into the general fund; the charging and accrual of which has no direct relation to the Parks and Recreation Department's operating budget. The City may want to study the potential of user fees to generate revenues for the operation and maintenance of Pleasure Beach.

The City of New London in its operation of Ocean City Beach charges various fees, and while such revenues also go into the City treasurey, they bare a direct relation to the operating budget of the beach. In speaking with the director of Ocean Beach, it was explained that revenues collected from beach uses equalled the cost of operating and maintaining the beach. Presently, revenues are generated through parking fees, admission fees, and concessions. No admission fees are charged to residents, and non-residents pay fifty-cents per person sixteen years of age and older, and twenty-five cents per person under the age of sixteen. A two-dollar parking fee is charged to residents and non-residents alike, or a seasonal parking sticker may be purchased by residents for twenty dollars and by non-residents for $25.00. The City itself operates three concessions, and has several private concessionaires who pay the City 15% of their gross.

With the renovation of Pleasure Beach, user-ship will increase. To ensure the continuation of use, the quality of park must be maintained. Given the fiscal constraints underwhich the City of Bridgeport must operate, it is recommended that the possibility of charging use fees commensurate with the operating budget of Pleasure Beach be studied.

H. Recreational and Educational Use

Pleasure Beach offers excellent opportunity for the development of a multi-use coastal recreational, educational, and environmental center. Facilities could be provided to serve the residents of Bridgeport, citizens of Connecticut, and tourists from neighboring metropolitan areas and states.

The site has the advantage of combining natural beach and estuarine areas suitable for swimming, fishing, walking and other recreational activities together with sites suitable for marine educational activities. Such educational activities could include: conservation projects, workshops and class tours, and fixed displays (descriptive signs, displays in buildings, etc.). Buildingson the island (rennovated existing ones or newly constructed buildings) could be the site of activities related to the coast or other acceptable functions (e.g., convention center).

In preparing plans for the use and enjoyment of this area, consideration should be given to the following:

1. A determination of the wooden bridge's ability to meet safety standards should be undertaken. This will have an impact upon the ability of a potentially high volume of vehicular traffic to travel to Pleasure Island in a safe manner.

2. Improve access to fishing pier (prevent washouts of material) by rebuilding retaining wall in front of Harbor Hut.

3. Repair granite wall on Lewis Gut side by road with groin to minimize wall maintenance.

4. Prevent installation of culvert on sand spit pond as discussed the day of the ERT's field review. It is extremely hazardous to have large tidal pipes in areas with small children.

5. Repair or rebuild concession stand for first-aid/ life guard station.

6. Build boat ramp on Lewis Gut due north of power transformer.

7. Plant cedar trees, black oak, or other appropriate species north and east of Long Beach concession stand for picnic grove.

8. Install walkways and access control measures to minimize damage to sand dunes (see Section II.A of this report).

9. Restore dunes as suggested in Section II.A of this report.

10. Plant native resistant plants for coastal conditions in selected areas and fertilize as needed (see Section II.B of this report).

11. Consider establishing a fee system for use of the Park as discussed in Section II.G of this report.

To conclude, Pleasure Beach is a coastal site that is unique in urban areas of Connecticut. It offers the opportunity to develop a multi-use coastal park that would offer urban residents access to a beach and associated natural areas, in addition to possible intensive use of the upland areas of the park. Development of recreational facilities at Pleasure Beach would also act to take pressure off Seaside Park which is filled to capacity during summer weekends.

Since the island is a public resource, it is reasonable to have the residents of the City of Bridgeport play a leading role in establishing future directions for Pleasure Beach. Consideration should be given to having representatives of the "average" resident take the leading role, including people representing: community organizations, religious organizations, labor unions, civil rights organizations, social and fraternal groups, and environmental groups as well as other groups that reflect the diversity of interests among the city's populace.

* * * * *

APPENDIX

Appendix I
Saving the American Beach: A Position Paper by Concerned Coastal Geologists

SAVING THE AMERICAN BEACH: A POSITION PAPER BY CONCERNED COASTAL GEOLOGISTS

Results of the Skidaway Institute of Oceanography Conference on America's Eroding Shoreline: The need for geologic input into shoreline management, decisions and strategy

25-27 March, 1981

Savannah, Georgia

Conveners:

Dr. Orrin H. Pilkey, Jr., Duke University, Durham, N.C. 27708

Dr. James D. Howard, Skidaway Inst. of Oceanography, Savannah, Ga. 31406

Participants:

Dr. Benno Brenninkmeyer, Boston College, Chestnut Hill, Ma. 02167

Dr. Robert W. Frey, University of Georgia, Athens, Ga. 30602

Dr. Albert C. Hine, University of South Florida, St. Petersburg, Fla. 33701

Dr. John C. Kraft, University of Delaware, Newark, Del. 19711

Dr. Robert Morton, Bureau of Economic Geology, Austin, Tx. 78712

Dr. Dag Nummedal, Louisiana State University, Baton Rouge, La. 70803

Dr. Harold Wanless, University of Miami, Miami, Fla. 33139

SUMMARY

New approaches to the management of the American shoreline are urgently needed to preserve our recreational beaches for future generations. Approximately half of the 10,000 miles of the "lower 48" American shoreline facing the open ocean is under development pressure. Well over 2,000 miles are considered by the U. S. Army Corps of Engineers to be in a state of critical erosion. Erosion is occurring along almost all of the U.S. coast and when shoreline retreat collides with shoreline development, a state of "critical erosion" is achieved. Shoreline retreat is due to many causes but a major one is rising sea level and indications are that the rise will continue for the foreseeable future.

The usual response to critical erosion on America's shore is stabilization; halting of shoreline retreat by engineering means. Such stabilization of America's shore has been successful in increasing the length of life of buildings built adjacent to the beach. However, stabilization in the long run (50 years +) and sometimes in a much shorter time frame has resulted in severe degradation of the recreational beach area. Dollar costs of halting shoreline retreat by stabilization is very high. Replacement of the beach by pumping in new sand costs about 1 million dollars or more per shoreline mile each time it is done and it must be carried out repeatedly, commonly in 3 to 10 year intervals. Another approach, the building of seawalls, costs between $100 to $600 per linear open ocean shoreline foot. Combining these cost figures with the 2,000 mile figure of critically eroding shoreline gives some idea of the magnitude of the potential economic crisis on the American shoreline if we continue to stabilize.

American taxpayers are paying huge sums of money to temporarily protect the private property of a relative few. Furthermore this practice commonly leads to the ultimate destruction of a highly valued public recreational area.

Stabilization costs can be justified for major coastal cities or harbor entraces (Chicago, Galveston, Miami Beach, Coney Island, the Columbia River entrance, for example), but stabilization of most American shores is not justifiable in the broader scope of national interests. Numerous projects, involving public and private money along virtually all developed coastal and lake shores presently threaten most of America's recreational shoreline.

The following summarizes our views on stabilization of America's open ocean shorelines.

1. People are directly responsible for the "erosion problem" by constructing buildings near the beach. For practical purposes, there is no erosion problem where there are no buildings or farms.
2. Fixed shoreline structures (breakwaters, groins, seawalls, etc.) can be successful in prolonging the life of beach buildings. However, they almost always accelerate the natural rate of beach erosion. Resulting degradation of the beach may occur in the immediate vicinity of structures or it may occur along adjacent shorelines sometimes miles away.
3. Most shoreline stabilization projects protect property, not beaches. The protected property belongs to a few individuals relative to the number of Americans who use beaches. If left alone, beaches will always be present, even if they are moving landward.
4. The cost of saving beach property by stabilization is very high. Often it is greater than the value of the property to be saved especially if long range costs are considered.
5. Shoreline stabilization in the long run (10 to 100 years) usually results

in severe degradation or total loss of a valuable natural resource, the open ocean beach.

6. Historical data show that shoreline stabilization is irreversible. Once a beach has been stabilized, it will almost always remain in a stabilized state at increasing cost to the taxpayer.

The consequences of responding to rising sea level by shoreline stabilization are so serious that we urge immediate measures to explore totally new approachs to shoreline management. Such approaches may even involve drastic and unpopular measures such as assuming that buildings adjacent to the beach are temporary or expendable. Equally important, the new approach to shoreline management must incorporate the very significant advances in geologic understanding of shoreline processes that have occurred during the last decades. In the past the American public has been largely unappraised and unaware of the long range environmental and dollar costs of shoreline stabilization. There is a critical and immediate need for the public to know the direction in which American shoreline management is leading.

I. STATUS OF THE AMERICAN SHORELINE

1. We Are Losing Our Beaches

Widespread erosion is occurring on the U.S. shoreline and in some areas the rate of erosion has significantly increased in the past two decades. Many factors are responsible for coastal erosion but it is so widespread that sea level rise appears to be a primary cause. Specific evidence of sea level rise is indicated by tide gauge records not only in American waters but throughout the world. Sea level rise is probably due to melting of ice in high latitudes and it must be assumed that the rise will continue for decades to come. The National Academy of Science recently has warned of continued or even accelerated melting of the ice due to climatic changes related to increasing atmospheric carbon dioxide from consumption of fossil fuels.

Sea level rise along the American coast is believed to be approximately 1 foot per century. On coastal plain coasts, this is accompanied by lateral shoreline retreat orders of magnitude greater than the vertical rise in sea level because of the gentle slope of the coastal plain surface. The present rate of sea level rise should be expected to cause between 500 to 1500 ft of shoreline retreat per 100 years over broad stretches of U.S. coast. Measured rates of shoreline retreat are highly variable ranging from zero to dozens of feet per year. Even though some areas near rivers or deltas are growing seaward, such conditions are unusual, generally local, and considered geologically ephemeral. Shoreline retreat along Mid Atlantic, Southeast Atlantic and Gulf sandy barrier coasts tends to be fairly regular and continuous. Retreat of West Coast, New England and the Great Lakes shores often is more sporadic. Cliffed shorelines occasionally retreat in catastrophic "jumps."

The epitome of the U.S. beach crisis is Cape May, New Jersey. Once America's foremost beach resort, swimmers in Cape May today have difficulty finding any sand to stand on. Cape May City is lined with massive seawalls.

The overall trend of erosion is perhaps most spectacularly illustrated by the present underwater location of old village sites; villages that existed before massive shoreline stabilization was considered an appropriate solution. Examples of such are Cove Point, Washington, Bay Ocean, Oregon, Balize, Louisiana, Edingsville Beach, South Carolina, and Hog Island, Virginia.

Retreat of the American shores does not threaten our recreational beaches. Beaches will essentially remain as they are but will move landward. Shoreline retreat does, however, pose a serious threat to buildings along the shore.

2. Crowding the Shore

Urbanization and construction on barrier islands, cliffed coasts, beaches, and coastal floodplains of the United States have increased markedly in recent years. NOAA (National Oceanographic and Atmospheric Administration) recently estimated that approximately 80% of the U.S. population will reside within easy driving distance of the coast by the year 1990. Mass migration of people to these areas poses immediate and unanticipated problems. Development of barrier islands on the Atlantic and Gulf coasts has brought about the installation of numerous stabilization structures (seawalls, revetments, groins, etc.) to protect coastal property. Development on cliffed coasts creates a distinctly different set of problems.

Between 1948 and 1978, California experienced a benign and quiescent climatic period characterized by few storms capable of generating large storm swell or heavy surface runoff. During this time extensive urbanization occurred along the coast. Studies of tree rings in Southern California show that this was the longest drought period since the 1520's. With urbanization, the ground-water table level has risen along the coast due to extensive watering of non-native vegetation, agricultural irrigation, septic tanks, leach lines and cess-pools; the equivalent of approximately 50 to 60 inches of precipitation per year. This has added weight to cliff material and contributes to landslides and cliff failures. These failures result in immediate and costly stabilization measures which in turn may greatly accelerate beach erosion.

3. Stabilization

Development of the American coastline has led to an endless program to protect investments whether they be individual homes or commercial enterprises. Property owners, because they have built in a dynamic and destructive environment, in many cases at great cost, demand stabilization structures to try and protect their homes and businesses. Many stabilization structures have been used but the most common are seawalls, rip rap revetements, groins and offshore breakwaters. These structures are fixed in space and represent considerable effort and expense to construct and maintain. They are designed for as long a life as possible and hence are not easily moved or replaced. They become permanent fixtures in our coastal scenery but their performance is poor in protecting communities and municipalities from beach retreat and destruction. Even more damaging is the fact that these shoreline defense structures frequently enhance erosion by reducing beach width, steepening offshore gradients, and increasing wave heights. As a result, they seriously degrade the environment and eventually help to destroy the areas they were designed to protect.

Some outstanding case histories prove these points:

1. The Galveston Seawall, America's mightiest, was built in response to the 1900 Hurricane which killed 6,000 people. As recently as 1965, a wide sand beach existed seaward of the wall. The beach has now essentially disappeared from in front of the wall and is being replaced by rows of rip-rap protecting the foot of the seawall. Beyond the west end of the seawall, the natural shoreline is now retreating at 15 feet per year due to the loss of its source of sand in front of the seawall.

2. The Sea Bright, Monmouth Beach, New Jersey shore section has little remaining beach even at low tide. The shoreline is fronted with a massive seawall extending to an elevation of 20 ft above M.L.W. with a cap width of 3 feet. The

wall was built in 1954 replacing an earlier seawall built in 1945. State officials now fear that due to the lack of beach and the much steepened offshore gradient, the seawall may fail completely in a storm. Even now, 25 knot sustained winds produce seawall-topping waves at Sea Bright. Steepening is to be expected in front of all open ocean structures; leading ultimately to the destruction of the seawall itself.

3. During the decade of the 70's and for a good part of the 60's there was no beach at Miami Beach. The seawalls and groins protecting the hotels had destroyed the original "raison d'etre" for this, the most famous of America's beach resorts. TV shows emanating from Miami Beach beaches managed to take advantage of occasional pocket remnant beaches. At a cost of $64,000,000 fifteen miles of Miami Beach were recently replenished. The economic justification for this expenditure of tax money is an assumed income generating 10 times the cost of sand pumping. This may be true for Miami Beach but if the total mileage of critically-threatened American shoreline is considered, the absurdity of the future economic picture of the American Beach becomes clear. Furthermore replenishment is akin to painting a house. It will have to be done repeatedly and probably at ever-shorter intervals.

4. The jetties at Indian River Inlet, Delaware have successfully protected navigable waters for over 50 years. The shoreline here has been receding at a steady 3 feet per year rate. When a replacement bridge was recently built it was placed closer to the sea than its predecessor. This was done for good engineering reasons and also because it was the cheapest construction alternative. Soon after construction the beach retreated to the northside bridge abutments and $715,000 was needed to pump in new sand. We can be assured that every few years from now on a million dollar replenishment job will be needed to save the bridge. If the bridge had been built on the backside of the barrier island, the problem would not have arisen for 50 years. At what point should the state abandon the bridge? They will soon spend more money protecting the bridge than constructing it.

5. There are other detrimental byproducts of stabilization that must be considered. For example replenishment of Waikiki beach involved replacement of coarse calareous sand by softer muddier calcareous sand. Destruction of the soft beach sand by breaking waves increased the turbidity of the water and killed offshore coral reefs. The replacement of quartz sand by calcareous sand on Miami Beach has resulted in increased water turbidity and is damaging local coral communities.

Frequently, the response to continued beach loss is to begin bigger and more expensive "stabilization" endeavors, which continue to aggravate the problem. Finally, we become locked into a dilemma of costly counter-productive measures - wherein the more we do, the worse the problem becomes. We can, unfortunately, look back on a sad history of small coastal communities originating small "stabilization" projects that attracted and caused an increase in development. This increase brought with it an expanded economic and political base which, when next threatened by beach erosion, demanded even larger coastal defenses. This set in motion a long and needless commitment to defend the development: a commitment doomed for ultimate failure.

In a rational and well-educated society, it is alarming to realize that few if any alternatives to stabilization methods have been seriously proposed or tried. It is time for imaginative, creative, and bold ideas. New ideas and approaches have surfaced from time to time. For example, bypassing of sand past jetties at harbor entrances has allowed beaches to persist where they would have completely disappeared otherwise. It seems clear that we cannot proceed with the "bigger is better" coastal defense scenarios. We know that coastal communities will exist for some time in the future, just as they have been in the past. Yet the "bigger is better" thinking does not provide for intelligent long-range planning. We must consider the "fate" of beaches based on scientific data and interpretation and set in motion a rational policy for living with nature. Our crisis approach to coastal management must come to an end.

4. The Price We Pay for Coastal Stabilization

The price we pay for the installation and maintenance of a "stabilized" shoreline whether it be in esthetic or fiscal terms, is enormous and it is accelerating. Although there are some examples of private sources paying for "beach protection" most commonly it is the taxpayers of the continental hinterlands that pay for shoreline stabilization. It is ironic that many people unwittingly and unknowingly pay for projects that degrade a public resource. Furthermore, this resource frequently becomes increasingly more inaccessible in the areas that receive the greatest infusion of funds. Too often the cost of stabilization is significantly higher than the value of the structure to be protected. The following examples dramatically illustrate the cost of shoreline stabilization:

1. The U.S. Park Service claims that 15 million dollars have been spent on various shoreline stabilization schemes in the vicinity of the Cape Hatteras Lighthouse. Additional plans are in the works to build more massive stabilization structures to save the lighthouse. The cheaper alternative, moving the lighthouse, has not been seriously considered. This in spite of the fact that the shoreline has moved landward almost 3,000 feet in front of the present lighthouse site since the mid 1850's.

2. The previously mentioned Galveston seawall has successfully protected the city over the past 80 years. At the same time, the beach in front of the wall has disappeared, the shoreface has steepened, and wave energy has increased. It is hard to deny the ultimate usefulness of the Galveston seawall. But was destruction of the beach by stabilization of Sea Bright and Monmouth Beach and Long Branch, New Jersey, also worth the cost? In order to save relatively small numbers of buildings, mostly vacation homes, the beach environment in these New Jersey communities has essentially disappeared at great financial cost.

5. Scientific Input into Shoreline Management

Most of our shoreline stabilization has been and is being carried out without consideration or understanding of fundamental principles of shoreline processes. Prediction of economic and environmental impact of shoreline stabilization is frequently done in the context of poor or no understanding of the coastal system in spite of our increased understanding of shoreline processes in the last two decades. Frequently, political considerations override scientific facts. Failure to consider scientific principles leads to increased shoreline damage and increased cost of stabilization.

To stop East Timbalier Island's continued landward migration, and the eventual exposure of Timbalier Bay (Louisiana) oil-field installations to waves of the Gulf of Mexico, the oil field owners have "stabilized" the shore with two seawalls, built in the late 1960's. Only the eastern part of the island, the part immediately adjacent to the installations, was stabilized; the western half (downdrift) was left in its natural state. The consequences of this stabilization scheme follow an all too familiar pattern. The eastern half became fixed in space while the western part continued to migrate with rapidly diminished sediment supply. The result as been a segmentation of the island; a deep and wide tidal inlet now separates the two halves. This result should not have surprised anyone; it could easily have been predicted prior to construction of the seawall.

A major shortcoming of design and planning for shoreline stabilization has been the short design-life consideration. Commonly a shoreline erosion problem is considered in a 15 to 35 years context. Yet we have a number of shorelines that have been stabilized for 50 years, where beaches have been essentially destroyed at great cost. Shoreline stabilization schemes that do not preserve the environment for future generations should not be carried out. The public-at-large and not just the few people with threatened buildings, should be clearly informed of the long range consequence of action being taken at the shore.

A second major shortcoming of shoreline stabilization solutions is the failure to understand the shoreline system in a regional context. We now know that beaches may exist in equilibrium with an entire shoreline for many miles. An action that halts the flow of sand at one location may well cause increased shoreline retreat at other locations. On coastal plain coasts, the beach exists in equilibrium with the inner continental shelf. Obtaining sand for beach nourishment from the shoreface or anywhere else within the dynamic system inevitably affects this equilibrium and enhances rates of shoreline retreat.

On cliffed coasts, erosion is episodic. It occurs catastrophically at widely spaced intervals of time. Failure to take the long range view of cliff failure continues to lead to economic and ecologic disasters. Complicating the situation further is the fact that along the Pacific shore, particularly of Southern California, a major source of sand has been cut off by dam construction on rivers.

Plans are in the mill to replenish some of the southshore Long Island barrier beaches (Westhampton Beach) with sand from offshore. Geologic studies indicate that removal of offshore sand (from a depth of less than 10 meters) will simply cause sand to move offshore more rapidly. In other words, the replenishment project bears with it the seeds of its own destruction.

Tybee Island, Georgia is an example of a beach system presently being stabilized on a relatively small scale. Over a period of 100 years more than 75 groins have been constructed at Tybee Island. Today only one of these, the most recent one built in 1974, has any significant effect. The recent history of stabilization projects on this island is fraught with large underestimates of sand volume and dollars required. At one point removal of sand from a nearby inlet to the south actually hastened the erosion of the new beach. Probably much of the long range erosion problem on Tybee is due to dredging of the Savannah River channel to the north, thus removing a natural supply of sand. Channel dredging and beach replenishment are funded from separate bureaucratic pots. Hence, as in many cases along the American shore, potentially good beach sand is removed from a channel and dumped at sea rather than on the adjacent beach.

Scientific input is needed both in long-range, large-scale planning and in community beach-management planning. Simple approaches such as bulldozing sand from the lower beach to the upper beach after storms has proven to be unwise. Such a procedure steepens the beach and increases the rate of shoreline retreat. Beach community officials apparently find this impossible to believe and, despite geological advice to the contrary, continually employ this technique.

II. SOLUTIONS TO AMERICAN SHORELINE PROBLEMS:

ALTERNATIVES FOR CONSIDERATION

Principles common to all immediate solutions are (1) sea level rise and coastal erosion are inevitable, (2) most stabilization and nourishment projects are untenable and indefensible in terms of physical realities, cost-benefit ratios, and escalating budgets, (3) increased public awareness through education is becoming paramount, not only of coastal residents but also regulatory agencies, legislators, and the general American public, and (4) new and in many cases, sweeping, legislation is required to reverse the trend of costly shoreline management practices.

Ultimate solutions to the problem will not be simple. They will involve political, sociological, economic, as well as scientific and engineering considerations. Solutions for the barrier island coasts of the Atlantic and Gulf will differ from the solutions for the cliffed Pacific coast. The solution for a developed New Jersey barrier island will differ from that of a pristine Texas barrier island. Complexity of the "solution" is clearly illustrated by the following alternative approaches to halting the accelerating loss of American recreational beaches.

1. Public Education

Inform all relevant interested parties of long-range and long-distance ramifications of proposed development-stabilization projects --

At present, the general public is unaware of the fact that sea level is rising or that most of the nation's beaches are retreating, whether cliff or barrier island, and that this process is inevitable. For example, few people realize that over the past 150 years, rates of erosion on the Atlantic coast have ranged from 1-3 feet per year to more than 100 feet per year, as documented by such federal agencies as the U.S. Geological Survey, National Oceanographic and Atmospheric Administration, Corps of Engineers, etc. Warning of the likelihood of continued sea level rise by the National Academy of Science must be communicated immediately to the public. Equally important, few people seem to realize that actions taken in one place on the shore may have a profound, direct, and adverse effect on adjacent beaches.

Not only should all interested or involved parties be notified of the attendant physical problems involved, they should also be apprised of the prospective long term financial burden. Economic estimates are that the long-term debt borne by the nation -- especially in view of the federal flood control act, which is stimulating acceleration of building activities in the coastal zone -- will lead to costs on the order of many billions of dollars during the next several decades.

In 1967, the federal government proposed a protection plan for Delaware's shoreline. Long range cost was estimated to be 25 million dollars plus annual maintenance costs. An independent estimate by University of Delaware economists indicated a cost approaching 3/4 of a billion dollars over a 50 year time span. Commonly long range estimates, by the federal government, of beach stabilization costs, fall far short of the mark.

The fate of the American recreational beaches must be determined by a broad segment of an informed populace. In most cases, the monies for coastal management are derived from public rather than private funds. If the American public were aware of its role in funding such projects, i.e.. that a Nebraska farmer is helping protect an Atlantic beach house with a private beach, then public support for these projects would quickly diminish.

2. Science

Obtain competent scientific input into shoreline planning --

This is a major principle; failure to do so in the past has resulted in large scale losses of recreational, commercial, and residential property representing both public and private resources. Generally coastal management agencies and the Corps of Engineers have not adequately developed or fully utilized scientific data. In numerous other cases, political considerations have negated sound scientific observations.

Open oceans groins built on Westhampton Beach, N.Y. were constructed against the advice of all involved engineers and geologists. The groins caused severe and immediate erosion to the west. A 40 million dollar federal beach replenishment project is now proposed to save threatened private homes.

3. Alternatives to Structural Stabilization

Halt all stabilization projects immediately whether funded privately or publicly --

In most cases, current efforts at stabilization should cease. Obvious exceptions include certain (1) military reservations, (2) industrial complexes, (3) harbor entrances, (4) densely populated urban areas, and (5) selected resort communities with high economic value with which the general public is not willing to part. Justification for cessation of these efforts hinges on the inevitability of beach erosion problems, uneconomical cost-benefit ratios, and projected exponential increases in coastal management budgets, especially on a long-term basis.

Spend the money slated for stabilization projects to move threatened buildings --

A fundamentally important but often overlooked aspect of expenditures on coastal management projects is that the buildings to be saved are frequently worth considerably less than the amount of money spent in their protection. Costs for removing these structures would be much less than costs for preserving them and would simultaneously remove the basic problem -- artificial perturbations in a naturally dynamic system. "Better to move than to protect."

The Federal flood insurance program moved a number of houses back in 1979 from the shores edge in South Nags Head, North Carolina. One house cost $36,000 to move. The impetus behind this was not to prevent stabilization but to save the Federal government's flood zone insurance program from paying the entire cost of the house when it was consumed by the surf.

Remove threatened buildings next to the beach --

In general, structures of low commerical, residential, or aesthetic value might well be sacrificed. A major impetus for this might be the possibility, otherwise, for damage to adjacent property or the obstruction of recreational beach area. Most important, building removal by whatever means, removes the need for shoreline stabilization.

Destabilize islands and beaches --

The fundamental problem is, as the sea level continues to rise, an artifically stabilized beach becomes more and more "out of equilibrium" with the sea level. This means that more and more "heroic" efforts (bigger seawalls) will be needed.

Can we move seawalls and let nature roll on? Will a natural equilibrium beach be reestablished? Should nature simply be allowed to do the job for us, or should we initiate remedial action? Related questions include, if action is taken to reverse stabilization, who should bear the cost and will these activities create additional, perhaps more costly, coastal problems? Finally, the solution should include the promise that no more development be allowed in the same area in the future.

Exceptions to this general neutralization of structures in the coastal zone include designated areas in which the national interest is affected, such as the preservation of national treasures, and the cases specified previously.

Establish setback lines and conservation easements --

In defining and establishing a buffer zone between stable areas and the shoreline, setback lines and conservation easements should be considered, as well as the "permanence" of the "stable" sites. A setback line is the necessary first step toward resolution of problems and principles addressed in points above. With the certainity of erosion and landward retreat of coasts, of course, a static or permanently defined line cannot be considered as a long-range solution; development and utilization of coastal resources must retreat with the shoreline.

North Carolina is experimenting with a setback line of 30 times the average annual erosion rate. Some islands are so narrow, that this will totally prevent the possibility of development. One solution to this aspect of the problem is the concept of a "rolling" setback line; one that by definition and law would periodically shift landward, or away from the onslaught of erosion. For example, a given oceanward site could be designated as the lifetime possession (30-40 years) of the current landowner, after which time the property would be condemned and vacated.

Inherent in this concept is the prospect of tremendous benefit to the general citizenry through (1) increased access to the nation's shorelines, (2) aesthetic enhancement of a "buffer" area, via parks and other types of open space, provided that condemned structures are removed satisfactorily and (3) a dramatic reduction in public funds otherwise diverted into stabilization schemes.

Establishment of such methods would require that (1) they be adhered to in perpetuity, i.e., no subsequent changes in rules or stipulations except in dire circumstances, that (2) a time frame be instituted, such as the "life expentancy" of buildings involved, and that (3) responsibility for removal and funding be designated.

4. Economic and Political Alternatives

Prevent the use of public funds for redevelopment after the "next" storm --

Destruction of shoreline development by a storm is essentially the only way that artificial stabilization can be halted or reversed. Thus storms on the one hand sow tragedy and destruction but on the other hand, they offer a golden opportunity to reverse beach management strategies that have failed.

Dauphin Island, Alabama has been affected by 20 hurricanes during this century. Three (1916, 1947, 1979) produced maximum damage at the same place, a location controlled by nearshore bathymetry which focuses storm wave energy. The taxpayer paid millions of dollars in Flood Insurance payments for Dauphin Island buildings that were destroyed by Hurricane Frederic in 1979. We taxpayers have just commited well over 50 million dollars to build a new bridge and to reestablish the major development of Dauphin Island at this most senseless of all locations.

There is immediate need for measures to prevent redevelopment after storms. No longer should local, state, and federal governments expend public funds in redevelopment; on the contrary, these governments should assume responsibility for the protection of the public (as opposed to the private) interest, not to recreate an untenable situation or to guarantee recurrent destruction of such properties.

Carefully review all federal expenditures in beach communities regarding their long range impact on natural systems --

The federal government not only is responsible for bearing much of the cost of shoreline stabilization construction, but also the costs of water and sewer systems and flood insurance programs.

A water line was recently laid from Buxton to Avon on North Carolina's Outer Banks. The line, which will support increased density of development in Avon, goes through an area of the Hatteras National Seashore which is highly susceptible to inlet formation during storms. Placement of the pipe in such a danger zone assures the need for large future expenditures of federal funds for stabilization. It is an example of federal expenditure leading to density of development far beyond the natural carrying capacity of the island. Experience tells us the dense development will ultimately lead to stabilization of the shoreline with all of the attendant economic and environmental problems.

Require deeds to state hazards and/or require home purchasers to sign "hazard documents" --

Deeds to shoreline property should clearly state all natural flood and erosion hazards known at the time of validation of the deed. Descriptions of hazardous conditions may change as new data accumulate and/or as scientific knowledge and technology advances with refinements.

III. FUTURE NEEDS

It is readily apparent from the numerous examples of submerged and stranded jetties, multiple seawalls, and groins now detached from the shoreline that many stabilization projects have been failures. It is further shown by the need to continually repeat renourishment programs that were initially supposed to "solve the problem" once and for all. Too often these expensive attempts at stabilization occurred because (1) the engineering solution to problems created by natural processes were undertaken without consideration of the magnitude and significance of the process itself, (2) failure to consider how artificial structures affect the environment, (3) failure to measure, describe and accurately interpret processes that occur in the vicinity of the stabilization project, (4) lack of appreciation of the fact that coastlines are systems, not components, and (5) completely ignoring the solid evidence for sea level rise.

We are clearly at a point today when decisions relating to coastal erosion can call upon a vast reserve of research results and capabilities as well as innovative technology. The fact that we continually fail to do so is absurd. The responsibility rests on the shoulders of shortsighted politicians, developers and coastal engineers among others who, through ignorance, haste, or in response to political pressure, fail to utilize the results of available research reports, the tools and techniques developed from coastal research and the talents of numerous highly qualified research scientists. Federal engineering organizations counter this argument by saying they have invested millions of dollars in coastal research and indeed they have. But time and again we find they have asked inadequate or inappropriate questions.

Another major blunder that stands out clearly in assessing what has gone awry is the failure to look at the short and long term economic realities of attempts at shoreline stabilization and beach renourishment. These include direct and indirect costs involved and cost-benefit ratios in light of the long term significance of causes and effects of coastal erosion. Many attempts at artificial stabilization should never have been undertaken in the first place. Many others should be stopped immediately and no new projects should be initiated until a solid, unbiased economic study is made and it is clearly determined who will benefit and who will suffer, what it will cost and who will initially and eventually pay for the project.

Coastal research has made tremendous strides in terms of shoreline dynamics and processes. There is much that remains to be done but the accumulation of knowledge in the past 20 years is remarkable. During this same period of time our coasts have undergone extensive economic development until at the present time there is extreme human-induced stress being applied to the coastal zone. This is obvious in many coastal areas and is reflected in the concern expressed by various environmental groups and by the numerous task forces, workshops and meetings dedicated to coastal urbanization.

Traditionally, problems of shoreline erosion are "solved" by the quickest and cheapest methods. But there are no quick and cheap solutions to "problems" that are the result of long term processes. Managers have failed to consider the long term costs and the cost/benefit ratios involved. Past, present and future coastal programs must be evaluated by using a combined scientific-economic yardstick. In most examples we have been able to ferret out there is a predictable scenario that occurs in dealing with beach erosion on a "developed" coast:

A. Buildings are constructed along the shore, erosion occurs and threatens the building, short term remedies are given to slow or "stop" erosion.
B. Temporary success encourages new building, however ongoing erosion occurs and it is now accelerated because (1) the artificial structures accelerates the rates of erosion by steepening the beach profile and/or (2) the structures were poorly designed or improperly placed, and (3) the sea level rises and makes the beach "out of equilibrium."
C. At this point there has been an increased tax base and accompanying increased hue and cry to again stop erosion, etc.

This is a seemingly endless cycle of events which, due to a compounding of errors and poorly-thought-out decisions, becomes increasingly more expensive. By the time someone is willing to admit it wasn't worth the initial expense even if it had worked, the shoreline has been so highly developed that engineers, planners, politicians are totally locked into a program of continued commitment.

An immediate need exists to determine realistic costs and cost-benefit of shoreline management. In retrospect many such projects should never have occurred to begin with. Granted we are tied to certain existing programs, but it is not too late to blow the whistle on some and to refuse to initiate others. Future cost/benefit studies must include experienced geologists, economists, and engineers who have no vested interest. and who can (1) dig out the subtle realities of hidden costs, (2) put into their estimate the role of sea level rise and (3) apply state-of-the-art knowledge of coastal processes.

APPENDIX II

PLANT CHECKLIST

This is an annotated checklist to the plants associated with the natural plant communities of Pleasure Beach namely the beach, sand dunes and sandflats (this includes sandflat-like environments such as sandy dredged material). Nomenclature follows that of Dowhan (1979)*. Indigenous species are indicated by bold face script below.

Ammmophila breviligulata - American Beachgrass. Common to locally abundant on sand dunes and sandflats
Aristida tuberculosa - Beach Needlegrass. Occasional on sandflats
Artemisia caudata - Tall Wormwood. Common to locally abundant on sandfalts
Asclepias syriaca - Common Milkweed. Occasional on sandflats
Bromus tectorum - Downy Bromegrass. Infrequent, but locally common on sandflats
Cakile edentula - Sea Rocket. Occasional on wracklines of beaches
Carex silicea - Sedge. Frequent and locally dominant on sandflats
Chenopodium cf. **macrocalycium** - Seabeach Goosefoot. Occasional on wracklines of beaches
Cichorium intybus - Chicory. Occasional on sandflats
Digitaria sp. - Crabgrass. Occasional on sandflats
Cyperus grayii - Sedge. Frequent on sandflats
Distichlis spicata - Spike Grass. Rare, restricted to pocket tidal wetland near fishing pier
Elymus virginicus - Terrell Grass. Occasional on sandflats
Eragrostis spectabilis - Purple Love-grass. Occasional on sandflats
Euphorbia polygonifolia - Seaside Spurge. Rare on wrackline of beach
Lactuca sp. - Wild Lettuce. Occasional on sandflats
Lathyrus japonicus - Beach Pea. Occasional on sand dunes and sandflats
Lechea maritima - Beach Pinweed. Frequent on sandflats
Linaria vulgaris - Butter-and-eggs. Occasional on sandflats
Oenothera parviflora - Small Flowering Evening-Primrose. Occasional on sandflats
Panicum amarum - Bitter Panicgrass. Rare on dunes and sandflats
Panicum virgatum - Switch Grass. Occasional on upper border of tidal wetlands and sandflats
Phragmites australis - Common Reed. Occasional but locally dominant on sandflats and ruderal sites

Potentilla sp. - Cinquefoil. Occasional on sandflats
Salsola kali var. caroliniana - Common Saltwort. Common on wracklines and spit near the fishing pier
Schizachyrium scoparius var. littoralis - Little Bluestem. occasional on sandflats
Solidago sempervirens - Seaside Goldenrod. Frequent on sand dunes and sandflats
Spartina alterniflora - Salt-marsh Cord-Grass. Locally common and restricted to the small pocket wetland near fishing pier and as fringe along portions of the Lewis Gut shoreline
Spartina patens - Salt-meadow Cord-Grass. Rare and restricted to the small pocket wetland near the fishing pier
Triplasis purpurea - Purple Sand-Grass. Frequent on sandflats
Verbascum thapsus - Mullein. Rare, on sandflats
Xanthium echinatum - Clotbur. Occasional on wracklines of beaches

*Dowhan, J. J. 1979. Preliminary Checklist of the Vascular Flora of Connecticut (Growing Without Cultivation). Conn. Geol. Nat. Hist. Surv. Rpt. Invest. No. 8.

Literature Cited

Crow, G.E., W.D. Countryman, G.L. Church, L.M. Eastman, C.B. Hellquist, L.L. Mehrhoff and I.M. Storkes.1981. Rare and endangered vascular plant species in New England: Rhodora 83:259-299.

Dowhan, J.J. 1979. Preliminary checklist of the vascular flora of Connecticut (growing without cultivation): Conn. Geol. Nat. Hist. Sur., Rpt. Invest. No. 8. 176 pp.

Dowhan, J.J. and R.J. Craig. 1976. Rare and endangered species of Connecticut and their habitats: Conn. Geol. Nat. Hist. Sur., Rpt. Invest. No. 6 137 pp.

Mehrhoff, L.J. 1978. Rare and endangered vascular plant species in Connecticut: The New England Botanical Clubs in cooperation with the U.S. Fish and Wildlife Service (Newton Corner, MA). 40 pp.

Appendix III
Coastal Policies Applicable to
Pleasure Beach Revitalization

Coastal Resource Policies:

General Resource

A. To preserve and enhance coastal resources in accordance with the policies established by chapters 439,440,447, 473,474,474a and 477.

(Source: C.G.S., Section 22a-92(a)(2))

B. The general assembly hereby declares that the policy of the state of Connecticut is to conserve, improve and protect its natural resources and environment and to control air, land and water pollution in order to enhance the health, safety and welfare of the people of the state.

(Source: C.G.S., Section 22a-1 as referenced by Section 22a-92(a)(2))

C. It is hereby found and declared that there is a public trust in the air, water and other natural resources of the state of Connecticut and that each person is entitled to the protection, preservation and enhancement of the same.

(Source: C.G.S., Section 22a-15 as referenced by Section 22a-92(a)(2))

Beaches and Dunes

A. To preserve the dynamic form and integrity of natural beach systems in order to provide critical wildlife habitats, a reservoir for sand supply, a buffer for coastal flooding and erosion, and valuable recreational opportunities.

(Source: C.G.S., Section 22a-92(b)(2)(C))

B. To insure that coastal uses are compatible with the capabilities of the system and do not unreasonably interfere with natural processes of erosion and sedimentation.

(Source: C.G.S., Section 22a-92(b)(2)(C))

C. To encourage the restoration and enhancement of disturbed or modifed beach systems.

(Source: C.G.S., Section 22a-92(b)(2)(C))

Intertidal Flats

A. To manage intertidal flats so as to preserve their value as a nutrient source and reservoir, a healthy shellfish habitat and a valuable feeding area for invertebrates, fish and shorebirds.

(Source: C.G.S., Section 22a-92(b)(2)(D))

B. To encourage the restoration and enhancement of degraded intertidal flats.

(Source: C.G.S., Section 22a-92(b)(2)(D))

C. To allow coastal uses that minimize change in the natural current flows, depth, slope, sedimentation, and nutrient storage functions.

(Source: C.G.S., Section 22a-92(b)(2)(D))

D. To disallow uses that substantially accelerate erosion or lead to significant despoliation of tidal flats.

(Source: C.G.S.,Section 22a-92(b)(2)(D))

Coastal Hazard Area

A. To manage coastal hazard areas so as to insure that development proceeds in such a manner that hazards to life and property are minimized.

(Source: C.G.S., Section 22a-92(b)(2)(F))

B. To promote nonstructural solutions to flood and erosion problems except in those instances where structural alternatives prove unavoidable and necessary to protect existing inhabited structures, infrastructural facilities or water dependent uses.

(Source: C.G.S., Section 22a-92(b)(2)(F))

Shellfish Concentration Areas

See:-Intertidal Flats Policy A (preservation of value as nutrient source and shellfish habitat).

-Water Dependent Uses Policy A (priority to uses and facilities which are dependent upon proximity to coastal waters).

-Boating Policy C (protection and upgrading of facilities serving the commercial fishing industry).

Coastal Waters and Estuarine Embayments

A. It is found and declared that the pollution of the waters of the state is inimical to the public health, safety and welfare of the inhabitants of the state, is a public nuisance and is harmful to wildlife, fish and aquatic life and impairs domestic, agricultural, industrial, recreational and other legitimate beneficial uses of water, and that the use of public funds and the granting of tax exemptions for the purpose of controlling and eliminating such pollution is a public use and purpose for which public monies may be expended and tax exemptions granted, and the necessity and public interest for the enactment of this chapter and the elimination of pollution is hereby declared as a matter of legislative determination.

(Source: C.G.S., Section 25-54a, referenced by Section 22a-92(a)(2))

Coastal Use Policies

General Development

A. To insure that the development, preservation or use of the land and water resources of the coastal area proceeds in a manner consistent with the capability of the land and water resources to support development, preservation or use without significantly disrupting either the natural environment or sound economic growth.

(Source:C.G.S., Section 22a-92(a)(1))

Water Dependent Uses

A. To give high priority and preference to uses and facilities which are dependent upon proximity to the water or the shoreland immediately adjacent to marine and tidal waters.

(Source:C.G.S., Section 22a-92(a)(3))

B. To manage uses in the coastal boundary through existing municipal planning, zoning and other local regulatory authorities and through existing state structures, dredging, wetlands, and other state siting and regulatory authorities, giving highest priority and preference to water dependent uses and facilities in shorefront areas.

(Source:C.G.S., Section 22a-92(b)(1)(A))

Boating

A. To encourage increased recreational boating use of coastal waters, where feasible, by(i) providing additional berthing space in existing harbors, (ii) limiting nonwater dependent land uses that preclude boating support facilities, (iii) increasing state owned launching facilities, and (iv) providing for new boating facilities in natural harbors, new protected water areas and in areas dredged from dry land.

(Source:C.G.S., Section 22a-92(b)(1)(G))

B. To protect coastal resources by requiring, where feasible, that such boating uses and facilities (i) minimize disruption or degradation of natural coastal resources, (ii) utilize existing altered, developed or redevelopment areas, (iii) are located to assure optimal distribution of state owned facilities to the statewide boating public and (iv) utilize ramps and dry storage rather than slips in environmentally sensitive areas.

(Source:C.G.S., Section 22a-92(b)(1)(H))

Sewer and Water Lines

B. To disapprove extension of sewer and water services into developed and undeveloped beaches, barrier beaches and tidal wetlands except that, when necessary to abate existing sources of pollution, sewers that will accommodate existing uses with limited excess capacity may be used.

(Source:C.G.S., Section 22a-92(b)(1)(B))

ABOUT THE TEAM

The King's Mark Environmental Review Team (ERT) is a group of environmental professionals drawn together from a variety of federal, state, and regional agencies. Specialists on the team include geologists, biologists, foresters, climatologists, soil scientists, landscape architects, recreation specialists, engineers, and planners. The ERT operates with state funding under the aegis of the King's Mark Resource Conservation and Development (RC&D) Area - a 47 town area in western Connecticut.

As a public service activity, the team is available to serve towns and developers within the King's Mark Area --- free of charge.

PURPOSE OF THE TEAM

The Environmental Review Team is available to help towns and developers in the review of sites proposed for major land use activities. To date, the ERT has been involved in the review of a wide range of significant activities including subdivisions, sanitary landfills, commercial and industrical developments, and recreation/open space projects.

Reviews are conducted in the interest of providing information and analysis that will assist towns and developers in environmentally sound decision-making. This is done through identifying the natural resource base of the project site and highlighting opportunities and limitations for the proposed land use.

REQUESTING A REVIEW

Environmental Reviews may be requested by the chief elected official of a municipality or the chairman of an administration agency such as planning and zoning, conservation, or inland wetlands. Requests for reviews should be directed to the Chairman of your local Soil and Water Conservation District. This request letter must include a summary of the proposed project, a location map of the project site, written permission from the landowner/developer allowing the team to enter the property for purposes of review, and a statement identifying the specific areas of concern the team should address. When this request is approved by the local Soil and Water Conservation District and the King's Mark RC&D Executive Committee, the team will undertake the review. At present, the ERT can undertake two reviews per month.

For additional information regarding the Environmental Review Team, please contact your local Soil Conservation District Office or Richard Lynn (868-7342), Environmental Review Team Coordinator, King's Mark RC&D Area, P.O. Box 30, Warren, Connecticut 06754.