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WAQUOIT BAY NATIONAL ESTUARINE RESEARCH RESERVE

MANAGEMENT PLAN

May 1989

U. S. Department of Commerce
National Oceanic and Atmospheric Administration
Office of Ocean and Coastal Resource Management
Washington, D.C. 20235

Commonwealth of Massachusetts
Department of Environmental Management
Boston, MA 02202

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and Coastal Zone Management
100 Cambridge Street
Boston, Ma. 02202

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FOREWORD

The management plan for Waquoit Bay is intended to serve three purposes. First, the plan outlines a strategy for management and operation of the National Estuarine Research Reserve by the Reserve Manager and related Administration with public review by the Waquoit Bay Advisory Committee. Toward that end, the document provides operation guidelines and management objectives, and details tasks for future completion.

Secondly, the plan serves to fulfill, in part, the requirements of the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration of the United States Department of Commerce for designation of Waquoit Bay as a National Estuarine Research Reserve. Designation of Waquoit Bay enables the Reserve to be eligible to receive Federal grants for operations and education and research projects leading to an improved base for coastal decision-making and a better understanding of estuarine areas throughout the biogeographic region.

Lastly, the plan serves as an information source for the public. Through a description of resources present in the Reserve and the uses and issues affecting the Reserve, the public is able to gain an insight into the complexity and importance of the estuarine environment. Through discussion and documentation of protective mechanisms in place within the Reserve, the public will have the information to ensure a healthy and productive coastal ecosystem for future generations.

EXECUTIVE SUMMARY

The National Estuarine Reserve Research Program (NERRP) (formerly the National Estuarine Sanctuary Program) is established under the authority of Section 315 of the Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1461). The NERRP provides for a Federal-State partnership to designate significant representative estuarine areas throughout the country as National Estuarine Research Reserves. Such Reserves are established to (1) provide opportunities for long-term estuarine research, education and interpretation; (2) provide a basis for more informed coastal management decisions; and (3) enhance public awareness and understanding of the estuarine environment. Under this partnership, Federal funding, along with matching funds provided by the state, are used to acquire, develop, and operate estuarine areas that are to be incorporated in the National System.

In recognition of the significance that estuarine areas hold for commercial and recreation industries, and the rapid change evident along the coast, Massachusetts first established a research program to study its estuaries in 1963. A scientific analysis of the results of this program was published in 1975, with the data subsequently utilized to calculate indicies comparing species diversity with environmental quality for selected estuaries within the state.

Between 1974 and 1978 the Commonwealth investigated the feasibility of applying to the National Estuarine Sanctuary Program, and considered several possible candidates for sanctuary status. At that time, the North-South River complex and Waquoit Bay were selected as sites most likely to meet the requirements of the Federal program, and benefit from the research and education programs and protection that the designation would provide.

In 1979, the Commonwealth of Massachusetts designated Waquoit Bay as an Area of Critical Environmental Concern in accordance with Massachusetts General Laws Chapter 21A Section 2 (7). This designation followed an extensive public participation process during which major management issues for the area were addressed, and during which interest in National Estuarine Sanctuary status was expressed.

Based on the results of the Commonwealth's early research program, and after a thorough review of the alternative sites within the coastal area of the state, Massachusetts recommended Waquoit Bay for designation as a National Estuarine Sanctuary in July 1981. The area proposed includes the land and water areas commonly known as Waquoit Bay, Washburn Island, South Cape Beach, the Swift Estate, Sage Lot Pond, Flat Pond, Hamblin Pond, Jehu Pond, and the major salt marshes immediately adjacent to these areas.

In 1981, the Commonwealth applied for and was awarded a Federal "pre-acquisition" Federal grant for further evaluation of the site, collection of information necessary for management plan and draft environmental impact statement preparation, and preliminary acquisition activities.

In December 1982, the Commonwealth acquired South Cape Beach, a barrier beach/salt pond/marsh/upland complex located immediately east of the inlet to the Bay. A few months later, in June 1983, the Commonwealth acquired an additional part of the proposed sanctuary, Washburn Island. Washburn, a barrier island located west of the inlet to Waquoit Bay, forms the western border of Waquoit Bay. Both acquisitions are now part of the South Cape Beach State Park, managed for limited use, low intensity recreation.

Based upon this commitment to the protection of significant components of the Waquoit Bay ecosystem, the Commonwealth successfully applied for additional Federal assistance to acquire and develop Waquoit Bay as a National Estuarine Sanctuary. The additional funding by NOAA will be used for the purpose of 1)acquiring the wetlands, waters, and uplands of the Swift Estate at the head of the Bay to serve as the Reserve Visitors Center/Headquarters, 2)the construction of necessary support facilities and equipment for Reserve research and education, and 3)acquisition of easements or property interests necessary to provide access to salt and freshwater marsh areas for research and educational purposes.

The management plan, as set forth by this document, outlines the major goals of the Waquoit Bay National Estuarine Research Reserve (NERR):

1. To enhance and facilitate resource protection within the Reserve and those surrounding areas that affect the Reserve.

2. To facilitate and encourage opportunities for short and long-term scientific research programs within the Reserve that serve to increase our knowledge and understanding of estuarine areas and assist in their protection.

3. To facilitate and encourage education and interpretation of conditions and resources existing at Waquoit Bay NERR, and education about general principles characteristic of all estuarine areas.

4. To develop information for improved coastal decision-making.

5. To heighten awareness and promote cooperative efforts among local, state, and Federal levels on issues pertaining to the Waquoit Bay NERR.

6. To encourage multiple use of Waquoit Bay NERR resources to the degree compatible and consistent with the protection of the Reserve and maintenance of education and research activities.

7. To develop a restorative activities plan if, and/or where appropriate.

To ensure protection of Waquoit Bay, and continued compliance with the stated objectives, the Reserve is managed by the Massachusetts' Department of Environmental Management (DEM), Division of Forests and Parks. It will be DEM's role to increase the scientific understanding of the estuarine ecosystem and improve the ability to effectively manage them.

I. INTRODUCTION

The inhabitants surrounding Waquoit Bay have utilized and enjoyed the resources provided by the estuarine area for generations. Today, the waters and shoreline of Waquoit Bay still provide a source of livelihood for some residents and a source of visual enjoyment and recreation for countless others. Because of the enormous importance of estuaries to society and because of the stresses apparent on many of them, a program has been established to increase the protection and interpretation of these complex and variable ecosystems.

Section 315 of the Federal Coastal Zone Management Act created a National Estuarine Sanctuary Program (later changed to National Estuarine Reserve Research Program) for "...acquiring, developing, or operating estuarine sanctuaries, to serve as natural field laboratories in which to study and gather data on the natural and human processes occurring within the estuaries of the coastal zone...". The Federal program provides funding and direction for the establishment of a system of National Estuarine Research Reserves throughout the country.

Since 1974, the Commonwealth of Massachusetts has engaged in efforts towards designation of Waquoit Bay as a National Estuarine Research Reserve. Such efforts have included an in-depth evaluation process to determine the most appropriate estuarine area for designation; extensive public participation, public awareness, and support- generating activities in those towns influenced by Waquoit Bay; and implementation of protection measures on several parcels of land adjacent to the Bay.

The management plan document that follows, is a direct effort to identify the significant resources affecting the Waquoit Bay estuarine area, and develop strategies that will protect these resources while allowing for their continued use. The management plan sets forth the goals and objectives by which long-term research, education, recreation, and interpretation will be accomplished in the Reserve.

The plan is divided into three parts: 1)Management Context, 2)Existing Resource Protection, and 3)Management Strategy. The first part details the natural characteristics present in the estuarine environment, and the activities presently occurring in the waters and along the shoreline of the Reserve. The second part depicts the degree of protection afforded to the Bay through acquisition, regulation, and natural means. The last part, Management Strategy, outlines the major goals of the Reserve, and details strategies to be employed towards satisfaction of those objectives. This part also contains a description of the administrative roles guiding reserve policy, a physical plan for continued protection and use of the Reserve, and programs guiding research and education.

The management plan is intended to function as an information source to assist in public education, and to give direction and guidance to the management of the Reserve by the Department of Environmental Management. The plan and direction of the Reserve will be reviewed on a yearly basis to ensure continued soundness and viability.

II. MANAGEMENT CONTEXT

A. Regional Perspective

Waquoit Bay is located in the towns of Falmouth and Mashpee in Barnstable County (Cape Cod), Massachusetts. The Bay is adjacent to Nantucket Sound on the south side of Cape Cod. Located just 70 miles from Boston, Massachusetts and Providence, Rhode Island, Waquoit Bay is only an hour and a half driving distance from two of New England's largest metropolitan areas.

Waquoit Village lies just beyond the northern edge of the Reserve within the town of Falmouth. Together, the populations of Falmouth and Mashpee total approximately 29,700 people (roughly 20% of total population of Cape Cod). By virtue of an established tourism base, however, the seasonal population reaches 3.5 times that total during the summer months. The Bay is served by Route 28, a major east-west corridor, linking the most highly populated areas on Cape Cod.

The Waquoit Bay National Estuarine Research Reserve is representative of the southern New England (Cape Cod to Sandy Hook) portion of the Virginian biogeographic region. The National Estuarine Research Reserve Program established the biogeographic classification scheme in order to reflect regional differences in biogeography and estuarine topology to ensure the inclusion of a variety of ecosystem types. Waquoit Bay is the northernmost Reserve within the Virginian Biogeographic Zone and is located within the transitional border between the Virginian and Acadian biogeographic regions.

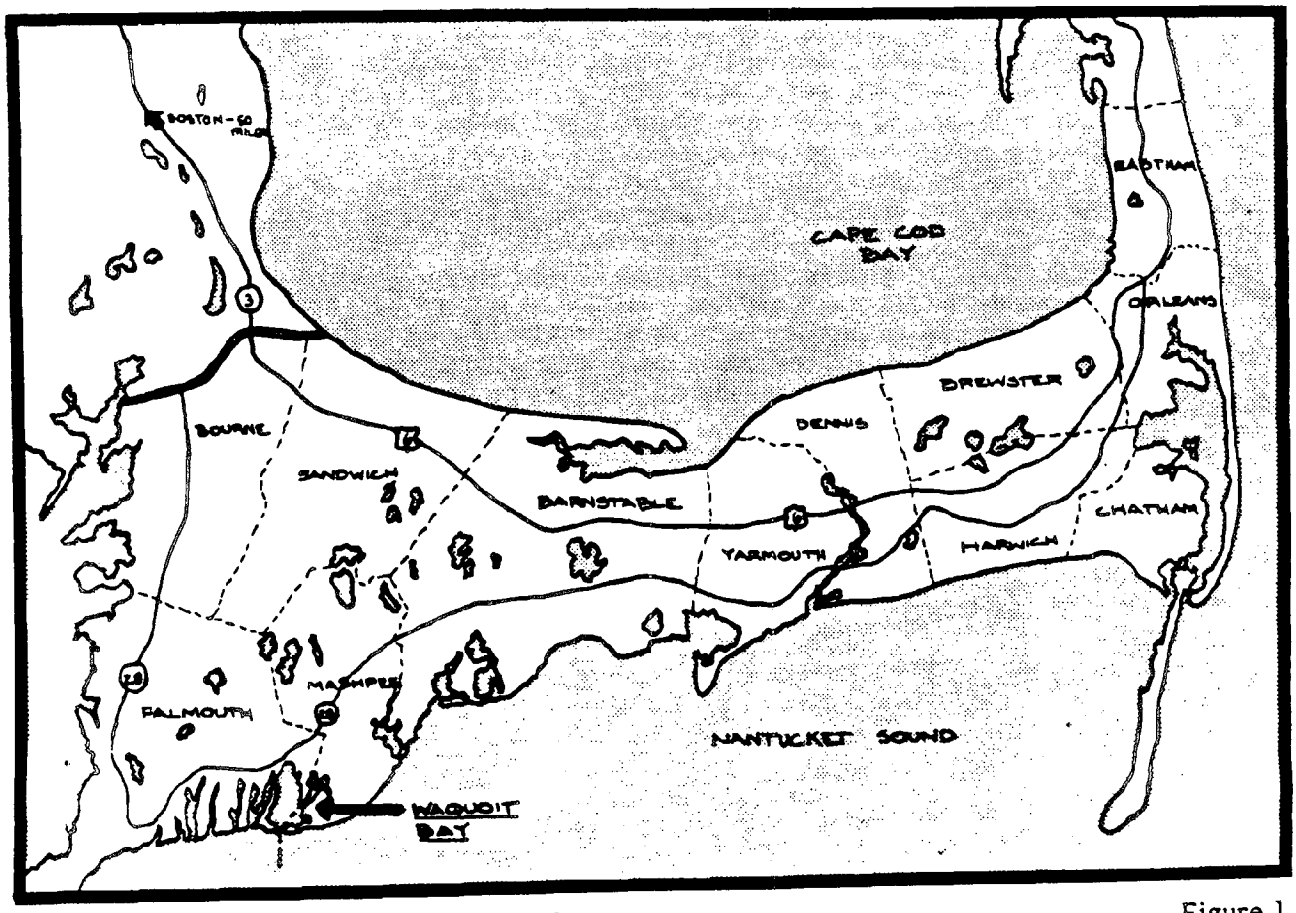


Figure 1

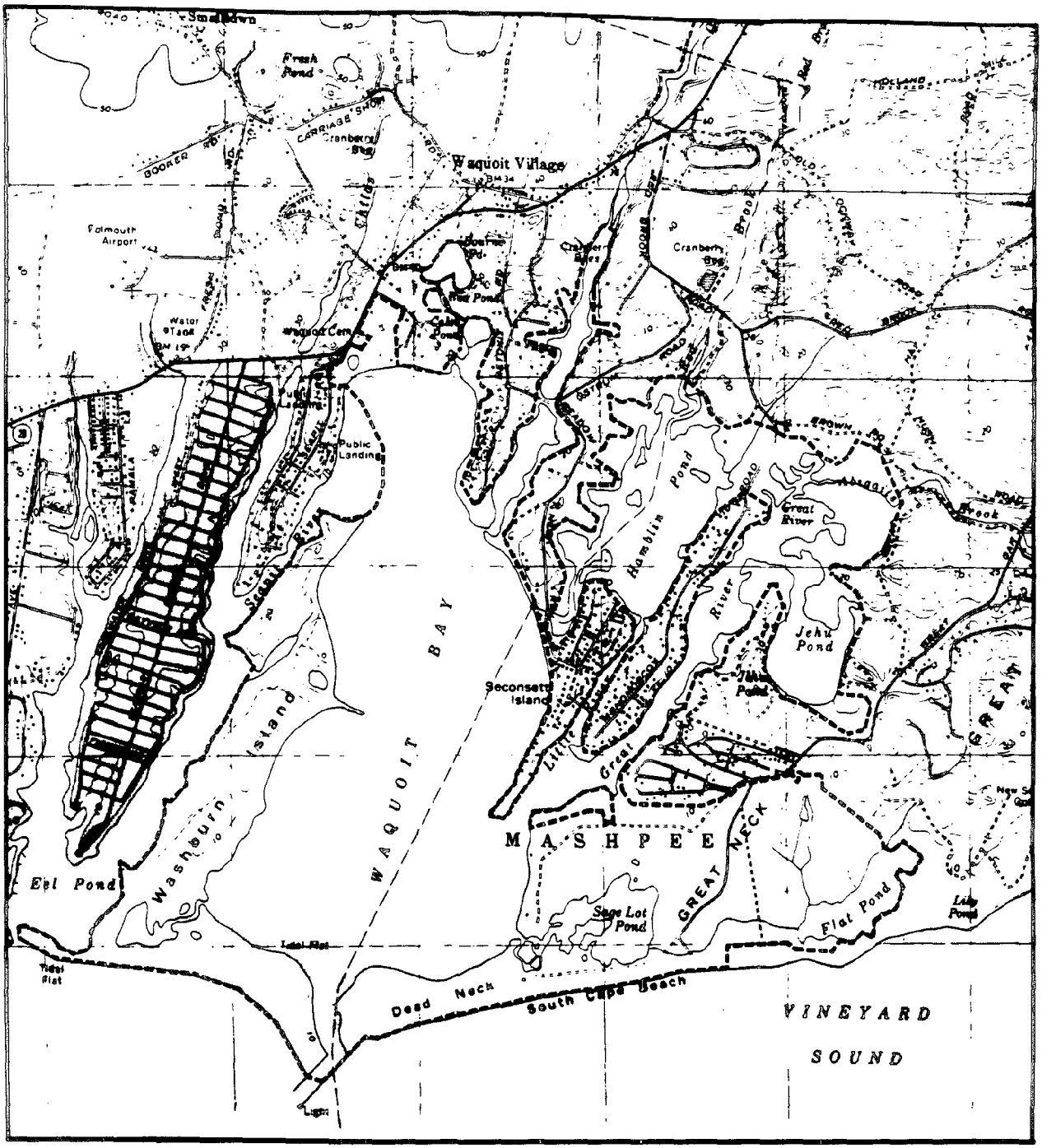
B. General Description

The boundaries of a National Estuarine Research Reserve incorporate those land and water areas considered a "natural ecological unit." As such, the Reserve only includes areas that are relatively undisturbed by human activities and are part of the estuarine system (including the estuary, adjoining transitional areas, and adjacent uplands.) The boundary of the Waquoit Bay NERR encompasses several distinct water bodies and upland areas within and adjacent to the Bay. (See Figure 2) The waters within the Reserve include all of Waquoit Bay; Jehu, Hamblin, Bourne, Bog, Caleb, Sage Lot and Flat Ponds; the Great and Little Rivers; and portions of the Quashnet/Moonakis River. (The Moonakis and Quashnet are part of the same river system with the name Quashnet applied to that portion of the river within the town of Mashpee, and Moonakis referring to that portion of the river in the town of Falmouth. For ease in understanding this Management Plan, Quashnet will refer to the entire river from its source to Waquoit Bay.) Upland and major marsh areas within the Reserve include Washburn Island, South Cape Beach, the Reserve Headquarters (a small acreage at the head of the Bay, locally known as the Swift Estate), and wetland areas adjacent to the ponds mentioned above.

The surface area within the Reserve totals 2,199 acres, or approximately 3.5 square miles. Of the total area, approximately 1,278 acres (or 58 percent) is water, 292 acres (or 13 percent) is marsh, and 629 acres (or 29 percent) is upland. The length of the north–south axis of the Reserve is 2.7 miles, while the east–west axis averages 2.0 miles. (See Table 1 for more detailed measurement data on the physical features within the Reserve)

Waquoit Bay, the dominant feature of the Reserve and the major water body of the estuary, exhibits a diversity in its shoreline characteristics. The Bay is protected from ocean waters of Nantucket Sound by the barrier beaches of Washburn Island and South Cape Beach. The area between these two beaches, measuring 300 feet across and eight feet in depth, is the major inlet to the Bay. This channel has been stabilized through the construction of two stone jetties along the banks. Washburn Island also serves as the western border for the Bay and the Reserve. The shoreline at the northern end of the Bay, refered to in this plan as the Reserve Headquarters, rises 50 feet above the water level producing steep coastal bluffs and the highest altitude within the Reserve boundaries. The eastern shoreline of the Bay is the most developed area of the Bay. Here, several seasonal and permanent residential units have been constructed along the shore and along several rivers that flow into the Bay on the eastern side.

Freshwater is supplied to the Waquoit Bay NERR from four principal sources: the Quashnet River (the largest and most direct source of freshwater to the Bay), Red Brook, Childs River, and groundwater flow. Thus, while Waquoit Bay is a distinct unit with clearly defined boundaries between the Bay and sea and freshwater sources, the estuary relies on several fresh and saltwater inputs.



WAQUOIT BAY

National Estuarine Research Reserve

scale in feet

0 500 2000

North

Reserve Boundary

Legend:

Reserve Boundary

Areas Outside the Reserve

Figure 2

Table 1. Morphometric data on the lands and waters within the Waquoit Bay National Estuarine Research Reserve (NERR)

Subsystem	Max. Length (mi.)	Max. Width (mi.)	Max. Depth (ft.)	Mean Depth (ft.)	Water Area (ac.)	Marsh Area (ac.)	Upland Area (ac.)	Shoreline Length (mi.)
Waquoit Bay	2.6	1.1	9.0	2.7	825	6		6.3
Quashnet River	1.1	0.1	7.6	UNK	42	6		
Hamblin Pond/ Little River	1.7	0.4	5.0	2.0	141	62		
Jehu Pond/ Great River	2.3	0.3	7.6	UNK	172	95		
Washburn Island						32.5	297.5	5.9
South Cape Beach						88.5	311.5	2.5
Reserve Headquarters						2.0	20.0	0.2
Sage Lot Pond	0.27	0.40	UNK	UNK	44			
Flat Pond	0.14	0.47	UNK	UNK	35			
Caleb Pond	0.12	0.11	UNK	UNK	5.7			
Bog Pond	0.08	0.08	UNK	UNK	2.75			
Bourne Pond	0.18	0.16	UNK	UNK	10.6			
TOTAL					1278.0	292	629	

C. Natural Environment

1. Climate

The Falmouth-Mashpee area, like most of Cape Cod, has the humid continental climate of the northeastern United States. The surrounding waters moderate temperature extremes producing milder winters and cooler summers. Humidity is often high in summer, with fog common in the spring and summer.

Winds are generally from the west with orientation depending on the season; between October and April from the northwest, and between May and September from the southwest. Major storms can come in any season with hurricanes most common in late summer and early fall; "northeasters," in winter and early spring; and local thunderstorms or squalls, in the summer. Major hurricanes affecting the area occurred in September of 1938 and 1944, August of 1954 and 1955, and September of 1960.

January and February are the coldest months on Cape Cod, and July and August are the warmest. The annual growing season (consecutive frost-free days) averages between 180-200 days.

Average annual precipitation is between 42-44 inches, fairly evenly distributed throughout the year at 3-4 inches per month. June and July are somewhat drier, averaging 2.9 and 2.7 inches, respectively. Snowfall is highly variable from one year to the next, but averages less than 30 inches per year. Generally, snow does not remain on the ground for extended periods of time.

2. Geology/Soils

Cape Cod is almost entirely composed of unconsolidated sand, gravel and boulders deposited by glacial ice during the last four major glaciations. Occasional clay and silt layers and masses occur within and beneath the coarser materials. The deposits, resting on very old bedrock, are generally 300 to 500 feet thick, but range from around 150 to nearly 1000 feet in thickness. As the last glacier retreated from the Cape 12,000 years ago, sand and gravel were spread smoothly in front of the ice as stream-bed deposits. The entire Waquoit Bay area lies within one such area known as the Mashpee Outwash Plain.

As the glacier retreated, sea levels rose quickly and had nearly reached present levels by 3500 years ago. The action of waves and currents shaped the coastline by filling some sheltered bays and tidal channels with fine sediment and organic matter producing tidal mud flats and salt marshes. This was likely the case with Flat, Sage Lot, Hamblin, and Jehu Ponds, probably low areas left as kettle holes after the formation of the outwash plain. The rise in sea level left them separated from the sea by only a narrow sandy spit which has been punctured periodically with inlets. All four ponds are brackish, though the marsh to the north of Flat Pond is fresh. Waves also have shaped the sand spits and barrier beaches, with some contribution from wind action. The shore line is continually shifting today, primarily due to wave action and tidal currents.

There are several types of glacial deposits on South Cape Beach and Washburn Island. The majority of the site consists of Mashpee pitted plain deposits, which are gravelly sand with some pebble to small boulder gravel. A smaller area bordering the northern edge of Flat Pond is composed of kame deposits, which differ from the Mashpee pitted plain deposits in having somewhat coarser sands and larger boulders.

Dune deposits along the beach are relatively young due to continual shifting of sands by wind and wave action. They are generally less than twenty feet thick and between ten and several hundreds of years old. Most are still active. Sandy beach deposits with some minor cobbles and pebbles occur as spits. They are composed of wave-eroded glacial sediments, and tend to be overlain by dune deposits. The marsh and swamp deposits mentioned above consist mainly of decaying estuarine marsh plants mixed with sand and clay, topped by live marsh plants.

The soils on South Cape Beach and Washburn Island correspond to the geology, with some variations and additional categories. In the upland areas are several types of loamy coarse sand within the Mashpee pitted plain and kame deposit areas. The marsh and swamp deposits contain both muck and tidal marsh. The soil categories described below are from reports by the U.S.D.A. Soil Conservation Service.

Muck - These are very poorly drained bog soils formed in accumulations of organic deposits that are underlain by mineral soil materials. The upper portion of the organic material is generally black and has decomposed to such a degree that plant remains cannot be identified by the unaided eye. Decomposition of the materials in the lower portion of the deep Muck soils varies from this condition to one of practically no decomposition, in which plant remains are readily identifiable. Muck soils occur in depressions and potholes. The water table in these soils is at or near the surface most of the year. Some Muck soils have only one to two-and-one-half feet of organic deposits over mineral soil materials, while in others the organic deposits are many feet thick.

Tidal Marsh - This land type consists of areas subject to regular tidal flooding. The areas commonly support salt-tolerant vegetation, such as grasses and sedges. The soil material ranges from soft, plastic silts and clays to matted, fibrous organic deposits.

Dune Sand - This land type consists of highly quartzose sands along the ocean shore. Individual sand particles have been rounded by the combined action of wind and waves. This land type is continually changing in shape and size. Dunes are formed by beach sand which is swept up by wind and deposited on the leeward side of the beach. Some are partially stabilized by beach grass and hardy shrubs such as beach plum and bayberry; others are devoid of vegetation and are actively shifting.

Coastal Beach - This land type consists of sandy, gravelly, or cobbly shores that are washed and rewashed by waves along the coast. Some areas are subject to periodic flooding by tides. Areas above tide level are subject to shifting by wind action.

Carver loamy sand, 0–3% slopes – These are excessively drained soils formed in thick sand deposits. Carver soils have a loamy coarse sand or coarse sand surface soil and subsoil. The subsoil is underlain by coarse sands. They contain little or no gravel. The soils are loose and have rapid permeability. In places, Carver soils are underlain at a depth of 5 feet or more by a firm slowly permeable substratum of compact glacial till, silt or clay. These areas are mapped as a firm substratum phase of the Carver soils. Carver soils occupy nearly level to very steep slopes.

Deerfield loamy course sand, 0–3% slopes – These are moderately well drained soils that have formed in thick deposits of sand. They have a loamy sand surface soil and subsoil that are usually free of gravel and cobbles to a depth of 3 feet or more. These soils have a seasonal high water table within 1–1/2 to 2 feet of the surface that keeps them saturated with water in the winter, early spring, and during prolonged periods of rainfall. They do not have stones and boulders on the surface or within the soil. They occur on level to gentle slopes.

Au Gres loamy course sand, 0–3% slopes – These are poorly drained soils developed in thick deposits of sand or sands and gravel. The water table is at or near the surface of these soils for about 7 to 9 months each year. They do not contain stones or boulders but may contain grabel and cobbles below the surface in some places. They have rapid permeability. Because they are saturated most of the time, they can absorb little additional water. The Au Gres soils occur on level to gentle slopes.

3. Hydrology

The loose, sandy soils of the Waquoit Bay area permit rapid percolation of precipitation. In unaltered areas there is virtually no run–off. Of the average annual precipitation of 42–44 inches, 17–18 inches seep into the soil to recharge groundwater aquifers (the other 25 inches are lost to the atmosphere through evaporation and water loss by plants).

In coastal areas like Waquoit Bay, groundwater is near the surface at approximately sea level. Low areas are often discharge points such as swamps, freshwater marshes or kettlehole ponds. The adjacent bodies of saltwater have a major effect on groundwater quality. Because freshwater is lighter than salt, fresh groundwater at Washburn Island or South Cape Beach tends to "float" above the saline in a relatively shallow lens. Along the edges and at the boundary there is some mixing to form brackish zones. The nature, and to some extent the level, of the groundwater can change with tidal oscillation, amount of freshwater percolation, and volume of freshwater withdrawal for human use. Excessive withdrawal can and does lead to salt intrusion into wells.

Analyses of groundwater in the Waquoit Bay area characterize it as slightly acidic (pH 6.5–7.0), very soft, and generally low in dissolved solids. Both sodium and chlorine levels can be high at individual sites due to salt water intrusion, and elevated iron and manganese levels are occasionally noted.

4. Biology

a. Plant and Animal Species

Estuaries are typified by variable ecosystems created by the mixing of fresh and salt water, opposing current systems, and oscillating tidal currents. These variable environmental conditions greatly influence the biota of the estuary creating a distinctive aquatic environment. Due to this large variation in the physical and chemical environment, Waquoit Bay supports a large diversity and abundance of plant and animal species.

A complete list of vegetative species, as well as marine invertebrates, fishes, birds, and mammals that inhabit the lands and waters within the Reserve can be found in Appendix A.

b. Rare and Endangered Plant and Animal Species

The Waquoit Bay NERR is an important refuge for many state-listed rare plants and animals of regional and national significance. The two most noteworthy rare and endangered species found within the boundaries of the Reserve include the plant Sandplain Gerardia (Agalinis acunta), and the bird piping plover (Charadrius melodus). The Swift Estate is potentially of key importance in terms of the long-term survival of the Sandplain Gerardia. At the present time there are only two confirmed localities of this particular plant in the Commonwealth, and the plant is now being actively considered for Federal listing by the U.S. Fish and Wildlife Service as it is found in only a handful of sites in Massachusetts and Long Island, New York.

The piping plover, listed as Federally Threatened on the East Coast, currently resides on Washburn Island within the Reserve.

The Waquoit Bay NERR will work with the Natural Heritage Program of the State Division of Fisheries and Wildlife towards the protection and nurturing of rare and endangered species within the Reserve. A complete list of each state-listed rare and endangered plant and animal species found in the Reserve is located in Appendix A.

c. Ecosystems

The following is a brief description of the various resource areas found within the Reserve boundaries. Collectively they make up the Bay's ecosystem.

Barrier Beach System: The low-lying beach forming South Cape Beach, Dead Neck and the southern segment of Washburn Island protects the estuarine resources within the Waquoit Bay system. Saltwater access into the estuary is restricted to two primary locations: up Eel River and around Washburn Island, and through the narrow cut between the east end of Washburn Island and Dead Neck. The barrier beach is undeveloped. Part of South Cape Beach is used as a public recreational beach.

Salt Marsh: There are approximately 292 acres of salt marsh in the Waquoit Bay system. The Mashpee portion of the system includes 240 of these acres, most of which surround Hamblin Pond, Jehu Pond, Sage Lot Pond and the head of Great River. Salt marsh acreage on the Falmouth side occurs in small parcels scattered mostly about Washburn Island and the head of Waquoit Bay. Many of the salt marshes on and around the Bay are privately owned, however state-owned South Cape Beach and Washburn Island include the Sage Lot Pond marsh and others, totaling 121 acres. The high productivity of the salt marshes contributes to the food chain of the near shore environment and protects adjacent uplands from erosion.

Shellfish Beds: The waters and bottom sediments of the bay provide an abundance of shellfish. In order of economic importance quahogs, softshelled clams and bay scallops are harvested both commercially and recreationally. Shellfishing provides income for approximately 75 commercial fisherman and supports several hundred recreational fisherman annually.

Both the towns of Falmouth and Mashpee conduct ongoing shellfish management and propagation programs to protect this valuable resource.

Anadromous and Catadromous Fish Run: The Quashnet River, stretching to Johns Pond in Mashpee, is an important alewife run. American eel, blueback herring, striped bass, white perch, brown trout, eastern brook trout, and rainbow trout are also found within the system.

Erosion and Accretion Areas: Moderate erosion occurs along the length of South Cape and the Western half of Washburn Island. Stone groins were constructed on the tidal flat at the western end of Washburn in the 1930's by the State Division of Waterways to trap easterly moving sand. These groins have now decayed to the point where they are no longer effective, and the beach continues to retreat. The eastern portion of Washburn fronting the Sound experiences accretion, but this build-up of sand does not seem to have seriously affected the entrance channel to Waquoit Bay.

Dunes: Sand dunes are found on both Dead Neck and the eastern and western ends of Washburn Island. Dunes in both these locations are currently under the management of the South Cape Beach State Park.

Beach: South Cape Beach has long been recognized as one of Cape Cod's finest sandy beaches by both summer visitors and permanent residents. It is also a prime surfcasting area for fishermen when bluefish and stripers are running. Motor vehicle access is limited to an ungraded extension of Great Oak Road in Mashpee.

Estuary: The Waquoit Bay estuarine system is composed of interconnected water bodies, including Waquoit Bay, and Hamblin, Jehu, Flat, Caleb, Bog, Bourne, and Sage Lot Ponds. Freshwater enters the system through the Quashnet River, which originates at Johns pond; Childs River; Red Brook; and through groundwater discharge. The waters are classified SA (suitable for propagation of aquatic life, primary and secondary contact recreation, and shellfish harvesting without depuration) by the Massachusetts Division of Water Pollution Control. Under the

antidegradation provisions of the Water Quality Standards, the waters are further classified as High Quality Waters and are thus protected from point pollution discharges. An exception to the high water quality, however, is found in the lower portion of the Quashnet, referred to as the Moonakis River, which is periodically closed to shellfishing due to high coliform bacteria counts. The Massachusetts Division of Marine Fisheries continuously monitors Waquoit Bay as well as other coastal waters of the Commonwealth to determine if waters are suitable for the harvesting of shellfish.

Fish Spawning and Nursery Area: Many species of finfish utilize the warm water and nutrient-rich conditions of this estuary as a spawning and nursery ground. In addition to the anadromous and catadromous species already mentioned, there are also exclusively marine species that use the estuary, including Atlantic menhaden, Atlantic tomcod, cunner, tautog, white hake and winter flounder. A Massachusetts Division of Marine Fisheries investigating team found that the Waquoit Bay system exhibited the greatest diversity of estuarine finfish species among the nine areas studied in the Commonwealth. The team attributed this abundance to Waquoit's location on the south shore of Cape Cod where cold water species from the Gulf of Maine and warm water species from the Mid-Atlantic intermingle.

Wildlife Habitat: An adequate supply of food, water and cover in the Bay area provides an important breeding ground for many species of land and sea birds. The Island, marshes, dunes, and uplands within the Reserve support a year-round population of squirrels, rabbits, raccoons, skunks, fox, and an occasional deer as well as quail, and pheasant.

D. Land and Water Use

1. General Background

The land and water areas included within the Reserve boundaries are assumed to have been a major summer and fall hunting and fishing area for Native American tribes.

Early subsistence farming gave way to a thriving seafaring center and development of accompanying commercial enterprises. Over a hundred acres of salt marsh were harvested for use as cattle feed; eel grass was dried for fertilizer; and upstream rivers were harnessed to provide valuable energy for the mills created on their banks. Shellfishing and fishing continued to be of primary importance to the economy of the community.

During the 1800's a summer colony developed when professional men sought relief for their families from the heat and congestion of large cities. Sportsmen from around the world, including such notables as President Grover Cleveland and Daniel Webster, came to enjoy the excellent fishing, boating, and other water related activities for which the area had become renowned.

Washburn Island was private property when the Army first set up a secret amphibious training center in 1940. After the army left the site, the Washburn family did not return to the Island. During the 1950's, people from the area began using the island for informal camping and recreational purposes. In 1983, DEM acquired the property and it has now become part of the designated Area of Critical Environmental Concern (ACEC).

2. Historic Documentation

South Cape Beach

Reports indicate that South Cape Beach was used as a summer fishing and hunting encampment for Native American tribes. A preliminary historic and archaelogic survey identified no areas of special interest for excavation.

Washburn Island

A walkover survey of Washburn Island found two areas with historic artifacts along the eastern shore. Further investigation will be required to relate the stone flakes found here to activities by Native Americans. The artifacts could indicate an encampment area or merely a temporary worksite.

Historic maps of Washburn Island show the existence of five structures between 1853 and 1910. Evidence of two additional structures was found during a recent (1982) survey. Evidence of some of the structures can no longer be found because of U.S. Army construction between 1942 and 1945. At that time, military barracks, mess halls, garages, and related structures were built as part of the defense effort of World War II. During this period the island was also used as a recreation and convalescence area for Army personnel. At this time, access to

the island was afforded by a bridge connecting the mainland and island. Although the bridge no longer exists, informal camping and other recreational uses have increased significantly since the 1950's.

Reserve Headquarters (former Swift Estate)

The buildings and grounds of the Reserve Headquarters are classic examples of rural, coastal Victorian architecture and landscaping. This style evolved at the end of the 1800's around the recreation and tourism influences of wealthy individuals leaving the cities, and summering along the coast. The potential for nomination of this site to the National Register of Historic Places is being explored. Such a listing would make it eligible for funding for preservation of National Register properties.

3. Recreation and Related Uses

Fishing

Considerable recreational (rod and reel) fishing occurs in the lower (southern) end of Waquoit Bay for such species as winter flounder, striped bass, bluefish, tautog, white perch, sea-run trout and tomcod. Most of this is done from boats, but there is a large surf fishing contingent who fish the mouth of the Bay on Washburn Island or along South Cape Beach.

There is some commercial fishing for eels in the upper parts of the estuary. Fishing is done with eel pots in the warm months and with spears in colder periods.

A springtime run of alewives and blueback herring enters the Bay and goes up the Quashnet River to spawn. Young of the year move down-river into the Bay during the summer months.

Local sportfishing groups, especially Trout Unlimited, in cooperation with the State Division of Fisheries and Wildlife, have reestablished a population of sea-run trout in the Quashnet River. These fish are found year-round in the Bay and seasonally in the Quashnet River.

Shellfishing

Shellfishing is done both recreationally and commercially in Waquoit Bay. It is directly managed by the communities of Falmouth and Mashpee, under plans approved by the State Division of Marine Fisheries. Species harvested include quahogs (Mercenaria mercenaria), bay scallops (Aequipecten irradians), and soft-shell clams (Mya arenaria).

Shellfish harvests are variable from year to year. Estimates of the harvest by recreational shellfishermen are unknown at this time. The 1983 Town Report for Falmouth lists the following harvest figures from that town's portion of the Bay: 410 bushels of soft-shell clams, 2,900 bushels of quahogs, and 250 bushels of bay scallops. These figures represent only one year of reported shellfish harvest for only one of the two Towns with jurisdiction over Waquoit Bay's shellfish resources.

A small degree of aquaculture activities also take place on the Bay at this time. (For a full discussion of these activities see "Commercial Activities" on page 17.)

Swimming

Containing one of the longest stretches of publicly accessible sandy beaches bordering Nantucket Sound, South Cape Beach is a popular facility for swimming and sunbathing for both residents and visitors to the Cape. With the number of parking spaces limited through an agreement with the town of Mashpee, South Cape Beach State Park offers an uncrowded beach experience and maintains the environmental integrity of the fragile barrier beach and dune system.

Swimming is also allowed at Washburn Island, though no formal facilities or transportation to the island are provided.

Boating

Recreational boating is very popular in and around Waquoit Bay and its connecting waterways. There are presently no marinas or heavily used mooring areas within the proposed Reserve. There are, however, two marinas (Little River Boatyard on the Little River and Edwards on the Childs River) in close proximity to the Reserve, and a heavy mooring area on the Bay adjacent to the public landing in Falmouth. This particular mooring area has become increasingly popular over the years due to the crowded conditions of other accessible harbors in the area. A Town of Mashpee landing is located on the Great River. An agreement between the Department of Environmental Management and the town provides for space on the Great River for the development of a town boat launching facility. There are also many docks and moorings for small boats along the shores of the Metoxit area of Falmouth and the Seconsett and Monomoscoy Islands.

A small proportion of the boating on Waquoit Bay is for commercial shellfishing purposes.

The shallow nature of the Bay, the size of the mouth and of the connecting waterways, and the prohibition against new dredging within the boundaries of the ACEC all serve as limiting factors to the size and type of boating. It is expected that boating in the Bay will remain principally recreational in nature (with a small degree of commercial shellfishing) with the size of the boats limited by the shallow waters of the Bay.

Hunting

Hunting has traditionally occurred on Washburn Island and South Cape Beach. No hunting is allowed at the Reserve Headquarters due to state and local regulations regarding hunting in residential areas.

Species generally hunted in the Waquoit Bay area include migratory waterfowl, rabbits, squirrels, quail, and pheasants. Hunting seasons and other regulations are set by the Massachusetts Division of Fisheries and Wildlife. For all the above species, hunting seasons occur between October and February.

Pheasants have been stocked on South Cape Beach since 1975 by the Division of Fisheries and Wildlife at a level of approximately 120 birds a year. Hunting policies on South Cape Beach are reviewed anually by the the South Cape Beach State Park Advisory Committee.

Aesthetics

The undeveloped, "pristine" nature of the Bay, Washburn Island, and South Cape Beach is enjoyed by many of the visitors to the area as well as nearby residents and townspeople of Falmouth and Mashpee. This appreciation was manifested in both local and statewide support for acquisition of the parcels now included in the State Park. People use the area for swimming in the high quality waters, walking the clean beaches, harvesting of shellfish, and viewing the plants and animals of the area in an unhurried and peaceful atmosphere.

4. Residential Development

Falmouth

The town of Falmouth contains two distinct developed areas adjacent to the Waquoit Bay NERR. The village of Waquoit lies within Falmouth just north of the Reserve boundary. Waquoit Village is a lightly settled development concentrated along Route 28. The village consists of single family homes and small neighborhood businesses. The land to the north of Waquoit Village is presently undeveloped and zoned residential with new development largely limited to single family housing units on one acre lots.

The second area of development in Falmouth lies to the west of Washburn Island. Here exist two densely developed peninsulas, Seapit and Sea Coast Shores, running parallel to the island. Both peninsulas are developed in their entirety, with the predominant land use being single family residential units on small lots. Development of the Seapit peninsula, the smaller of the two and directly abutting Waquoit Bay, occurred gradually through the 1900's, while Sea Coast Shores was intensely developed during the 1950's. Today, new development on the peninsulas is limited to infill construction on the few remaining open lots, and upgrading of older structures. No sewer service is supplied to any of the residential areas adjacent to Waquoit Bay.

Mashpee

Previous to 1870 most of the Bay was commonly owned and utilized for haying purposes. After 1870, the upland surrounding the Bay was divided among the residents as private property. There was no significant development of the area until the early part of this century. In 1913, the upper half of Monomoscoy Island was subdivided into hundreds of 25 foot wide lots as part of a development called "Waquoit Park." Over the succeeding 40 years, the remainder of Monomoscoy Island and Seconsett Island was subdivided into lots which were typically 50 foot wide and averaged 100 feet deep. These lots were primarily utilized for the construction of summer cottages.

Development of the mainland to any significant extent did not occur until the late 1960's. Most of what is known as "Little Neck" between Jehu Pond and Great River was subdivided in the late 1960's and early 1970's into approximately 300 lots ranging from 10,000 to 20,000 square feet. In 1963, a special permit was issued for a development, called New Seabury, that would extend across the entire lower portion of Mashpee along the coast. That permit called for 3,484 dwelling units and 970,000 square feet of commercial area. Over the succeeding 20 years much of that development has been completed except for a 401 acre portion adjacent to Waquoit Bay which is now South Cape Beach State Park.

In recent years development has continued on the north side of Hamblin Pond, with two subdivisions totalling 100 lots. In addition, a 30 unit condominium project has been constructed on the eastern shore of Jehu Pond.

Two remaining sizeable parcels of undeveloped land in proximity to the Waquoit Bay NERR exist today. One is a 386 acre parcel on the north and east sides of Jehu Pond along Dutchmans and Abigail Brooks. The New Seabury Corporation has proposed a residential development, including 530 single family residences and condominiums, and an eighteen hole golf course, but has not been able to proceed due to title problems which will probably continue to stall the development for a number of years.

The second is an undeveloped tract of land along the Quashnet River, north of the Reserve. Protection of this property is considered significant to the maintenance of high water quality of the Quashnet River, an important feeder stream to the Waquoit Bay estuary. The Department of Environmental Management purchased 361 acres of undeveloped land along the Quashnet River in July 1988 in order to insure that the integrity of the Quashnet River and adjoining Waquoit Bay is maintained. Several environmental groups are actively seeking support for the protection of the remaining undeveloped land along the Quashnet.

5. Commercial Activities

Commercial activity within and adjacent to the Reserve is, for the most part, small in scale. Activities within the Reserve include shellfishing and a small degree of aquaculture. There are presently three private shellfish aquaculture grants in the bay; one in the Falmouth portion and two in Mashpee. The grant in Falmouth (Seapit River) is comprised of 22 acres and has been existence by various owners prior to 1900. The present grant owner reported harvesting of 15,919 bushels of quahogs and 1,231 bushels of oysters in 1986.

Two private shellfish grants of 8 and 1.5 acres respectively, were established in Mashpee in 1983. These two abutting grants, which are located near the confluence of the Great and Little Rivers, are attempting to grow quahogs from seed to marketable size. One grantholder reported harvesting 40 bushels of quahogs in 1986, while the other reported no harvest for that year.

The only commercial activity outside the boundary of the Reserve with a potential impact upon Waquoit Bay is cranberry bog farming. Active bogs are located adjacent to the Moonakis River, and adjacent to the Quashnet River near its source.

E. Issues and Problems

Several concerns exist at Waquoit Bay that in some way potentially threaten the resources and land and water uses outlined on the preceding pages. These concerns are presented here to raise the level of consciousness and provide a better understanding of the fragility of Waquoit Bay and the constraints imposed upon the ecosystem to the people who use, enjoy, and administer policies affecting the Bay environment.

Most of the concerns existing at Waquoit Bay are, to some degree, caused by the development and/or popularity of the resources present here. The Cape Cod geographic area has been experiencing extremely rapid population growth and development over the last decade and a half. Population figures reveal a 53% population increase on the Cape for the decade between 1970 and 1980 at a time when the population for the state as a whole only increased 1%. Population estimates for the 1980's indicate a sustained population increase, though slightly below the previous decade. In addition, the population of Cape Cod during the summer months is estimated to be 3.5 times that of the permanent population. (Cape Cod Planning and Economic Development Commission) Popularity and resulting use of Cape resources have produced a number of "problems" at Waquoit Bay that should be monitored closely.

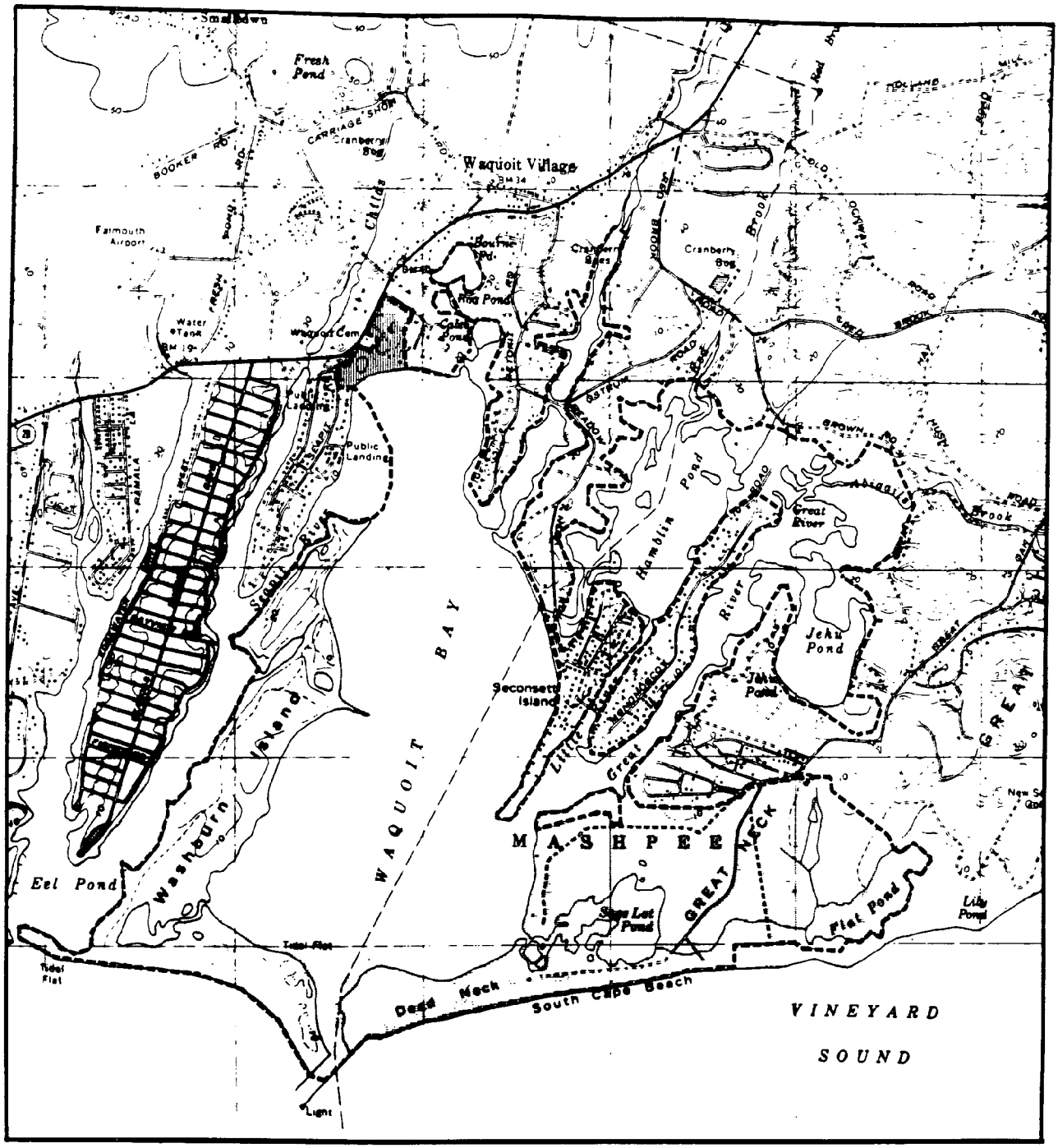
An obvious and readily observable result of increased population and popularity of Cape Cod, and specifically the towns of Falmouth and Mashpee, is the increased use of the waters of and adjacent to the Bay. The number of boat moorings within the Bay has increased sharply in recent years. In the last two years alone the number of boat moorings on Waquoit Bay has increased from 285 to 400. This increase has caused conflicts among boaters and between boaters and other users of the Bay competing for limited water resources. Another concern is the increased construction of docking facilities on the Bay and adjacent waterbodies. Dock construction and use over saltmarsh areas impairs the productivity of the saltmarsh (through shading of vegetation and increased sedimentation), while random construction of docks along the Bay adds to the problem of congestion on the water.

Observed popularity is not just confined to water use at Waquoit. Real estate development Capewide is currently experiencing tremendous growth. Land speculation and development are occurring in many places within the watershed of Waquoit Bay and adjacent ponds. Development along feeder streams to the Bay could potentially disrupt the natural functioning of the system through short and long-term effects of pollution and erosion. Currently the area surrounding Waquoit Bay contains no public sewer service. The sandy soils and low water table of the Cape provide little buffer to effectively treat the types of pollution normally associated with dense residential development. The towns and state recognize the problems associated with increased development in the Bay area but are limited in their efforts of large scale land preservation due to the rapidly rising land values on the Cape.

Other pollution sources threatening Waquoit Bay include rubbish, oil, nonconsumed fuel, paint toxins, and sewage release associated with boat use; storm water

runoff; pesticides and nutrients associated with cranberry bog farming; and pollution resulting from high concentrations of waterfowl. While regulations exist for the proper disposal of sewage from boats, practical problems exist with enforcement. As boating levels increase within the Reserve, problems associated with pollution will likely increase as well. At the present time, a shellfishing bed on the Moonakis River is periodically ordered closed by the state due to contamination. The Massachusetts Division of Marine Fisheries conducts coliform bacteria testing of shellfish beds in Waquoit Bay and feeder streams three to four times each year.

The Waquoit Bay NERR will strive to minimize the impact of the problems described above by focusing greater attention on the problems and their potential solutions, by providing additional monitoring capabilities, and by bringing together individuals and organizations with expertise in a variety of disciplines involving coastal issues.



WAQUOIT BAY

National Estuarine Research Reserve

scale in feet

0 500 2000

North

State Owned Lands

Legend:

- Reserve Boundary
- South Cape Beach
- Washburn Island
- Proposed Reserve Headquarters

Figure 3

III. EXISTING RESOURCE PROTECTION

A. Land Ownership

Land ownership is a critical factor when discussing the degree of protection afforded to the lands and waters within the Estuarine Reserve boundaries. The preceding section reveals the alarming trends in population and development in the Waquoit Bay area. These statistics serve to underscore the importance of land ownership in determining the character and use of Waquoit Bay in the future. Public ownership of land serves to prevent land uses with potential to adversely impact the resources within the Reserve, while also opening the land to the public for education, enjoyment, and research application.

The Waquoit Bay NERR contains a large acreage of land devoted to public use and protection. This land includes two state park segments, South Cape Beach and Washburn Island, acquired by the Department of Environmental Management (DEM) in 1982 and 1983 respectively, and the Reserve Headquarters acquired by DEM in 1988 (See Figure 3). Together, these two State Parks comprise approximately 736 acres, or 60% of the total land area within the Reserve. The majority of the remaining land area within the Reserve are wetlands. Collectively, the State Parkland serves to protect 3.8 miles, or 60% of the shoreline fronting on Waquoit Bay. With the Department's commitment to the protection of environmental integrity, the Commonwealth has effectively utilized land ownership to protect ecologically significant lands within the Reserve.

South Cape Beach

South Cape Beach contains 401 acres of land along the coast in the town of Mashpee. The DEM acquired South Cape Beach in 1982 for coastal ecosystem protection and public recreation.

South Cape contains a diversity of ecosystems including barrier beach and dunes (104 acres), two salt ponds (79 acres), salt marsh (88 acres), and coastal lowland forest (130 acres). At the present time, the park is only lightly developed, including one small cottage, a mile of gravel roads, and two gravel based parking lots with a total capacity for 110 cars. Although only recently established, South Cape Beach attracts approximately a thousand visitors on a typical clear summer day, primarily to take advantage of the warm ocean waters and 6,000 feet of sandy beach.

A development plan is currently being completed for the park incorporating the terms of an agreement between the Commonwealth and the town of Mashpee. That agreement of June 29, 1981 (see Appendix B) stipulates that development and use of the park shall be limited to "bathing, sunning, hiking, fishing, nature interpretation, non-motorized biking, and associated passive enjoyment through recreational use consistent with the fragile ecology of the site..." Overnight camping is forbidden under the agreement, and off-road vehicles may only be used by the elderly or disabled, and are limited in number, by route, and time of day.

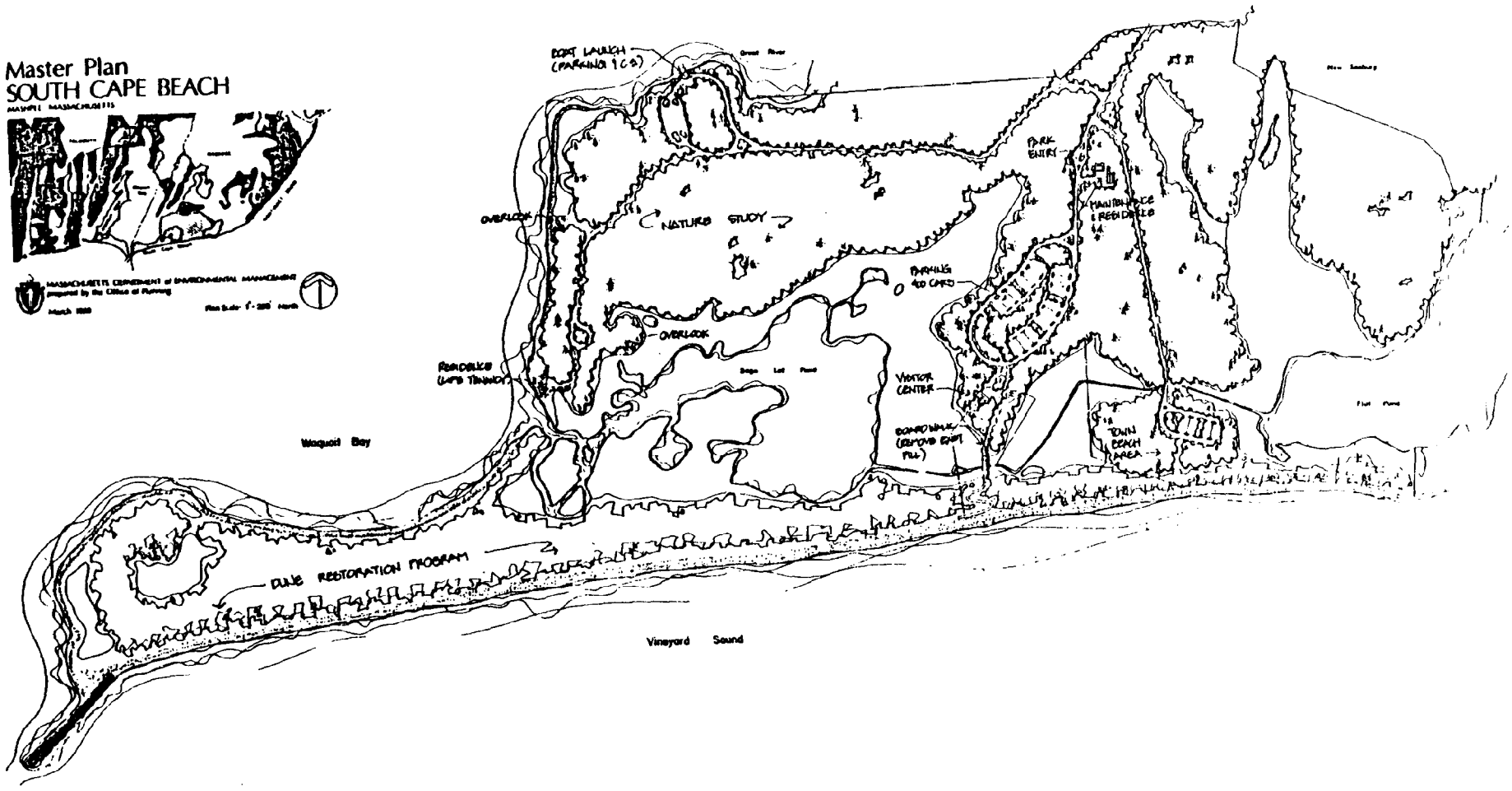

Master Plan
SOUTH CAPE BEACH
BOAT LAUNCH
OVERLOOK
NATURE STUDY
PARKING
OVERLOOK
VISITOR CENTER
BOARDWALK
TOWN BEACH AREA
Waquoit Bay
DUNE RESTORATION PROGRAM
Vineyard Sound

Figure 4

Permits may be issued for a maximum of six such vehicles during the hours between sunset and sunrise, and are intended only to provide access for fishing. By agreement, public parking is limited to a total of 400 vehicles in "several landscaped sites".

It is further required that "all park facilities will be designed, sited and maintained so that they do not harm the natural and scenic qualities of the area..." and that the Commonwealth "will manage the fragile wetland, dune and upland areas of the site to prevent erosion and to preserve critical habitat and the area's natural scenic qualities."

The agreement also establishes a South Cape Beach State Park Advisory Committee which meets monthly to review and advise on matters of park management and operations, rules and regulations, and development planning and design. (A copy of the agreement between the Town and DEM is located in Appendix B.) A park supervisor and staff have been appointed for South Cape Beach and they work closely with the Advisory Committee.

The development plan for South Cape Beach State Park is currently undergoing state environmental review.

Washburn Island

Washburn Island, located in the town of Falmouth, makes up the western border of Waquoit Bay. Comprised of some 330 acres, this barrier island includes a sandy barrier beach and dune system at the southern end bordering on Nantucket Sound. This barrier is a western extension of that on South Cape Beach. North from the barrier extend acres of oak and pine forests, salt marshes, and salt ponds. This parcel was acquired by the Department of Environmental Management in June of 1983 and has become part of the State Forest and Parks system. It is managed in conjunction with South Cape Beach State Park.

A preliminary management plan developed for the park recommends that the island be managed for limited use, primarily passive recreational activities such as hiking, nature study, etc. (A copy of an excerpt of the management plan pertaining to recreation use is located in Appendix C.) Access to the island is by boat only. There are no plans to construct any sort of vehicle connector to the island, and no formal transportation to the island for visitor use will be provided by DEM in the foreseeable future due to a lack of appropriate docking facilities and comprehensive management plan. Docks are proposed to accommodate visitors and staff. Trails and interpretive displays are being planned. Consideration is also being given to tent camping on the eastern side of the island. Comfort stations, boardwalks, and scenic overlooks are proposed. Any construction on Washburn must consider potential archaelogical resources. Unsupervised swimming and fishing are designated for certain portions of the island.

Least terns and ospreys have established nesting sites on Washburn Island. To protect these significant resources, portions of the beach and inland areas may be closed during the nesting season. Appropriate boardwalk design and location will facilitate this protective measure.

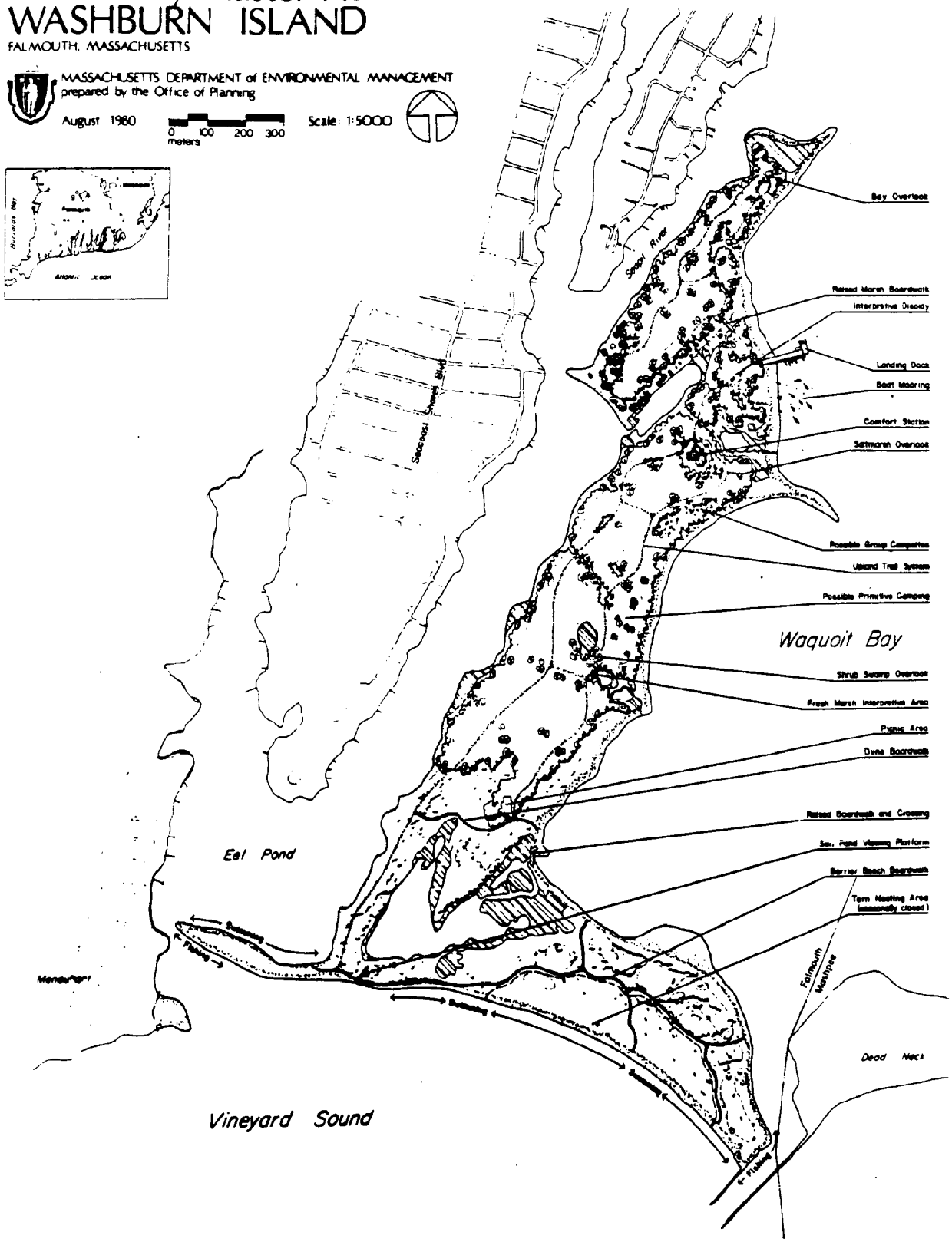

Preliminary Master Plan
WASHBURN ISLAND
FALMOUTH, MASSACHUSETTS
MASSACHUSETTS DEPARTMENT of ENVIRONMENTAL MANAGEMENT
prepared by the Office of Planning
August 1980
0 100 200 300
meters
Scale: 1:5000
Bay Overlook
Raised Marsh Boardwalk
Interpretive Display
Landing Dock
Boat Mooring
Comfort Station
Saltmarsh Overlook
Possible Group Campsites
Upland Trail System
Possible Primitive Camping
Waquoit Bay
Shrub Swamp Overlook
Fresh Marsh Interpretive Area
Picnic Area
Dune Boardwalk
Raised Boardwalk and Crossing
Sail Pond Viewing Platform
Barrier Beach Boardwalk
Tern Nesting Area
(seasonally closed)
Seacoast Shores Blvd
Seapit River
Eel Pond
Mendenhall
Falmouth
Mashpee
Dead Neck
Vineyard Sound
Swimming
Fishing

Figure 5

Reserve Headquarters

In November of 1987, the Department of Environmental Management acquired 23 acres at the head of Waquoit Bay, which now serves as the headquarters/visitors center for the Reserve. Locally referred to as the Swift Estate, the Reserve Headquarters is located in Falmouth on a bluff thirty feet above the waters at the north end of Waquoit Bay. (See Figure 3) The property is bounded to the south by Waquoit Bay, to the west by a private yacht club, to the north by Route 28, and to the east by Whistlers Road, a private way. Site improvements on the property include: three buildings (a 100-year-old three story, 16 room Victorian Mansion; a carriage house; and a two story boathouse); a paved road leading to the buildings; and a stone wall fronting on Route 28. The mansion and carriage house have not been occupied for many years, however, are structurally sound, and with considerable renovation are proposed as the central facility for the Waquoit Bay NERR.

The former Swift Estate is considered an ideal parcel to accommodate the Reserve Center for several reasons, including: a desirable physical location providing access along Route 28 and a central viewing point overlooking the entire Bay; ready pedestrian access to the water edge; proximity to a small salt marsh and pond, potentially significant for research and education; and existence of a "quality presence" with its landscaped grounds, stone walls, and historic significance of the buildings on site. Establishment of a Headquarters/Visitors Center at the Swift Estate will contribute greatly to the successful operation of the Waquoit Bay NERR by providing an on-site presence in which research, education and interpretation, and monitoring activities can be based.

The grounds of the Reserve Headquarters contain several plant species listed as rare and endangered statewide. Any construction associated with rehabilitation of the site as the Reserve Headquarters/Visitors Center must take into account these species. The soils of the property are especially conducive to the growth of state-listed Sandplain Gerardia, and would provide a suitable site for propagation and transplant efforts. The Waquoit Bay NERR will be working with the Natural Heritage Program to enact management techniques that will lead towards maintenance and potential expansion of rare and endangered plant species populations on the headquarters property.

The remaining lands within the Reserve are privately owned, most being undeveloped saltmarshes surrounding the many small waterbodies in the Reserve. Lands adjacent to the Reserve are also predominantly under private ownership with the exception of a two acre tract located on the Bay in Falmouth, north of Washburn Island, serving as a town public landing; and two tracts of land adjacent to South Cape Beach State Park owned by the Town of Mashpee. One of these tracts is the Town of Mashpee public beach, and the other is a ten acre parcel located at the mouth of the Little and Great Rivers, proposed for a municipal boat launching facility.

B. Regulation

A number of regulations exist at the the Federal, state, and local levels of government serving to protect the environmental integrity of Waquoit Bay. Successful application and enforcement of these regulations within the Reserve require regular and continual monitoring of resources and activities. Toward this end, an inventory of the laws and regulations relevant to the management and protection of Waquoit Bay NERR has been developed and is provided below. The inventory includes the title and citation of each statute, the administrative body charged to implement the provisions of the law, and a brief explanation of the purpose of each law. The inventory is a useful tool for assisting local officials and interested public in the understanding of the host of regulations available to help protect the Waquoit Bay environment.

Federal

1.	US Coastal Zone Management Act as Reauthorized in 1985 Purpose: Allows participating states to review any Federal plans, projects, or funding for consistency with state CZM plan; provides financial assistance.	US Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA)/ National Ocean Service (NOS), Office of Ocean and Coastal Resource Management (OCRM)
2.	US CZMA as Reauthorized in 1985, especially National Estuarine Reserve Regulations (Ch. IX NOAA, Part 921) Purpose: Allows for creation of National Estuarine Research Reserves and planning for coordinated Reserve management.	US DOC/NOAA/NOS/OCRM/ Marine and Estuarine Management Division
3.	US Coastal Barrier Resources Act (Public Law 97-348) Purpose: Prohibits the expenditure of Federal money on development of units within the Coastal Barrier Resources System.	Office of Management and Budget
4.	US Clean Waters Act, especially Section 404 (33 US Code Sect. 1344 (1976) as amended Pub. G. No.95-217 (1977)). Purpose: Regulates filling of all waters and adjacent wetlands.	US Dept. of Defense/ Army Corps of Engineers' Regulatory Branch with US Environmental Protection Agency oversight

5.	Federal Water Pollution Control Act amendments (86 Stat. 816, 1972) Purpose: Creates a National Pollution Discharge Elimination system which applies to discharge into the territorial seas, waters of the contiguous zones, and the oceans.	Environmental Protection Agency (EPA)
6.	US Rivers and Harbors Appropriation Act of 1899, especially Section 10 (33 USC Section 403, 1976) Purpose: Prohibits unauthorized obstruction or alteration of navigable waters in US.	US Dept. of Defense/ Army Corps of Engineers' Regulatory Branch
7.	US Safe Drinking Water Act, especially Section 1424(e) (42 USC 300h-3(e), P.L. 93-523) (see: Federal Register, Vol. 47, No. 134, Tuesday July 13, 1982, Notices, pp. 30282 - 30284 for Cape Cod Sole Source Aquifer Designation Final Determination) Purpose: Requires EPA to review all Federal financially assisted projects constructed on Cape Cod to be reviewed for their effects on the aquifer and to ensure that there is no significant hazard to public health as a result of the project.	US EPA, Water Quality Branch
8.	US Endangered Species Act of 1973 Purpose: Protects Federally listed plants and animals.	US Dept. of the Interior/ Fish and Wildlife Service/ USDOC/NOAA/ National Marine Fisheries Service (NMFS)
9.	US Marine Mammal Protection Act of 1973 Purpose: Protects Federally listed marine mammals.	US DOC/ NOAA/NMFS
10.	US Flood Disaster Protection Act of 1973 (PL 93-234,87 statute 975.) Purpose: Requires known flood-prone communities to participate in the Flood Insurance Program; provides coverage.	Federal Emergency Management Agency (FEMA)

11. US National Flood Insurance Act, as amended (42 USC 4321 et seq.) Purpose: To map flood boundaries in U.S. and provide for insurance to those who reside within the designated floodplains.	FEMA
12. US Floodplain Management Executive Order No. 11938 (5/24/79) Purpose: Requires Federal agencies to consider alternatives to conducting, supporting, or allowing actions to be located in a floodplain.	Executive Department and all Federal Agencies
13. National Historic Preservation Act of 1966 as amended by PL 96-515 (1980) Purpose: Allows the development of a National Register of Historic Places to protect historically and culturally significant places, districts, structures, houses, buildings, and sites.	US Department of the Interior, National Park Service
14. National Environmental Policy Act of 1969. (42 USC 4321 et seq.; amended by PL 94-52, 7/3/75; PL 94-83, 8/9/75; 40 CFR S 5100) Purpose: Requires Environmental Impact Reports on all major Federal actions significantly affecting the quality of the human environment.	EPA and all Federal and Federally assisted agencies

State

1. An Act Relative to the Protection of the Massachusetts Coastline (Acts and Resolves of 1983, Ch. 589, Sect. 17; 310 Code of Massachusetts Regulations 9.00) Purpose: Establishes a Massachusetts Coastal Zone Management Office; provides funding to municipalities through a Coastal Facilities Improvement Program; amends MGL Ch. 91 to provide for water dependent uses in Commonwealth tidelands.	Massachusetts Executive Office of Environmental Affairs (EOEA), Coastal Zone Management Office (CZM)

2.	Mass. Wetlands Protection Act (Mass. General Laws (MGL) Ch. 131, Sect. 40; 310 CMR: 10.00) Purpose: Allows for the establishment of local conservation commissions, who, along with DEQE regulate the filling, dredging, and altering of wetlands.	Mass. EOEA/Department of Environmental Quality Engineering (DEQE), Division of Wetlands and Waterways
3.	Mass. Coastal Wetlands Restriction Act (MGL Ch. 130, Sect. 105; 302 CMR: 4.00) Purpose: Allows for the protection of certain wetlands from dredging, filling, removing and altering through placement of a restriction on the property deed.	Mass. EOEA/DEQE, Division of Wetlands and Waterways Regulation
4.	Mass. Waterways Act (MGL Ch. 91; esp. 310 CMR: 9.00 on Tidelands Licensing) Purpose: Provides for the review and licensing of all projects proposed to take place between mean high water and extreme low tide, or 100 rods, whichever is less, with particular emphasis on promoting water dependent uses in Commonwealth Tidelands.	Mass. EOEA/DEQE, Division of Wetlands and Waterways Regulation
5.	Mass. Environmental Policy Act (MGL Ch. 30 Sect. 61–62–H; 301 CMR: 10.06) Purpose: Provides for public and agency review of proposed projects or activities in order to minimize or prevent damage to the environment. Environmental Notification Forms and Impact Reports are issued under this statute.	Mass. EOEA/MEPA Unit
6.	Mass. Clean Waters Act (MGL Ch. 21, Sect. 26–53; 314 CMR: 9.00 Certification for dredging, dredged material disposal and filling in waters) Purpose: Requires certification for any project that would dredge within or fill waters of the Commonwealth in order to protect marine water quality.	Mass. EOEA/DEQE, Division of Water Pollution Control

7.	Mass. Ocean Sanctuary Act (MGL Ch. 132A; 302 CMR: 5.00) Purpose: Creates five state Ocean Sanctuaries and prohibits new municipal wastewater treatment discharges and construction on seabed floor in three Cape Sanctuaries.	Mass. EOEA/Department of Environmental Management (DEM)
8.	Mass. Scenic and Recreation Rivers Act (MGL Ch. 21, Sect. 17B) Purpose: Establishes a statewide system for rivers and streams in order to promote their use and protection.	Mass. EOEA/DEM
9.	Mass. Marine Fish and Fisheries Law (MGL Ch. 130, Sects. 1–105; 322 CMR: 2.0–11.05) Purpose: Regulates fishing, equipment use, catches, conservation and management in the marine waters of the Commonwealth.	Mass. EOEA/Dept. of Fisheries., Wildlife and Environmental Law Enforcement DFWELE, Division of Marine Fisheries
10.	Mass. Inland Fisheries and Game (MGL Ch. 131 Sect. 4,5,24,26,30, 50 and 51; 311 CMR: 4.01–4.09) Purpose: Regulates the taking of fish in the fresh waters of the Commonwealth.	Mass. EOEA/DFWELE, Division of Fisheries and Wildlife
11.	Mass. Inland Fisheries and Game (MGL Ch. 131 Sect. 4,5,6 and 7; 321 CMR: 3.00; MGL Ch. 30A Sect. 5; 321 CMR: 3.01) Purpose: Regulates hunting and trapping of certain animal and bird species in the Commonwealth.	Mass. EOEA/DFWELE, Division of Fisheries and Wildlife
12.	Mass. Endangered Wildlife and Plants Law (MGL Ch. 131 Sect. 4, Ch. 1.13A as amended by Ch. 572 of the Acts of 1980; 311 CMR: 8.00) Purpose: Inventories and protects endangered wildlife and plants.	Mass. EOEA/DFWELE, Natural Heritage Program

13. Mass. Historic and Archeological Law (MGL Ch. 9 Sects. 26 and 27) Purpose: Allows for local historical commissions to work alongside MHC to protect the historic and pre-historic resources of the Commonwealth. Establishes a State Register of Historic Places.	Mass. Secretary of State Office, Mass. Historical Commission (MHC)
14. Mass. Floodplain Management (Executive Order No. 149, 11/29/78) Purpose: Calls on state agencies to avoid the use of floodplains and to avoid financial assistance in floodplains for inappropriate activities.	Executive Department and all state agencies
15. Mass. State Building Code (S. 744.0) Purpose: Establishes minimum building design requirements for construction in floodplains and coastal high hazard areas.	Municipal Building Inspector
16. Mass. Barrier Beaches (Executive Order No. 181, 8/8/80) Purpose: Prohibits state agencies from spending money on the development of barrier beaches; promotes their acquisition; and prohibits development in barrier primary dunes and velocity zone.	Executive Department and all state agencies
17. Mass. Off Road Recreational Vehicle Use on Public Lands Containing Coastal Wetland Resources Purpose: Directs state agencies to establish scientifically supported guidelines and monitoring procedures for ORV use on state lands and lands acquired with state and state administered Federal funds. Channels ORV use onto environmentally acceptable areas in balance with other uses.	Executive Department and all state agencies
18. Minimum Requirements for the Subsurface Disposal of Sanitary Sewage (Title Five, 1977) Purpose: Provides minimum standards for disposal of sanitary sewage on-site.	Mass. EOEA/DEQE and Municipal Boards of Health

LOCAL

Mashpee

1.	Mashpee Wetlands Protection By-Law (Article 4.13) Purpose: Protects interests in fore-shores and wetlands. Also protects wetland: wildlife, recreation and aesthetics.	Conservation Commission
2.	The Use of Waterways, Ponds and Lakes By-law (Article 4.17) Purpose: To regulate speed, pollution, moorings, abandonment of objects, water skiing, and jet skiing, divers and diving in and over the waters within the town.	Harbormaster
3.	Public Beach By-law (Article 4.8) Purpose: Regulates the use and care of public beaches.	Board of Selectmen, Fire Dept., Police
4.	Shellfish By-law (Article 4.9) Purpose: Regulates the taking of shellfish.	Board of Selectmen and Shellfish Officer
5.	Zoning By-laws (April 1985) -Floodplain Provisions (Sect. 11) Purpose: Regulates construction and development in the FEMA mapped floodplains. -Mashpee Quashnet River Protective District (Sect. 11A) Purpose: preserves the Mashpee and Quashnet Rivers along with a 100 ft. buffer, and their wildlife resources. -Water Resource District (Sect. 11B) Purpose: Protects the public health by preventing contamination of ground and surface water resources providing water supply for the town.	Planning Board, Board of Appeals, Building Inspector Above and the Board of Health

-Areas of Critical Environmental Concern (Sect. 11C)

Purpose: Protects the Waquoit Bay ACEC and a fifty foot buffer zone from inappropriate uses.

-Pier Provisions (Sect. 6, I. 9) — Board of Appeals, Conservation Commission and Harbormaster

Purpose: Protects navigation rights and marine environment through reviews and special permit.

6. Board of Health Regulations — Board of Health

Purpose: protects public health and environment by exceeding provisions of state Title 5; provides for 75 foot setback between septic systems and water course for single family residences and 100 ft. for multi-family residences.

Falmouth

1. Beach By-laws (Ch. VI. Sect. 1.0 - 1.8) — Beach Committee and Fire Department

Purpose: Establishes procedures for town use, care, regulation and control of beaches (Ch. 315).

2. Waterways By-laws (Ch. XIV, Sect. 1.0 - 1.21; Article 57, A.T.M., 1980) — Harbormaster, Waterways Committee

Purpose: Establishes procedures for town wharves, fees, marinas, floats, slips, docks, moorings, navigation, ramps, swimming, diving, pollution, waterskiing, and vessels.

3. Wetland By-laws (Ch. XV Sect. 1.0 - 1.9, Sect. 2, Ch. 209; see also policy guidelines) — Conservation Commission and Conservation Officer

Purpose: Protects interests in fore-shores and wetlands including wildlife, recreation and aesthetics.

4. Fisheries Regulations (Ch. VI Sect. 1.0 – 7.0) (1.0 – 3.19 do not include herring or shellfish grants) — Boards of Selectmen and Shellfish Constable

   Purpose: Regulates raising and taking of clams, quahogs, eels, herring, and scallops.

5. Pesticides Regulation (Ch. IX 1.0) — Board of Health

   Purpose: Protects ground and surface waters from pesticide pollution.

6. Hunting, Trapping and Shooting (Ch. X Sect. 1.4) — Police Department

   Purpose: Prohibits hunting, trapping and shooting on town parks.

7. Water/Sewer regulations (Ch. XIII Sect. 2.1 – 2.2, et. seq) — Board of Health

   Purpose: Defines "water course" and exceeds state Title 5 by requiring a minimum 100 ft. setback from septic system leaching facility to watercourse.

8. Zoning By-laws (1979 plus 1984 update and yearly amendments) — Planning Board, Board of Appeals and Building Inspector

   Overlay Regulations (Article IV):

   -Water Resource Protection Districts (4100)

   Purpose: Protects public health, ground and surface waters.

   -Wetland Regulations (4300)

   Purpose: Protects certain irreplaceable wetlands.

   -Floodplain Zone (4400)

   Purpose: Regulates construction of structures and use of land in recognized areas subject to flooding.

   -Area of Critical Environmental Concern (4500)

   Purpose: Protects wetlands in the ACEC and prohibits structures and vegetation alteration within 50 feet of ACEC.

-Uplands (Article II. Definitions, 1983)

Purpose: Excludes wetlands from inclusion in lot area required for zoning compliance.

-Building Setback (Article III. Basic District Regulations (Sect. 3454), 1983)

Purpose: Requires 50 ft. building setback from salt and fresh waterbodies.

-Marine Districts (Article III. Basic District Regulations (Sect. 3350), 1986)

Purpose: Preserves and protects water dependent uses around waterfront in accordance with CZM and town plans.

The regulations set forth on the preceding pages represent a comprehensive network of protection for lands and waters within the Waquoit Bay NERR. Successful enforcement of these regulations depend on an integrated system of local, state, and Federal oversight. The chart depicted on the next page lists the land and water uses that are likely to occur within the Reserve, along with the authorities that are responsible for enforcement, and the mechanisms that are utilized to insure compliance with the regulations.

Surveillance of land activities within the Reserve will largely be the responsibility of the Reserve Manager. Surveillance of water activities within the Reserve and the majority of activities outside the Reserve lies principally with the towns. In most instances, state involvement is limited to hearing and deciding appeals of local decisions. The WBNERR Advisory Committee is currently discussing the possible establishment of radio contact among the entities responsible for surveillance of activities within and on the waters of the bay for more efficient enforcement. Please note that the majority of the land area within the Reserve is owned by the Commonwealth and subject to direct control by the Department of Environmental Management. In addition, the remaining private lands within the Reserve are wetland areas, and thus strictly regulated by both state and local levels of government.

While establishment of the Reserve does not directly affect enforcement responsibilities at Waquoit Bay, the Reserve staff and committee members will actively provide an increased level of monitoring of Reserve activities, thus better insuring that activities potentially posing detrimental impacts to the estuarine system are minimized.

Table 2. Listing of land uses and activities likely to take place within or adjacent to the Reserve; the authority responsible for enforcement of that use or activitiy; and the compliance mechanism.

ACTIVITY	TOWN (FALMOUTH AND MASHPEE)	STATE	FEDERAL
Shellfishing	The Town Shellfish Officer enforces licensing of recreational and commercial fisherman; enforces shellfish harvesting regulations; maintains a shellfish management and propagation program. Board of Selectmen approve shellfish grants.	The Division of Marine Fisheries (DMF) issues state licenses for the commercial sale and handling of shellfish. State shellfish regulations enforced by Environmental Protection Officers of the Division of Environmental Law Enforcement (DELE).	
Marine Finfishing	Natural Resource Officers manage the harvesting of alewives.	The DMF enacts laws to regulate the harvesting of certain species of fish; manages the passage of anadromous fish (alewives, shad, and smelt); constructs fishways. DMF laws are enforced by DELE.	
Hunting	Town Natural Resource Officers or Police Officers enforce hunting regulations as established by the Division of Fisheries and Wildlife (DFW).	DELE enforces regulations established by DFW and migratory waterfowl laws established by the U.S. Fish and Wildlife Service (U.S. FWS).	Migratory Waterfowl laws are enforced by game wardens of the U.S. FWS.
Wetlands Alteration	The Conservation Commission reviews and decides upon development requests based on the State Wetlands Protection Act.	The Department of Environmental Quality Engineering (DEQE) hears appeals of town Conservation Commission decisions; and places deed restrictions on wetland areas through the Wetlands Restriction Act.	
Moorings Construction	The Harbormaster enforces town bylaws and state regulations.	Oversight responsibilities by DEQE, Division of Wetlands and Waterways.	
Private Pier Construction	The Board of Selectmen have permitting authority; the Conservation Commission issues order of conditions based on state Wetlands Protection Act.	Oversight by Mass. Environmental Protection Agency (MEPA) if project is over 2,000 sq. ft. or within an ACEC; CZM reviews for consistency certification if MEPA is involved.	Army Corps of Engineers (ACE) grant Section 10 permits.
Dredging and Filling	The Conservation Commission issues order of conditions based on the State Wetlands Protection Act.	DEQE grants Chapter 91 licenses and water quality certificates; MEPA reviews if project is 10,000 cu.yds. or more; CZM reviews for consistency certification if MEPA is involved.	ACE grant Section 10 permits; EPA has oversight responsibilities.

Table 2. continued...

ACTIVITY	TOWN (FALMOUTH AND MASHPEE)	STATE	FEDERAL
Building Construction	The towns regulate the use and location of development through development of zoning and health regulations. The Conservation Commission reviews and decides upon development requests in or adjacent to wetlands based on the state Wetlands Protection Act.	The Attorney General's Office is responsible for approval of town zoning regulations. DEQE establishes minimum standards for disposal of sanitary sewage on-site (based on soil character and distance from drinking water supply.) DEQE also regulates development in wetlands areas (where the Wetlands Restriction Act is in place and through the Wetlands Protection Act) and on those portions of barrier beaches within velocity zones or primary dune areas (Barrier Beach Executive Order 181.)	
Agriculture		The state Department of Food and Agriculture licenses pesticide applicators for use of certain specified pesticides.	The EPA registers pesicides for general or restricted use.

C. Natural Protection

1. Barrier Beaches

In addition to the land protection mechanisms of ownership and regulatory controls are the naturally created protection afforded by certain landforms within the Reserve. The beaches along the south shore of Washburn Island and South Cape Beach provide a physical barrier protecting the Bay and adjacent land uses from the erosional effects of tidal and off-shore currents, and the potentially destructive effects of ocean storms. Protection of these barrier beach systems by the Department of Environmental Management will ensure that the natural storm defense provided by the systems will continue to protect the harbor and adjacent upland.

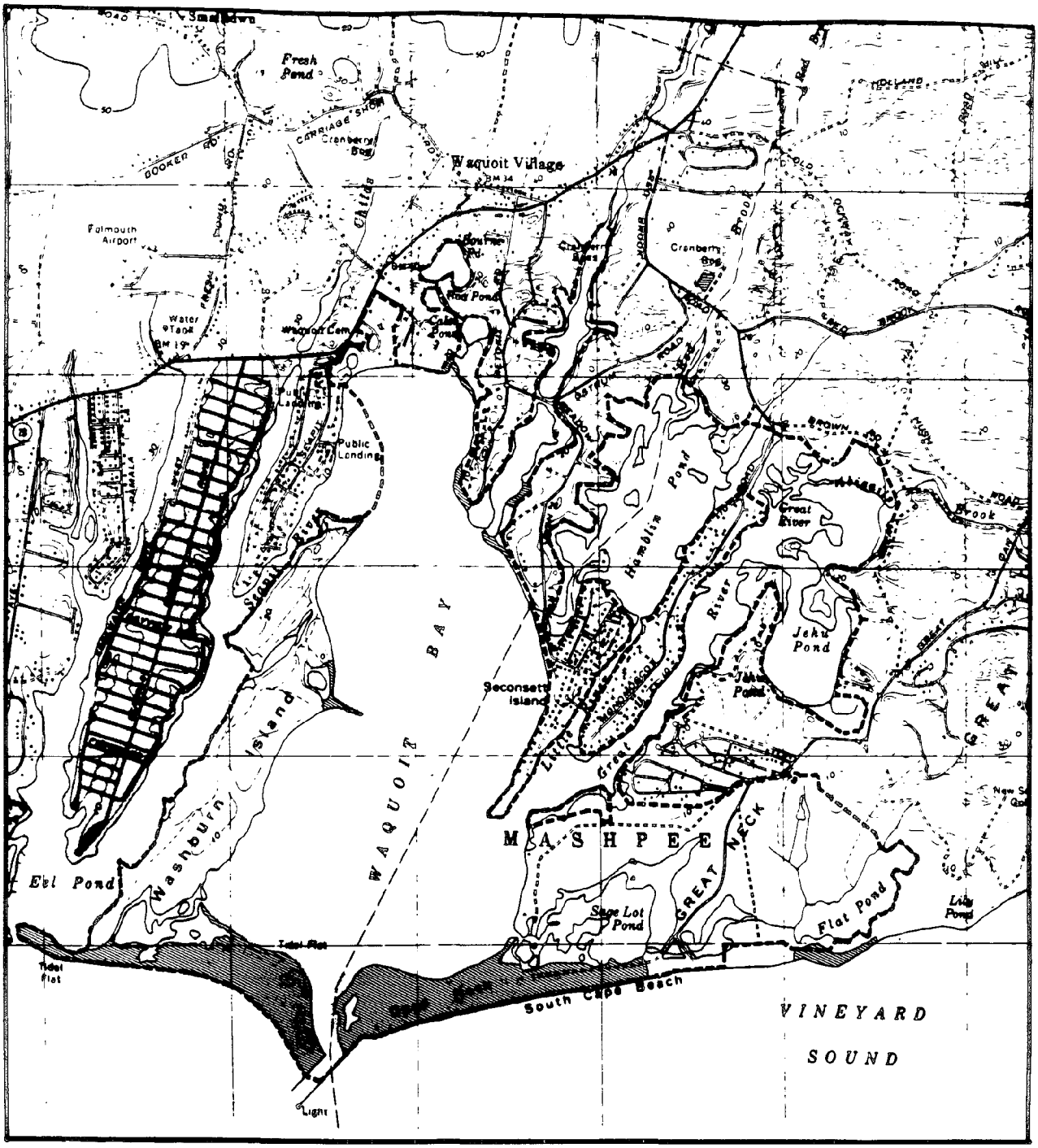
2. Salt Marshes

The 292 acres of salt marsh and freshwater wetlands within the Reserve provide a host of protectionary benefits to the physical characteristics of the Reserve as well as the plant and animal species inhabiting the estuary.

A saltmarsh is characterized by a relatively impervious layer of peat and fine sediment. This impervious layer is significant for its role in maintaining the balance between fresh and saltwater in the estuarine system. The layer serves to maintain the level of the water table landward of the saltmarsh, and acts as a barrier preventing free, uninterrupted flow between fresh groundwater and the ocean.

Salt marshes also play an important role in the protection and nurturing of marine fisheries and shellfish. The salt marsh is an extremely productive natural system providing large volumes of organic material upon which the coastal marine food web depends. The marsh materials may be used by consumers inhabiting the marsh or may be flushed by tidal flow from the marsh as dissolved nutrients or detritus.

The composition and distribution of salt marsh vegetation is also significant for reducing the effects of pollution by removing excess nutrients and heavy metals delivered by surface runoff from upland areas. (See Figure 4 for the location and extent of barrier beaches and salt marshes within the Reserve.)



WAQUOIT BAY

National Estuarine Research Reserve

scale in feet

0 500 2000

North

Land Types

Legend:

- Reserve Boundary
- Salt Marsh
- Barrier Beach

Figure 6

IV. MANAGEMENT STRATEGY

A. Reserve Goals and Strategies

In order to provide adequate management and efficient development of the resources within the Waquoit Bay NERR, the following management strategy has been devised. The Goals and Strategies are meant as guidelines for all actions taking place or affecting conditions within the Reserve. Since the factors affecting Waquoit Bay continually change, likewise the Goals and Strategies must be flexible and may be revised as conditions warrant.

GOAL 1. To enhance and facilitate resource protection within the Reserve and those surrounding areas that affect the Reserve.

Strategy 1. Compile information on existing regulatory programs affecting Waquoit Bay NERR into a usable format, and design a program for disseminating this information.

Strategy 2. Clearly define Reserve boundaries and monitor activities within those borders.

Strategy 3. Evaluate existing regulations and activities affecting the quality of the Reserve, provide recommendations as needed, and assist in their implementation.

Strategy 4. Develop guidelines and a program for enforcement and surveillance of activities conducted within the Waquoit Bay NERR.

Work Plan:
- identify enforcement agencies and officers and discuss enforcement guidelines and schedules
- assist in the establishment and implementation of management plans for state owned land

Strategy 5. Keep abreast of funding opportunities for land acquisition and real estate conditions within and adjacent to the Reserve, and seek funding when needed or desired; and investigate acquisition or voluntary donation of fee simple rights or conservation restrictions of land within and adjacent to the Reserve.

Strategy 6. Promote cooperative ventures between individuals, property owner organizations, and municipal, state, and Federal agencies.

Work Plan:
- identify property owners abutting Reserve
- prepare newsletter and disseminate
- consider special benefits for locals and abutters
- provide technical assistance

GOAL 2. To facilitate and encourage opportunities for short and long-term scientific research programs within the Reserve that serve to increase our knowledge and understanding of estuarine areas and assist in their protection.

Strategy 1. Encourage and assist in the acquisition of facilities, manpower, and equipment necessary to support year-round research opportunities.

Work Plan:
- identify existing public and private funding sources and solicit funding
- create funding opportunities through innovative fund-raising functions
- establish a corps of volunteers to assist in the work of the Reserve
- develop a training program for volunteers.

Strategy 2. Encourage and assist in the establishment of research projects pertaining to estuarine resources.

Strategy 3. To promote cooperation among the different investigators working within the Reserve, and between the investigators and the Reserve Manager.

Work Plan:
- encourage all investigators to register with the Reserve Manager
- contact researchers whose projects may be complementary and encourage cooperation

Strategy 4. To identify private lands within and adjacent to the Reserve that are suitable and desirable for research opportunities, and to approach landowners to develop access agreements or, where compensation is found appropriate, initiate negotiations for acquisition of property interests (e.g. easements) such that the DEM land acquisition process towards acquiring property rights such that research in these areas may take place.

Strategy 5. To catalog and disseminate information on estuarine resources and ecosystems to the general public and to those organizations and individuals with coastal management decision-making responsibility or a general interest in research results, and, as a result, improve estuarine use and protection.

Strategy 6. In coordination with the Research Subcommittee, to evaluate and monitor all research activities taking place within the Reserve.

Strategy 7. In coordination with the Research subcommittee, to assign priorities to research projects which are competing for Reserve funds, equipment, or space.

Strategy 8. In conjunction with the Research, Education, and Regulations Subcommittees, to select sites in which research activities may take place, to protect these sites and make them available for continuous study.

Strategy 9. To establish guidelines for evaluating and monitoring research activities that include manipulation of the environment.

Strategy 10 Promote and assist in the development and rehabilitation of the Reserve Headquarters.

Work Plan:

- develop a promotional brochure outlining the quality of Waquoit Bay NERR resources, and research opportunities available
- disseminate brochures to appropriate individuals and organizations
- identify funding programs for research and distribute information
- create funding opportunities through innovative fund-raising functions
- develop and make available a data base of completed research projects

GOAL 3. To facilitate and encourage education and interpretation of conditions and resources existing at Waquoit Bay NERR, and education of general principles characteristic of all estuarine areas.

Strategy 1. Encourage and assist in the acquisition of materials, manpower, and equipment necessary to administer educational and interpretive programs.

Work Plan: Same as Goal 2, Strategy 2

Strategy 2. Encourage and assist in the establishment of education and interpretive projects pertaining to estuarine resources.

Work Plan:
- develop a brochure outlining the significance and value of Waquoit Bay NERR and all estuarine areas
- disseminate brochures to appropriate individuals, organizations and institutions
- identify funding programs for education and interpretation
- create funding opportunities through innovative funding raising functions

Strategy 3. In cooperation with the Educational Advisory Subcommittee to develop a document that outlines the policies and procedures for:

* Ranking in order of priority themes for education and interpretation that will serve to most effectively increase public awareness and appreciation of estuarine resources, problems, and opportunities.
* Developing appropriate techniques for interpretation and education:

For example: Multi-media events (video, slide show, etc.) conferences, lectures, on-site tours, written leaflets and newsletters, exhibits, etc.

* Selection of sites which have greater potential value for the conduct of interpretive and educational activities.
* Cataloging and disseminating information.
* Transferring scientific information gained from research projects into terms that can be understood and appreciated by the general public and coastal zone decision-makers.

Strategy 4. Develop strategies for public awareness and promotion of Waquoit Bay NERR and its importance to the protection of estuarine systems everywhere.

Strategy 5. To identify private lands within and adjacent to the Reserve that are suitable and desirable for education opportunities, and to approach landowners to develop access agreements or, where compensation is found appropriate, initiate negotiations for acquisition of property interests (e.g. easements) such that the DEM land acquisition process towards acquiring property rights such that educational activities in these areas may take place.

Strategy 6. Define and protect specific sites suitable and desirable for education and interpretation, and make them available for continuous use.

Strategy 7. Promote and assist in the development and rehabilitation of the Reserve Headquarters.

GOAL 4. To compile, develop, and distribute information for improved coastal decision-making.

Strategy 1. Gather existing information pertaining to the resources and uses of Waquoit Bay, and compile information in a format suitable for dissemination.

Strategy 2. Design and maintain a library and comprehensive bibliography for information specific to Waquoit Bay, and estuarine systems in general.

Strategy 3. Establish a standard format for presentation of research results.

Strategy 4. Identify coastal zone decision-makers and interest groups, maintain a mailing list, and provide information on a regular schedule.

Strategy 5. Assist in the documentation of existing conditions within the Reserve and monitor changes as they occur.

Strategy 6. Encourage and coordinate planned research as a part of the national effort to acquire, assimilate, and disseminate estuarine information.

Strategy 7. Be responsive to specific needs and concerns of coastal areas, communities, and organizations, and their requests for information and assistance.

Strategy 8. Research and maintain a list of sources for technical assistance in those disciplines pertinent to the coast, and establish a clearing-house capability to reveal these sources to the public when the need arises.

GOAL 5. To heighten awareness and promote cooperative efforts among local, state, and federal levels on issues pertaining to the Waquoit Bay NERR.

Strategy 1. Utilize a regular flow of information to stimulate and maintain interest at all levels.

Work Plan:
- design the most effective method for disseminating information
- compile a mailing list of interested agencies, groups, and individuals
- distribute information on a regular basis in a consistent format
- maintain a centralized headquarters to direct requests for information and assistance

Strategy 2. Design, encourage, and conduct forums for regular updates concerning the status of activities at Waquoit Bay NERR.

Strategy 3. Participate in special meetings, conferences, and workshops sponsored by local, state, or Federal government agencies to promote a "presence" and to encourage interaction and communication.

Strategy 4. In particular, encourage and assist in cooperative efforts pertaining to use and protection of Waquoit Bay NERR between the towns of Falmouth and Mashpee.

Strategy 5. Establish an alliance with decision-makers of component sites within the Reserve, namely South Cape Beach and Washburn Island.

GOAL 6. To encourage multiple use of Waquoit Bay NERR resources to the degree compatible and consistent with the protection of the Reserve and maintenance of education and research activities.

Strategy 1. Provide for multiple use of the Reserve to allow for those recreational and commercial uses which are compatible with the Reserve's character as a natural field laboratory.

Work Plan:
- identify potential multiple uses of the Reserve that would be compatible with the designation
- define areas appropriate for those activities, and assist in the proper utilization of these areas (ie. erection of signage describing public access points)
- identify legal constraints to these activities under present local and state law
- publish and disseminate information on uses which are encouraged, restricted/controlled or prohibited within the Reserve

Strategy 2. Promote and design programs for monitoring and evaluating traditional recreational and commercial activities taqking place within the Reserve.

Work Plan:
- identify component sites and allowed recreational activities at those sites
- analyze compatibility of public uses at each site
- present recommendations to appropriate state and local agencies and/or advisory committees on the need to regulate activities in specific environments

Strategy 3. Assist in the documentation of cultural and historical as well as natural resources of the Reserve for education, research and public enjoyment, and assist in their protection.

Work Plan:
- compile data on cultural, historical, and natural resources and their uses
- survey resources and nominate those eligible to the National Register of Historic Places
- perform an archaelogical reconnaissance survey
- map natural resources of the Reserve
- make recommendations to the state and local agencies and advisory committees regarding the need for additional and coordinated protection

Strategy 4. Promote and encourage compliance with local and state land use planning goals.

Work Plan:
- compile local health, wetland, and zoning regulations that impact the Reserve
- review local open space, conservation and recreation plans, and any master plans
- review the Statewide Comprehensive Outdoor Recreation Plan (SCORP)
- review state and Federal laws and programs

GOAL 7. To develop a restoration plan if, and/or where appropriate.

Strategy 1. Determine the need for restoration within the Waquoit Bay NERR.

Work Plan:
- compile a list of degraded or potentially degraded areas within the Reserve
- utilize written research works to identify potential "problem" areas
- determine whether the types of "problems" discovered are able to be solved given current or anticipated technology

Note: To date, only one need for restoration has been identified within the Reserve. That need is for dune restoration on South Cape Beach. Restoration of the dune ecosystem is taking place under the auspices of the Wetlands Protection Act in order to enhance the interests of this act which include: prevention of storm damage, flood control, and protection of wildlife habitat.

Dune restoration activities have been limited to stablization of dunes through erection of snow fencing and planting of native vegetation.

Strategy 2. Develop a program for restoration if found to be a desirable solution to "problems".

Work Plan:
- establish criteria for undertaking restoration
- develop monitoring plan and schedule for use during and after restoration takes place
- identify and document approvals necessary before activities can be conducted

Strategy 3. Document the physical conditions, both before and after restoration takes place.

B. Administration and Operation

1. Personnel

The Reserve Manager will be the principal administrator of the Reserve and will be responsible for ensuring that the policies contained in the Reserve Management Plan are followed. This individual will be employed and supervised by DEM, Division of Forest and Parks, and will be responsible for the following activities:

I. General administration of the Reserve including the preparation of required State, Federal, and other grant applications, budgets and other fiscal matters, reports, and management of any necessary records.

II. Representation of the Reserve program and policies in public hearings and meetings where appropriate.

III. Approval and implementation of the Reserve Education Program, with the advice and assistance of the Education Advisory Subcommittee. This will include coordination of on and off-site interpretive activities, preparation, publication and distribution of brochures, reports, newsletters, slide shows, and other forms of educational material.

IV. Approval and implementation of the Reserve Research Program, with the advice and assistance of the Research Advisory Subcommittee. This will include active recruitment of research projects for the Reserve, providing logistical support for researchers, monitoring and evaluating research projects and proposals, and continual assessment of research objectives.

V. Approval and implementation of the Reserve Regulatory Program, with the advice and assistance of the Regulation Advisory Subcommittee. This will include public awareness efforts, assessment of existing regulations and enforcement, and identification of additional regulatory needs as they arise.

VI. Responsibility for upkeep of the buildings and grounds at the Reserve Headquarters.

VII. Supervision of Reserve staff and volunteers involved in activities of the Reserve.

VIII. Coordination with the Federal National Estuarine Research Reserve program.

IX. Completion of an annual report on activity and progress of the Reserve.

It is expected that a Visitors Services Assistant/Interpreter and a clerical assistant to the Manager will be needed. The Assistant/Interpreter would be

responsible for conducting environmental education programs, assisting in public information tasks, assisting in the development and maintenance of exhibits and audiovisual materials, maintaining logs and schedules, and related tasks. The clerical assistant would perform routine secretarial, clerical and office management functions.

As activities and programs develop at the Waquoit Bay National Estuarine Research Reserve, it may be necessary to consider employing a Research Director and/or an Education Director, or a Coordinator of Volunteers.

2. Advisory Committee and Subcommittees

Advisory Committee

In order to provide for effective coordination and cooperation among all interests involved with Reserve programs, a Reserve Advisory Committee has been established. Thirteen members will be appointed to this Committee by the Secretary of Environmental Affairs. Representatives of the following interest groups shall be included in the membership:

I. The Board of Selectmen of the Town of Falmouth

II. The Board of Selectmen of the Town of Mashpee

III. The Cape Cod Planning and Economic Development Commission

IV. The South Cape Beach State Park Advisory Committee

V. The Commissioner of the Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement

VI. The Director of the Massachusetts Office of Coastal Zone Management

VII. The Commissioner of The Massachusetts Department of Environmental Quality Engineering.

VIII. The scientific community

IX. The education community

X. Environmental interest group

XI. Hunting, fishing, shellfishing interest groups

XII. Boating, waterways, marina interest groups

XIII. The Native American community

XIV. Resource Protection Interest

Representatives are nominated to the Secretary of Environmental Affairs for one year appointments with no limit on the number of reappointments. A representative of the Federal National Oceanic and Atmospheric Administration will be included as an ex-officio, non-voting member.

The activities of the Reserve Advisory Committee shall include the following:

I. Advise the Reserve Manager on matters of policy related to planning for and operation of the Reserve;

II. Appoint the members of the Research, Educational and Regulations Advisory Subcommittees;

III. Assist in seeking support for the Research and Educational programs and other financial matters;

IV. Conduct annual review of the Management Plan and assist in the preparation of any periodic summary or annual reports on the operations of the Reserve; and

V. Represent the interests of the users of the Reserve, its neighbors, and the users of information and educational materials generated by the Reserve.

The Committee shall conduct regular meetings, open to the public. The Reserve Manager or staff shall act as staff to the Committee. A Chairman shall be selected by vote of the Committee on a yearly basis.

Research Advisory Subcommittee

The Waquoit Bay NERR Advisory Committee will be responsible for recruiting and appointing a Research Advisory Subcommittee. Membership on the Research Subcommittee should include persons with a scientific research background, persons with a resource management background, and persons involved in land-use decision-making. It will be the function of this Subcommittee to work with the Reserve Manager to:

I. develop and refine the Reserve Research program;

II. review research proposals and results of work within the Reserve for suitability and conformance with the established goals of the Research program;

III. publicize Reserve facilities and recruit researchers to work in the Reserve; and

IV. with the Reserve Manager, determine sources of funding and advise WBNERR on the distribution of such funding for research within the Reserve.

Committee members will serve one-year terms with no limit on reappointments. Their work is critical in assuring that research done in the Reserve meets the goals and standards of the Research Program. In doing so, they will assure the continuation and direction of the Research Program and help to protect the resources of the Reserve.

Education Advisory Subcommittee

The Waquoit Bay NERR Advisory Committee will be responsible for recruiting and appointing an Education Advisory Subcommittee. Membership should include persons with a background in education at various levels, from primary education through college, persons with a media background, and local decision-makers. It will be the role of this subcommittee to work with the Reserve Manager to:

I. develop and refine the Reserve Education program;

II. develop and define educational activities, with various formats for presentation to varying audiences;

III. publicize Reserve educational activities and recruit individuals and groups to use the facilities of the Reserve; and

IV. develop sources of funding to sponsor educational activities publications, media presentations, etc.

The subcommittee members will serve one-year terms with no limit on reappointments. Their work will be critical in assuring that information about the Reserve and coastal and estuarine resources in general is disseminated to the public.

Resource Protection Advisory Subcommittee

The Waquoit Bay NERR Advisory Committee will be responsible for recruiting and appointing a Regulations Advisory Subcommittee. Membership on the Subcommittee should include representatives from the Regional Planning Agency; Commonwealth of Massachusetts, Department of Environmental Quality Engineering or Coastal Zone Management Office; a private marina; the U.S. Coast Guard; and at least one each from the towns of Falmouth and Mashpee. It will be the function of this Subcommittee to work with the Reserve Manager to:

I. determine all Federal, state, and local laws affecting Waquoit Bay NERR, and establish a database for Reserve use.

II. analyze the effectiveness of the legal apparatuses impacting the Bay.

III. identify additional legal needs and requirements necessary for optimum environmental protection of the Bay.

The subcommittee members will serve one year terms with no limit on reappointments.

A fourth subcommittee, designed to develop volunteer services, is currently in the planning stages.

3. Forest and Park Supervision

It is intended that supervisory responsibilities at South Cape Beach State Park and on Washburn Island will remain as they are presently structured. Operation of the state facilities, however, will recognize the goals and objectives set forth in the Waquoit Bay NERR Management Plan. The Park Supervisor will continue to assume these responsibilities on parkland, except at the Reserve headquarters where the Reserve Manager will have responsibility for all supervision. The educational program at the Reserve headquarters will be organized by the Reserve Manager, while educational activities at South Cape Beach and Washburn Island will be coordinated cooperatively by the Reserve Manager, DEM's Bureau of Interpretive Services, and the Park Supervisor.

Use of South Cape Beach or Washburn Island for research purposes will be coordinated by the Reserve Manager with the approval of the South Cape Beach State Park Supervisor.

4. Volunteer Program

The use of volunteers for program implementation as well as day-to-day operation of the Reserve is still in the planning stages. It is felt, however, that the use of volunteers is a cost-effective method of providing meaningful education and research programs.

A survey will be conducted to determine the various areas of need, potential sources of volunteer expertise, and best methods to attract, train, and utilize area volunteers. A separate policies and procedures statement regarding the use of volunteers will be designed by the Reserve Manager with the assistance of the Advisory Committee. Upon completion of this statement and a review of the survey results, the Manager will initiate an outreach program designed to attract potential volunteers and will include the use of all media.

Training, job assignment, and evaluation will be the responsibility of the Reserve Manager. Materials needed for the entire program will be developed in cooperation with DEM's Bureau of Interpretive Services, and the Advisory Committees and Subcommittees.

C. Resource Protection and Use

1. Acquisition Plan

In the past, acquisition within the Reserve by DEM has been utilized for a twofold purpose of environmental resource protection and the provision of recreation. It was for these reasons that South Cape Beach and Washburn Island were acquired.

Protection and use of Waquoit Bay as a National Estuarine Research Reserve may require that additional land be acquired. Acquisition of fee simple or partial interests in the land are necessary to protect and provide access to those resources within the Reserve significant for research opportunities and public education and interpretation. At the present time, two areas have been identified for potential land acquisition by the Department of Environmental Management: 1) access to the marshes and ponds within the Reserve, and 2) the Quashnet River watershed.

Access to Marsh and Pond Areas for Limited Education and Research Purposes

As mentioned previously in the plan, the Reserve includes several ponds and adjacent marsh under private ownership. Under existing regulations, the Commonwealth has adequate authority to ensure major activities that would have a significant adverse impact on the estuarine resources of the Reserve will not be undertaken in the marsh areas. The marshes in both Falmouth and Mashpee are protected from development by the Wetlands Protection Act (as described on page 27) which authorizes the Conservation Commissions within the towns to prohibit activities that would destroy any portion of the marsh, or impair its productivity. An additional measure of protection is provided to the salt marsh areas in both towns by the Coastal Wetlands Restriction Act (also described on page 27). Under this Act, an order of Restriction is recorded in the Local Registry of Deeds serving to prohibit a specified list of activities on each designated wetland area. (Figure 5 depicts the wetlands restricted under the Act.) Together, these Acts provide permanent protection of the wetlands within the Reserve from a variety of land use activities that might otherwise damage these resources.

In addition to their protection, guaranteed access to these marshes and ponds for research and educational purposes is considered important to the Reserve operation. The fragile nature of the marshes precludes wide public access, but assured limited access is important for both research and interpretive activities. As a result, upon evaluation of the ownership patterns in these areas and identification of those parcels most valuable for limited access, it is the intention of DEM to approach the owners of these parcels to ascertain their interests in donation or sale of easements over these parcels, or at the very least, permission for access to their land. Avenues of tax abatement or exemption will be investigated to make such actions as attractive as possible. Every effort will be made to pursue these actions with willing landowners only.

Evaluation of the saltmarsh/pond areas to determine their significance for research and education will proceed through the remainder of this year

culminating in a recommendation of desired access points by December 1989. Providing that state monies exist for the acquisition of land and/or easements, owner contacts will be initiated in January of 1990, with proposals presented for acquisition consideration throughout 1990.

Quashnet River Watershed

The Quashnet River, located north of Waquoit Bay, is a vital freshwater source to the estuary. At the present time, the lands on either side of the Quashnet River are in a predominantly undeveloped condition. In July of 1988 DEM, together with the Division of Fisheries and Wildlife, acquired 361 acres of land adjacent to Quashnet River. This purchase helps to insure the continuance of a vital, high quality freshwater supply to Waquoit Bay.

Other private, undeveloped properties still exist along the banks of the Quashnet River. DEM will continue to monitor the status of these parcels and consider them for potential acquisition when appropriate.

WAQUOIT BAY

National Estuarine Research Reserve

scale in feet

0 500 2000

North

Wetlands Restriction Act

Legend:

- Reserve Boundary
- Areas Restricted in Falmouth
- Areas Restricted in Mashpee

Figure 7

Other Acquisition Efforts

From time to time, other parcels outside the Reserve boundaries that are important to the maintenance of environmental quality within the Waquoit Bay NERR might become available for sale or be threatened by development that would adversely impact the quality of resources within the Reserve. As these cases arise, the properties will be evaluated by DEM, with acquisition proceedings initiated (assuming adequate funding exists) for those properties found to be significant to the protection or use of the Reserve.

It is recognized that any change in the Reserve boundaries or use of Federal (NOAA) funds for the acquisition of land will necessarily require written approval by NOAA.

2. Access Plan

While sixty percent of the shoreline abutting Waquoit Bay is state owned, access to the Bay is somewhat limited. Public access is presently available at three locations: Washburn Island and a Town Landing in Falmouth, and South Cape Beach in Mashpee. As part of the State Forest and Parks system, South Cape Beach and Washburn Island are managed primarily for passive recreation. South Cape currently provides parking for 110 vehicles, with a planned maximum capacity of 400 vehicles. From the parking lots, the Bay is accessible by foot over established trails or along the beach. Washburn Island contains the largest stretch of shoreline along the Bay at two and a half miles but is only accessible by boat. The public landing in Falmouth provides a boat ramp and small parking lot. The landing is open to the general public and is available year-round. The landing is located near the north end of the Bay on the western shore.

For vehicular, boat, and pedestrian access to the Bay for research and educational activities associated with the Reserve, special accommodations are planned at South Cape Beach and the Swift Estate.

South Cape Beach

Researchers will be able to access the Bay by vehicle via a packed dirt road through the northern portion of South Cape Beach. While no improvements exist for boat launching from a vehicle, the site will accommodate boats that can be hand carried from a vehicle to the water. This access is located along an undeveloped portion of shoreline away from organized recreation.

For education purposes, South Cape Beach and Washburn Island will be available for trail-oriented interpretive functions. Limited interpretive displays and notices of Reserve activities will be created on South Cape Beach as funding permits.

Reserve Headquarters

The Reserve Headquarters provides a convenient access point, a quality environment, and a range of facilities for both research and education. The Headquarters site abuts the Bay to the north, and fronts on Route 28, a major road corridor along the southern Cape. The site is the primary access point on the Bay for researchers, visitors, and others. Planned parking at the Headquarters includes fifteen spaces adjacent to the proposed Headquarters/Visitors Center (mansion) for visitor use, and eight spaces proximate to the carriage house for researchers and staff. (See Figure 6) The boathouse provides the Reserve with convenient access to the water for research and educational activities, as well as temporary laboratory space in the basement, and conference facilities in the main room upstairs.

3. Construction Plan

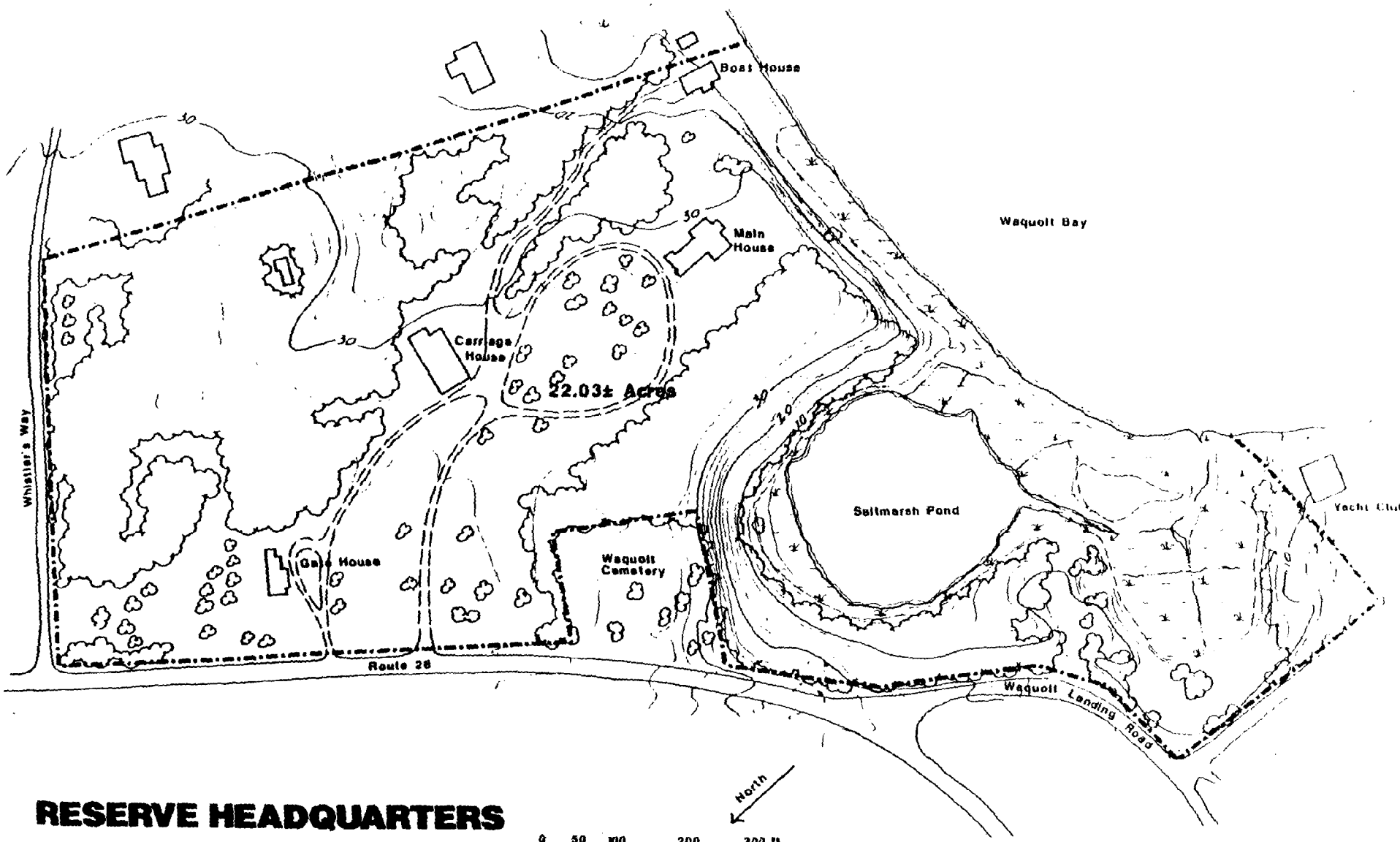
Reserve Headquarters

The buildings existing on the Reserve Headquarters site include the mansion, carriage house, gatehouse, and boathouse. All the buildings are structurally sound, and planned for use in Reserve operations and management.

The focal point of the property is the mansion, and this structure will serve as the center of activity for the Reserve. The mansion contains approximately 5,800 square feet of floor area, and affords a superior view to the Bay and surrounding lands. Both the size of the building and its location in relation to the Reserve is ideal for the establishment of a Reserve Headquarters/Visitors Center. Unfortunately, the mansion is need of major revovations before its use as a Center can be realized. Long-term improvements and renovations are expected to take approximately 4-5 years. Preliminary plans for the proposed Center provide for visitor services including display space, and a conference room on the first floor, with smaller space needs such as offices, a library, and storage and filing rooms on the second floor.

On an interim basis, the gatehouse building will be rehabilitated to serve as the Reserve Center until such time as operations can be moved to the mansion at the completion of renovation. The gatehouse is in need of little alteration and is conveniently located near the entrance to the property off Route 28.

The carriage house is set behind the gatehouse with the proposed uses including equipment storage and laboratory research. The boathouse structure is located at the water's edge at the rear end of the property. The boathouse contains residence space and a garage, with the proposed use scheduled for conference/meeting space, and storage space for boating equipment. Based on preliminary inspection, existing buildings and grounds could be converted for short-term Reserve operations in eighteen months time upon initiation of work.



RESERVE HEADQUARTERS

(Former Swift Estate)

Figure 8

Construction Schedule (assuming NOAA funding for rehabilitation before Spring of 1989)

Activity	Proposed Date of Completion
1. Conversion of existing Gatehouse, Boathouse and Carriage house	September 1990
2. Provision of parking and landscaping	September 1990
3. Renovation of Mansion	June 1994

Estimated Construction Costs (not including mansion rehabilitation costs)

1. Sitework/Utilities	$157,000
2. Gatehouse Restoration	48,000
3. Carriage House Restoration	129,000
4. Boat House Restoration	31,000
Subtotal	$365,000
Indirect Costs	
6. 10% Contingency	$36,500
7. 5% Engineering	18,250
8. 5% Administration	18,250
Subtotal	$73,000
Grand Total	$438,000

D. Research Program

1. Goals

The Waquoit Bay NERR is a complex environment consisting of a diversity of habitats including a barrier beach area, extensive salt and freshwater marshes, a number of brackish water ponds, and large areas of eel grass. The Bay shares many characteristics with other estuaries and coastal ponds of the Virginia Biogeographic Region. Waquoit Bay is constantly undergoing change, both from natural and man made forces. Most of these changes, such as dune erosion and migration, residential development, increased nutrient loading, and increased fishing pressures are also occurring in estuaries nationwide but are especially typical of problems experienced by estuaries in the northeast. Therefore, the establishment of a National Estuarine Research Reserve at Waquoit Bay presents an opportunity not only to gain valuable information on the status and functioning of this estuary, but to gather information that will lead to a better understanding and future protection of all similar estuaries. Towards that aim, the research goals for Waquoit Bay NERR include:

1. To establish comprehensive baseline data on the nature and functioning of a protected or viable estuary, so that knowledge may be used as a control against which to judge activities in similar areas.

2. To develop an understanding of the impacts of human activities, both obvious and subtle, on the resources of the Reserve.

3. To make information developed from the above research available and useful to those responsible for resource management and land-use planning at individual, local, state, and Federal levels.

2. Research Process

a. Permit Application

All investigators planning to conduct research efforts within the Waquoit Bay NERR on land belonging to DEM will be required to apply to the Reserve Manager for a research permit, while all others using non-DEM areas will be encouraged to apply. The purpose of this permit is to coordinate and facilitate research activities in the Reserve, and to prevent interference between research, educational and recreational activities. In addition, a limited amount of logistical support and volunteer help is available to assist investigators in their research activities. The permit application will allow the allocation of these resources among the research projects taking place.

All permit applications should include the following information:

1. Name, address, telephone number, and affiliation of the principal investigator
2. Accurate location(s) of proposed research site(s)

3. Explanation of methods, materials, and complete description of how the site(s) will be marked
4. Anticipated starting and completion dates
5. Documentation that any necessary handling or collecting permits have been obtained
6. A detailed list of Reserve facilities that the researcher desires access to.
7. One page abstract of the research, including major objectives

This information will enable adequate coordination and documentation of research activities and allow monitoring and protection of research sites and equipment. All completed applications are to be sent to the Reserve Manager.

b. Review

All applications will be reviewed by the Research Subcommittee who will pass their recommendation on to the Reserve Manager. No access to state lands for field work will be given until the principal investigator receives a special use permit from DEM. All attempts will be made to make the review process as efficient as possible, and to respond to a permit application within one month. Occasionally, unexpected short-lived phenomena occur in the natural environment which present unique research opportunities. Investigators wanting to take advantage of such events may receive verbal permission from the Reserve Manager to begin sampling provided an application is filed within two weeks.

c. Reports

All investigators using Reserve facilities or receiving funding from the National Oceanic and Atmospheric Administration or directly from the Waquoit bay NERR are required to submit a final report. Final project reports should be submitted no later than 90 days after the completion of the research. For projects extending longer than one year, an annual progress report should be made to the Reserve Manager at the end of the fiscal year. Progress reports are to contain an abstract summarizing the project and the results.

All projects funded by the Marine and Estuarine Management Division of NOAA must conform to their guidelines for reports. Principal investigators are required to submit quarterly, draft and final reports by the delivery dates given in the final award document.

Other investigators working in Waquoit Bay are strongly encouraged to file a brief report and to send copies of reports, papers, and theses resulting from their work to the Reserve Manager.

In some cases an investigator's raw data may be useful to help build upon an existing Reserve data base. Investigators are encouraged to consult with the Reserve Manager at the start of their projects to see what data is already available, and how further data acquisition can be secured.

d. Dissemination of Information

Copies of research abstracts and other publications will be filed in the Reserve Office along with the research proposal and progress reports. Availability of research results and information taken from the abstract will be disseminated to local, state and Federal agencies, environmental groups and other interested parties. A centralized repository for all research products from the Reserve will facilitate review and dissemination of the information. The Reserve Manager and staff will be responsible for directing such products to the agencies, groups or individuals where they will be most useful. A format for applications, and abstracts will be developed to facilitate understanding, dissemination, organization, and retrieval of information.

As a base of research builds at Waquoit Bay NERR, other researchers should be attracted. It will be the function of the Reserve Manager and staff to make known the previous work, facilities available, access to, and research opportunities of the Reserve. Research summaries will be provided to the news media and newsletters of various scientific and regulatory agencies.

e. Funding

It is hoped that the Waquoit Bay NERR will be able to provide limited funds for research. Initially these may be provided, on a competitive basis, under the National Estuarine Reserve Research Program administered by the Federal Office of Ocean and Coastal Resource Management. Further sources of funding, from foundations, funding agencies, or private individuals will be sought. Such funds will be used to support researchers directly or to acquire necessary equipment for studies within the Reserve.

All proposals submitted for funding through the Reserve or through the Federal Office of Ocean and Coastal Resource Management will be evaluated by the Research Committee using the following criteria:

1. Quality of the proposal - projects should be of a high scientific merit, build upon research undertaken to date and not unnecessarily duplicate past investigations. The scope of the project should be manageable and able to yield conclusive results within the grant time period. The approach should be sound and the principal investigators should demonstrate experience related to the proposed methodologies.
2. Relevance to Reserve Research Objectives in Waquoit Bay - priority will be given to projects which pertain directly to the management of resources in the Bay. These are outlined in section five. Priorities will be revised periodically as the research needs of the Reserve change.
3. Relevance to the National objectives - NOAA gives priority to five core areas: water management, sediment management, chemical inputs and other pollutants, coupling of primary and secondary productivity, and fishery habitat requirements. All else being equal, proposals which thoroughly discuss the relationships between the local/regional issues and national issues and tie them in with the proposed research will be given higher rank than those that do not.

4. Budget considerations – the budget should be reasonable, and the research should be cost effective. Matching funds are required for projects receiving funding from the Marine and Estuarine Management Division, while all other projects are encouraged to seek matching funds.

(Final review and selection of projects for Federal funding under the National Estuarine Reserve Research Program will be made by the National Oceanic and Atmospheric Administration.)

3. Responsibilities

a. Reserve Manager and Staff

The Reserve Manager and staff, under the Research Program, will be responsible for the facilitation and coordination of research within the Reserve. The Manager is responsible for administration and review of research applications; periodic monitoring of research progress; organization and dissemination of research results; and recruitment of additional research efforts in the Reserve.

The Reserve Manager will be the primary contact person for any questions relating to research results or opportunities.

b. Research Advisory Subcommittee

The Research Advisory Subcommittee shall work with the Reserve Manager to develop and refine the Reserve Research Program; to review research proposals and results of work within the Reserve for suitability and conformance with the established goals of the Research Program; to publicize Reserve facilities and recruit researchers to work in the Reserve; and in conjunction with the Reserve Manager, develop sources of funding for research within the Reserve.

c. Researchers

Researchers shall be responsible for following proper application and progress reporting procedures; to conduct the study as outlined in the application form; to maintain all equipment in a safe and operable condition during the experiment period, and for removing it upon completion of the research; and to respect the natural condition of the estuarine ecosystem to the greatest extent possible.

4. Facilities and Equipment

The Reserve Headquarters/Visitors Center, upon rehabilitation, will offer office space, library and research file areas, short-term dormitory space for researchers, and if funding permits, a small-scale laboratory space and computer facilities. The carriage house will be used for rough laboratory space, workshops, and equipment storage. It is expected that the majority of research activity will be initiated and coordinated from this site.

The boathouse at the Reserve Headquarters provides pedestrian access to the water for boat launching.

It is anticipated that logistic support, in the form of small boat use, will be made available to the researchers on a permitted basis.

5. Research Priorities

Several factors have been taken into account in determining the research priorities at Waquoit Bay NERR. These factors include: the meager amount of historic research data available; issues that need immediate attention within the Reserve, such as water pollution and the effects of human disturbance; and the qualities of Waquoit Bay that are unique among the Reserves within the System of National Estuarine Research Reserves, and would lead towards a more comprehensive research approach nationwide. Various characteristics that separate Waquoit Bay NERR apart from many other Reserves include: 1)the existence of state controlled recreation facilities within the Reserve that opens the possibility of applied research; 2)the existence of several freshwater inputs rather than one principal supply; 3) extremely high development pressure upon both the water and land resources; 4)the unique geological features; and 5)a history of strong rehabilitation efforts towards establishing a sea run trout population.

In consideration of each of these factors, a preliminary list of research priorities has been developed to provide direction for the Research Program at Waquoit Bay NERR. Research projects allowed at Waquoit Bay will not be limited to the priorities presented in this list, however, the list represents the greatest needs for research at the Reserve during the formative years.

1. Research that pertains directly to the management of the resources of the Reserve.

As stated above, the principal goal for research within the Reserve is the development of appropriate management techniques for coastal resources. To meet this objective, the following research areas will be priorities within the Reserve:

A. Baseline measurements of the biological, chemical, and physical characteristics of the Reserve and the areas which affect it.

   - Characterization and documentation of the location, extent, and composition of the biological resources of the Reserve.
   - Identification of the hydrologic and geomorphologic processes such as water currents, sediment characteristics, and movement that shape the Reserve.
   - Determination of water quality in various areas of the Reserve.

B. Periodic monitoring of changes in the biological, chemical, and physical conditions of the Reserve.

- Tracking of changes over time in the location, extent, and composition of the biological resources of the Reserve, and identification of causes for these changes.
- Tracking of changes over time in water circulation patterns and landform change, and identification of causes of these changes.
- Tracking of changes in water quality over time to determine seasonality, storm effects, etc., and identification of causes for these changes.

At the present time, funds for routine monitoring in the Reserve are not available, however, funds for this purpose will be sought. Some monitoring is presently being carried out in Waquoit Bay and nearby by local, state, and Federal agencies. This information includes regular climate monitoring (NOAA), coliform counts (DEQE), finfish assessment (DMF), and shellfish catch statistics (towns of Falmouth and Mashpee). The first priority is to supplement this information with other measures of water quality. These include regular measurements of oxygen, temperature, light penetration and salinity throughout the Bay, as well as frequent measurements of nutrients and Chlorophyll a. At least some of these measurements will be carried out next year by NOAA grant recipients. More detailed monitoring would include regular measurements of primary production, assessments of macrophyte biomass, production estimates for improtant finfish and shellfish species, measurements of toxins, species composition changes in the plankton and benthos, mapping of changes in dunes and channels, and hydrologic monitoring.

In addition to professional monitoring activities, where possible, collection of data will also be conducted by the Reserve Manager, interns, and by students as a part of the education program.

C. Studies of the effects of commercial and recreational shellfishing on the resources and habitats of the Reserve.

- Determination of the level of shellfishing resources and the appropriate level of harvesting to reach a maximum sustainable yield.
- Evaluation of the effects of various means of shellfish harvesting on the habitat and populations of various species.

D. Studies of the effects of other human activities on the flora, fauna, physical processes, and ecological composition of the Reserve.

- Review of the effects of recreational boating on the resources of the Reserve in order to help communities devise practical resource-related harbor use and mooring plans.
- Monitoring of the effects of development in the uplands around the Bay and connecting ponds on water quality, sedimentation, salt marshes and other resources.
- Determination of the effects from the recreational activities along the beach, and determination of a "carrying capacity" in order to maximize human use and minimize adverse impacts on the natural resources.

2. Research that will provide information on estuarine ecosystems which will improve coastal resource management decision-making at the Reserve, on Cape Cod and the Islands, in Massachusetts and other states in the Virginian biogeographic region, and in the nation.

Estuarine areas are extremely complex systems, and although Waquoit Bay contains significant differences, it also shares similar processes and makeups as other estuaries. Long-term research designed to increase our understanding of Waquoit Bay as an ecosystem can help us to predict future problems and aid in estuarine management everywhere. The following research areas exemplify this "ecosystem level" approach:

A. Nutrient dynamics of Waquoit Bay (natural and anthropogenic inputs)
B. Groundwater and tidal flushing to the system
C. Coupling between primary and secondary production
D. Factors controlling recruitment to fin and shellfish populations

E. Education Program

1. Goals

The Education Program of the Waquoit Bay NERR will provide opportunities and activities which will foster public awareness, understanding and appreciation of the estuarine ecosystems; human effects on them; and the importance of these systems to the community, region, state, and nation. It will be the task of the Education Program to identify the needs, gather the information, develop education tools, and disseminate the information to the public. Learning more about the estuary, its functioning, and the methods of its protection will be a valuable experience for many recipients, especially decision-makers such as Planning Boards, Boards of Health, and Conservation Commissions; state or Federal agencies, and for the decision-makers of tomorrow – our children. The education goals for Waquoit Bay NERR include:

1. To develop and implement various means for increasing public knowledge and awareness of the complex nature of estuarine ecosystems, their values and benefits to society and nature, and the problems confronting them.

2. To provide opportunities for increasing public understanding of the need to protect, preserve, and utilize the natural resources of estuarine areas.

3. To provide a focal point for educational activities and opportunities.

4. To increase public understanding of the interrelationships between research, preservation, management, and utilization.

5. To establish the policies and procedures for educational activities, including the planning, development, implementation, dissemination, and evaluation processes.

6. To aid in the transfer of scientific information into lay terms, and for making it available to the public and coastal management decision-makers.

7. To maintain a library of general information on estuaries and their resource values, and specific information on Waquoit Bay.

8. To promote and encourage development of opportunities for field studies, research, and educational activities.

2. Strategies

Strategy 1. Develop off-site educational programs with school systems, civic and environmental organizations, colleges and other educational institutions in order to increase public awareness of

the estuary, Reserve facilities, and the role of the Reserve to generate information that will lead to a better understanding and protection of estuarine systems.

–develop visitor information packets, trail guides, and other materials which will allow individuals to explore and learn at their own pace.

–provide a training course for public school educators in order to expand estuarine education efforts.

–provide informational meetings to schools, organizations, local regional, state and Federal agencies to explain the role of the Reserve.

Strategy 2. Develop and distribute literature, graphics and other related materials in order to convey to the general public, management agencies, and scientific community, the goals, programs, and accomplishments of the Reserve.

–prepare brochures, newsletter(s), slide shows, video tapes to convey the mission of the Reserve.

–work with DEM's Interpretive Services to increase Reserve outreach to component sites within the Reserve.

Strategy 3. Develop on–site programs to provide contact with estuary elements.

–nature walks and interpretive programs will be available to provide overview of resources and multi–use aspects of the Reserve.

–arrange research site tours with assistance of researchers to provide an insight into methods and types of data gathering and interpretation available.

Strategy 4. To disseminate information generated through Reserve activities.

–encourage researchers to make public presentations to explain their work, and provide a forum for these presentations.

–distribute research findings through publication of abstracts in a newsletter(s).

3. Educational/Interpretive Activities

On–site Activities

1. School programs – materials and curricula will be developed in cooperation

with curriculum coordinators of the Mashpee and Falmouth schools and members of the Education Advisory Subcommittee.

2. College and University Program – Students will be encouraged to identify specific topics of interest and coordinate projects within the Research Program through the Reserve Manager. Information gathered will be incorporated into the Education Program where appropriate. Will also develop conditions and interest favorable for attracting internship activities within the Reserve.

3. Teacher Workshops – workshops will be provided to orient educators to estuarine concepts and the facilities available at the Reserve. Teacher workshops will be planned at the center and, possibly, as an "in service" at respective schools.

4. Volunteer and Docent Training – a volunteer program will be initiated at the Reserve to increase outreach efforts and interpretive potential.

5. Special Groups – Senior citizens, scout groups, gifted or handicapped programs, etc., often require program adjustments or special activities. The Reserve will work to meet these needs and to provide them with educational opportunities throughout the year.

6. Workshops – led by professionals in their respective fields are planned. Possible topics which will be explored include: natural ecosystems; research in the Reserve; historical, geological, ecological and economic perspectives of Waquoit Bay; wildlife and plant identification; intertidal organisms, etc.

7. Presentations – the Reserve will provide presentations, lectures, and audiovisuals of a shorter format than workshops.

8. Interpretive Field Trips – the Reserve will provide hikes for individuals and families or other groups focusing on estuarine/ecological/historical concepts. These field trips will be coordinated with DEM's Bureau of Interpretive Services.

9. Interpretive Media:

   -Interpretive Exhibits – will be developed to depict major habitats within Waquoit Bay; problems associated with estuarine health; protection mechanisms present within the Reserve; significance of estuaries; history of the Bay; etc.

   -Brochures – to be developed on an ongoing basis to describe various concepts, to identify flora and fauna, and to inform the visitor of the natural processes taking place in the Reserve. Additional brochures will be developed as the Reserve programs and facilities expand.

   -Newsletter(s) – will be designed and distributed that will include a calendar of events, illustrations, research results, and other items of note. It will be a

means for disseminating information about the Reserve programs and resources.

-Self-guided Nature Trail - will explore the establishment of nature trails on state parkland.

-Slide Show - a valuable tool for both on-site and off-site education will be developed during the first year and periodically updated.

-Library - will provide access to research results conducted on Waquoit Bay, and general information on estuarine systems.

Off-site Activities

1. Traveling Outreach Program - a mobile outreach program might be useful to gain maximum exposure for the Reserve and its activities. Contact with schools, service organizations and community groups will be provided by Reserve Manger who will present films, slide shows, lectures, and talks on the Reserve. A mobile trailer used as a "traveling classroom" has been suggested if future monies allow.

2. Special Activities - such as environmental forums or conferences will be initiated to increase awareness and support of research activities.

3. Interpretive Media:

   -Mobile Displays - will be used at conference workshops, fairs, etc. summarizing Reserve educational opportunities.

   -News Media - local and regional news media releases for newspaper, radio, and television as a source of program advertisement and public information.

4. Education Priorities

To increase awareness of the estuarine ecosystem as a valuable resource and its sensitivity to increasing environmental pressures, the Education Advisory Subcommittee sets forth the following as initial educational priorities:

1. Establishment of a Resource Center within the Reserve to include, but not be limited to, classrooms, library, and a conference room to facilitate and coordinate educational activities.

2. Identification of target populations, in addition to the ninety-one school systems located in Southeastern Massachusetts, which encompass the Southeast Regional District, state and local officials involved in coastal decision-making, etc.

3. Preparation of outreach educational materials relating to the value of the total ecosystem to overall coastal productivity; the unique qualities of Waquoit Bay in comparison to other estuaries; natural history of estuaries, etc.

5. Funding

It is intended that, to the greatest extent possible, the education program of the Reserve will be financially self-sufficient. Tuition for classes or donations for lectures and slideshows, sale of publications, memberships in a Reserve support group, grants from funding agencies, etc., can all help to defray the costs of education. It is not intended that each educational program be self-supporting, but that the program as a whole cover its costs.

6. Responsibilities

a. Reserve Manager and Staff

The Reserve Manager and staff, under the Education Program, will be responsible for the facilitation and coordination of educational activities for the Reserve. The manager is responsible for administration of the Education Program and will be the primary contact person for any questions relating to the educational activities of the Reserve, and for making any educational activity commitments for the Reserve.

b. Education Advisory Subcommittee

The Education Advisory Subcommittee shall work with the Reserve Manager to develop and define the Reserve Education Program; develop and define educational activities with various formats for presentation to varying audiences; publicize Reserve educational activities and recruit individuals and groups to use the facilities of the Reserve; and to develop sources of funding to sponsor educational activities, publications, media presentations, workshops, etc.

F. Resource Protection Program

1. Goals

Massachusetts relies, to a great extent, on regulations and their enforcement for protection of the environment. Both state and local levels of government are active in enacting laws and regulations serving to protect environmental integrity. The organization of a subcommittee devoted to discussion of existing and potential regulations relevant to the protection of Waquoit Bay is viewed as a crucial element to the successful operation of Waquoit Bay NERR. The goals of the Resource Protection Subcommittee include:

1. To increase public awareness of the significant role regulations play in protection of the resources found within the Waquoit Bay NERR.

2. To regularly assess the enforcement of regulations and restrictions applicable to existing activities taking place within the Reserve.

3. To monitor the effectiveness of existing regulations to protect environmental quality of Reserve resources, and identify needs for additional legal mechanisms.

2. Dissemination of Information

All information gathered and recommendations generated by the Resource Protection Advisory Subcommittee will be forwarded to the Reserve Manager. Workshops are planned to disseminate appropriate information to decision-makers.

3. Responsibilities

a. Reserve Manager and Staff

The Reserve Manager and staff, under the Resource Protection Program, will be responsible for the dissemination of information to the public, and where appropriate; for the review of subcommittee recommendations with acxtion taken when appropriate (ie. notification of appropriate state or local officials in the event of regulation violations, submission of new legislation where necessary, etc.)

b. Resource Protection Advisory Subcommittee

The Resource Protection Advisory Subcommittee shall work with the Reserve Manager to develop and refine the Resource Protection Program; to monitor activities taking place within the Reserve boundaries and review for compliance with existing regulations.

APPENDIX

Appendix A List of Plant and Animal Species inhabiting the Waquoit Bay NERR

Plants

1. Preliminary vegetative species list for aquatic areas within the Waquoit Bay NERR:

Algae

Green algae

- Cladaphora sp.
- Codium fragile
- Enteromopha intestinalis
- Entermopha plumosa
- Ulva lactuca

Brown algae

- Ascophylum nodosum
- Fucus spiralis
- Fucus resiculosus
- Sargarssum filipendula
- Laminaria agardhii

Red algae

- Agardhiella tenera
- Chondrus crispus
- Polysiphonia urceolata

Vascular Plants

- Zostera marina

2. Preliminary Species List - Marsh and Upland Areas

Common Name	Scientific Name	Fresh-Water Marsh	Salt-Water Marsh	Beach/ Barrier Beach	Mixed Hard-Woods	Mixed Oak/ Aspen	Pine Scrub	Pine Grass	Open	Dense Pine
Marsh Elder	Iva frutescens		x	x						
Willow	Salix sp.			x						
Saltmarsh Cordgrass	Spartina alterniflora		x							
Saltmarsh Hay	Spartina patens		x							
Freshwater Cordgrass	Spartina pectinata							x		
Broom-Beardgrass	Andropogon scoparius							x	x	
Beardgrass	Andropogon sp.							x	x	
Hairgrass	Deschampsia flexuosa						x	x	x	
Spikegrass	Distichlis spicata		x							
Dune Grass	Ammophila breviligulata			x				x	x	
Sedges	Carex sp.	x								
Rushes	Juncus sp.	x								
Cattail	Typha angustifolia, letifolia	x								
Virginia Creeper	Parthenocissus quinquefolia				x	x	x	x	x	
Common Greenbrier	Smilax rotundifolia						x	x	x	
Glaucous Greenbrier	Smilax glauca						x	x	x	
Grape	Vitis sp.					x				
Bearberry	Arctostaphylos uva-ursi			x			x	x	x	
Sphagnum Moss	Sphagnum sp.	x								
Cranberry	Vaccinium macrocarpon	x								
Sundew	Drosera rotundifolia	x								
Thread-leaved sundew	Drosera filiformis	x								
Three square sedge	Scirpus americanus	x								
Marsh fern	Dryopteris thelypteris	x								
Yarrow	Achillea millefolium						x		x	
Daisy	Chrysanthemum leucanthemum						x			
Wild Carrot	Daucus carota						x		x	
Ragweed	Ambrosia artemisifolia						x		x	
Mullien	Verbascum thapsus						x		x	
Salt Marsh Aster	Aster enuifolius						x	x		
Late Purple Aster	Aster patens						x	x		
Blazing Star	Liatris sp.						x	x		
Chicory	Cichorium intybus						x		x	

Vegetative Species List – Marsh and Upland Areas continued:

Common Name	Scientific Name	Fresh-Water Marsh	Salt-Water Marsh	Beach/ Barrier Beach	Mixed Hard-woods	Mixed Oak/ Aspen	Pine Scrub	Pine Grass	Open	Pine
Pitch Pine	Pinus rigida			x	x	x	x	x	x	x
Black Oak	Quercus velutina				x	x	x		x	x
Scarlet Oak	Quercus cocinea				x	x	x		x	
White Oak	Quercus alba	x			x		x			
Scrub Oak	Quercus ilicifolia			x	x	x	x	x	x	x
Post Oak	Quercus stellata						x		x	
Red Oak	Quercus rubra				x	x				
Red Maple	Acer rubrum	x								
Black Locust	Robinia pseudo-acacia				x					
Black Gum	Nyssa sylvatica	x								
Quaking Aspen	Populus tremuloides				x	x				
Red Cedar	Juniperus virginia						x	x	x	
Sassafras	Sassafras albidum				x					
Grey Birch	Betula populifolia				x					
Black Cherry	Prunus serotina	x			x					
Chokecherry	Prunus virginian				x		x			
Beach Plum	Prunus maritima			x				x	x	
Rose	Rosa rugosa			x						
Bayberry	Myrica pensylvanica			x			x	x	x	
Lowbush Blueberry	Vaccinium vacillans				x				x	x
Highbush Blueberry	Vaccinium corymbosum	x					x		x	x
Black Huckleberry	Gaylussacia baccata	x								
Swamp Azalea	Rododendron viscosum	x								
Pink Azalea	Rododendron nudiflorum	x								
Coast Pepperbush	Clethra alnifolia			x	x	x				
Winged Sumac	Rhus coppallina				x	x				
Staghorn Sumac	Rhus typhina				x	x				
Poison Ivy	Rhus radicans	x		x	x	x	x	x		
Winterberry	Ilex verticillata	x								
Inkberry	Ilex glabra								x	
Buckthorn	Rhamnus frangula	x								
Groundsel-tree	Baccharis halimiifolia		x	x						
No. Wild Raisin	Viburnum cassinoides	x								

Vegetative Species List - Marsh and Upland Areas continued:

Common Name	Scientific Name	Fresh-Water Marsh or swamp	Salt-Water Marsh	Beach/ Barrier Beach	Mixed Hard-woods	Oak/ Aspen	Pine Scrub	Pine Grass	Open	Pine
Starflower	Trientalis borealis				x					
Blue Flag Iris	Iris versicolor	x								
Pink Ladyslipper	Cypripedium accule				x					
St. Johnswort	Hypercum perforatum	x								
Wild Sarsaparilla	Aralia nudicaulis				x					
Canada Mayflower	Maianthemum canadense				x					x
Wintergreen	Gaultheria procumbens				x				x	x
Spotted Wintergreen	Chimaphila maculata				x				x	x
Trailing Arbutus	Epigaea repens				x					
Solomon's Seal	Polygonatum pubescens									
Indian Pipe	Monotropa uniflora				x				x	x
Sweetfern	Comptonia perearina					x	x		x	
Seaside Goldenrod	Solidago sempervirens			x			x	x	x	
Goldenrods	Solidage sp.			x			x	x	x	
Beach Peal	Lathyrus japonicus			x						
Sea Rocket	Cakile edentula			x						
Common Saltwort	Salsola Kali			x						
Seabeach Sandwort	Arenaria peploides			x						
Seaside Spurge	Euphorbia polygonifolia			x						
Dusty Miller	Artemesia stellariana			x						
Tall Wormwood	Artemesia caudata			x						
Glassworts	Salicornia europaea, bigelovii, virginica		x	x						
Sea Lavender	Limonium nashii		x							
Marsh Rosemary	Limonium Carolinianum		x							
Phrasmiter	Phragmites communis	x								
Rose Shadbush	Amelanchir canadensis	x								
Red Chokeberry	Pyrus arbitifolia	x								
Fragrant waterlily	Nymphaea odorata	x								

Animals

Shellfish

Marine invertebrates living within the Waquoit Bay NERR:

Common Name	Scientific Name
Molluscs	
Slipper Shell	Crepidula fornicata
Slipper Limpet	Crepidula plana
Common Periwinkle	Littorina littorea
Moon Snail	Lunatia heros
Soft Shelled Clam	Mya arenaria
Quahog	Mercenaria mercenaria
Ribbed Mussel	Modiolus demissus
Jingle Shell	Anomia simplex
Blood Ark	Andara osalis
Common Mussel	Mytilus edulis
Bay Scallop	Aequipecten irradians
Razor Clam	Ensis directus
Moon Snails	Polinices duplicatus
Knobbled Whelk	Busycon carica
Channeled Whelk	Busycon canalialatum
Sea Clam	Mactra solidissima
American oyster	Crassostrea virginica
Lunar dove-shell	Mitrella lunata
Thick-lipped drill	Eupleura candata
Oyster drill	Urosalpinx cinerea
Eastern Mud Snail	Nassarius obsoletus
Stimpson's surf clam	Spisula polynyma
Atlantic surf clam	Spisula solidissima
Morton's egg cockle	Laevicardium mortoni
False angel wing	Petricola pholadiformis
Gem Clam	Gemma gemma
Arthropods	
Barnacle	Balanus sp
Blue crab	Callinectes sapidus
Mole crab	Emerita talpoida
Horseshoe crab	Limulus polyphemus
Spider crab	Limulus polyphemus
Green crab	Carcinus maenas
Hermit crab	Pagurus longicarpus
Decapods	
Squid	Loligo paelci

Fish

Preliminary list of fish species taken from Waquoit Bay and its connecting waters within the Waquoit Bay NERR:

Family Clupeidae

Alosa aestivalis (Mitchill) - blueback herring
Alosa pseudoharengus (Wilson) - alewife
Brevoortia tyrannus (Latrobe) - Atlantic menhaden

Family Salmonidae

Salvelinus fontinalis (Mitchill) - brook trout

Family: Osmeridae

Osmerus mordax (Mitchill) - rainbow smelt

Family: Cyprinidae

Notemigonus crysoleucas (Mitchill) - golden shiner

Family: Catostomidae

Catostomus commersoni (Lacepede) - white sucker

Family: Anguillidae

Anguilla rostrata (LeSueur) - American eel

Family: Belonidae

Strongylura marina (Walbaum) - Atlantic needlefish

Family: Cyprinodontidae

Cyprinodon variegatus (Lacepede) - sheepshead minnow
Fundulus diaphanus (Lesueur) - banded killifish
Fundulus heteroclitus (Linnaeus) - mummichog
Fundlus majalis (Walbaum) - striped killifish
Lacania parva (Baird) - rainwater killifish

Family: Atherinidae

Menidia Beryllina (Cope) - tidewater silverside
Menidia mendidia (Linnaeus) - Atlantic silverside

Family: Gadidae

Gadus morhua (Linnaeus) - Atlantic cod
Microgadus tomcod (Walbaum) - Atlantic tomcod
Pollachius virens (Linnaeus) - pollock
Urophycis tenuis (Mitchill_ - whike hake

Family: Gasterosteidae

Apeltes quardracus (Mitchill) - fourspine stickleback
Gasterosteus aculeatus (Linnaeus) - threespine stickleback
Gasterosteus wheatlandi (Putnam) - blackspotted stickleback
Pungitius pungitius (Linnaeus) - ninespine stickleback

Family: Syngnathidae

Syngnathus fuscus (Storer) - northern pipefish

Family: Serranidae

Centropristis striata (Linnaeus) - black seabass

Family: Percichthyidae

Morone americana (Gmelin) - white perch
Morone saxatilis (Walbaum) - striped bass

Family: Percidae

Etheostoma nigrum (Rafinesque) - Johnny darter

Family: Pomatomidae

Pomatomus saltatrix (Linnaeus) - bluefish

Family: Sciaenidae

Menticirrhus saxitilis (Block and Schneider) - northern kingfish

Family: Sparidae

Stenotomus chrysops (Linnaeus) - scup

Family: Labridae

Tautoga onitus (Linnaeus) - tautog
Tautogolabrus adspersus (Walbaum) - cunner

Family: Triglidae

Prionotus carolinus (Linnaeus) - northern searobin
Prionotus evolans (Linnaeus) - striped searobin

Family: Cottidae

Myoxocephalus aenaeus (Mitchill) - grubby
Myoxocephalus octodecemspinosus (Mitchill) - longhorn sculpin

Family: Cycolpeteridae

Cycolperus lumpus (Linnaeus) - lumpfish

Family: Ammodytidae

Ammodytes americanus (Dekay) - American sand lance

Family: Pholidae

Pholis gunnellus (Li

Truly estuarine species which spend their entire lives in the estuary:

Atlantic silverside	ninespine stickleback
fourspine stickleback	northern pipefish
mummichog	oyster toadfish
rainwater killifish	sheepshead minnow
threespine stickleback	tidewater silverside
blackspotted stickleback	

Anadromous and catadromous fish species:

alewife	striped bass
American eel	white perch
rainbow smelt	blueback herring
brown trout	

Marine species which pay regular seasonal visits to the estuary usually as adults:

American sand lance	northern kingfish
Atlantic needlefish	northern puffer
striped mullet	northern searobin
grubby	striped searobin
longhorn sculpin	summer flounder
	scup

Marine species which use the estuary primarily as a nursery ground usually spawning and spending much of their adult life at sea, but ofter returning seasonally to the estuary:

Atlantic menhaden	tautog
atlantic tomcod	white hake
cunner	winter flounder

Adventitious visitors, which appear irregularly and have no apparent estuarine requirements:

Atlantic cod	lumpfish
black seabass	pollock
bluefish	rock gunnel

Birds

A preliminary listing of bird species found within the Waquoit Bay NERR:

Common Loon	Merganser species
Red throated Loon	Hawks
Various varieties of Grebes	Bob-White Quail
Sheerwater Species	Pheasant
American Egret	Plover species
Green Heron	Ruddy Turnstone

Black Crowned Night Heron	Sandpiper species
American Bittern	Yellow legs
Mute Swan	Owls, various species
Common Canade Goose	Flickers
American Brant	Gulls, various species
Mallard and Black Ducks	Song birds
Baldpate Duck	Whip-Poor-will
Green and Blue-Winged Teal	Catbird
Greater and Lesser Scaup	Blackbird
Golden Eye Duck	Yellow Warbler
Buffle-head Duck	Common Yellow throat
Scoter species	Eider

A checklist of Massachusetts breeding birds in the Waquoit Bay NERR vicinity:*

Species	Code	Species	Code
Green Heron	PRobable	Eastern Kingbird	PO
Snowy Egret	COnfirmed	Horned Lark	CO
Mute Swan	POssible	Tree Swallow	PR
Canade Goose	CO	Barn Swallow	PR
Mallard	CO	Blue Jay	CO
Black Duck	CO	Common Crow	CO
Osprey	PR	Black-capped Chickadee	CO
Ruffed Grouse	PO	White-breasted Nuthatch	PO
Bobwhite	CO	Brown Creeper	PO
Ring-neck Pheasant	PR	Grey Catbird	CO
Piping Plover	CO	Brown Thrasher	PO
Killdeer	PO	American Robin	CO
Spotted Sandpiper	CO	Eastern Bluebird	PO
Great Black-backed Gull	PO	Starling	CO
Herring Gull	PO	Common Yellowthroat	PR
Laughing Gull	PO	House Sparrow	CO
Common Tern	CO	Red-winged Blackbird	CO
Least Tern	CO	Northern Oriole	CO
Rock Dove	CO	Common Grackle	PR
Mourning Dove	CO	Brown-headed Cowbird	PR
Whip-poor-will	PO	Cardinal	PO
Belted Kingfisher	PR	Purple Finch	PO
Common Flicker	CO	House Finch	CO
Downy Woodpecker	PO	American Goldfinch	PR
Savannah Sparrow	CO	Rufous-sided Towhee	CO

* "Massachusetts Breeding Bird Atlas Project", Massachusetts Audubon Society, (unpublished).

Mammals

A preliminary listing of mammal species found within the Waquoit Bay NERR:

Various Species of Moles
Shrews
Bats
Skunk
Red Fox
Red and Gray Squirrels
Chipmunk
Muskrat
Cotton tail rabbit
Deer
Racoon
Woodchuck

Rare, Threatened, or Endangered Species

Rare, endangered, or threatened species noted in the Waquoit Bay NERR:

RARE PLANT SPECIES*

Name	Common Name	Mass. status	Federal Status
Agalinis acuta	Sandplain gerardia	Critically endangered throughout range	Considered for listing as Endangered under ESA, (Category 1).
Heliathemum dumosum	Bushy Rockrose	Threatened throughout range	Considered for listing as Threatened under ESA, (Category 2).
Asclepias tuberosa	Butterfly Weed	Apparently secure in state and range.1	
Spiranthes tuberosa	Little Ladies' Tresses	Apparently secure in state throughout range. 1	

1. Recently removed from Division of Fisheries & Wildlife Rare Plant List.

* Source: Massachusetts Natural Heritage Program, Department of Fisheries Wildlife and Environmental Law Enforcememt, 1984.

RARE ANIMAL SPECIES

Acipenser brevirostrum2	Shortnose Sturgeon	Proposed for listing as Endangered.3	Listed as Endangered under ESA.
Sterna antillarum	Least Tern	Proposed for listing as Threatened.3	
Charadrius melodus	Piping Plover	Threatened throughout range	Considered for listing as Threatened under ESA, (Category 2).
Malaclemys terrapin	Northern Diamond-back terrapin	Proposed for listing as a Species of Special Concern3	

2. Historical occurrence (last verified before 1978).

3. Division of Fisheries & Wildlife Rare Animal List currently under revision.

Appendix B Agreement as to use of South Cape Beach between the Department of Environmental Management and the town of Mashpee

AMENDED AGREEMENT

Agreement entered into this 29 day of June in the year 1981, by and between the Town of Mashpee and the Commonwealth of Massachusetts acting through the Commissioner of the Department of Environmental Management (DEM) pursuant to Chapter 1058 of the Acts of 1971, as amended whereby DEM is authorized to acquire by gift, purchase or eminent domain South Cape Beach in the Town of Mashpee.

WHEREAS, the aforementioned parties entered into an agreement dated September 22, 1980 by substituting in its entirety therefor this Amended Agreement and all the provisions, covenants, and condition wherein contained.

IN CONSIDERATION OF the mutual covenants herein contained and expressed and for other good and valuable consideration the parties mutually covenant and agree as follows:

(1) That development and use of the park shall be limited to bathing, sunning, hiking, fishing, nature interpretation, non-motorized biking, and associated passive enjoyment through recreational use consistent with the fragile ecology of the site, which shall expressly exclude overnight camping, and private vehicles, except only as provided for in paragraph (4) below. Any proposed recreational use not specified in this paragraph shall first be submitted to South Cape Beach Advisory Committee for it review and recommendation.

(2) That all park facilities will be designed, sited and maintained so that they do not harm the natural and scenic qualities of the area. The Executive Order for Barrier Beaches of Governor Edward J. King signed August 8, 1980, (attached as "Exhibit A") shall be incorporated by reference into this Agreement and the Department will undertake to enforce all its provisions throughout the area designated as South Cape Beach State Park

(3) That the Department will manage the fragile wetland, dune and upland areas of the site to prevent erosion and to preserve critical habitat and the area's natural scenic qualities. Local ordinance and bylaws now effective will be incorporated into and made part of the park's rules and regulations and shall govern and control, provided no legal conflict exists. No park rule or regulation will permit an activity or use otherwise prohibited by the rules, regulations and bylaws of the Town of Mashpee in existence as of the date of execution of this Agreement.

(4) That the Department may allow vehicle access to designated service roads for the sole pupose of access to fishing areas to persons over sixty years of age, those suffering from ambulatory disabilities, or holding disabled veteran status. Said access shall be by permit only, restricted to a maximum of six vehicles at any one time, and such travel shall be allowed only between the hours of sunset and sunrise. Such vehicles shall be limited to designated ways and shall in no circumstances be driven off the designated route onto sand or other unimproved terrain or used for overnight stays. Any violations of the permit provisions shall, upon finding of violation by the South Cape Advisory Committee, cause the revocation of said permits.

In the event the above provisions are deemed discriminatory under the law, such use of vehicles shall be prohibited altogether. In no event, and under no circumstance shall there ever be an increase in said vehicle use above the 6 maximum herein provided for.

(5) That parking shall be limited to several landscaped sites, with a total maximum capacity of no more than 400 vehicles. Buses will be allowed by permit only. Such parking areas shall be finished with a permeable or semi-permeable material acceptable to the South Cape Beach Advisory Committee. The parking area shall be, if at all feasible, on land purchased in fee by the Department. Failing the reaching of agreement for such negotiated purchase, the Department will exercise rights available for taking by eminent domain. In any event and however acquired the Department will promptly initiate and expeditiously support legislation which will authorize the Department to deed, subject to conservation and other restrictions contained herein, said land to the Town of Mashpee for a nominal consideration of one dollar; and the Town, covenants, in turn, that it shall promptly execute a renewable lease to the Department for a period of 99 years for a nominal consideration of one dollar, said land, which lease shall contain a right to re-entry for breach of any one of the covenants and conditions contained herein. It is expressly covenanted and agreed that no other land within the park other than that specifically designated and identified in accordance with these provisions will be used as a parking area or for purposes of public parking.

(6) All Town owned land acquired by the Department will be acquired by Deed of the Town conveying the subject land in fee simple.

(7) Any land in private ownership purchased by the Department for parking purposes shall be subject to a restriction limiting use to the Department to 400 cars; and all the other condition contained in this Agreement.

(8) The Department shall be responsible for a management system for traffic control on Great Oak Road and its point of intersection with other roads leading into the Park, to insure orderly traffic.

(9) The acquistion by the Commonwealth of 432 acres, more or less, is an express condition precedent to the legal existence of this Agreement. In the event that the acquistion by the state is less than 432 acres, this Agreement may, at the exclusive option of the Town of Mashpee, be terminated and declared void. The parcel of land to be acquired is the Southerly portion of the the Town of Mashpee, bounded on the West by Waquoit Bay, on the South by Nantucket Sound, and on the East by Great Flat Pond.

(10) That primary effort shall be made by the Department to negotiate purchase of the aforementioned privately owned lands.

(11) That recognizing the possibility that all such privately owned lands within the proposed boundaries of the Park may not be able to be acquired through negotiated purchase, the Department will consider the exercise of its power of eminent domain.

(12) That any specific taking by eminent domain would be considered only when efforts for a negotiated purchase have failed despite due diligence by the Department to reach a settlement; or when title to the land in question is of such unmarketability that remedial title action would be impractical.

(13) That the Mashpee Board of Selectmen will grant the Department eminent domain authority by appropriate vote for the purpose of acquisition of the proposed South Cape Beach State Park.

(14) That as a result of the proposed development of the Park, it may be necessary for the Department to acquire all municipally owned lands within the proposed boundaries of the Park. These lands include the existing town beach, a portion of Great Oak Road and other isolated parcels standing in the name of the Town of Mashpee.

(15) That such acquisition of town owned lands would be in the form of land exchange in which the Town would received from the Commonwealth land of equal value adjacent to the existing town beach. In conjunction with any exchange, the Department will make improvements to Great Oak Road, from its intersection with Red Brook Road all the way to the Beach. In addition, the Department will assume costs associated with the relocation of the town beach, including the cost of a new access road, parking areas and necessary fencing and other essential improvements. Said town beach will be to the east of the state beach in the area of Great Flat Pond and shall consist of approximately 30 acres and shall have an ocean frontage of approximately 1700 linear feet. (Map attached and incorporated by reference "Exhibit B").

(16) That the town regards as recreation/conservation lands, all properties which may be transferred to the Department in any land exchange in conjunction with the establishment of the Park.

(17) That the Department will reserve a suitable site on Great River, Waquoit Bay for future use and development by the Town of Mashpee for construction for a boat launch/pier facility, the metes and bounds to be mutually agreed upon by the Town of Mashpee and the Department. The area, or site, is to be no less than 10 acres with access to and from Wills Work Road. The Department will construct an improved access road to said facility and will seek on behalf of the Town of Mashpee such state funds that are available for municipal boat launching facilities. In furtherance of the above, the Department will initiate and support legislation transferring title of said site to the Town of Mashpee. In the event such legislation fails of passage, the Department will lease such land to the Town of Mashpee for a period of ninety-nine years for nominal consideration of one dollar.

(18) That the Department shall at all times continue to recognize a South Cape Beach State Park Advisory Committee comprised of eleven (11) voting members and four (4) ex-officio, non-voting members. The voting membership of the Committee shall consist of the following eight (8) residents of or representatives for the Town to be appointed by the Board of Selectmen of the Town, and one (1) resident of or representative for the Town of Sandwich,

Falmouth, and Barnstable to be appointed by those respective Boards of Selectmen. The non-voting membership of the Committee shall consist of one (1) representative each from the Office of Coastal Zone Management and the Department of Fisheries, Wildlife and Recreational Vehicles to be appointed by their respective agency heads, together with the sitting State Representative of the Third Barnstable Representative District and the State Senator from the Cape and Islands Senatorial District. All succeeding members shall be appointed in the same manner as stated above. The terms of all voting members shall be (3) years.

(19) That the Committee shall continue to be responsible for making recommendations to the Department on such matters to include, but not be limited to, park management and operations, rules and regulations, design and plan review. The Department, when possible, shall submit to the Committee for review all architectural and design plans and construction plans for facilities including structures roadways, and parking areas in an effort to accomplish the project. The Department will include a clause in the project's design contracts providing for periodic review by the Committee during the duration of the contract. The provisions of this agreement shall not be amended or changed without the express consent in writing of all parties thereto, except as otherwise provided for in paragraph 20 below. Except as provided for in such amendments this agreement shall be for a term of ninety nine (99) years. The parties agree to renew those provisions contained herein which otherwise expire by operation of law.

(20) The passage of legislation, by the General Court of the Commonwealth, incorporating and adopting all the terms, provisions, conditions and restrictions contained in this Agreement shall be an express condition precedent to the legal existence and enforceability of this Agreement, to the contemplated transfer of Town owned land to the Department and to the Authority for Acquisition of land to be granted by the Board of Selectmen of the Town of Mashpee. In the event that all the terms, provisions, conditions and restrictions are not incorporated and adopted into legislation, the Town, at its sole option, may elect to terminate this Agreement, or in the alternative amend this Agreement to conform to the legislation as enacted, in which event the Agreement, as amended, shall be binding upon all the parties thereto.

(21) The acceptance of Deeds by the Department to Town owned lands shall not be deemed, and in fact shall not be legally construed to be a full performance and discharge of the terms, conditions, provisions and restrictions of this Agreement; rather, it is expressly agreed and understood that this Agreement and all its terms, conditions, provisions and restrictions shall survive the delivery of Deeds, and shall thereafter be fully enforceable in all aspects thereof.

(22) It is expressly agreed that the terms, conditions, provision and restrictions herein contained shall be specifically enforceable, in law or equity, by a Court of competent jurisdiction, and that standing in any action shall be given to the Town of Mashpee or to any ten (10) citizens domiciled in the Commonwealth of Massachusetts.

CERTIFICATE OF VOTE

At a meeting of the Board of Selectmen of the Town of Mashpee, Barnstable County, in the Commonwealth of Massachusetts, said meeting being held on July 15, 1981, having been duly called and a quorom being present and voting, upon motion duly made and seconded, it was,

VOTED: That the Commissioner of Environmental Management be, and is hereby authorized, pursuant to the provisions of Chapter 132A, Sections 3 and 3A of the General Laws, and Chapter 1058 of the Acts of 1971 as amended to acquire by eminent domain all that land as shown on a two sheet plan entitled, "Plan of Land-South Cape Beach - Mashpee, Mass. - prepared for Dept. of Environmental Management - Scale 1" = 200' Feb. 16, 1976 - Briggs Engineering & Testing Co.", on file with said Department, provided however, that no land owned by the Town of Mashpee shall be taken. The approval and vote hereunder is expressly subject to and conditional upon the full performance and compliance by both the Commonwealth of Massachusetts and the Department of Environmental Management of the terms, promises, covenants and conditions all of which are included and incorporated into a written agreement entitle "Amended Agreement" dated June 29, 1981 between the Town of Mashpee and the Commonwealth of Massachusetts acting through the Commissioner of the Department of Environmental Management, a copy of which agreement is attached hereto, incorporated and made part of the Certificate of Vote; the approval and vote hereunder is also expressly conditional upon the passage of Legislation by the General Court of the Commonwealth incorporating and adopting all the terms, provisions, conditions and restrictions contained in the agreement dated June 29, 1981. The Board of Selectmen reserve to itself the unconditional right to rescind and cancel the within vote for breach of any of the conditions above stated.

(Signed by Mashpee Board of Selectmen)

Conservation & Recreational Uses

CARRYING CAPACITY

The Relative Carrying Capacity Map measures the ability of the island's natural environment to absorb future recreational use without being damaged. Some areas on Washburn Island have a high capacity to absorb future recreational activity while others would be severely impacted by only a slight increase in use. A sound master plan for the island's future should be based on a good understanding of the site's carrying capacity in order to assign future activities to the most appropriate locations.

Certain portions of the dense pitch pine forests in the island's interior appear to be most tolerant and amenable to recreational use. These areas have been given a "high" carrying capacity rating on the map. Though fire danger is a problem in these areas, the pitch pine forests with hardy grass and shrub understory could support carefully planned passive recreation without significantly losing their present quality. Some possible future improvements include a comfort station, dispersed camping areas and pedestrian trails. These uses would be screened by the dense, absorptive pine forest, which is more resistant to erosion and visual degradation than the more open areas on the island. The high carrying capacity areas within the pine forests are also well above dangerous flood and velocity zones, and are located away from the important visual and envi-

ronmental zones located earlier in this report. This zone of high carrying capacity would logically be the center of future development use of the island. Areas of "moderately high" carrying capacity generally occur in the pitch pine forests as well, though these zones contain a more fragile and scenic herb understory. Past fires have often occurred in this portion of the forest, so particular care should be taken here to avoid fire hazards. The moderately high carrying capacity zone could support hiking, nature study, some carefully controlled camping, and perhaps a few well-sited structures. Future users of the island could be encouraged to travel from their arrival in the high carrying capacity zone through this moderately high carrying capacity zone on their way to the more fragile areas of Washburn Island. In this manner, intensity of use would be gradually dispersed from the durable central upland portions of the island to the sensitive barrier beaches and marshes to the south. This would result in only limited, dispersed use of fragile outlying zones such as the dunes and salt marshes, while high capacity areas would become the focus of major trails and activities.

The "moderate" carrying capacity zone, generally covering the northern and central shores of the island, could support carefully controlled seasonal uses such as bathing, hiking trails and nature study areas. More intensive development would be prohibited here, though the arrival dock would of necessity be located at some point along the shore. The weakest link in the ability of this zone to absorb future uses consists of the highly erodable coastal banks and fringing salt marshes. Pedestrian traffic in these areas will have to be confined to established trails and, where necessary, to constructed stairs and boardwalks.

The "low-moderate" carrying capacity zone, located primarily in the southern portion of the island, consists of fragile dune and salt marsh vegetation presently preserved in wild, untouched expanses of seashore. Excessive use of this zone, possible with even a few as three hundred visitors a day, could drastically alter the primitive and untrammelled quality of this area. Access to this area by large groups of people should therefore not be actively encouraged. Major access points to the island should be located well away from this zone, and pedestrian paths leading to it should be carefully designed to keep visitors away from the most critically sensitive areas. Strict and enforcable criteria for future use should be prepared in order to allow for its future enjoyment by as many people as it will reasonably support. This open, treeless area is especially vulnerable to visual intrusions.

Finally, areas of "low" carrying capacity - primarily the salt marshes - should be restricted from most future uses. These areas can support only occasional pedestrian access. Sustained traffic in the marshes would quickly result in the death of salt marsh grasses and the rapid erosion of the soft, peaty soils. The flat, open salt marshes are the most visually sensitive zones on the island.

THE MASTER PLAN

The Preliminary Master Plan for Washburn Island directly responds to the implications in the Regional Context and Site Analysis portions of this report. The Waquoit Bay area is becoming increasingly developed, especially the land directly on the coast. Reserving Washburn Island for recreation and conservation is fundamental in helping to preserve the region's environmental vitality and marine resource values.

This report recommends that Washburn Island be allowed to remain largely in its present state. Minor improvements will allow the island to absorb limited recreational use by local residents and a limited number of visitors. Proposed uses have been carefully planned to respect the island's natural resources and physical carrying capacity. Priority has been placed on maintaining the current environmental and visual quality, rather than accomodating large numbers of visitors.

The property should be managed in conjunction with South Cape Beach across the Bay. South Cape Beach provides a beach front park with easy access by car, and will be designed to accomodate parking for up to 400 vehicles. Washburn Island, on the other hand, will be managed for more limited use, primarily passive recreation such as hiking, nature study, etc. Access to the island will be by private boat from So. Cape Beach. Wooden docks on the east and west side of the island would be built to accommodate boat traffic to the site. Here, a small interpretive display of maps and information will greet the visitor, and from here trails lead out to the north and south portions of the island. A few private boats could also be allowed to dock. From the beach, access up the side of the island would be through an area previously graded by the military.

Possible tent camping is located in the plan on the island's eastern side. This location is accessible to the landing point while being isolated from the development to the west, and is on a more durable portion of the land. The main comfort station is located between the camping area and the main access point. The desireability of allowing limited camping on the site will have to be looked into carefully before making a final decision.

The proposed trail system utilizes the old main road as the western north-south trail. Cross trails are provided to a similar trail along the east side of the island through the upland forests. The system is layed out to minimize impact and yet bring visitors into contact with a variety of landscapes. People will be directed by the trails to cross the zones of low carrying capacity around the main salt marsh to the south by using either the western old-road route, or hard sand and a raised boardwalk on the eastern side of the marsh.

A few overlook structures are carefully located to take advantage of good views and interpretive features. Unsupervised swimming will be allowed on the major south-facing beach, and fishing can take place at the mouth of Eel Pond and Waquoit Bay. A carry on/carry off trash policy would be in effect.

Least Terns have been observed nesting on the barrier beach in the southern portion of Washburn Island. In order to protect this significant island resident, portions of the beach should be closed during the mid-summer nesting season. Boardwalk design and location should facilitate this protective management activity.

PARK MANAGEMENT

If Washburn Island is acquired by DEM in the near future, the Department proposes to staff the island with volunteer "island managers" during the summer season of 1983. The island manager system, used successfully for several years in the Boston Harbor Islands, allows environmental interns to staff an

island 24 hours a day, providing guidance, maintenance and site supervision around the clock. The island managers, usually college students majoring in environmental or recreation fields, would be supervised by full-time DEM staff based at South Cape Beach State Park.

Permanent staffing of Washburn Island would begin in the summer of 1984. Estimated permanent staff would include one seasonal park supervisor, two seasonal interpreters and two seasonal skilled conservation helpers. These positions would be filled during the peak season (May through September) with wintertime supervision provided by full-time staff based at South Cape Beach.

SUMMARY

Washburn Island is a property of unique environmental, scenic and recreational value. Its protection from rapidly increasing development pressures is of major concern to the Commonwealth of Massachusetts.

This report has described Washburn Island's resources in detail, and has proposed preliminary plans for the preservation of the island. Because environmental protection is the primary concern, control of visitor access to, and use of, the island is of key importance. The Washburn Island master plan has accommodated this need to maintain remoteness and to minimize disturbance of the site while providing for a certain amount of controlled public access. Visitor numbers on the island will be regulated by the low volume of boat traffic reaching the site from the mainland. Access to the island will be encouraged at the designated landings in the central portion of the site, so the more fragile southern portions will receive proportion-

ately fewer users. Structures and associated development will be limited and inconspicuously sited. An emphasis will be placed instead on the interpretation and enjoyment of a natural, remote and undisturbed environment, cluttered with as few buildings as possible.

Since Washburn Island's abandonment by the military at the end of World War II, natural processes have been working to reclaim the landscape. This report proposes a master plan and management policy for the site that will encourage this process of natural reclamation to continue. The island, now an invaluable assett, will continue to appreciate in scenic, environmental and recreational value in future years if given the opportunity.

Appendix D Area of Critical Environmental Concern (ACEC) designation

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, Massachusetts 02202

EDWARD J. KING
GOVERNOR

JOHN A. BEWICK
SECRETARY

Designation of Waquoit Bay as an
Area of Critical Environmental Concern
and Supporting Findings

Following an extensive process, including nomination, research, informal meetings with local groups, public informational meetings, public hearings, on-site visits, and a formal evaluation of all assembled data, I, the Secretary of Environmental Affairs, hereby designate Waquoit Bay an Area of Critical Environmental Concern pursuant to the authority granted to me by G.L. c. 21A, s. 2(7).

I also hereby, find that the Waquoit Bay ACEC is significant to flood control, the prevention of storm damage, the protection of land containing shellfish and fisheries; public interests protected by the Wetlands Protection Act, G.L. c. 131, §40.

1. Boundary of the Waquoit Bay ACEC

The Area of Critical Environmental Concern (ACEC) extends from the extreme southwestern end of Dead Neck barrier beach (mean low water, MLW) and extends straight across the entrance channel to Waquoit Bay by the shortest distance to the mean low water line of the western side of the entrance channel. The ACEC boundary then follows the MLW line in a westerly direction (excluding the western jetty of the Waquoit Bay entrance channel) to a point approximately 1370 feet (straight line measure) from the westernmost tip of Washburn Island. This point falls on a line perpendicular to the MLW line of Vineyard Sound and tangent to a segment of shoreline which is both the southeast MLW shoreline of Eel Pond and a western edge of Washburn Island.

The ACEC boundary then follows that perpendicular line to the intersection with the western MLW shore of Washburn Island. The boundary follows the MLW line along the Washburn Island to its extreme northeastern point. The boundary then extends from this point north into Waquoit Bay by the shortest distance to the 6 foot depth curve (datum: MLW). The boundary follows the 6 foot depth curve in a northerly direction to the point of intersection with a true azimuth bearing line of 150°, drawn from the southwestern most point of shoreline of the un-named pond east of Seapit Road. From this point of intersection the ACEC boundary then follows this above-mentioned bearing line in a northwesterly direction to the southwestern most point of shoreline of the un-named pond east of Seapit Road and continues along an extension of this straight line to the intersection with the 100 year flood boundary still east of Seapit Road.

The ACEC boundary then follows the 100 year flood boundary in a generally easterly direction including all of Bourne Pond, Bog Pond, Caleb Pond, parts of the Quashnet River and Red Brook and all of Witch Pond, Fells Pond, and Jehu Pond. At the point of the fifth intersection of the 100 year flood boundary with Great Oak Road, the ACEC boundary extends west on the northern side line of Great Oak Road across the 10 foot contour line (datum: mean sea level) to the second intersection with the 10 foot contour line (MSL). The ACEC boundary extends from this point in a northwesterly direction along the 10 foot contour line (MSL) to the point closest to the eastern shore (MLW) of the Great River. From this point the line extends by the shortest distance to the eastern shore (MLW) of the Great River. The boundary then extends in a northerly direction along the eastern shore (MLW) of the Great River to the western most point of the entrance channel to Jehu Pond. The boundary then extends due west to the MLW line on the west side of Great River and following the MLW line northward to the boundary between Monomoscoy Island and the adjacent northerly salt marsh. The boundary follows a northwesterly trend along the southern edge of this salt marsh, crosses Monomoscoy Road, and continues along the southern edge of this salt marsh to the intersection with the MLW line on the eastern side of Hamblin Pond. The boundary continues in a southerly direction along the MLW line on the east side of Hamblin Pond, across the northern channel entrance of the Little River and continues along the MLW line on the northern edge of Seconsett Island to the intersection of the MLW line and the town boundary between Falmouth and Mashpee. The ACEC boundary follows the town boundary to the intersection with the MLW line on the eastern shore of Waquoit Bay. The ACEC boundary extends from this point in a southerly direction along the MLW line, around Seconsett Island and then in a northerly direction to the point of intersection (Point A) with a true azimuth bearing line of 290°, drawn from the point (Point B) along the MLW line on the eastern shore of the Great River which is also the northernmost point (Point B) of property along the MLW line on the eastern shore of the Great River as described in the Plan of Land, South Cape Beach, Mashpee, Mass., prepared for the Department of Environmental Management, Scale 1"=200', February 16, 1976, Briggs Engineering and Testing Co., Inc., Norwell, Mass., as revised March 31, 1976. The ACEC boundary then proceeds southeasterly from Point A along the previously described true azimuth bearing line of 290° to Point B and continues in an easterly direction along the northern boundary line of said Plan of Land for South Cape Beach to the intersection with the southern side line of Wills Work Road. The ACEC boundary follows the southerly side line of said Road to the intersection with Great Oak Road and then follows the southerly side line of Great Oak Road to the intersection with 100 year flood boundary. The ACEC boundary follows the 100 year flood boundary in a northeasterly direction to the intersection of the southerly side line of Great Oak Road. The ACEC boundary then follows the southerly side line of said Road to the next intersection with the 100 year flood boundary. From this point, the ACEC boundary follows the 100 year flood boundary in a southerly direction to the southernmost extent of the 100 year flood boundary in Mashpee. The boundary then extends due south in a straight line to the MLW line of Vineyard Sount and thence in a westerly direction along the MLW line along South Cape Beach to the point of origin.

Also included within the ACEC boundary is the land along the upper reaches of the Child's River. The ACEC boundary begins at the intersection of the northerly side line of Rt. 28 and the 100 year flood boundary on the eastern side of the Childs River. The ACEC boundary proceeds northerly along the 100 year flood boundary on the eastern side of the Childs River to the point where the 100 year flood boundary crosses in a westerly direction the Childs River. The ACEC boundary then follows the 100 year flood boundary on the western side of the Childs River in a southerly direction to the point of intersection with the northern side line of Rt. 28. The ACEC boundary then proceeds from this point in an easterly direction across the Childs River to the point of origin.

Within the boundary the following exclusions exist:

1) The existing Waquoit Bay navigational channel (6 foot depth, Mean Low Water) extending in a northerly direction from the entrance jetties of Waquoit Bay to the head of Waquoit Bay. Specifically, this measn the channel delineated by existing U.S. Coast Guard buoys (See National Oceanic and Atmospheric Administration, nautical chart #13229, 15th Ad., February 3, 1979, page C, Waquoit Bay and U.S. Coast Guard navigational buoys). Where the channel is unmarked by buoys, the west channel boundary will be delineated by a straight line drawn from buoy C-7 northerly to the western edge of Bourne Pond. This channel would extend no further than 100 feet to the east of the west channel boundary and not exceed a dredged depth of 6 feet below mean low water. This channel will extend no further north than the present Falmouth town landing (near Seapit Road).

2) The existing Seconsett navigational channel extending from U.S. Coast Guard buoy N-6 (see NOAA nautical chart #13229, 15th Ad., February 3, 1979, page C, Waquoit Bay and U.S. Coast Coast navigational buoys) to the entrance of the Great and Little Rivers, Mashpee. The southern boundary of the Seconsett channel extends from buoy N-6, southeasterly in a direct line not to extend beyond Seconsett point. The width of the Seconsett channel will not exceed 100 feet from the southern boundary line. The Seconsett channel will not exceed a dredged depth of 6 feet below MLW.

3) The existing small culvert beneath Monomoscoy Road, Mashpee.

II. Designation of the Resources of Waquoit Bay

Waquoit Bay area is an extensive and largely unaltered resource system. Among the natural components of the system are many specified as Significant Resource Areas (SRA's) in the Massachusetts CZM Program. These include a long barrier beach system, dunes and sandy beaches, many acres of salt marsh, productive shellfish beds, a large estuary, anadromous fish runs and floodplain, erosion and accretion areas. The area is a spawning and nursery ground for many marine species, as well as an important habitat for upland species and waterfowl. The beaches, dunes, and salt marshes provide protection against storms for low-lying inland areas. The region clearly meets the regulatory criterion of the ACEC Program, that a region proposed for designation must contain at least five of the specified Significant Resource Areas.

III. Procedures Leading to ACEC Designation

The Waquoit Bay Area was first proposed for ACEC consideration by local citizens at a CZM planning meeting over two years ago. Active planning commenced in March 1979. Meetings on May 3, May 24, and August 2 were held in Falmouth and Mashpee and attended by local officials and local planning boards, committee members, owners of the area's three marinas and some property owners.

On August 2 a proposed boundary was unanimously endorsed by the six officials and marina owners present at this meeting. On July 9, 1979, a letter nominating the Waquoit Bay Estuarine System as an Area of Critical Enviornmental Concern was submitted by the Selectmen, Conservation Commission and Waterways Committee/ Harbormaster of the Towns of Falmouth and Mashpee. After reviewing this nomination, the Secretary of Environmental Affairs decided, on August 21, 1979 to proceed with a full review of the proposed area.

Notice of the receipt of the nomination request and a public hearing notice were published in the Environmental Monitor on August 22, 1979. The public hearing notice also appeared in two local newspapers: The Cape Cod Times and The Falmouth Enterprise. Additional information on the region was collected by the Coastal Zone Management office staff in consultation with local officials, town boards and natural resource officers. The results of this research were forwarded for comment and review to the Selectmen, Conservation Commissions, Planning Boards, Waterways Committee, and Natural Resource Officers and members of the CZM Citizen Advisory Council for Cape Cod. Copies also went to interested individuals and were available to the general public upon request. Informational articles about the proposed nomination appeared in the local newspaper. A final informational meeting was held at Mashpee Town Hall on August 30, 1979.

A public hearing was conducted on September 27, 1979 in the Falmouth Town Hall. The recorded testimony was largely favorable and an informal vote was 50-3 in favor of the designation. As the result of a number of concerns raised at this meeting, on-site visits were also arranged. On October 19, eighteen citizens and officials toured Waquoit Bay by boat following existing main navigational channels. In addition, CZM staff conducted site visits with individual landowners who had concerns.

A second public hearing was scheduled for October 25, 1979. A public hearing notice was published in the Environmental Monitor on October 22, 1979. The public hearing notice also appeared in the Cape Cod Times and The Falmouth Enterprise.

The hearing record remained open until November 7, 1979 for those persons who wished to submit written comments. After careful consideration of all public comments, final boundary modifications were defined.

IV. Discussion of Factors Specified in Section 6.48 of the CZM Program Regulations

Prior to designation of a region as an Area of Critical Environmental Concern, the Secretary must consider the factors specified in Section 6.48 of the CZM Program regulations. Based on research and information from local residents, I find that the following factors are applicable to the Waquoit Bay Barrier Beach System.

Quality of Natural Characteristics: This estuarine system is a relatively large unaltered physical and biological resource. Its unpolluted water attracts a wide range of finfish species and nurtures large numbers of shellfish. The undeveloped stretches of Washburn Island and Dead Neck accommodate contiguous environments of beach, dune, marsh, and low wooded hills. Minimum alteration of the natural features of this area will allow them to function at their maximum capacity. These undeveloped expanses also contribute significantly to the scenic beauty enjoyed by users of the area.

Public Health: The high water quality currently existing supports many important activities, including swimming, boating, fishing and shellfishing. Clean water must be maintained to ensure the safety of the recreational users of the area. Activities that would degrade water quality would have both environmental and economic consequences. The barrier beach formed by Washburn Island and Dead Neck acts as a natural storm buffer to protect the property of shore dwellers within the system. Development of this barrier would impair its natural form and protective function.

Uniqueness: An estuary, where fresh water inflow meets and mixes with salt water, is the most significant of all coastal features in the amount and variety of biological production. The largely unaltered Waquoit Bay estuarine system makes this area both a highly significant and uncommon feature of the Massachusetts coast. The availability of nutrients supports a great number and variety of species. These conditions provide excellent opportunities for scientific research. In a study conducted in the late 1960's, the Massachusetts Division of Marine Fisheries determined that of nine sample estuaries in the state, Waquoit Bay supported the greatest diversity of estuarine-associated fin-fish. Currently, a biologist from the Woods Hole Oceanographic Institution is studying the genetics and distribution of quahogs in the estuary.

Productivity: The region contains diverse and viable populations of fish, shellfish and waterfowl. The biological productivity of this area is sustained by its ponds and salt marshes which contribute large quantities of nutrients to the coastal food chain.

Imminence of Threat to the Resource: Alterations which could severely impact the natural functions or reduce productivity of the components of the Waquoit Bay system have been considered for the area. The ACEC designation would focus attention on the area's significant environmental and economic resources, and would serve as a guide regarding future activity in the area.

Irreversibility of Impact: Because the estuary has only limited access to the open Sound through the narrow cuts at the east end of Washburn Island, the entire basin is susceptible to inadequate flushing. The discharge of pollutants into this system would tend to remain concentrated rather than to disperse. As a result, impacts on shellfish and finfish could be severe, thereby damaging an important economic resource of the Waquoit basin. Other habitat alterations such as filling or removal could also severely affect sensitive spawning or nursery areas, thereby decreasing the abundance of valuable commercial, recreational, and aesthetic resources.

Economic Benefits: This ACEC brings significant income to Falmouth and Mashpee through tourists and area residents who purchase shellfish permits, the use of area services such as boatyards, and the wholesale trade in shellfish. Any alteration in the area that threatens to disrupt its utilization and/or attractiveness carries a potentially detrimental economic impact. Damage to the groundwater is also an important consideration because the shore-dwellers depend on private groundwells for their fresh water supply.

Supporting Factors: Residents, business persons and other users of the ACEC agree that the area carries environmental importance, economic utility and aesthetic qualities. Groups at many levels, including local residents, town authorities and state administrative agencies, have voiced their concern about the need to preserve the undeveloped portions, particularly Washburn Island and South Cape Beach.

John A. Bewick
Secretary of Environmental Affairs

11/26/79
Date

MEMORANDUM OF UNDERSTANDING

BETWEEN

THE DEPARTMENT OF ENVIRONMENTAL MANAGEMENT AND THE

THE OFFICE OF COASTAL ZONE MANAGEMENT

CONCERNING THE

WAQUOIT BAY NATIONAL ESTUARINE RESEARCH RESERVE

Waquoit Bay is a major estuarine system located on the south shore of Cape Cod in the towns of Falmouth and Mashpee. The Bay is a shallow, highly productive ecosystem located in a rapidly developing area of Massachusetts. The abundant fish and wildlife resources, and the clean water of this Bay are important values to preserve for their environmental, scientific, economic, and aesthetic significance. The designation of Waquoit Bay as a National Estuarine Research Reserve protects the Bay and establishes a research and education program which can be of value to the management of this and other estuaries within the region.

WHEREAS Waquoit Bay represents an ecosystem representative of the Virginian biogeographic region; and

WHEREAS the Massachusetts Department of Environmental Management (DEM) and the Massachusetts Office of Coastal Zone Management (CZM) are committed to the protection and wise use of the resources of Waquoit Bay; and

WHEREAS DEM has acquired significant holdings in and adjacent to Waquoit Bay, including Washburn Island and South Cape Beach and;

WHEREAS the designation of Waquoit Bay as a National Estuarine Research Reserve furthers the goals of DEM and CZM by ensuring the protection and a greater understanding of its ecosystem and resources.

THEREFORE CZM and DEM support the Reserve designation and agree as follows:

1. CZM will work with DEM to coordinate any activities with the Federal National Estuarine Reserve Research System and other appropriate state agencies and organizations;

2. DEM will, upon receipt of state and federal funds, initiate architectural and/or engineering services for the rehabilitation of the Estate's buildings for Reserve purposes;

3. Pending the availability of federal Estuarine Reserve funding and annual appropriations at the state and federal level, DEM will maintain and operate the Reserve headquarters and, in cooperation with other agencies, organizations, and academic institutions, will coordinate and administer interpretive, education and research programs;

4. DEM will develop a final Reserve management plan in consultation with CZM, and review the plan on a yearly basis;

5. CZM will continue to provide technical assistance relative to the Reserve program, particularly in regard to Federal agency coordination, Federal grant applications, and reporting.

James Gutensohn, Commissioner
Department of Environmental Management

Steve Bliven, Acting Director
Office of Coastal Zone Management

Feb 6, 1988
Date

MEMORANDUM OF UNDERSTANDING

BETWEEN

THE DEPARTMENT OF ENVIRONMENTAL MANAGEMENT AND THE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

CONCERNING THE

ESTABLISHMENT AND ADMINISTRATION OF THE

WAQUOIT BAY NATIONAL ESTUARINE RESEARCH RESERVE

WHEREAS, the Department of Environmental Management, Commonwealth of Massachusetts (Commonwealth) has determined that the designation of the Waquoit Bay National Estuarine Research Reserve (Reserve) under the National Estuarine Reserve Research System (System) as provided for in Section 315 of the Coastal Zone Management Act of 1972, P.L. 92-583, as amended (CZMA), and the implementing regulations in 15 CFR Part 921, will provide for beneficial long-term research and public education to improve the coastal management capabilities of the Commonwealth; and

WHEREAS, the Office of Ocean and Coastal Resource Management (OCRM), National Oceanic and Atmospheric Administration, U.S. Department of Commerce, intends to designate Waquoit Bay in the Commonwealth as a National Estuarine Research Reserve; and

WHEREAS, the Commonwealth and OCRM recognize that the designation of the Reserve is an acknowledgement that the area is a natural field laboratory to be used to gather and study data on natural and human processes occurring within the Waquoit Bay estuarine system, and to provide a basis for increasing public awareness and understanding of the complex nature of estuarine systems, their values and benefits to man and nature, and the problems that confront them; and

WHEREAS, to carry out Reserve purposes as specified in the Reserve Management Plan approved by NOAA, OCRM will provide Federal funds (on a fifty-fifty matching basis) for acquisition and development purposes and initial program operation, and, as specified in 15 CFR 921, may provide additional funds for supplemental acquisition and development and, on a competitive basis, for research and education/interpretive projects; and

WHEREAS, the Commonwealth and OCRM recognize the need for State-Federal cooperation in managing the designated Reserve consistent with the Mission and Goals of the System and the Objectives of the Reserve, as specified in the Reserve Management Plan approved by NOAA (see Article 1):

NOW, THEREFORE, for and in consideration of the mutual covenants herein contained it is agreed by and between the Commonwealth and OCRM as follows:

ARTICLE 1 - RESERVE PURPOSES

The Reserve is to be operated on a permanent basis in a manner consistent with the Mission and Goals of the System, as defined below, and the Reserve Objectives as specified in the Reserve Management Plan approved by NOAA.

A. Mission and Goals

(1) The mission of the System is the establishment and management, through Federal-State cooperation, of a permanent national system of estuarine reserves representative of the various regions and estuarine types in the United States, in order to provide opportunities for long-term research, education, and interpretation.

(2) The goals of the System for carrying out this mission are:

(a) To provide opportunities for long-term scientific and educational programs in estuarine areas to develop information for improved coastal management decision making;

(b) To enhance resource protection by implementing a long-term management plan tailored to the site's specific resources;

(c) To enhance public awareness and understanding of the estuarine environment through resource interpretive programs; and

(d) To promote Federal-State cooperative efforts in the management of estuarine areas.

B. Reserve Objectives

(1) Monitoring and Research Objectives

(a) To gain a clearer understanding of the ecological relationships within the estuarine environment through a coordinated program of baseline studies and related research;

(b) To identify significant changes that may occur in the estuarine environment; and

(c) To assess the effects of man's impact on the ecosystem and to forecast or mitigate possible environmental deterioration caused by human activities.

(2) Education Objectives

(a) To help the public better understand the ecological relationships within this estuarine environment through a broad range of education programs; and

(b) To increase the public's awareness of the problems that can arise from man's misuse of this environment; and

(c) To foster a higher level of commitment toward solving some of the Waquoit Bay - related problems.

(3) Resource Protection Objectives

(a) To protect the Reserve's fragile or rare natural resources;

(b) To preserve cultural resources including archaeological sites; and

(c) To balance the demands placed on the Reserve's resources through various activities to determine the levels and types of uses consistent with protecting the estuarine environment for future generations to study, enjoy and utilize.

(4) Resource Utilization Objectives

(a) To provide for traditional resource utilization (such as fishing, shellfishing and hunting) at levels which maintain the resources at stable, healthy levels; and

(b) To encourage low impact recreational activities that will help the public appreciate and understand the estuarine environment.

ARTICLE II - STATE-FEDERAL ROLES IN THE RESERVE

A. During the period of Federal funding after the Reserve is designated (the "Operation and Management" phase), the Commonwealth's role will include, but not be limited to,

implementing the Reserve Management Plan, developing strategies for the continued operation of the Reserve after Federal funding expires, and acquiring remaining interests in property and undertaking construction in a manner consistent with the Reserve Management Plan. OCRM's role during this phase will be to provide funding on a matching basis to implement the Reserve Management Plan (through operation and management awards) and for remaining acquisition and construction (through supplemental acquisition and development awards) and periodically to evaluate the Commonwealth's progress in establishing the Reserve, including initial implementation of the System's Mission and Goals and the Reserve Objectives.

B. After Federal funding expires, the Commonwealth's role will be to ensure that the Reserve continues to be operated and managed in a manner consistent with the approved Reserve Management Plan, the Program's Mission and Goals and the Reserve Objectives. OCRM's role during this phase will be to monitor the Commonwealth's performance in effectively operating the Reserve (see Article III).

ARTICLE III - EVALUATION

OCRM will evaluate, on an annual basis, the Commonwealth's progress in operating and managing the Reserve. Periodically, pursuant to Sections 315 and 312 of the CZMA, OCRM will also conduct a formal evaluation of Reserve operation and management by the Commonwealth. If OCRM finds, after an evaluation of the Commonwealth's performance that the site is not being managed as National Estuarine Research Reserve, i.e., that the System's Missions and Goals and the Reserve's Objectives are not being attained, the Commonwealth and OCRM shall attempt to resolve the issue in a manner consistent with the purposes for which the Reserve was established. If such resolution is not possible, Reserve designation may be withdrawn.

In the absence of specific mediation procedures present in the Reserve Management Plan or System regulations, the following procedures for resolution shall be followed:

A. Upon a finding by OCRM that the Commonwealth is not operating the Reserve consistent with Article I, OCRM shall provide the Commonwealth with written notice of the deficiency. Such notice shall explain the deficiencies in the Commonwealth's approach; propose a solution or solutions to the deficiency and provide a schedule by which the State should remedy the deficiency. The Commonwealth shall also be advised in writing that it may comment on OCRM's finding of a deficiency and meet with OCRM officials to discuss the finding and to seek to remedy the deficiency.

B. If OCRM recommends to the Assistant Administrator for Ocean Services and Coastal Zone Management (AA) that Reserve designation be withdrawn, then the Commonwealth shall be provided

the opportunity for an informal hearing before the AA to consider OCRM's recommendation and finding of deficiency, and the Commonwealth comments on and response to the recommendation and finding.

C. The AA shall make all reasonable efforts to issue a written decision regarding the Reserve within 30 days after the informal hearing. If a decision is made to withdraw Reserve designation, real property acquired in whole or in part with Federal funds shall be disposed of in accordance with the applicable provisions of Program regulations at 15 CFR 921 and OMB Circular No. A-102, Revised.

IN WITNESS WHEREOF, the parties hereto have caused this Memorandum to be executed.

Commissioner
Department of Environmental Management
Executive Office of Environmental Affairs
Commonwealths of Massachusetts
DATE: 6/20/88

Chief
Marine and Estuarine Management Division
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

DATE: 6/24/88

for Director
Office of Ocean and Coastal Resource Management
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

DATE: 6/14/88

BY-LAWS
of the

WAQUOIT BAY NATIONAL ESTUARINE RESEARCH RESERVE
ADVISORY COMMITTEE

A. Name - The name of this entity shall be the Waquoit Bay National Estuarine Research Resrve (WBNERR) Advisory Committee (hereafter referred to as "the Committee.")

B. Authority - The Committee is defined in the WBNERR Management Plan (draft July 1984, September 1984; final November 1987) and required by the financial assistance award (85-AA-D-CZ013) from the National Oceanic and Atmospheric Administration to the Commonwealth of Massachusetts. The Committee is appointed by the Secretary of the Executive Office of Environmental Affairs of the Commonwealth of Massachusetts. Original appointments were made in February 1986.

C. Purpose - The purpose of the Committee is to provide "effective coordination and cooperation among all interests involved with Reserve programs." (source: WBNERR Management Plan, November 1987, p. 52 .)

Specifically, the Committee shall perform, among other actions, the following functions:

I. Advise the Department of Environmental Management (DEM) on matters of policy related to planning for and operation of the Reserve;

II. Appoint the members of the Research, Educational and Resource Protection Advisory Subcommittee, or other subcommittees on an as-needed basis;

III. Assist in seeking support for the Research and Educational programs and other financial matters;

IV. Conduct annual review of the Management Plan and assist in the preparation of any periodic summary or annual reports on the operations of the Reserve;

V. Represent the interests of the users of the Reserve, its neighbors, and the users of information and educational materials generated by the Reserve; and

VI. Review capital planning and operating budgets of the Reserve and suggest funding priorities.

D. Membership - The Committee shall be composed of fourteen (14) members, representing each of the following interests:

I. The Board of Selectmen of the Town of Falmouth

II. The Board of Selectmen of the Town of Mashpee

III. The Cape Cod Planning and Economic Development Commission

IV. The South Cape Beach State Park Advisory Committee

V. The Commissioner of the Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement

VI. The Director of the Massachusetts Office of Coastal Zone Management

VII. The Commissioner of the Massachusetts Department of Environmental Quality Engineering

VIII. The scientific community

IX. The education community

X Environmental interest group

XI. Hunting, fishing, shellfishing interest groups

XII. Boating, waterways, marina interest groups

XIII. The Native American community

XIV. Resource Protection Interest

Alternates for each Member may be appointed by the Secretary. Alternates may attend all meetings and shall receive all correspondence received by the Members.

E. Meetings - The March meeting of the Committee shall constitute the Annual Meeting. At said Annual Meeting, the Members shall elect, by

majority vote of a quorum being present, a Chairman, Vice-Chairman and Secretary.

Regular meetings of the Committee will be held on the third Thursday of each month in the evening at the Reserve. The time, date and place, of a meeting may be changed by consent of the majority at the next previous meeting.

Special meetings may be called at anytime by the Chairman or at the written request of at least five Members to the Chairman. All annual, regular and special meetings shall be open to the public.

F. Notice and Quorum - Notice of any meeting of the Committee shall be given by the Chairman or Secretary to all Members and duly appointed Alternates at least 10 calendar days before the date set for the meeting. (This time frame may be shortened upon the decision of the chairman in order to accomodate emergency situations.) Said notice shall include an agenda and any written material which requires a vote by the Committee at the meeting.

A quorum shall consist of a majority of the Members duly appointed at the time of the meeting. Alternates may be counted towards the quorum in the absence of the Members they represent, but not in addition to their Members, if present, in order to achieve a quorum.

G. Attendance - A Member who misses five consecutive regular meetings of the Committee shall, upon majority vote of the Committee, be asked to resign by the Chairman. The Chairman shall notify the Secretary of Environmental Affairs of the situation and request that the Member's Alternate, if any, be appointed to replace the Member, or that a new Member be appointed. The Secretary may take into account any mitigating factors in his decision to replace a Member.

H. Voting - Each interest cited in paragraph D shall have one vote on all matters brought before the Committee. In the absence of a Member, an Alternate may vote, but both the Member and Alternate may not vote at the same meeting. A simple majority of a quorum being present shall decide all issues.

I. Officers - The officers of the Committee shall include a Chairman, Vice-Chairman, and Secretary elected at the Annual Meeting. The Chairman shall call meetings, preside at said meetings, sign all formal correspondence of the Committee, and, in general, represent the

interests of the Committee to DEM and outside groups. The Vice-Chairman shall perform any of the Chairman's duties in the absence of the Chairman. The Secrtetary shall be responsible for all correspondence, meeting minutes and other documents of the Committee, but may authorize others to perform this duty.

Officers shall be elected for one calendar year and may be re-elected.

Officers must be Members, not Alternates, of the committee and must not be employed by an agency of the Executive Office of Environmental Affairs of the Commonwealth of Massachusetts.

All vacancies of any of the offices of the Committee may be filled by the Committee at any scheduled meeting. Successors elected to fill vacancies shall hold office until the end of the unexpired term, though re-election may be appropriate.

J. Rules of Procedure - In the event of a challenge to proceedings in an informal letter, all meetings of the Committee shall be conducted under Roberts' Rules of Order.

K. Amendments - These by-laws may be amended, altered or repealed by majority vote at any meeting of the committee, provided that the Members and Alternates are notified in writing of the proposed change at least ten days prior to the meeting.

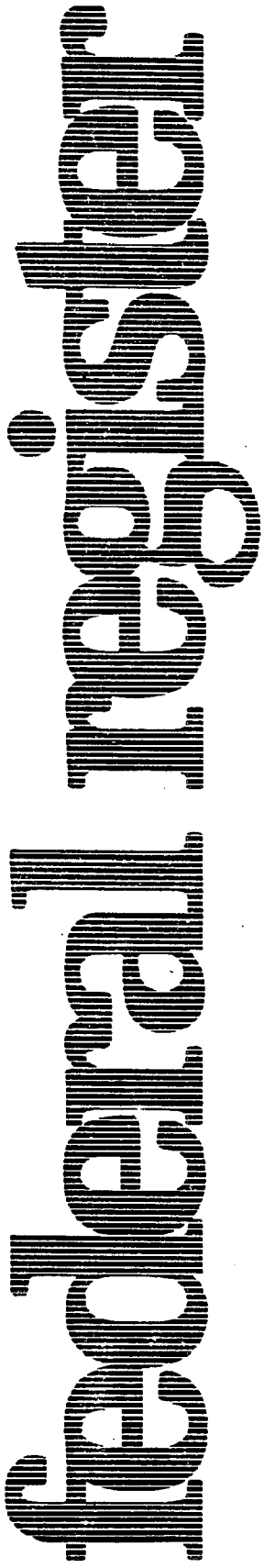
Approved by vote of the Waquoit Bay National Estuarine Research Reserve Advisory Committee on October 27, 1988.

Charles Swain
Chairman, WBNERR Advisory Committee

I certify that these by-laws are consistent with the intents and purposes of the WBNERR Advisory Committee as cited in the WBNERR Management Plan and agreements between the Commonwealth of Massachusetts and NOAA.

December 2, 1988
Date

James S. Hoyte, Secretary EOEA



Wednesday
June 27, 1984

Part IV

Department of Commerce

National Oceanic and Atmospheric Administration

15 CFR Part 921

National Estuarine Sanctuary Program Regulations; Final Rule

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

15 CFR Part 921

[Docket No. 40315-30]

National Estuarine Sanctuary Program Regulations

AGENCY: Office of Ocean and Coastal Resource Management (OCRM), National Ocean Service (NOS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Final rule.

SUMMARY: These final regulations revise existing procedures for selecting and designating national estuarine sanctuaries and provide guidance for their long-term management. Site identification and selection is to be based on a revised biogeographic classification scheme and typology of estuarine areas. The regulations place a greater emphasis on management planning by individual states early in the process of evaluating a potential site. The regulations reflect a progression from the initial identification of a site, through the designation process, and continued management of the sanctuary by the state after Federal financial assistance has ended. The regulations provide for regular programmatic evaluations of sanctuary performance. Clarifications in the financial assistance application and award process have also been made.

EFFECTIVE DATE: These regulations are effective Friday, October 5, 1984. This delayed effective date will allow sufficient time for the Congress to enact legislation pertaining to the conduct of the National Estuarine Sanctuary Program if it chooses to do so. If necessary, the effective date of these regulations will be postponed, and a notice thereof published in the **Federal Register**, in compliance with the notice provisions contained in section 12 of the Coastal Zone Management Act, 16 U.S.C. 1463a.

FOR FURTHER INFORMATION CONTACT: Dr. Nancy Foster, Chief, Sanctuary Programs Division, Office of Ocean and Coastal Resource Management, NOAA/NOS, 3300 Whitehaven St., NW., Washington, D.C. 20235, (202) 634–4236.

SUPPLEMENTARY INFORMATION:

I. Authority

This notice of final rulemaking is issued under the authority of Section 315(1) of the Coastal Zone Management Act, 16 U.S.C. 1461(1). The National Estuarine Sanctuary Program has been operating under guidelines published June 4, 1974 (39 FR 19922) and proposed regulations published September 9, 1977 (42 FR 45522).

II. General Background

On August 3, 1983 (48 FR 35120), NOAA published proposed regulations for continued inplementation of the National Esturine Sanctuary Program pursuant to Section 315 of the Coastal Zone Management Act, 16 U.S.C. 1461, (the Act). Written comments on the proposed regulations were accepted until October 3, 1983. These comments have been considered in preparing these final regulations. A summary of significant comments on the proposed regulations and NOAA's responses are presented below.

The final regulations establish the Program's Mission and Goals and revise the procedures for selecting, designating, and operating national estuarine sanctuaries.

III. Refinements to the Regulations for the National Estuarine Sanctuary Program

Based on experience in operating the Program and comments on the proposed regulations, a number of refinements in operational procedure and policy have been designed. The final regulations implement these refinements, which include:

A. Defining the Mission and Goals of the Program

The Mission Statement and Goals for the continued implementation of the National Estuarine Sanctuary Program stress the importance of designating estuarine area, through Federal-state cooperative efforts, for long-term research and educational benefits. Though broad in scope, they establish a framework within which specific Program activities are conducted. The Mission Statement and Goals are adopted by the final regulations (§ 921.1).

B. Revision of the Procedures for Selecting, Designating and Operating Estuarine Sanctuaries

(1) Revision of the Biogeographic Classification Scheme and Proposed Estuarine Typologies

The 1974 guidelines identified 11 biogeographic regions from which representative sites throughout the coastal waters of the United States would be chosen. Section 921.4(b) of the 1974 guidelines provided that "various sub-categories will be developed and utilized as appropriate."

In 1981, a study was undertaken to assess the original biogeographic classification scheme and make recommendations, as necessary. A system with 27 subcategories was proposed. The subcategories fit within the original scheme and further define the coastal areas to assure adequate sanctuary representation (Clark, *Assessing the National Estuarine Sanctuary Program: Action Summary*, March 1982, cited as *The Clark Report*).

The Clark Report also recommends consideration of an estuarine typology in evaluating and selecting sites. The typology system recognizes that there are significant differences in estuary characteristics not related to regional location. Such factors include water source, water depth, type of circulation, inlet dynamics, basin configuration, watershed type, and dominant ecological community.

The final regulations adopt the revised biogeographic classification scheme and the recommendation to consider typology in site selection (see § 921.3).

(2) Site Designation

Eligible states may apply for preacquisition awards to aid in selecting an estuarine site in conformity with the classification scheme and typology system. A description of the site selection process to be carried out by the state, including a provision for public participation in the process, must be submitted for NOAA's approval. This ensures that the procedures for the site selection process are planned prior to implementing the selection process and approval of the preacquisition award. Figure 1 depicts the entire designation process.

After selection of a site, a draft management plan is prepared. Requiring the development of a comprehensive draft management plan in the preacquisition phase is designed to guarantee that early in the estuarine sanctuary designation process the state considers management policies, an acquisition and construction plan (including schedules and priorities), staffing requirements, a research component, interpretive and education plans, future funding and other resource requirements, and alternatives. Draft and final environmental impact statements (EIS) are prepared analyzing the environmental and socioeconomic

impacts of establishing a sanctuary and implementing the draft management plan. The EIS is prepared in accordance with National Environmental Policy Act (NEPA) procedures, including provisions for public comment and hearings.

Following NOAA approval of the draft management plan and the final EIS, the site enters an initial acquisition and development phase. The state is then eligible for an initial acquisition and development award. During this phase, award funds may be used to purchase land, construct minor facilities (subject to pre-designation construction policies, see § 921.21), prepare the final management plan, and initiate onsite research and education programs. All of these tasks are to be carried out in conformance with the NOAA-approved draft management plan.

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Figure 1. National Estuarine Sanctuary Program Designation Process

AWARD	STAGE	PUBLIC INPUT
Preacquisition Award	Site Selection (§ 921.11)	Public Meeting on Site(s)
	↓	
	Approval of Site by NOAA (§ 921.11)	
	↓	
	Development of Draft Management Plan and Draft EIS (§ 921.12)	Public Meeting; Public Hearing on the Draft EIS
	↓	
	NOAA Approval of Draft Management Plan (§ 921.12)	
	↓	
	Development of Final EIS (§ 921.12)	Final EIS
	↓	
Initial Acquisition and Development Awards	Preparation of Final Management Plan; Acquisition of Key Land and Water Areas; Minor Construction (§ 921.21)	Public Meeting on Final Plan
	↓	
	Final Management Plan Approved by NOAA; Other Findings (§ 921.30)	
	↓	
	Sanctuary Designation (§ 921.30)	
	↓	
Operation and Management Award; Subsequent Acquisition and Development Award; Potential Research Awards	Implementation of Final Management Plan; Acquisition of Remaining Land; Construction (§ 921.32)	
	↓	
	Programmatic Evaluation (§ 921.34)	Public Meeting(s) on Evaluation

BILLING CODE 3510-08-C

The task under the intial acquisition and development phase should be completed within two years. At this point, NOAA must make formal findings, as specified § 921.30, that the final management plan has been completed and is approved, that the key land and water areas as specified in the management plan are under state control, and that a memorandum of understanding between the state and NOAA concerning the state's long-term commitment to the sanctuary has been signed. After NOAA makes these findings, the sanctuary is considered "designated". The state than begins implementation of the final management plan, including the construction of necessary facilities and additional land acquisition. The state is also eligible for operation and management awards to provide assistance in implementing the final management plan.

The regulations also provide procedures for the programmatic evaluation of a sanctuary during the period of the operation and management awards (or under the initial acquisition and development award if the sanctuary is not designated within two years) and for a continuing, biennial review of an estuarine sanctuary after Federal funding has expired. Procedures for withdrawing designation, if a sanctuary fails to meet established standards, have been added (§ 921.35).

To foster scientific studies within national estuarine sanctuaries, NOAA is setting aside funds for research within sites with approved final management plans. This is a separate category of financial assistance from the operation and management or acquisition and development support. The research funding is described in Subpart E.

Financial assistance requirements and procedures have been revised. The programmatic information required for each type of award is specified in the appropriate sections—in preacquisition (Subpart B); acquisition and development (Subpart C); and operation and management (§ 921.32). General financial assistance information is provided in Subpart F.

In summary, the regulations include more standards and guidelines for states to follow in developing and operating a national estuarine saanctuary, as well as additional guidelines for NOAA in overseeing the Program. Based on experience and from discussions with several states with estuarine sanctuaries, NOAA has found that the previous lack of guidance raised many concerns about what an estuarine sanctuary should be, the state's role in developing and operating a sanctuary, and how decisions should be made. The regulations ensure that a state will have adequate flexibility in long-term operation of an estuarine sanctuary to deal with changing circumstances. The regulations require more information about the sanctuary, particularly through the development of a site-specific management plan, prior to each step in the funding process. In this manner, it is expected that decisions affecting the sanctuary and management priorities will be planned for in advance, rather than in an *ad hoc* fashion.

IV. Summary of Significant Comments on the Proposed Regulations and NOAA's Responses

Comments were received from 17 sources. Commenters included Federal and state agencies, representatives of the oil and gas industry, representatives of the electric utility industry, and environmental and public interest groups. All comments received are on file at the Sanctuary Programs Division, Office of Ocean and Coastal Resource Management, 2001 Wisconsin Avenue, NW., Room 334 Washington, D.C. 20235. The comments are available for review at that office. Each of the major issues raised by the commenters has been summarized and NOAA's response provided under the relevant subheading in this section.

General

Impact on Existing Sanctuaries

One commenter suggested that the final regulations indicate the impact of the changes on existing sanctuaries.

Response: The changes in procedure reflected in these regulations will improve the Program's operation and the effective implementation of national estuarine sanctuaries over time. They will therefore be applied to existing sanctuaries to the degree practicable.

Public Participation

Because of the potential impacts resulting from an area being designated as a national estuarine sanctuary, one commenter noted that the maximum opportunity for the participation of interested persons should be provided. The commenter encouraged NOAA to ensure that states comply with the conditions of §§ 921.11(d) and 921.12(d). The commenter recommended that a careful review of all established and potential industrial activities be undertaken to ensure a well-balanced decision on the site's suitability for designation as a national estuarine sanctuary.

Response: NOAA agrees with the comment on the importance of public participation. Public participation efforts by the states, in conjunction with NOAA, are mandated by these regulations as an integral part of site selection, designation, and management.

The Program's purpose is to establish selected estuarine areas as sanctuaries to serve as natural field laboratories and provide opportunities for long-term research, education, and interpretation. Because of this, the present and future uses of such an area are certainly an important factor in considering whether it should be a national estuarine sanctuary.

It is also important to emphasize that the Program does not involve broad scale regulation on land uses apart from that already undertaken by the state or proposed by the state under its own applicable authorities. Multiple use of national estuarine sanctuaries is encouraged (see § 921.1(d)). Resource protection is, however, the highest priority goal of the National Estuarine Sanctuary Program and uses must be compatible with long-term resource protection. Within national estuarine sanctuaries, states may impose certain regulatory controls to ensure the continued protection of sanctuary resources. Areas proposed for designation are evaluated through the EIS process with opportunities for public comment.

Section-by-Section Analysis

Subpart A—General

Section 921.1—Mission and Goals.

(1) Several commenters supported the Program Mission and Goals and found them to be a substantial improvement over the 1974 guidelines and 1977 proposed regulations.

Response: The Mission and Goals were established to guide continued effective implementation of the National Estuarine Sanctuary Program. Program experience over the past several years led to the development of refinements designed to improve the original guidelines.

The concept of a national estuarine sanctuary does not easily merge with that of existing natural resource protection programs, such as wildlife refuges or parks. National estuarine sanctuaries are designed to ensure protection of a natural habitat unit in which long-term research and educational projects can be focused. A primary aim of these research and education projects is to provide information to states that is useful for decisionmaking concerning the development or protection of its coast and associated resources.

National estuarine sanctuaries are not established primarily for recreational pursuits, although compatible uses are encouraged. Sanctuaries are also not intended solely to enhance habitat for a single species by modification of the natural character of the estuarine system.

The final regulations, including the Mission and Goals, are designed to clarify the definition and function of a national estuarine sanctuary.

(2) Another commenter, however, suggested that the section on Mission and Goals, which replaced the "Policy and Objectives" section of the 1974 guidelines, expands the scope of the Program in ways not originally intended. The commenter suggested that Goal 2 (concerning research) was adequate, and that the other three should be deleted. The commenter suggested that the first goal, concerning long-term management planning, should be left to the National Marine Sanctuary Program or state coastal zone programs. The commenter further suggested that the third goal, involving enhancement of public awareness through interpretation, should also be dropped even though it was recognized that such interpretive efforts often stem from scientific research. Finally, the commenter suggested that the fourth goal, involving stimulating Federal-state cooperation to promote the management of estuarine areas, should be dropped since it allegedly provides the Federal government with more authority than needed. The commenter supports this view by citing legislative history to assert that the Act "authorizes Federal grants-in-aid, but makes no attempt to diminish State authority through Federal preemption."

The same commenter generally questions the need for the National Estuarine Sanctuary Program and need for revisions to the existing program. The commenter encouraged NOAA to examine the legal and scientific bases for the estuarine sanctuary program and to ensure that the regulations conform to the intended goals of the Coastal Zone Management Act.

Response: The Mission and Goals described in Section 921.1 are in no way an expansion of the Program. Rather they reflect the legislative history and a synthesis of the Program's past experience and need for basic policy guidance. Goals 2 and 3 are both valid; since both education and interpretive efforts are natural outgrowths of science. The first goal, involving management planning, represents a logical mechanism for achieving Program purposes with maximum utility and a minimum amount of waste. NOAA disagrees with the commenter on Goal 4. The purpose of the goal is to ensure the protection of selected estuarine areas. Federal/state cooperative efforts to ensure such protection are emphasized; the Federal role encompasses more then grants-in-aid, but includes continuing evaluation and coordination of research and education to ensure that the sites remain as natural field laboratories consistent with the legislative intent.

NOAA has based these revised regulations on the Act and its legislative history. Through experience with the Program, NOAA has made certain refinements to the process. In fact, by explicitly providing for Section 312 evaluations (as required by the Coastal Zone Management Act) as seeking to coordinate research and education from the national level, the Program has made significant strides to fulfill the Congressional intent (see §§ 921.1(c) and 921.34).

(3) One reviewer felt that the idea of coordinating research and education information expressed in § 921.1(c) was a good idea, but should be carefully thought out and developed in coordination with individual states.

Response: NOAA is now in the process of developing a detailed plan for coordinating research and education. Comments from states and other interested groups are being actively solicited in preparing this plan.

(4) Several commenters strongly supported the concept in § 921.1(d) of encouraging multiple use of estuarine sanctuaries. One of the same commenters also supported the statement in Section 921.11(c)(5) that the site selection process consider "the site's compatibility with existing and potential land and water use in contiguous areas."

Response: NOAA is strongly committed to the concept of multiple use in estuarine sanctuaries as long as the purposes for which the sanctuary is established are maintained. Therefore it is important that site selection efforts closely analyze existing and potential uses of the area and adjacent areas.

Section 921.3—Biogeographic Classification Scheme. (1) One state requested that the goal of one site per region be revised to allow for more sites per region based on the estuarine typology system. The commenter noted that only by including several sites per region could all significant national variation be included. The commenter suggested that outright acquisition was not always necessary. The alternative suggested was to incorporate into the National Estuarine Sanctuary Program those sites, as appropriate, that are owned by a state or conservation group. In this way actual ownership would not be as important as the site's value to the Program.

Response: NOAA believes that the inclusion of representatives of all national estuarine variations would be impracticable from a management perspective. It should be noted that control of estuarine land and water areas is only one facet in sanctuary designation. Properties already owned by the state or a conservation group may not comprise a natural unit or have the research and educational foundation required by the Program. Such areas are already in a protected status and are available for research and educational purposes, along with those regional representatives comprising the National Estuarine Sanctuary system. Adding these sites to the Program may not serve beneficial purposes. Thus, while the biogeographic classification scheme sets the initial parameters within which detailed site selecion and analysis is focused, it should not be considered alone. Many other factors must be considered.

Within regions without an estuarine sanctuary, however, the non-acquisition alternatives suggested by the commenter will be utilized to the greatest degree possible.

(3) Another commenter was concerned that implementation of the biogeographic classification scheme on the basis of one site per region would lead to too many estuarine sanctuaries.

Response: As detailed in *The Clark Report*, the classification scheme and estuarine typology are designed to provide the Program with an array of sanctuaries broadly reflective of our Nation's estuarine zones. Only with this diversity of sites can the Program produce beneficial research and educational projects useful in coastal decisionmaking. There are presently 14 biogeographic regions represented in the system.

(4) Another commenter stated that by including 27 regions, and providing for one site per region, NOAA has extened the Program in an unwarranted manner. The commenter recommended instead that NOAA use the classification scheme in the Program Development Plan for the National Marine Sanctuary Program which relied on eight regions.

Response: Estuarine sanctuaries, in order to be beneficial for long-term research and educational purposes, should reflect the Nation's coastal areas. The biogeographic classification scheme and estuarine typologies were developed from this premise as demonstrated in *The Clark Report*. In

identifying sites for potential marine sanctuary status, eight regions were used, but for administrative purposes rather than representativeness. On top of this scheme, a detailed marine classification scheme, developed solely for marine areas and illustrative of the Nation's oceans, was applied. As a result of this process, twenty-nine sites were selected by NOAA for placement on the Site Evaluation List (see 48 FR 35568 (1983)).

Section 921.4(b)—Coordination With the National Marine Sanctuary Program. One commenter was concerned about the possible duplication of time and effort if an area is established as an estuarine sanctuary and a marine sanctuary. The commenter requested that NOAA address the possibility of a dual designation and means by which both programs could coexist without generating serious problems.

Response: Section 921.4(b) is intended only to ensure that the National Estuarine Sanctuary Program and National Marine Sanctuary Program work closely together; this is particularly true in terms of management planning, research projects, and education/interpretive activities. It is also important to note that the Programs are not duplicative and could serve complementary purposes. The regulations have been clarified to provide that the boundaries of the national marine and estuarine sanctuaries would not overlap, even though they may be adjacent (similar to the case where a National Wildlife Refuge abuts a National Park).

Subpart B—Preacquisition: Site Selection and Management Plan Development

Section 921.10—General. (1) One state suggested that the $50,000 Federal share was not enough to accomplish the goals of the preacquisition award (e.g., site selection and draft managment plan development) and recommended that a small sum be set aside for site selection, and that other funds to prepare the draft plan be negotiated between the state and the Federal government based on the proposed sanctuary's complexity.

Response: Based on past experience, the $50,000 Federal funding level, supplemented by state match, is adequate for site selection and draft plan development. Additional funds to complete the final plan are available under the acquisition and development award (see § 921.21).

(2) One commenter suggested that specific reference to the need for Federal agency coordination be included in Subpart B. Such coordination could appropriately occur during the EIS process, but the commenter suggested that states may wish to involve Federal agencies with special expertise earlier during the site selection process.

Response: The regulations require that states seek the views of Federal agencies as well as other parties early in the site selection process (see §§ 921.11(d) and 921.12(a)(3)). Federal agencies will also be actively involved in the management planning process and EIS development (see § 921.12 (d) and (e)).

Section 921.11—Site Selection. (1) Several states suggested that the regulations address multiple-site national estuarine sanctuaries.

Response: Section 921.10(b) has been revised to specifically reference multiple-site systems within the National Estuarine Sanctuary Program.

(2) One commenter urged early and frequent public involvement in the designation and management of national estuarine sanctuaries. It was suggested that where the proposed regulations limit notice to the local media (for example in § 921.11(d) concerning preliminary site selection), notice should also be made in the **Federal Register** since not all parties interested in the proposed designation live in the adjacent area and the Program has a broad national interest.

Response: This change has been made (see § 921.11(d)).

Section 921.12—Management Plan Development. (1) One state noted that § 921.12(b), concerning management plan development, should include a description of the sanctuary administrative structure as a required plan component. It was suggested that the plan should at least outline the staff's roles for research, education/interpretation, and enforcement.

Response: NOAA agrees and language to this effect has been added at § 921.12(b)(2).

(2) One state suggested that an environmental impact statement not be required in all cases. Rather, in less complex situations, the flexibility to prepare an environmental assessment should be left open.

Response: NOAA disagrees. Based on experience with the program, an environmental assessment is not an adequate mechanism to fully consider the environmental and socioeconomic impacts of a proposed national estuarine sanctuary, particularly where a management program is being proposed. Further, it does not provide for the extensive public review required through the NEPA process. We believe that designation of any site qualifies as a significant Federal action for the purposes of the NEPA EIS requirement.

(3) One commenter noted that since resource protection is a primary program goal, the regulations should specify that the plan detail responsibilities for surveillance and enforcement of human activities.

Response: NOAA agrees and the regulations (at § 921.12(b)(8)) have been revised to require that responsibilities for surveillance and enforcement be detailed in the management plan.

(4) One commenter questioned the usefulness of the NOAA-state memorandum of understanding (MOU), which is required as part of the management plan (see § 921.12 (a)(5) and (b)(10)). The commenter suggested that the MOU could not be considered legally binding on future legislatures.

Response: The MOU emphasizes the significance of establishing an estuarine sanctuary and recognition by the state and Federal government of the long-term commitment to management of the area in accordance with the agreed-upon goals and objectives. The MOU spells out, at the beginning of the process, the roles of the Federal and state governments, and what is expected of each party. It will clearly indicate that each party is aware of its commitment and responsibilities at the beginning of the process. The MOU emphasizes that lands acquired under the National Estuarine Sanctuary Program must continue to be used in a manner consistent with sanctuary purposes.

(5) Several states approved requiring the management plan early in the process as a guide to future decisions before the expenditure of substantial funds. Other commenters, however, expressed concern that requiring the preparation of a draft management plan prior to any commitment to the site from NOAA could lead to the waste of extensive staff time, public participation, and resources.

Response: These regulations are predicated upon ten years of experience in administering the National Estuarine Sanctuary Program. The regulations are intended to rectify many of the problems that have occurred in specific sanctuaries in the past. Many of these problems could have been foreseen and overcome by thoughtful, pre-sanctuary planning. Thus, NOAA is strongly supportive of developing a management plan early in the decision process. The concern that NOAA is not committed to the state during the draft management plan process is unwarranted given the procedures specified in the regulations. NOAA's financial commitment begins with the preacquisition award for site

selection and continues through all the developmental stages. NOAA may support up to one-half of the total costs of establishing a particular sanctuary. NOAA's programmatic commitment to a proposed sanctuary begins with approval of a site and continues through the management plan review and preparation of the EIS. If the sanctuary proposal is approved, and if the requirements of the preacquisition phase are met, NOAA will proceed with establishing the site as a national estuarine sanctuary.

Decision points early in the process provide opportunities for either party to withdraw before too much time and effort have been committed.

(6) In terms of § 921.12(b)(7), one commenter suggested that the schedule for acquisition, required as part of the management plan, was useful as a guide, but not as a rigid planning document.

Response: NOAA views the acquisition strategy as a flexible planning tool. It does, however, identify key areas where acquisition should be focused and acquisition priorities developed. The strategy will also contain alternatives (including boundary changes) if selected priority areas eventually cannot be acquired.

(7) One commenter suggested that the requirements for the draft management plan should reference three additional elements, all of which were included in the 1974 guidelines: (1) Definitions of permitted, compatible, restricted and prohibited uses; (2) a monitoring plan to ensure that the integrity of the sanctuary is maintained; and (3) a description of the authorities which will be put in place to manage the Sanctuary and enforce the policy and use restrictions.

Response: A resource protection plan requirement has been added (see § 921.12(b)(8)) which encompasses elements (1) and (3). A monitoring plan should be included as part of the research plan (see § 921.12(b)(3)).

Subpart C—Development and Preparation of the Final Management Plan

Section 921.21—Initial Acquisition and Development Awards. (1) One state noted that the limit of 5 percent of the initial acquisition and development awards which may be expended on minor construction activities which aid in implementing portions of the management plan may not be adequate for multiple-site systems.

Response: After careful consideration, NOAA has determined that necessary construction can be planned for and included as part of the initial award. The intent of this restriction is to limit large capital expenditures until a final plan is prepared and substantial progress in land acquisition has been made.

Section 921.32—Operation and Management: Implementation of the Management Plan. (1) One state suggested the $250,000 cap on federal funding for operation and management in Section 921.32(b) should be modified to provide for additional funds based on need.

Response: The Program is designed to assist states in establishing estuarine sanctuaries. Funds are provided for an initial period of implemenatation; thereafter the states must assume responsibility for continued operation.

Section 921.33—Boundary Changes and Amendments to the Management Plan. (1) Several states requested that this section be modified to apply only to laws specifically applicable to the sanctuary, and not general environmental quality laws such as for air and water.

Response: Section 921.33 has been clarified to reflect this point.

(2) One commenter recommended that public notice and opportunity to comment be provided in all cases where boundaries are changed or management plans are amended under § 921.33.

Response: The proposed regulations provide that if NOAA determines it is necessary, public notice and an opportunity for comment on boundary changes and changes to the final management plan will be provided. Major changes do require public notice and opportunity for comment and, in certain cases, preparation of an environmental assessment. Thus, the clear intent of these regulations is to provide for public notice where applicable. There may, however, be times where changes to the management plan are minor and will not require such notice.

Section 921.34—Program Evaluation. (1) One commenter specifically questioned the value of Section 312-type evaluations of sanctuary performance; the commenter stated that performance reports, which are required as a condition of the financial award, are adequate for NOAA's purposes.

Response: Performance reports are of course helpful. But such reports do not address the specific range and depth of issues needed to assess the effectiveness of sanctuary operation and opportunities for improvement. In addition during an evaluation, individuals or groups that are, or should be, involved in sanctuary management or are affected by the sanctuary are contacted. This provides NOAA with valuable feedback that is necessary to gauge the effectiveness of the sanctuary's program.

(2) The same commenter as in (1) also questioned the value of a program evaluation after Federal funding expires.

Response: The required evaluations will ensure that sanctuary objectives, as specified in the management plan, are still being attained and that proposed boundary changes and amendments to the management plan can be reviewed. The evaluations will ensure that the purposes for which the sanctuary was established continue to be met and that the site meets the criteria of the national system.

After Federal funding expires, the state is required to submit an annual report on the sanctuary. The report will detail program successes and accomplishments in implementing the policies and activities described in the sanctuary management plan. The report also should propose a work plan for the next year of sanctuary operations and describe the state's role in ongoing sanctuary programs. Inadequate annual reports will trigger a full-scale evaluation with a site-visit. In addition, on a periodic basis, NOAA will also conduct a full-scale Section 312 evaluation with a site visit.

Section 921.35—Withdrawal of Designation. (1) Several reviewers suggested that the section on the withdrawal of designation be modified to allow the applicable state to participate in decisions regarding the disposition of property..

Response: The state will of course be consulted by NOAA in any decision regarding property disposition, which will be carried out according to Attachment N of OMB Circular A-102, Revised, and these regulations.

(2) Several reviewers questioned, in the event of withdrawal of sanctuary designation, the method of disposal for property held in less-than-fee simple or controlled by a lease.

Response: Section 921.21(e) [which was § 921.35(e) in the proposed regulations] would be followed to the extent it applies. Leasehold and other real property interests purchased in whole or in part with Federal funds are subject to the provisions of Attachment N, OMB Circular A-102, Revised.

(3) Another state requested that the deed language be rewritten so that a state would be "entitled to retain title to property which the state determines is no longer needed for grant purposes, so long as the property is used for other purposes approved by NOAA as being consistent with the sanctuary program."

Response: When property purchased in fee simple or less-than-fee simple is

no longer used for the purposes of the National Estuarine Sanctuary Program, NOAA is required to dispose of the property according to the provisions of Attachment N, OMB Circular A-102, Revised. These provisions are essentially the same as stated in § 921.21 (e) of the final regulations.

(4) One commenter suggested that specific criteria and an appeals procedure (including public notice of the proposed withdrawal of designation) be added to the regulations.

Response: As specified in §§ 921.34 and 921.35, NOAA's continuing evaluation of sanctuary performance will examine the state's performance in upholding the mandate of Section 315 of the Act, the national Program goals, and the policies established in the management plan. Specific criteria to judge these factors cannot be enumerated, but will be examined on a case-by-case basis. Section 921.35 spells out a procedure for withdrawal of designation, including an appeal to the Assistant Administrator for Ocean Services and Coastal Zone Management.

(5) One state questioned who would decide the "current fair market value" of lands slated for withdrawal of designation in § 921.35(e)(i) [now § 921.21(e)(i)]. It was recommended that an arbitration system of three independent appraisers or comparable system be established.

Response: Fair market value would be determined by an independent appraiser (e.g., certified real property appraiser or GSA representatives) and certified by a responsible official of the state, as provided by Attachment F of OMB Circular A-102, Revised.

Subpart E—Research Funds

(1) Several reviewers suggested that research funds be offered on a 100 percent Federal basis, i.e., without a state match requirement.

Response: Section 315 of the Coastal Zone Management Act requires that all funds to coastal states for national estuarine sanctuary purposes be provided on a fifty-fifty matching basis.

(2) Other commenters suggested that funding limits and the total research budget be discussed in the regulations.

Response: Funding limits and the total Federal funds for research in national estuarine sanctuaries will vary from year-to-year; thus, these figures are not included in the final regulations. NOAA will, however, distribute information about the relative funding limits and funding totals. Such information will be sent to states with national estuarine sanctuaries and to other interested parties.

Subpart F—General Financial Assistance Provisions

(1) One state criticized the exclusion of land as state match for the operation and management awards. The state found such an exclusion to be an undue constraint upon management and operation alternatives available to states.

Response: In order to maximize the support provided to a sanctuary during its early years, NOAA has precluded land as match for the operation and management award. To a reasonable degree, state match should relate to the purpose of the particular award. Since the purpose of the operation and management award is to provide for the sanctuary's operation and implementation of the management plan, the use of land as match is inappropriate, particularly since land acquisition should be well underway prior to the state's receiving an operation and management award. The allowable categories of match [see § 921.51(e)] provide the state with sufficient flexibility.

Appendix 2—Estuarine Typology

(1) One reviewer stated that in Group III—Chemical, the proposed salinity limits were particularly confusing. The reviewer noted that a salinity zone of 10 ppt to 20 ppt is very important because numerous estuaries possess waters in this salinity range, but the proposed polyhaline zone is too broad to describe this. The reviewer included the following table of salinity ranges from *Introduction to Marine Biology* by Mosby:

Salinity (0/00)	Type of water
0 to 0.5	Fresh water.
0.5 to 3.0	Oligohaline brackish water.
3.0 to 10	Mesohaline brackish water.
10.0 to 17	Polyhaline brackish water.
17 to 30	Oligohaline seawater.
30 to 34	Mesohaline seawater.
34 to 38	Polyhaline seawater.
>38	Brine.

From Valikangas, I. 1933. Uber die Biologie der Ostsee als Brackwassergebiet. Verh. int. Verein. theor. angew. Limnol. 6:1.

Response: Polyhaline should be 30 ppt to *18* ppt; the "5" was a typographical error. NOAA considered the information provided, but has decided to continue to use the proposed salinity ranges which are from *Ecology of Inland Waters and Estuaries* (Reid and Wood, 1976). This is the standard limnology test used in college. The table used as an example is from a 1933 paper; the salinity table used in the typology is the widely accepted "Venice System" adopted in 1958.

(2) The same reviewer also questioned the pH values suggesting that a pH of 5.5 is somewhat acid. It was suggested that the circumneutral range should be 6.5 rather than 5.5.

Response: For the reasons indicated in the above response, we decided to continue with the proposed system.

(3) Another reviewer stated that in Group II-Transition Areas, the description of coastal marshes and coastal mangroves as the only coastal wetland transition areas is too narrow. Other wetland areas (marshes, swamps, bogs) should be included.

Response: A new subtitle "Coastal Marshes and Swamps" has been added.

(4) Another commenter stated that the typology did not appear to contain criteria which adequately describe a Great Lakes-type site.

Response: Great Lakes areas can fall under Class II, Group I.B (Basin Structure); I.C (Inlet Type); I.D. (Bottom Composition); Group II.A (Circulation); II.C (Freshwater); and Group III-Chemical.

V. Other Actions Associated With the Proposed Rulemaking

(A) Classification Under Executive Order 12291

NOAA has concluded that these regulations are not major because they will *not* result in:

(1) An annual effect on the economy of $100 million or more;

(2) A major increase in costs or prices for consumers, individual industries, Federal, state or local government agencies, or geographic regions; or

(3) Significant adverse effects on competition, employment, investment, productivity, innovation or on the ability of United States-based enterprises to compete with foreign-based enterprises in domestic or export markets.

These final rules amend existing procedures for selecting and processing potential national estuarine sanctuaries in accordance with a revised biogeographic classification scheme and estuarine typologies. These rules establish a revised process for identifying, designating and managing national estuarine sanctuaries. They will not result in any direct economic or environmental effect nor will they lead to any major indirect economic or environmental impacts.

(B) Regulatory Flexibility Act Analysis

The General Counsel of the Department of Commerce certified to the Small Business Administration that this rule will not have a significant economic impact on a substantial number of small entities. Thus, regulatory Flexibility Analysis is not

required for this notice of final rulemaking. The regulations set forth procedures for identifying and designating national estuarine sanctuaries, and managing sites once designated.

These rules do not directly affect "small government jurisidictions" as defined by Pub. L. 96-354, the Regulatory Flexibility Act, and the rules will have no effect on small businesses.

(C) Paper Work Reduction Act of 1980 (Pub. L. 96-511)

These regulations do not impose any information requirements of the type covered by Pub. L. 96-511 other than those already approved by the Office of Management and Budget (approval number 0648-0121) for use through September 30, 1986.

(D) National Environmental Policy Act

NOAA has concluded that publication of these rules does not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, an environmental impact statement is not required.

List of Subjects in 15 CFR Part 921

Administrative practice and procedure, Coastal zone, Environmental protection, Natural resources, Wetlands.

(Federal Domestic Assistance Catalog Number 11.420 Estuarine Sanctuary Program)

Dated: February 29, 1984.

Paul M. Wolff,

Assistant Administrator for Ocean Services and Coastal Zone Management.

Accordingly, 15 CFR Part 921 is revised as follows:

PART 921—NATIONAL ESTUARINE SANCTUARY PROGRAM REGULATIONS

Subpart A—General

Sec.

921.1 Mission and goals.
921.2 Definitions.
921.3 National Estuarine Sanctuary Biogeographic Classification Scheme and Estuarine Typologies.
921.4 Relationship to other provisions of the Coastal Zone Management Act and to the National Marine Sanctuary Program.

Subpart B—Preacquisition: Site Selection and Management Plan Development

921.10 General.
921.11 Site selection.
921.12 Management Plan development.

Subpart C—Acquisition, Development, and Preparation of the Final Management Plan

921.20 General.
921.21 Initial acquisition and development awards.

Subpart D—Sancturay Designation and Subsequent Operation

Sec.

921.30 Designation of National Estuarine Sanctuaries.
921.31 Supplemental acquisition and development awards.
921.32 Operation and management: Implementation of the Management Plan.
921.33 Boundary changes, Amendments to the Management Plan, and addition of multiple-site components.
921.34 Program evaluation.
921.35 Withdrawal of designation.

Subpart E—Research Funds

921.40 General.
921.41 Categories of potential research projects; evaluation criteria.

Subpart F—General Financial Assistance Provisions

921.50 Application information.
921.51 Allowable costs.
921.52 Amendments to financial assistance awards.

Appendix 1—Biogeographic Classification Scheme
Appendix 2—Typology of National Estuarine Areas

Authority: Sec. 315(l), Pub. L. 92-583, as amended; 86 Stat. 1280 (16 U.S.C. 1461(1)).

Subpart A—General

§ 921.1 Mission and goals.

(a) The mission of the National Estuarine Sanctuary Program is the establishment and management, through Federal-state cooperation, of a national system of estuarine sanctuaries representative of the various regions and estuarine types in the United States. Estuarine sanctuaries will be established to provide opportunities for long-term research, education, and interpretation.

(b) The goals of the Program for carrying out this mission are:

(1) Enhance resource protection by implementing a long-term management plan tailored to the site's specific resources;

(2) Provide opportunities for long-term scientific and educational programs in estuarine areas to develop information for improved coastal decisionmaking;

(3) Enhance public awareness and understanding of the estuarine environment through resource interpretive programs; and

(4) Promote Federal-state cooperative efforts in managing estuarine areas.

(c) To assist the states in carrying out the Program's goals in an effective manner, the National Oceanic and Atmospheric Administration (NOAA) will coordinate a research and education information exchange throughout the national estuarine sanctuary system. As part of this role, NOAA will ensure that information and ideas from one sanctuary are made available to others in the system. The network that will be established will enable sanctuaries to exchange information and research data with each other, with universities engaged in estuarine research, and with Federal and state agencies. NOAA's objective is a system-wide program of research and monitoring capable of addressing the management issues that affect long-term productivity of our Nation's estuaries.

(d) Multiple uses are encouraged to the degree compatible with the sanctuary's overall purpose as provided in the management plan and consistent with subsections (a) and (b), above. Use levels are set by the individual state and analyzed in the management plan. The sanctuary management plan (see § 921.12) will describe the uses and establishes priorities among these uses. The plan shall identify uses requiring a state permit, as well as areas where uses are encouraged or prohibited. In general, sanctuaries are intended to be open to the public; low-intensity recreational and interpretive activities are generally encouraged.

(e) Certain manipulative research activities may be allowed on a limited basis, but only if specified in the management plan and only if the activity is consistent with overall sanctuary purposes and the sanctuary resources are protected. Manipulative research activities require the prior approval of the state and NOAA. Habitat manipulation for resource management purposes is not permitted within national estuarine sanctuaries.

(f) While the Program is aimed at protecting natural, pristine sites, NOAA recognizes that many estuarine areas have undergone ecological change as a result of human activities. Although restoration of degraded areas is not a primary purpose of the Program, some restorative activities may be permitted in an estuarine sanctuary as specified in the management plan.

(g) NOAA may provide financial assistance to coastal states, not to exceed 50 percent of all actual costs, to assist in the designation and operation of national estuarine sanctuaries (see section 921.51(e)). Three types of awards are available under the National Estuarine Sanctuary Program. The *preacquisition award* is for site selection and draft management plan preparation. The *acquisition and development award* is intended primarily for land acquisition and construction purposes. The *operation and management award* provides funds to assist in implementing the research, educational, and administrative

programs detailed in the sanctuary management plan. Under the Act, the Federal share of funding for a national estuarine sanctuary shall not exceed $3,000,000. At the conclusion of Federal financial assistance, funding for the long-term operation of the sanctuary becomes the responsibility of the state.

(h) Lands already in protected status by another Federal, state, local government or private organization can be included within national estuarine sanctuaries only if the managing entity commits to long-term non-manipulative management. Federal lands already in protected status cannot comprise the key land and water areas of a sanctuary (see § 921.11(c)(3)).

§ 921.2 Definitions.

(a) "Act" means the Coastal Zone Management Act, as amended, 16 U.S.C. 1451 *et seq.* Section 315(1) of the Act, 16 U.S.C. 1461(1), establishes the National Estuarine Sanctuary Program.

(b) "Assistant Administrator" (AA) means the Assistant Administrator for Ocean Services and Coastal Zone Management, National Ocean Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, or his/her successor or designee.

(c) "Coastal state" means a state of the United States in, or bordering on, the Atlantic, Pacific, or Arctic Ocean, the Gulf of Mexico, Long Island Sound, or one or more of the Great Lakes. For the purposes of this title, the term also includes Puerto Rico, the Virgin Islands, Guam, the Commonwealth of the Northern Marianas, and the Trust Territories of the Pacific Islands, and American Samoa (see 16 U.S.C. 1454(4)).

(d) "Estuary" means that part of a river or stream or body of water having unimpaired connection with the open sea, where the sea water is measurably diluted with fresh water derived from land drainage. The term also includes estuary-type areas of the Great Lakes, see 16 U.S.C. 1454(7).

(e) "National Estuarine Sanctuary" means and area, which may include all or the key land and water portion of an estuary, and adjacent transitional areas and uplands, constituting to the extent feasible a natural unit, set asides as a natural field laboratory to provide long-term opportunities for research, educational, and interpretation on the ecological relationships within the area (see 16 U.S.C. 1454(8)).

§ 921.3 National Estuarine Sanctuary Biogeographic Classification Scheme and Estuarine Typologies.

(a) National estuarine sanctuaries are chosen to reflect regional differences and to include a variety of ecosystem types. A biogeographic classification scheme based on regional variations in the nation's coastal zone has been developed. The biogeographic classification scheme is used to ensure that the National Estuarine Sanctuary System includes at least one site from each region. The estuarine typology system is utilized to ensure that sites in the Program reflect the wide range of estuarine types within the United States.

(b) The biogeographic classification scheme, presented in Appendix 1, contains 27 regions. Figure 2 graphically depicts the biogeographic regions of the United States.

(c) The typology system is presented in Appendix 2.

§ 921.4 Relationship to other provisions of the Coastal Zone Management Act and to the National Marine Sanctuary Program.

(a) The National Estuarine Sanctuary Program is intended to provide information to state agencies and other entities involved in coastal zone management decisionmaking pursuant to the Coastal Zone Management Act, 16 U.S.C. 1451 *et seq.* Any coastal state, including those that do not have approved coastal zone management programs under section 306 of the Act, is eligible for an award under the National Estuarine Sanctuary Program (see § 921.2(e)).

(b) Where feasible, the National Estuarine Sanctuary Program will be conducted in close coordination with the National Marine Sanctuary Program (Title III of the Marine Protection, Research and Sanctuaries Act, as amended, 16 U.S.C. 1431–1434), also administered by NOAA. Title III authorizes the Secretary of Commerce to designate ocean waters as marine sanctuaries to protect or restore such areas for their conservation, recreational, ecological, or esthetic values. National marine and estuarine sanctuaries will not overlap, though they may be adjacent.

Subpart B—Preacquisition: Site Selection and Management Plan Development

§ 921.10 General.

(a) A state may apply for a preacquisition award for the purpose of site selection and preparation of documents specified in § 921.12 (draft management plan and environmental impact statement (EIS)). The total Federal share of the preacquisition award may not exceed $50,000, of which up to $10,000 may be used for site selection as described in § 921.11. Financial assistance application procedures are specified in Subpart F.

(b) In selecting a site, a state may choose to develop a multiple-site sanctuary reflecting a diversity of habitats in a single biogeographic region. A multiple-site sanctuary also allows the state to develop complementary research and educational programs within the multiple components of its sanctuary. Multiple-site sanctuaries are treated as one sanctuary in terms of financial assistance and development of an overall management framework and plan. Each individual component of a proposed multiple-site sanctuary shall be evaluated separately under § 921.11(c) as part of the site selection process. A state may propose to establish a multiple-site sanctuary at the time of the initial site selection, or at any point in the development or operation of the estuarine sanctuary, even after Federal funding for the single component sanctuary has expired. If the state decides to develop a multiple-site national estuarine sanctuary after the initial acquisition and development award is made on a single site, the proposal is subject to the requirements set forth in § 921.33. It should be noted, however, that the total funding for a multiple-site sanctuary remains at the $3,000,000 limit; the funding for operation of a multiple-site sanctuary is also limited to the $250,000 standard (see § 921.32(b)).

§ 921.11 Site selection.

(a) A state may use up to $10,000 in Federal preacquisition funds to establish and implement a site selection process which is approved by NOAA.

(b) In Addition to the requirements set forth in Subpart F, a request for Federal funds for site selection must contain the following programmatic information:

(1) A description of the proposed site selection process and how it will be implemented in conformance with the biogeographic classification scheme and typology (§ 921.3);

(2) An identification of the site selection agency and the potential management agency; and

(3) A description of how public participation will be incorporated into the process (see § 921.11(d)).

(c) As part of the site selection process, the state and NOAA shall evaluate and select the final site(s). NOAA has final authority in approving such sites. Site selection shall be guided by the following principles:

(1) The site's benefit to the National Estuarine Sanctuary Program relative to the biogeographic classification scheme

and typology set forth in § 921.3 and Appendices 1 and 2;

(2) The site's ecological characteristics, including its biological productivity, diversity of flora and fauna, and capacity to attract a broad range of research and educational interests. The proposed site should, to the maximum extent possible, be a natural system;

(3) Assurance that the site's boundaries encompass an adequate portion of the key land and water areas of the natural system to approximate an ecological unit and to ensure effective conservation. Boundary size will vary greatly depending on the nature of the ecosystem. National estuarine sanctuaries may include existing Federal or state lands already in a protected status where mutual benefit can be enhanced, see § 921.51(e)(2). Importantly, however, NOAA will not approve a site for potential sanctuary status that is dependent upon the inclusion of currently protected Federal lands in order to meet the requirements for sanctuary status (such as key land and water areas). Such lands may only be included within a sanctuary to serve as a buffer or for other ancillary purposes;

(4) The site's importance for research, including proximity to existing research facilities and educational institutions; *(Comment:* NOAA is developing more detailed criteria for selecting potential national estuarine sanctuaries based upon research characteristics. Once these criteria are developed, a notice of their availability will be published in the **Federal Register**).

(5) The site's compatibility with existing and potential land and water uses in contiguous areas; and

(6) The site's importance to education and interpretive efforts, consistent with the need for continued protection of the natural system.

(d) Early in the site selection process, the state must seek the views of affected landowners, local governments, other state and Federal agencies, and other parties who are interested in the area(s) being considered for selection as a potential national estuarine sanctuary. After the local government and affected landowners have been contacted, at least one public meeting shall be held in the area of the proposed site. Notice of such a meeting, including the time, place, and relevant subject matter, shall be announced by the state through the area's principal news media at least 15 days prior to the date of the meeting and by NOAA in the **Federal Register.**

§ 921.12 Management Plan development.

(a) After the selected site is approved by NOAA and the state, the state may request the remainder of the preacquisition funds to develop the draft management plan and environmental impact statement. The request must be accompanied by the information specified in Subpart F and the following programmatic information:

(1) An analysis of the site based on the biogeographic scheme/typology discussed in § 921.3 and set forth in Appendices 1 and 2;

(2) A description of the site and its major resources, including location, proposed boundaries, and adjacent land uses. Maps, including aerial photographs, are required;

(3) A description of the public participation process used by the state to solicit the views of interested parties, a summary of comments, and, if interstate issues are involved, documentation that the Governor(s) of the other affected state(s) has been contacted;

(4) A list of all sites considered and a brief statement of the basis for not selecting the non-preferred sites; and

(5) A draft management plan outline (see subsection (b) below) and an outline of a draft memorandum of understanding (MOU) between the state and NOAA detailing the Federal-state roles in sanctuary management during the period of federal funding and expressing the state's long-term commitment to operate and manage the sancturay.

(b) After NOAA approves the state's request to use the remaining preacquisition funds, the state shall begin developing a draft management plan. The plan will set out in detail:

(1) Sanctuary goals and objectives, management issues, and strategies or actions for meeting the goals and objectives;

(2) An administrative section including staff roles in administration, research, education/interpretation, and surveillance and enforcement.

(3) A research plan, including a monitoring design;

(4) An interpretive plan (including interpretive, educational and recreational activities);

(5) A plan for public access to the sanctuary;

(6) A construction plan, including a proposed construction schedule, and drawings of proposed developments. If a visitor center, research center or any other facilities are proposed for construction or renovation at the site, a preliminary engineering report must be prepared;

Note.—Information on preparing a preliminary engineering report (PER) is provided in "Engineering and Construction Guidelines for Coastal Energy Impact Program Applicants" (42 FR 64830 (1977)), which is supplied to award recipients;

(7) An acquisition plan identifying the ecologically key land and water areas of the sanctuary, priority acquisitions, and strategies for acquiring these areas. This plan should identify ownership patterns within the proposed sanctuary boundaries; land already in the public domain; an estimate of the fair market value of land to be acquired; the method of acquisition, or the feasible alternatives (including less-than-fee techniques) for the protection of the estuarine area; a schedule for acquisition with an estimate of the time required to complete the proposed sanctuary; and a discussion of any anticipated problems;

Note.—As discussed in § 921.11(c)(3), if protected lands are to be included within the proposed sanctuary, the state must demonstrate to NOAA that the site meets the criteria for national estuarine sanctuary status independent of the inclusion of such protected lands.

(8) A resource protection plan detailing applicable authorities, including allowable uses, uses requiring a permit and permit requirements, any restrictions on use of the sanctuary, and a strategy for sanctuary surveillance and enforcement of such use restrictions, including appropriate government enforcement agencies;

(9) If applicable, a restoration plan describing those portions of the site that may require habitat modification to restore natural conditions; and

(10) A proposed memorandum of understanding (MOU) between the state and NOAA regarding the Federal-state relationship during the establishment and development of the national estuarine sanctuary, and expressing the long-term commitment by the state to maintain effectively the sanctuary after Federal financial assistance ends. In conjunction with the MOU and where possible under state law, the state will consider taking appropriate administrative or legislative action to ensure the long-term protection of the sanctuary. The MOU shall be signed prior to sanctuary designation. If other MOUs are necessary (such as with a federal agency or another state agency), drafts of such MOUs also must be included in the plan.

(c) Regarding the preparation of an environmental impact statement (EIS) under the National Environmental Polic Act on a national estuarine sanctuary proposal, the state shall provide all

necessary information to NOAA concerning the socioeconomic and environmental impacts associated with implementing the draft management plan and feasible alternatives to the plan. Based on this information, NOAA will prepare the draft EIS.

(d) Early in the development of the draft management plan and the draft EIS, the state shall hold a meeting in the area or areas most affected to solicit public and government comments on the significant issues related to the proposed action. NOAA will publish a notice of the meeting in the **Federal Register** and in local media.

(e) NOAA will publish a **Federal Register** notice of intent to prepare a DEIS. After the draft EIS is prepared and filed with the Environmental Protection Agency (EPA), a Notice of Availability of the DEIS will appear in the **Federal Register**. Not less than 30 days after publication of the notice, NOAA will hold at least one public hearing in the area or areas most affected by the proposed sanctuary. The hearing will be held no sooner than 15 days after appropriate notice by NOAA of the meeting has been given in the principal news media and in the **Federal Register**. After a 45-day comment period, a final EIS is prepared by NOAA.

Subpart C—Acquisition, Development, and Preparation of the Final Management Plan

§ 921.20 General.

After NOAA approval of the site, the draft management plan and the draft MOU, and completion of the final EIS, a state is eligible for an acquisition and development award to acquire land and water areas for inclusion in the sanctuary and to construct research and educational facilities in accordance with the draft management plan. The acquisition and development award has two phases. In the initial phase, state performance should work to meet the criteria required for formal sanctuary designation, i.e., acquiring the key land and water areas as specified in the draft management plan and preparing the final plan. These requirements are specified in § 921.30. The initial acquisition and development phase is expected to last no longer than two years after the start of the award. If necessary, a longer time period may be negotiated between the state and NOAA. After the sanctuary is designated, funds may be used to acquire any remaining land and for construction purposes.

§ 921.21 Initial acquisition and development awards.

(a) Assistance is provided to aid the recipient in: (1) Acquiring land and water areas to be included in the sanctuary boundaries; (2) minor construction, as provided in paragraphs (b) and (c) of this section; (3) preparing the final management plan; and (4) up to the point of sanctuary designation, for initial management costs, e.g., implementing the NOAA approved draft management plan, preparing the final management plan, hiring a sanctuary manager and other staff as necessary, and for other management-related activities. Application procedures are specified in Subpart F.

(b) The expenditure of Federal and state funds on major construction activities is not allowed during the initial acquisition and development phase. The preparation of architectural and engineering plans, including specifications, for any proposed construction is permitted. In addition, minor construction activities, consistent with paragraph (c) of this section also are allowed. The NOAA-approved draft management plan must, however, include a construction plan and a public access plan before any award funds can be spent on construction activities.

(c) Only minor construction activities that aid in implementing portions of the management plan (such as boat ramps and nature trails) are permitted under the initial acquisition and development award. No more than five (5) percent of the initial acquisition and development award may be expended on such facilities. NOAA must make a specific determination, based on the final EIS, that the construction activity will not be detrimental to the environment.

(d) Except as specifically provided in paragraphs (a)–(c) of this section, construction projects, to be funded in whole or in part under the acquisition and development award, may not be initiated until the sanctuary receives formal designation, see § 921.30.

Note.—The intent of these requirements and the phasing of the acquisition and development award is to ensure that substantial progress in acquiring the key land and waters areas has been made and that a final management plan is completed before major sums are spent on construction. Once substantial progress in acquisition has been made, as defined by the state in the management plan, other activities guided by the final management plan may begin with NOAA's approval.

(e) Deeds for real property acquired for the sanctuary under acquisition funding shall contain substantially the following provision:

Title to the property conveyed by this deed shall vest in the [recipient of the CZMA Section 315 award or other Federally-approved entity] subject to the condition that the property shall remain part of the Federally-designated [name of National Estuarine Sanctuary]. In the event that the property is no longer included as part of the sanctuary, or if the sanctuary designation of which it is part is withdrawn, then the National Oceanic and Atmospheric Administration or its successor agency, in conjunction with the State, may exercise any of the following rights regarding the disposition of the property:

(i) The recipient may be required to transfer title to the Federal Government. In such cases, the recipient shall be entitled to compensation computed by applying the recipient's percentage of participation in the cost of the program or project to the current fair market value of the property; or

(ii) At the discretion of the Federal Government, (a) the recipient may either be directed to sell the property and pay the Federal Government an amount computed by applying the Federal percentage of participation in the cost of the original project to the proceeds from the sale (minus actual and reasonable selling and fix-up expenses, if any, from the sale proceeds); or (b) the recipient may be permitted to retain title after paying the Federal Government an amount computed by applying the Federal percentage of participation in the cost of the original project to the current fair market value of the property.

Note.—Fair market value of the property must be determined by an independent appraiser and certified by a responsible official of the state, as provided by OMB Circular A-102 Revised, Attachment F.

(f) Prior to submitting the final management plan to NOAA for review and approval, the state should hold a public meeting in the area affected by the estuarine sanctuary. NOAA will publish a notice of the meeting in the **Federal Register** and in the local media.

Subpart D—Sanctuary Designation and Subsequent Operation

§ 921.30 Designation of National Estuarine Sanctuaries.

(a) The AA shall designate an area as a national estuarine sanctuary pursuant to Section 315 of the Act, based upon written findings that the state has met the following conditions:

(1) A final management plan has been approved by NOAA;

(2) Sanctuary construction and access policies, § 921.21(b)–(d), have been followed;

(3) Key land and water areas of the proposed sanctuary, as identified in the management plan, are under state control; and

(4) An MOU between the state and NOAA ensuring a long-term commitment by the state to the

sanctuary's effective operation and implementation has been signed.

(b) A notice of designation of a national estuarine sanctuary will be placed in the Federal Register and in the local media.

(c) The term "state control" in § 921.30(a)(3) does not necessarily require that the land be owned by the state in fee simple. Less-than-fee interests and regulatory measures may suffice where the state makes a showing that the lands are adequately controlled consistent with the purposes of the sanctuary.

§ 921.31 Supplemental acquisition and development awards.

After sanctuary designation, and as specified in the approved management plan, the state may request a supplemental acquisition and development award for construction and acquiring any remaining land. Application procedures are specified in Subpart F. Land acquisition must follow the procedures specified in § 921.21(e).

§ 921.32 Operation and management: Implementation of the Management plan.

(a) After the sanctuary is formally designated, the state may apply for assistance to provide for operation and management. The purpose of this phase in the national estuarine sanctuary process is to implement the approved final management plan and to take the necessary steps to ensure the continued effective operation of the sanctuary after direct Federal support is concluded.

(b) Federal funds of up to $250,000, to be matched by the state, are available for the operation and management of the national estuarine sanctuary. Operation and management awards are subject to the following limitations:

(1) No more than $50,000 in Federal funds per annual award; and

(2) No more than ten percent of the total amount (state and Federal shares) of each operation and management award may be used for construction-type activities (i.e., $10,000 maximum per year).

§ 921.33 Boundary changes, amendments to the Management Plan, and addition of multiple-site components.

(a) Changes in sanctuary boundaries and major changes to the final management plan, including state laws or regulations promulgated specifically for the sanctuary, may be made only after written approval by NOAA. If determined to be necessary, NOAA may require public notice including notice in the Federal Register and an opportunity for comment. Changes in the boundary involving the acquisition of properties not listed in the management plan or final EIS require public notice and the opportunity for comment; in certain cases, an environmental assessment may be required. Where public notice is required, NOAA will place a notice in the Federal Register of any proposed changes in sanctuary boundaries or proposed major changes to the final management plan and ensure that a notice is published in the local media.

(b) As discussed in § 921.10(b), a state may choose to develop a multiple-site national estuarine sanctuary after the initial acquisition and development award for a single site has been made. Public notice of the proposed addition in the Federal Register and local media, and the opportunity for comment, in addition to the preparation of either an environmental assessment or environment impact statement on the proposal will be required. An environmental impact statement, if required, will be prepared in accordance with section 921.12 and will also include an administrative framework for the multiple-site sanctuary that describes the complementary research and educational programs within the sanctuary. If NOAA determines, based on the scope of the project and the issues associated with the additional site, that an environmental assessment is sufficient to establish a mulitple-site sanctuary, then the state shall develop a revised management plan as described in § 921.12(b). The revised management plan will address the sanctuary-wide goals and objectives and the additional component's relationship to the original site.

§ 921.34 Program evaluation.

(a) Performance during the term of the operation and management award (or under the initial acquisition and development award, if the sanctuary is not designated within two years) will be evaluated annually by the Program Office and periodically in accordance with the provisions of Section 312 of the Act to determine compliance with the conditions of the award and overall progress in implementing the management plan.

(b) To ensure effective sanctuary oversight after the major federal funding expires, the state is required to submit an annual report on the sanctuary. The report should detail program successes and accomplishments in meeting the policies and activities described in the sanctuary management plan. A work plan, detailing the projects to be undertaken the next year to meet the Program goals and the state's role in ongoing sanctuary programs, should also be included. Inadequate annual reports will trigger a full-scale management audit with a site-visit. On a periodic basis, NOAA will also conduct a full-scale Section 312 evaluation with a site visit and public meeting.

§ 921.35 Withdrawal of designation.

(a) Upon a finding by the Program Office through its programmatic evaluation (§ 921.34) that a national estuarine sanctuary is not meeting the mandate of Section 315 of the Act, the national Program goals or the policies established in the management plan, NOAA will provide the state with a written notice of the deficiency. Such a notice will explain the deficiencies in the state's approach, propose a solution or solutions to the deficiency and provide a schedule by which the state should remedy the deficiency. The state shall also be advised in writing that it may comment on the Program Office's finding of a deficiency and meet with Program officials to discuss the finding and seek to remedy the deficiency.

(b) If the issues cannot be resolved within a reasonable time, the Program Office will make recommendation regarding withdrawal of designation to the AA. A notice of intent to withdraw designation, with an opportunity for comment, will be placed in the Federal Register.

(c) The state shall be provided the opportunity for an informal hearing before the AA to consider the Program Office's recommendation and finding of deficiency, as well as the state's comments on and response to the recommendation and finding.

(d) Within 30 day after the informal hearing, the AA shall issue a written decision regarding the sanctuary. If a decision is made to withdraw sanctuary designation, the procedures specified in § 921.21(e) regarding the disposition of real property acquired with federal funds shall be followed.

Subpart E—Research Funds

§ 921.40 General.

(a) To stimulate high quality research within designated national estuarine sanctuaries, NOAA may find research on a competitive basis to sanctuaries having an approval final management plan. Research funds are intended to support significant research projects that will lead to enhanced scientific understanding of the sanctuary environment, improved coastal decisionmaking, improved sanctuary management, or enhanced public appreciation and understanding of the sanctuary ecosystem. Research opportunities will be identified in final

management plans for national estuarine sanctuaries. Research funds will be used to fill obvious voids in available data, as well as to support creative or innovative projects.

(b) Research funds are provided in addition to any funds available to the state under the operation and management or acquisition and development awards. Research funds must be matched by the state, consistent with § 921.51(e)(iii) ("allowable costs"). Individual states may apply for funding for more than one research project per sanctuary.

§ 921.41 Categories of potential research project; evaluation criteria.

(a) While research funds may be used to start-up long-term projects, they are not intended as a source of continuing funding for a particular project over time. Emphasis will be placed on projects that are also of benefit to other sanctuaries in the system. Proposals for research under the following categories will be considered:

(1) Establishing a Data Base and Monitoring Program (e.g., studies related to gathering and interpreting baseline information on the estuary. Funds are available to establish a data base and monitoring system; however, the long-term support for such a system must be carried out as part of overall sanctuary implementation);

(2) Estuarine Ecology (e.g., studies of the relationships between estuarine species and their environment, studies of biological populations community relationships, studies on factors and processes that govern the biological productivity of the estuary);

(3) Estuarine Processes (e.g., studies on dynamic physical processes that influence and give the estuary its particular physical characteristics, including studies related to climate, patterns of watershed drainage and freshwater inflow, patterns of water circulation within the estuary, and studies on oceanic or terrestrial factors that influence the condition of estuarine waters and bottoms);

(4) Applied Research (e.g., studies designed to answer specific management questions); and

(5) Socioeconomic Research (e.g., studies on patterns of land use, sanctuary visitation, archaeological research).

(b) Proposals for research in national estuarine sanctuaries will be evaluated in accordance with criteria listed below:

(1) Scientific merits;

(2) Relevance or importance to sanctuary management or coastal decisionmaking;

(3) Research quality (i.e., soundness of approach, environmental consequences, experience related to methodologies);

(4) Importance to the National Estuarine Sanctuary Program;

(5) Budget and Institutional Capabilities (i.e., reasonableness of budget, sufficiency of logistical support); and

(6) In addition, in the case of long-term monitoring projects, the ability of the state or the research grant recipient to support the grant beyond this initial funding.

Subpart F—General Financial Assistance Provisions

§ 921.50 Application information.

(a) The maximum total Federal funding per sanctuary is $3,000,000 for the preacquisition, acquisition and development, and operation and management awards. The research funding under § 921.40 is excluded from this total.

(b) Only a state Governor, or his/her designated state agency, may apply for national estuarine sanctuary financial assistance awards. If a state is participating in the national Coastal Zone Management Progam, the recipient of an award under Section 315 of the Act shall consult with the state coastal management agency regarding the application.

(c) No acquisition and development award may be made by NOAA without the approval of the Governor of the state, or his/her designated agency, in which the land to be acquired is located.

(d) All applications are to be submitted to: Management and Budget Group, Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration, 3300 Whitehaven St., NW., Washington, D.C. 20235.

(e) An original and two copies of the complete application must be submitted at least 120 working days prior to the proposed beginning of the project. The Application for Federal Assistance Standard Form 424 (Non-construction Program) constitutes the formal application for preacquisition, operation and management, and research awards. The Application for Federal Assistance Standard Form 424 (Construction Program) constitutes the formal application for land acquisition and development awards. The application must be accompanied by the information required in Subpart B (preacquisition), Subpart C and Section 921.31 (acquisition and development), and § 921.32 (operation and management), as applicable. All applications must contain back up data for budget estimates (Federal and non-Federal shares), and evidence that the application complies with the Executive Order 12372, "Intergovernmental Review of Federal Programs." In addition, applications for acquisition and development awards must contain:

(1) State Historic Preservation Office comments;

(2) Appraisals and title information;

(3) Governor's letter approving the sanctuary proposal; and

(4) Written approval from NOAA of the draft or final management plan.

The Standard Form 424 has been approved by the Office of Management and Budget (Approval number 0648-0121) for use through September 30, 1986.

§ 921.51 Allowable costs.

(a) Allowable costs will be determined in accordance with OMB Circulars A-102, "Uniform Administrative Requirements for Grants-in-Aid to State and Local Governments", and A-87, "Principles for Determining Costs Applicable to Grants and Contracts with State, Local, and Federally Recognized Indian Tribal Governments"; the financial assistance agreement; these regulations; and other Department of Commerce and NOAA directives. The term "costs" applies to both the Federal and non-Federal shares.

(b) Costs claimed as charges to the award must be reasonable, beneficial and necessary for the proper and efficient administration of the financial assistance award and must be incurred during the awards period, except as provided under preagreement costs, subsection (d).

(c) Costs must not be allocable to or included as a cost of any other Federally-financed program in either the current or a prior award period.

(d) Costs incurred prior to the effective date of the award (preagreement costs) are allowable only when specifically approved in the financial assistance agreement. For non-construction awards, costs incurred more than three months before the award beginning date will not be approved. For construction and land acquisition awards, NOAA will evaluate preagreement costs on a case-by-case basis.

(e) General guidelines for the non-Federal share are contained in OMB Circular A-102, Attachment F. The following may be used by the state in satisfying the matching requirement:

(1) *Preacquisition Awards.* Cash and in-kind contributions (value of goods

and services directly benefiting and specifically identifiable to this part of the project) are allowable. Land may not be used as match.

(2) *Acquisition and Development Awards.* Cash and in-kind contributions are allowable In general, the fair market value of lands to be included within the sanctuary boundaries and acquired pursuant to the Act, with other than Federal funds, may be used as match. The fair market value of privately donated land, at the time of donation, as establishment by an independent appraiser and certified by a responsible official of the State (pursuant to OMB Circular A-102 Revised, Attachment F) may also be used as match. Appraisals must be performed according to Federal appraisal standards as detailed in NOAA regulations and the "Uniform Appraisal Standards for Federal Land Acquisitions." Costs related to land acquisition, such as appraisals, legal fees and surveys, may also be used as match. Land, including submerged lands, already in the state's possession, in a fully-protected status consistent with the purposes of the National Estuarine Sanctuary Program, may be used as match only if it was acquired within a one-year period prior to the award of preacquisition or acquisition funds and with the intent to establish a national estuarine sanctuary. For state lands not in a fully-protected status (e.g., a state park containing an easement for subsurface mineral rights), the value of the development right or foregone value may be used as match if acquired by or donated to the state for inclusion within the sanctuary.

A state may initially use as match land valued at greater than the Federal share of the acquisition and development award. The value in excess of the amount required as match for the initial award may be used to match subsequent supplemental acquisition and development awards for the estuarine sanctuary.

(3) *Operations and Management Awards; Research Funds.* Cash and in-kind contributions (directly benefiting and specifically identifiable to this phase of the project), except land, are allowable.

§ 921.52 Amendments to financial assistance awards.

Actions requiring an amendment to the financial assistance award, such as a request for additional Federal funds, revisions of the approved project budget, or extension of the performance period must be submitted to NOAA on Standard Form 424 (OMB approved number 0748-0121 for use through September 30, 1986) and approved in writing.

Appendix 1—Biographic Classification Scheme

Acadian

1. Northern Gulf of Maine (Eastport to the Sheepscot River).
2. Southern Gulf of Maine (Sheepscot River to Cape Cod).

Virginian

3. Southern New England (Cape Cod to Sandy Hook).
4. Middle Atlantic (Sandy Hook to Cape Hatteras).
5. Chesapeake Bay.

Carolinian

6. Northern Carolinas (Cape Hatteras to Santee River).
7. South Atlantic (Santee River to St. John's River).
8. East Florida (St. John's River to Cape Canaveral).

West Indian

9. Caribbean (Cape Canaveral to Ft. Jefferson and south).
10. West Florida (Ft. Jefferson to Cedar Key).

Louisianian

11. Panhandle Coast (Cedar Key to Mobile Bay).
12. Mississippi Delta (Mobile Bay to Calveston).
13. Western Gulf (Calveston to Mexican border).

Californian

14. Southern California (Mexican border to Point Concepcion).
15. Central California (Point Concepcion to Cape Mendocino).
16. San Francisco Bay.

Columbian

17. Middle Pacific (Cape Mendocino to the Columbia River).
18. Washington Coast (Columbia River to Vancouver Island).
19. Puget Sound.

Great Lakes

20. Western Lakes (Superior, Michigan, Huron).
21. Eastern Lakes (Ontario, Erie).

Fjord

22. Southern Alaska (Prince of Wales Island to Cook Inlet).
23. Aleutian Islands (Cook Inlet to Bristol Bay).

Sub-Arctic

24. Northern Alaska (Bristol Bay to Damarcation Point).

Insular

25. Hawaiian Islands.
26. Western Pacific Island.
27. Eastern Pacific Island.

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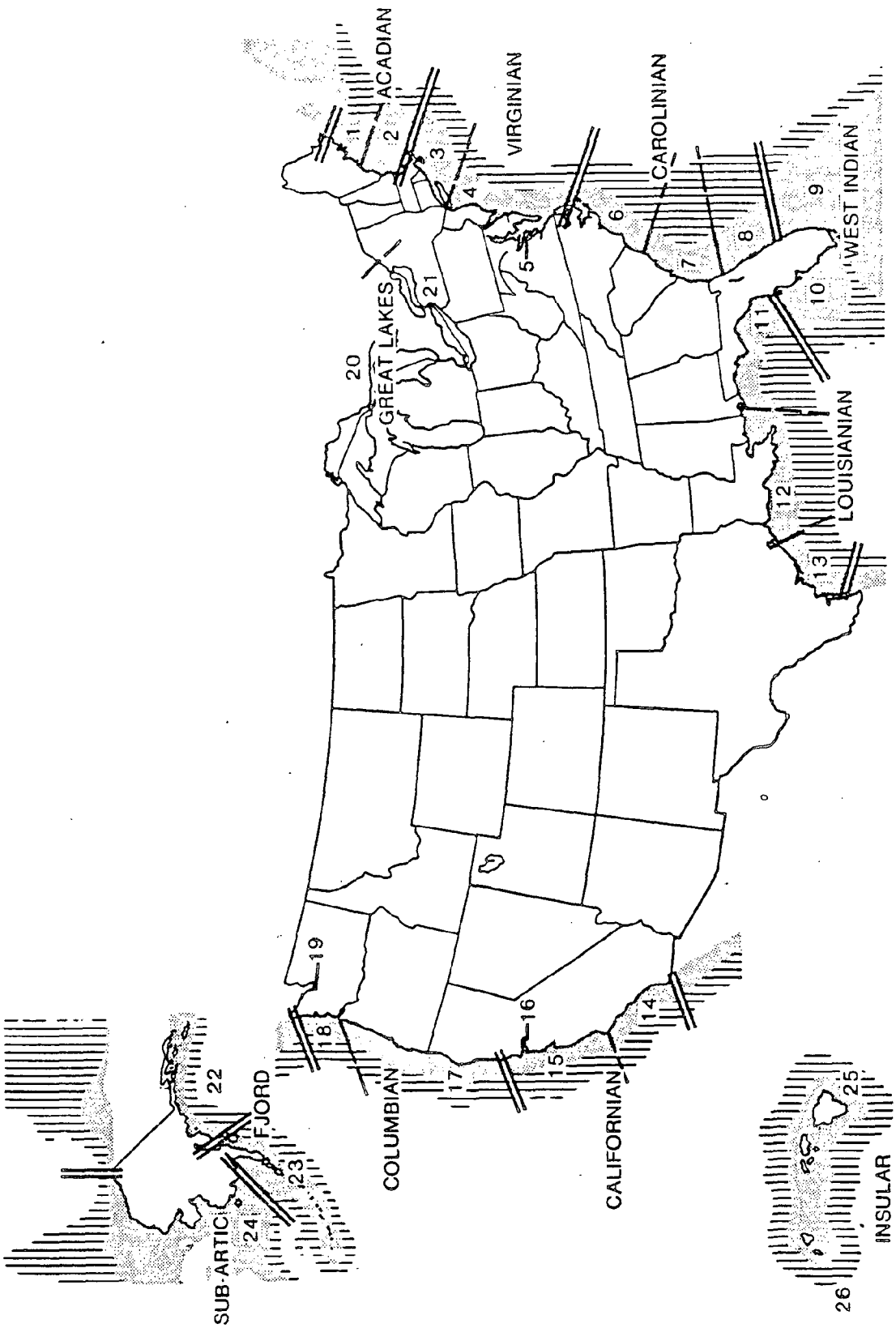

Figure 1. Biogeographic Regions of the United States.

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Appendix 2—Typology of National Estuarine Areas

This typology system reflects significant differences in estuarine characteristics that are not necessarily related to regional location. The purpose of this type of classification is to maximize ecosystem variety in the selection of national estuarine sanctuaries. Priority will be given to important ecosystem type as yet unrepresented in the sanctuary system. It should be noted that any one site may represent several ecosystem types or physical characteristics.

Class I—Ecosystem Types

Group I—Shorelands

A. *Maritime Forest-Woodland:* This type of ecosystem consists of single-stemmed species that have developed under the influence of salt spray. It can be found on coastal uplands or recent features, such as barrier islands and beaches, and may be divided into the following biomes:

1. *Northern Coniferous Forest Biome:* This is an area of predominantly evergeens such as the sitka spruce (*Picea*), grand fir (*Abies*), and white cedar (*Thuja*), with poor development of the shrub and herb layers, but high annual productivity and pronounced seasonal periodicity.

2. *Moist Temperate (Mesothermal) Coniferous Forest Biome:* Found along the west coast of North America from California to Alaska, this area is dominated by conifers, has a relatively small seasonal range, high humidity with rainfall ranging from 30 to 150 inches, and a well-developed understory of vegetation with an abundance of mosses and other moisture-tolerant plants.

3. *Temperate Deciduous Forest Biome:* This biome is characterized by abundant, evenly distributed rainfall, moderate temperatures which exhibt a distinct seasonal pattern, well-developed soil biota and herb and shrub layers, and numerous plants which produce pulpy fruits and nuts. A distant subdivision of this biome is the *pine edaphic forest* of the southeastern coastal plain, in which only a small portion of the area is occupied by climax vegetation, although it has large areas covered by edaphic climax pines.

4. *Broad-leaved Evergreen Subtropical Forest Biomes:* The main characteristic of this biome is high moisture with less pronounced differences between winter and summer. Examples are the hammocks of Florida and the live oak forests of the Gulf and South Atlantic coasts. Floral dominants include pines, magnolias, bays, hollies, wild tamarind, strangler fig, gumbo limbo, and palms.

B. *Coast Shrublands:* This is a transitional area between the coastal grasslands and woodlands and is characterized by woody species with multiple stems a few centimeters to several meters above the ground developing under the influence of salt spray and occasional sand burial. This includes thickets, scrub, scrub savanna, heathlands, and coastal chaparral. There is a great variety of shrubland vegetation exhibiting regional specificity:

1. *Northern Areas:* Characterized by *Hudsonia*, various erinaceous species, and thickets of *Myrica*, *Prunus*, and *Rosa*.

2. *Southeast Areas:* Floral dominants include *Myrica*, *Baccharis*, and *Ilex*.

3. *Western Areas: Adenostoma*, *Arcotyphylos*, and *Eucalyptus* are the dominant floral species.

C. *Coastal Grasslands:* This area, which possesses sand dunes and coastal flats, has low rainfall (10 to 30 inches per year) and large amounts of humus in the soil. Ecological succession is slow, resulting in the presence of a number of seral stages of community development. Dominant vegetation includes mid-grasses (2 to 4 feet tall), such as *Ammophila*, *Agropyron*, and *Calamovilfa*, tall grasses (5 to 8 feet tall), such as *Spartina*, and trees such as the willow (*Salix* sp.), cherry (*Prunus* sp.), and cottonwood (*Populus deltoides*). This area is divided into four regions with the following typical strand vegetation:

1. Arctic/Boreal: *Elymus;*
2. Northeast/West: *Ammophila;*
3. Southeast/Gulf: *Uniola;* and
4. Mid-Atlantic/Gulf: *Spartina patens.*

D. *Coastal Tundra:* This ecosystem, which is found along the Arctic and Boreal coasts of North America, is characterized by low temperatures, a short growing season, and some permafrost, producing a low, treeless mat community made up of mosses, lichens, heath, shrubs, grasses, sedges, rushes, and herbaceous and dwarf woody plants. Common species include arctic/alpine plants such as *Empetrum nigrum* and *Betula nana*, the lichens *Cetraria* and *Cladonia*, and herbaceous plants such as *Potentilla tridentata* and *Rubus chamaemorus*. Common species on the coastal beach ridges of the high arctic desert include *Dryas intergrifolia* and *Saxifrage oppositifolia*.

This area can be divided into two main subdivisions:

1. *Low Tundra:* characterized by a thick, spongy mat of living and undecayed vegetation, often with water and dotted with ponds when not frozen; and

2. *High Tundra:* a bare area except for a scanty growth of lichens and grasses, with underlying ice wedges forming raised polygonal areas.

E. *Coastal Cliffs:* This ecosystem is an important nesting site for many sea and shore birds. It consists of communities of herbaceaous, graminoid, or low woody plants (shrubs, heath, etc.) on the top or along rocky faces exposed to salt spray. There is a diversity of plant species including mosses, lichens, liverworts, and "higher" plant representatives.

Group II—Transition Areas

A. *Coastal Marshes:* These are wetland areas dominated by grasses (Poacea), sedges (Cyperaceae), rushes (Juncaceae), cattails (Typhaceae), and other graminoid species and is subject to periodic flooding by either salt or freshwater. This ecosystem may be subdivided into: (a) tidal, which is periodically flooded by either salt or brackish water; (b) non-tidal (freshwater); or (c) tidal freshwater. These are essential habitats for many important estuarine species of fish and invertebrates as well as shorebirds and waterfowl and serves important roles in shore stabilization, flood control, water purification, and nutrient transport and storage.

B. *Coastal Swamps:* These are wet lowland areas that support mosses and shrubs together with large trees such as cypress or gum.

C. *Coastal Mangroves:* This ecosystem experiences regular flooding on either a daily, monthly, or seasonal basis, has low wave action, and is dominated by variety of salt-tolerant trees, such as the red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia nitida*), and the white mangrove (*Laguncularia racemosa*). It is also an important habitat for large populations of fish, invertebrates, and birds. This type of ecosystem can be found from central Florida to extreme south Texas to the islands of the Western Pacific.

D. *Intertidal Beaches:* This ecosystem has a distinct biota of microscopic animals, bacteria, and unicelluar algae along with macroscopic crustaceans, mollusks, and worms with a detritus-based nutrient cycle. This area also includes the driftline communities found at high tide levels on the beach. The dominant organisms in this ecosystem include crustaceans such as the mole crab (*Emerita*), amphipods (Gammaridae), ghost crabs (*Ocypode*), and bivalve molluscs such as the coquina (*Donax*) and surf clams (*Spisula* and *Mactra*).

E. *Intertidal Mud and Sand Flats:* These areas are composed of unconsolidated, high organic content sediments that function as a short-term storage area for nutrients and organic carbons. Macrophytes are nearly absent in this ecosystem, although it may be heavily colonized by benthic diatoms, dino-flagellates, filamentous blue-green and green algae, and chaemosynthetic purple sulfur bacteria. This system may support a considerable population of gastropods, bivalves, and polychaetes, and may serve as a feeding area for a variety of fish and wading birds. In sand, the dominant fauna include the wedge shell *Donax*, the scallop *Pecten*, tellin shells *Tellina*, the heart urchin *Echinocardium*, the lug worm *Arenicola*, sand dollar *Dendraster*, and the sea pansy *Renilla*. In mud, faunal dominants adapted to low oxygen levels include the terebellid *Amphitrite*, the boring clam *Playdon*, the deep sea scallop *Placopecten*, the quahog *Mercenaria*, the echiurid worm *Urechis*, the mud snail *Nassarius*, and the sea cucumber *Thyone*.

F. *Intertidal Algal Beds:* These are hard substrates along the marine edge that are dominated by macroscopic algae, usually thalloid, but also filamentous or unicellular in growth form. This also includes the rocky coast tidepools that fall within the intertidal zone. Dominant fauna of these areas are barnacles, mussels, periwinkles, anemones, and chitons. Three regions are apparent:

1. *Northern Latitude Rocky Shores:* It is in this region that the community structure is best developed. The dominant algal species include *Chondrus* at the low tide level, *Fucus* and *Ascophyllum* at the mid-tidal level, and *Laminaria* and other kelp-like algae just beyond the intertidal, although they can be exposed at extremely low tides or found in very deep tidepools.

2. *Southern Latitudes:* The communities in this region are reduced in comparison to

those of the northern latitudes and possesses algae consisting mostly of single-celled or filamentous green, blue-green, and red algae, and small thalloid brown algae.

3. *Tropical and Subtropical Latitudes:* The intertidal in this region is very reduced and contains numerous calcareous algae such as *Porolithon* and *Lithothamnion*, as well as green algae with calcareous particles such as *Halimeda*, and numerous other green, red, and brown algae.

Group III—Submerged Bottoms

A. *Subtidal Hardbottoms:* This system is characterized by a consolidated layer of solid rock or large pieces of rock (neither of biotic origin) and is found in association with geomorphological features such as submarine canyons and fjords and is usually covered with assemblages of sponges, sea fans, bivalves, hard corals, tunicates, and other attached organisms. A significant feature of estuaries in many parts of the world is the oyster reef, a type of subtidal hardbottom. Composed of assemblages of organisms (usually bivalves), it is usually found near an estuary's mouth in a zone of moderate wave action, salt content, and turbidity. If light levels are sufficient, a covering of microscopic and attached macroscopic algae, such as kelp, may also be found.

B. *Subtidal Softbottoms:* Major characteristics of this ecosystem are an unconsolidated layer of fine particles of silt, sand, clay, and gravel, high hydrogen sulfide levels, and anaerobic conditions often existing below the surface. Macrophytes are either sparse or absent, although a layer of benthic microalgae may be present if light levels are sufficient. The faunal community is dominated by a diverse population of deposit feeders including polychaetes, bivalves, and burrowing crustaceans.

C. *Subtidal Plants:* This system is found in relatively shallow water (less than 8 to 10 meters) below mean low tide. It is an area of extremely high primary production that provides food and refuge for a diversity of faunal groups, especially juvenile and adult fish, and in some regions, manatees and sea turtles. Along the North Atlantic and Pacific coasts, the seagrass *Zostera marina* predominates. In the South Atlantic and Gulf coast areas, *Thalassia* and *Diplanthera* predominate. The grasses in both areas support a number of epiphytic organisms.

Class II—Physical Characteristics

Group I—Geologic

A. *Basin Type:* Coastal water basins occur in a variety of shapes, sizes, depths, and appearances. The eight basic types discussed below will cover most of the cases:

1. *Exposed Coast:* Solid rock formations or heavy sand deposits characterize exposed ocean shore fronts, which are subject to the full force of ocean storms. The sand beaches are very resilient, although the dunes lying just behind the beaches are fragile and easily damaged. The dunes serve as a sand storage area, making them chief stabilizers of the ocean shorefront.

2. *Sheltered Coast:* Sand or coral barriers, built up by natural forces, provide sheltered areas inside a bar or reef where the ecosystem takes on many characteristics of confined waters—abundant marine grasses, shellfish, and juvenile fish. Water movement is reduced, with the consequent effects of pollution being more severe in this area than in exposed coastal areas.

3. *Bay:* Bays are larger confined bodies of water that are open to the sea and receive strong tidal flow. When stratification is pronounced, the flushing action is augmented by river discharge. Bays vary in size and in type of shorefront.

4. *Embayment:* A confined coastal water body with narrow, restricted inlets and with a significant freshwater inflow can be classified as an embayment. These areas have more restricted inlets than bays, are usually smaller and shallower, have low tidal action, and are subject to sedimentation.

5. *Tidal River:* The lower reach of a coastal river is referred to as a tidal river. The coastal water segment extends from the sea or estuary into which the river discharges to a point as far upstream as there is significant salt content in the water, forming a salt front. A combination of tidal action and freshwater outflow makes tidal rivers well-flushed. The tidal river basin may be a simple channel or a complex of tributaries, small associated embayments, marshfronts, tidal flats, and a variety of others.

6. *Lagoon:* Lagoons are confined coastal bodies of water with restricted inlets to the sea and without significant freshwater inflow. Water circulation is limited, resulting in a poorly flushed, relatively stagnant body of water. Sedimentation is rapid with a great potential for basin shoaling. Shores are often gently sloping and marshy.

7. *Perched Coastal Wetlands:* Unique to Pacific islands, this wetland type, found above sea level in volcanic crater remnants, forms as a result of poor drainage characteristics of the crater rather than from sedimentation. Floral assemblages exhibit distinct zonation while the faunal constituents may include freshwater, brackish, and/or marine species. Example: Aunu'u Island, American Samoa.

8. *Anchialine Systems:* These small coastal exposures of brackish water form in lava depressions or elevated fossil reefs, have only a subsurface connection to the ocean, but show tidal fluctuations. Differing from true estuaries in having no surface continuity with streams or ocean, this system is characterized by a distinct biotic community dominated by benthic algae such as *Rhizoclonium*, the mineral encrusting *Schizothrix*, and the vascular plant *Ruppia maritima*. Characteristic fauna, which exhibit a high degree of endemicity, include the mollusks *Theodoxus neglectus* and *T. cariosus*, the small red shrimp *Metabetaeus lohena* and *Halocaridina rubra*, and the fish *Eleotris sandwicensis* and *Kuhlia sandvicensus*. Although found throughout the world, the high islands of the Pacific are the only areas within the U.S. where this system can be found.

B. *Basin Structure:* Estuary basins may result from the drowning of a river valley (coastal plains estuary), the drowning of a glacial valley (fjord), the occurrence of an offshore barrier (bar-bounded estuary), some tectonic process (tectonic estuary), or volcanic activity (volcanic estuary).

1. *Coastal plains estuary:* Where a drowned valley consists mainly of a single channel, the form of the basin is fairly regular, forming a simple coastal plains estuary. When a channel is flooded with numerous tributaries, an irregular estuary results. Many estuaries of the eastern United States are of this type.

2. *Fjord:* Estuaries that form in elongated, steep headlands that alternate with deep U-shaped valleys resulting from glacial scouring are called fjords. They generally possess rocky floors or very thin veneers of sediment, with deposition generally being restricted to the head where the main river enters. Compared to total fjord volume, river discharge is small. But many fjords have restricted tidal ranges at their mouths, due to sills, or upreaching sections of the bottom which limit free movement of water, often making river flow large with respect to the tidal prism. The deepest portions are in the upstream reaches, where maximum depths can range from 800 m to 1200 m, while sill depths usually range from 40 m to 150 m.

3. *Bar-bounded Estuary:* These result from the development of an offshore barrier, such as a beach strand, a line of barrier islands, reef formations, a line of moraine debris, or the subsiding remnants of a deltaic lobe. The basin is often partially exposed at low tide and is enclosed by a chain of offshore bars or barrier islands, broken at intervals by inlets. These bars may be either deposited offshore or may be coastal dunes that have become isolated by recent sea level rises.

4. *Tectonic Estuary:* These are coastal indentures that have formed through tectonic processes such as slippage along a fault line (San Francisco Bay), folding, or movement of the earth's bedrock, often with a large inflow of freshwater.

5. *Volcanic Estuary:* These coastal bodies of open water, a result of volcanic processes, are depressions or craters that have direct and/or subsurface connections with the ocean and may or may not have surface continuity with streams. These formations are unique to island areas of volcanic origin.

C. *Inlet Type:* Inlets in various forms are an integral part of the estuarine environment, as they regulate, to a certain extent, the velocity and magnitude of tidal exchange, the degree of mixing, and volume of discharge to the sea. There are four major types of inlets:

1. *Unrestricted:* An estuary with a wide, unrestricted inlet typically has slow currents, no significant turbulence, and receive the full effect of ocean waves and local disturbances which serve to modify the shoreline. These estuaries are partially mixed, as the open mouth permits the incursion of marine waters to considerable distances upstream, depending on the tidal amplitude and stream gradient.

2. *Restricted:* Restrictions of estuaries can exist in many forms: bars, barrier islands, spits, sills, and more. Restricted inlets result in decreased circulation, more pronounced longitudinal and vertical salinity gradients, and more rapid sedimentation. However, if the estuary mouth is restricted by depositional features or land closures, the incoming tide may be held back until it suddenly breaks forth into the basin as a

tidal wave, or *bore*. Such currents exert profound effects on the nature of the substrate, turbidity, and biota of the estuary.

3. *Permanent:* Permanent inlets are usually opposite the mouths of major rivers and permit river water to flow into the sea. Sedimentation and deposition are minimal.

4. *Temporary (Intermittent):* Temporary inlets are formed by storms and frequently shift position, depending on tidal flow, the depth of the sea and sound waters, the frequency of storms, and the amount of littoral transport.

D. *Bottom Composition:* The bottom composition of estuaries attests to the vigorous, rapid, and complex sedimentation processes characteristic of most coastal regions with low relief. Sediments are derived through the hydrologic processes of erosion, transport, and deposition carried on by the sea and the stream.

1. *Sand:* Near estuary mouths, where the predominating forces of the sea build spits or other depositional features, the shores and substrates of the estuary are sandy. The bottom sediments in this area are usually coarse, with a graduation toward finer particles in the head of the estuary. In the head region and other zones of reduced flow, fine silty sands are deposited. Sand deposition occurs only in wider or deeper regions where velocity is reduced.

2. *Mud:* At the base level of a stream near its mouth, the bottom is typically composed of loose muds, silt, and organic detritus as a result of erosion and transport from the upper stream reaches and organic decomposition. Just inside the estuary entrance, the bottom contains considerable quantities of sand and mud, which support a rich fauna. Mud flats, commonly built up in estuarine basins, are composed of loose, coarse, and fine mud and sand, often dividing the original channel.

3. *Rock:* Rocks usually occur in areas where the stream runs rapidly over a steep gradient with its coarse materials being derived from the higher elevations where the stream slope is greater. The larger fragments are usually found in shallow areas near the stream mouth.

4. *Oyster shell:* Throughout a major portion of the world, the oyster reef is one of the most significant features of estuaries, usually being found near the mouth of the estuary in a zone of moderate wave action, salt content, and turbidity. It is often a major factor in modifying estuarine current systems and sedimentation, and may occur as an elongated island or peninsula oriented across the main current, or may develop parallel to the direction of the current.

Group II—Hydrographic

A. *Circulation:* Circulation patterns are the result of the combined influences of freshwater flow, tidal action, wind and oceanic forces, and serve many functions: nutrient transport, plankton dispersal, ecosystem flushing, salinity control, water mixing, and more.

1. *Stratified:* This is typical of estuaries with a strong freshwater influx and is commonly found in bays formed from "drowned" river valleys, fjords, and other deep basins. There is a net movement of freshwater outward at the top layer and saltwater at the bottom layer, resulting in a net outward transport of surface organisms and net inward transport of bottom organisms.

2. *Non-stratified:* Estuaries of this type are found where water movement is sluggish and flushing rate is low, although there may be sufficient circulation to provide the basis for a high carrying capacity. This is common to shallow embayments and bays lacking a good supply of freshwater from land drainage.

3. *Lagoonal:* An estuary of this type is characterized by low rates of water movement resulting from a lack of significant freshwater influx and a lack of strong tidal exchange because of the typically narrow inlet connecting the lagoon to the sea. Circulation, whose major driving force is wind, is the major limiting factor in biological productivity within lagoons.

B. *Tides:* This is the most important ecological factor in an estuary, as it affects water exchange and its vertical range determines the extent of tidal flats which may be exposed and submerged with each tidal cycle. Tidal action against the volume of river water discharged into an estuary results in a complex system whose properties vary according to estuary structure as well as the magnitude of river flow and tidal range. Tides are usually described in terms of their cycle and their relative heights. In the United States, tide height is reckoned on the basis of average low tide, which is referred to as *datum*. The tides, although complex, falls into three main categories:

1. *Diurnal:* This refers to a daily change in water level that can be observed along the shoreline. There is one high tide and one low tide per day.

2. *Semidiurnal:* This refers to a twice daily rise and fall in water that can be observed along the shoreline.

3. *Wind/Storm Tides:* This refers to fluctuations in water elevation to wind and storm events, where influence of lunar tides is less.

C. *Freshwater:* According to nearly all the definitions advanced, it is inherent that all estuaries need freshwater, which is drained from the land and measurably dilutes seawater to create a brackish condition. Freshwater enters an estuary as runoff from the land either from a surface and/or subsurface source.

1. *Surface water:* This is water flowing over the ground in the form of streams. Local variation in runoff is dependent upon the nature of the soil (porosity and solubility), degree of surface slope, vegetational type and development, local climatic conditions, and volume and intensity of precipitation.

2. *Subsurface water:* This refers to the precipitation that has been absorbed by the soil and stored below the surface. The distribution of subsurface water depends on local climate, topography, and the porosity and permeability of the underlying soils and rocks. There are two main subtypes of surface water:

a. *Vadose water:* This is water in the soil above the water table. Its volume with respect to the soil, is subject to considerable fluctuation.

b. *Groundwater:* This is water contained in the rocks below the water table, is usually of more uniform volume than vadose water, and generally follows the topographic relief of the land, being high below hills and sloping into valleys.

Group III—Chemical

A. *Salinity:* This reflects a complex mixture of salts, the most abundant being sodium chloride, and is a very critical factor in the distribution and maintenance of many estuarine organisms. Based on salinity, there are two basic estuarine types and eight different salinity zones (expressed in parts per thousand—ppt).

1. *Positive estuary:* This is an estuary in which the freshwater influx is sufficient to maintain mixing, resulting in a pattern of increasing salinity toward the estuary mouth. It is characterized by low oxygen concentration in the deeper waters and considerable organic content in bottom sediments.

2. *Negative estuary:* This is found in particularly arid regions, where estuary evaporation may exceed freshwater inflow, resulting in increased salinity in the upper part of the basin, especially if the estuary mouth is restricted so that tidal flow is inhibited. These are typically very salty (hyperhaline), moderately oxygenated at depth, and possess bottom sediments that are poor in organic content.

3. *Salinity zones (expressed in ppt):*

a. *Hyperhaline*—greater than 40 ppt.

b. *Euhaline*—40 ppt to 30 ppt.

c. *Mixohaline:* 30 ppt to 0.5 ppt.

(1) Mixoeuhaline—greater than 30 ppt but less than the adjacent euhaline sea.

(2) Polyhaline—30 ppt to 18 ppt.

(3) Mesohaline—18 ppt to 5 ppt.

(4) Oligohaline—5 ppt to 0.5 ppt.

d. *Limnetic:* Less than 0.5 ppt.

B. *pH Regime:* This is indicative of the mineral richness of estuarine waters and fall into three main categories:

1. *Acid:* Waters with a pH of less than 5.5.

2. *Circumneutral:* A condition where the pH ranges from 5.5 to 7.4.

3. *Alkaline:* Waters with a pH greater than 7.4.

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