

# North Inlet/Winyah Bay National Estuarine Research Reserve

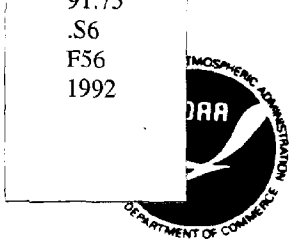
Final Management Plan  
October 1992



U.S. Department of Commerce  
National Oceanic and Atmospheric Administration  
National Ocean Service

Coastal Resource Management  
Reserves Division  
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Belle W. Baruch Institute  
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UNITED STATES  
DEPARTMENT OF COMMERCE

FINAL MANAGEMENT PLAN,

NORTH INLET/WINYAH BAY

NATIONAL ESTUARINE RESEARCH RESERVE

OCTOBER 1992

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## ACRONYMS

BI	Belle W. Baruch Institute for Marine Biology and Coastal Research
DMP	Draft Management Plan
EPA	Environmental Protection Agency
FMP	Final Management Plan
LTER	Long-Term Ecological Research
MOU	Memorandum of Understanding
NERRS	National Estuarine Research Reserve System
NI/WB NERR	North Inlet/Winyah Bay National Estuarine Research Reserve
NOAA	National Oceanic and Atmospheric Administration
OCRM	Office of Ocean and Coastal Resource Management (NOAA)
ORW	Outstanding Resource Waters
SCDHEC	South Carolina Department of Health and Environmental Control
SCDWMR	South Carolina Department of Wildlife and Marine Resources
SFH	Shellfish Harvesting Waters
SRD	Sanctuaries and Reserves Division (NOAA)
USC	The University of South Carolina



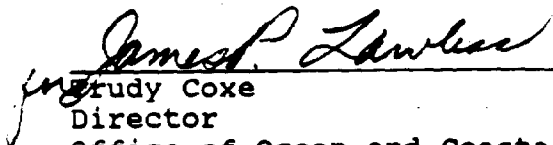
UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL OCEAN SERVICE  
OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT  
Washington, D.C. 20235

DESIGNATION OF THE NORTH INLET/WINYAH BAY  
NATIONAL ESTUARINE RESEARCH RESERVE

Consistent with the provisions of Section 315 of the Coastal Zone Management Act, 16 U.S.C. 1461, the State of South Carolina has met the following conditions to establish the North Inlet/Winyah Bay National Estuarine Research Reserve.

- 1) North Inlet/Winyah Bay regions are representative ecosystems that are suitable for long-term research and contribute to the biogeographical and topological balance of the National Estuarine Research Reserve System.
- 2) South Carolina state laws provide long-term protection for Reserve resources to ensure a stable environment for research.
- 3) Designation of North Inlet/Winyah Bay as a Reserve will serve to enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation.
- 4) The State of South Carolina has complied with the requirements of the regulations relating to designation of a National Estuarine Research Reserve.

Accordingly, I hereby designate the areas of North Inlet and Winyah Bay as a National Estuarine Research Reserve, the boundaries of which are specified in the Final Management Plan.

  
Grudy Coxé  
Director  
Office of Ocean and Coastal  
Resource Management



## I. EXECUTIVE SUMMARY

Section 315 of the Federal Coastal Zone Management Act of 1972 established the National Estuarine Research Reserve System (originally called the National Estuarine Sanctuary Program) as a Federal/state cooperative venture. Federal matching funds are available to coastal states to develop and manage a national system of estuarine research reserves which are representative of various regions and estuarine types in the United States. In addition, annual Federal matching funds for research and education projects are available. The goal of the program is to protect areas of representative estuaries, including valuable wetland habitat, for use as natural field laboratories. National Estuarine Research Reserves (NERRS) are established to: (1) provide opportunities for long-term estuarine research and monitoring; (2) provide opportunities for estuarine education and interpretation; (3) provide a basis for more informed coastal management decisions; and (4) promote public awareness, understanding and appreciation of estuarine ecosystems and their relationships to the environment as a whole.

The National Estuarine Research Reserve System (NERRS) has established a classification scheme that reflects differences in regional biogeography and estuarine typology to ensure that established sites are representative and that a variety of ecosystem types are included. The biogeographic classification scheme and estuarine typology system are shown in Appendix D. The North Inlet/Winyah Bay NERR (NI/WB NERR) is in the Northern Carolinas section of the Carolinian Biogeographic Classification Scheme.

The North Inlet/Winyah Bay NERR was proposed by the Belle W. Baruch Institute for Marine Biology and Coastal Research, The University of South Carolina (USC), a State agency, in cooperation with the South Carolina Coastal Council (SCCC), the state's lead agency in coastal zone management. In 1990 the Governor of South Carolina nominated the site to the National Oceanic and Atmospheric Administration (NOAA) and it was approved.

The NI/WB NERR encompasses a core area of approximately 9,000 acres of tidally flushed wetland, riparian habitats, and a limited amount of upland habitats (the Marsh Islands and lands associated with the laboratory complex, the Kimbel Living Center and the Clambank Landing area). With the exception of the State-controlled navigable waters, the remaining Reserve property is owned by the Belle W. Baruch Foundation which was established in perpetuity to preserve and conserve the environmental qualities of its property as well as to preserve its historical and cultural value. The Baruch Institute, USC, through a long-term agreement with the Foundation signed by the SC Attorney General, manages that portion of its lands which was a part of the Reserve. The Foundation has given its approval for its lands, described

in this Management Plan, to be included in the Reserve. This area is in Georgetown County, immediately east of Winyah Bay near Georgetown, SC, and south of the Debordieu Colony property located on the Waccamaw Neck peninsula.

This area was selected after an exhaustive selection process and a series of public meetings. It includes an undisturbed estuary (North Inlet) and an estuary which has been influenced by human activities (Winyah Bay). The Belle W. Baruch Institute for Marine Biology and Coastal Research, The University of South Carolina, as stated in a Memorandum of Understanding with the South Carolina Coastal Council and NOAA, is the lead agency.

The purpose of the NI/WB NERR is to establish and manage the areas within the boundaries as natural field laboratories and to develop a coordinated program of research and education for the reserve. Comparative ecosystem studies involving an undisturbed system and a human-influenced estuary will provide valuable scientific insights into the ecological processes controlling estuaries. Under the preferred alternative, the SC Coastal Council designated the Baruch Institute of the University of South Carolina to be the lead agency operating the Reserve in cooperation with the Belle W. Baruch Foundation, neighboring landowners, private citizens, state and Federal agencies, and advisory committees.

Reserve staff will initially include a Reserve Manager, Research/Resource Coordinator, Education Coordinator, and Secretary/Data Processor. 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 person will be employed and supervised by the Director of the Baruch Institute, USC. The Research/Resource Coordinator will develop and implement a resource assessment program, including long-term monitoring and research activities. The Education Coordinator will develop and coordinate education program activities that are consistent with the goals and objectives of the Reserve and the NERRS Network. The Secretary/Data Processor will assist the program staff by providing secretarial service and also assisting with data processing.

Research and education programs will gather and make available information necessary to improve understanding, appreciation, and management of the reserve site and national research and management issues. The NI/WB Reserve activities will augment, not replace, activities of other government agencies and the site owners. Traditional uses of the sites will continue and current site access policies will be enforced to protect the integrity of the Reserve. Facilities will be developed as necessary to aid in research and education.

The Management Plan provides information about the North Inlet/Winyah Bay National Estuarine Research Reserve and the programs and activities planned for the Reserve in the next few years. The Final Environmental Impact Statement, prepared

in May 1992, further established the boundary for the Reserve and outlined the general framework for the Management Plan. The present document finalizes the Reserve boundary and details the research and education activities and programs that will guide the management of the Reserve.

The Management Plan will be reviewed and updated periodically to ensure that it is meeting the overall goals and objectives of the Reserve and achieving effective management through the experience gained by on-going operations.

Valuable natural resources will be protected for long-term research and education by designation of the Reserve. Natural resources affected by the proposed action include a diverse, highly productive estuarine system (North Inlet) made up of wetlands and open water. The comparison of responses of an undisturbed estuary (North Inlet) with those responses of an estuarine system influenced by human activities (Winyah Bay) will provide useful data on resource utilization, protection, and restoration. In addition to the natural resources, the Reserve is endowed with nearby cultural reservoirs, including important historical and archaeological sites located on adjacent highlands.

Traditional public uses of the Reserve will not be altered. These uses include boating, fishing, observation of wildlife, swimming, and recreational harvesting of oysters and clams as permitted by state laws. Traditional uses of Winyah Bay permitted by state and Federal agencies will continue, including those associated with existing shipping channels.

The environmental consequences of the proposed action are strongly positive, the primary impact will be long-term protection of the natural resources. No resources will be irreversibly or irretrievably lost. On the contrary, these precious resources will be provided with long-term protection and will serve both now and in the future as sites for important estuarine research and education.

The Management Plan is in accordance with all relevant state, local and Federal regulations and is consistent with the objectives of Federal, state, regional, and local land use plans, policies, and controls for the areas concerned.



## II. INTRODUCTION

### A. Purpose and Scope of Plan

The State of South Carolina established the North Inlet/Winyah Bay National Estuarine Research Reserve (NERR) to provide representative natural areas for long-term research, monitoring, and education. The mission of the North Inlet/Winyah Bay NERR is to improve coastal resource management by increasing scientific understanding of estuarine systems and to provide useful information for decision makers and the public. This Management Plan will guide the activities carried out for the Reserve program and ensure that they are consistent with this primary mission.

This Management Plan has been developed according to National Oceanic and Atmospheric Administration (NOAA) regulations 15 CFR Part 921 (January 1, 1992) (Appendix C) using information derived from research and public input. It is consistent with the Congressional intent of the National Estuarine Research Reserve System (NERRS), the NOAA-State of South Carolina Memorandum of Understanding (MOU) concerning the North Inlet/Winyah Bay NERR, and provisions of the South Carolina Coastal Zone Management Program.

The purpose of this Management Plan is to inform parties about the Reserve and provide a framework for activities that will be conducted. Though it is long-term in scope, the Management Plan will be reviewed by NOAA every two years and revised every five years. Public comments will be received prior to changes in the Management Plan. Public notice of meetings dealing with changes in the Management Plan will be published in the local newspapers at least two weeks prior to these meetings.

### B. Background

#### 1. National Estuarine Research Reserve System (NERR)

In response to intense pressures on the coastal resources of the United States, Congress enacted the Coastal Zone Management Act (CZMA). The Act was signed into law in 1972, and amended in 1975, 1976, 1977, 1978, 1980, 1986, and 1990. The CZMA authorized a Federal grant-in-aid and assistance program to be administered by the Secretary of Commerce, who in turn delegated this responsibility to the NOAA's Assistant Administrator for Ocean Services and Coastal Zone Management.

The Act and its amendments affirm a national interest in the effective protection and careful development of the coastal zone by providing financial and technical assistance to U.S. coastal states and territories to voluntarily develop and

implement coastal zone management programs. The Act established a variety of grant-in-aid programs to coastal states for the purposes of:

- o Developing coastal zone management programs. (Sec. 305)
- o Implementing and administering coastal management programs that receive Federal approval. (Sec. 306)
  
- o Conducting technical assistance and management oriented research to support the development and implementation of state coastal management programs. (Sec. 309); and
  
- o Establishing the National Estuarine Research Reserve System. Funds are available to assist in the site selection, acquisition, development, and operation of reserves, and to support educational or interpretive activities and research and monitoring programs. (Sec. 315)

Recognizing the need to address threats to the country's important and sensitive estuarine areas, Congress established the National Estuarine Sanctuary Program as Section 315 of the CZMA. (See Appendix C) The reauthorization of the CZMA in 1986 included an amendment changing the name of the program to the National Estuarine Research Reserve System, reflecting a stronger emphasis on research. What were formerly "sanctuaries" are now called "research reserves." The goal of the program is to create a system of reserves that represents distinct estuarine ecosystems found nationally and to manage these areas for long-term research and education. Although the program is national in scope, individual states are responsible for implementing and administering their own programs.

The CZMA was reauthorized in 1990. Regulations revised the process for designation of research reserves. Greater emphasis is placed on the use of reserves to address national estuarine research and management issues, and to make maximum use of the System for research purposes through coordination with NOAA and other Federal and state agencies which are sponsoring estuarine research. Other activities were emphasized: (a) providing financial assistance to states to enhance public awareness and understanding of estuarine areas; (b) providing new guidance for delineating reserve boundaries and new procedures for arriving at the most effective and least costly approach to acquisition of land; and (c) clarifying the amount of financial assistance authorized for each national estuarine research reserve and criteria for withdrawing the designation of a reserve.

Coordination of the National Estuarine Research Reserve System (NERRS) is provided by the National Oceanic and Atmospheric Administration (NOAA), specifically the Sanctuaries and Reserves Division (SRD). In this Final Management Plan (FMP),

the coordinating entity will be referred to simply as NOAA, with the understanding that SRD is actually the responsible division within NOAA.

NERRS Regulations appear at 15 CFR Part 921. This Management Plan is consistent with these regulations. According to the regulations after designation NOAA will conduct periodic performance evaluations of a reserve at least every three years. Evaluations may be conducted more frequently as determined necessary by NOAA. These evaluations are required by Sections 312 and 315 of the Coastal Zone Management Act (CZMA) and will follow the evaluations procedures described in Section 312. Evaluations may assess all aspects of reserve operation and management, or they may focus on selected issues. Evaluations may also examine whether a reserve is in compliance with NERR designation regulations, and particularly whether the operations and management of the reserve are consistent with and further the mission and goals of the NERRS.

Federal officials will conduct the performance evaluations. When necessary, NOAA may request Federal and non-Federal experts to participate in the evaluations. Performance evaluations will be conducted in accordance with procedural and public participation provisions of CZMA regulations.

If performance evaluations reveal that the operation and management of the reserve is deficient or the research is inconsistent with the Reserve Guidelines, the eligibility of the reserve for Federal financial assistance may be suspended until the situation is remedied. If major deficiencies are not remedied within a reasonable amount of time, NOAA may initiate a process to withdraw designation of the reserve.

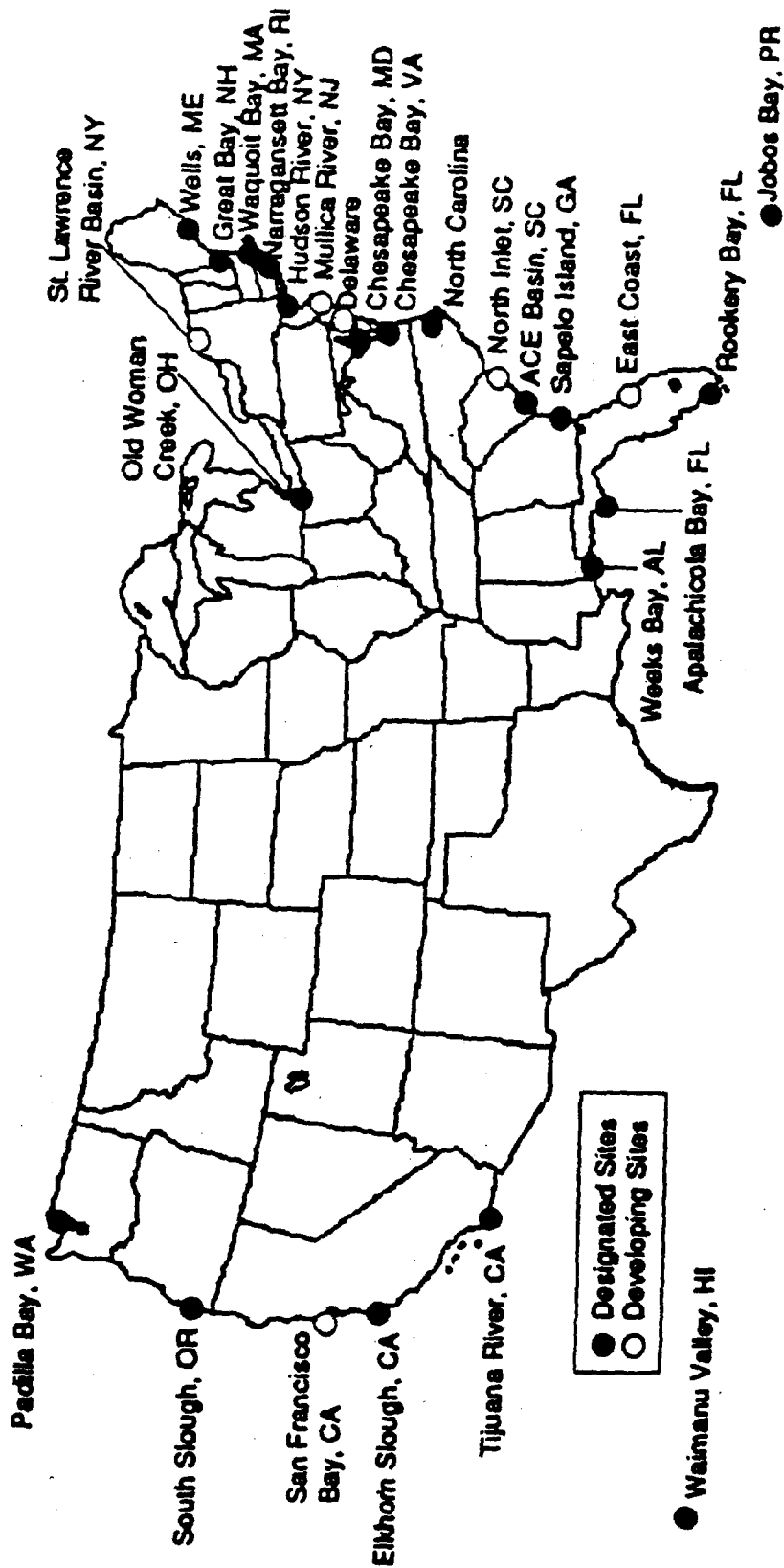
To ensure that the National Estuarine Research System includes sites that adequately represent regional and ecological differences, the NERRS regulations establish a biogeographical classification scheme that reflects regional differences in biogeography and an estuarine typology system which includes a variety of ecosystem types. (See Appendix C for a description of the biogeographic regions of the United States). Upon completion, the NERRS will contain representation of the 27 biogeographic regions of the Nation's coastal zone. The North Inlet/Winyah Bay National Estuarine Research Reserve (NI/WB NERR) lies in the Northern Carolinas sub-region of the Carolinian biogeographic region.

At the present time, twenty reserve sites have been designated across the country (Figure 1). Designated sites are:

# The National Estuarine Research Reserve System



Figure 1. Designated and Proposed National Estuarine Research Reserves



Research Reserve

Biogeographic Classification

Wells  
York County, Maine

Acadian

Great Bay  
Great Bay, New Hampshire

Acadian

Waquoit Bay  
Mashpee and Falmouth, Massachusetts

Virginian

Narragansett Bay  
Newport County, Rhode Island

Virginian

Hudson River (4 components)  
Hudson River, New York

Virginian

Chesapeake Bay, Maryland  
(3 components) Anne Arundel,  
Harford, Prince Georges, and  
Somerset Counties

Virginian

Chesapeake Bay, Virginia,  
(4 components) York, Gloucester,  
James City, and King William Counties

Virginian

North Carolina (4 components)  
Brunswick, Carteret, Currituck  
and New Hanover Counties

Virginian/Carolinian

Sapelo Island  
McIntosh County, Georgia

Carolinian

Rookery Bay  
Collier County, Florida

West Indian

Jobos Bay  
Guayama, Puerto Rico

West Indian

Apalachicola River/Bay  
Franklin County, Florida

Louisianan

Weeks Bay  
Baldwin County, Alabama

Louisianan

Tijuana River San Diego County, California	Californian
Elkhorn Slough Monterey County, California	Californian
South Slough Coos Bay, Oregon	Columbian
Padilla Bay Skagit County, Washington	Columbian
Old Woman Creek Erie County, Ohio	Great Lakes
Waimanu Valley Island of Hawaii, Hawaii	Insular
Ashepoo-Combahee-Edisto (ACE) Basin Colleton County, South Carolina	Carolinian

In addition, California-San Francisco Bay (San Francisco Bay), New York-St. Lawrence River Basin (Acadian), Delaware (Virginian), and East Coast Florida (Carolinian) have proposed sites to be included as National Estuarine Research Reserves and are in the process of producing environmental impact statements and management plans.

## **2. North Inlet/Winyah Bay National Estuarine Research Reserve**

Much of South Carolina's coastal zone is experiencing rapid population growth with attendant demands for residential, commercial and industrial development. In spite of the State's strong and effective coastal zone management program, these changes cannot be made without some adverse effects on our natural environment.

South Carolina's participation in the NERRS Program is based upon the recognition that the state contains a vast wealth of estuarine area that is affected through many diverse uses of the coastal zone.

Due to the immense complexity of relationships between the state's living marine and estuarine resources and their environment, sustained study of these resources is critical to our understanding of them and of the impact of human

activities on their future health and well-being. Unfortunately, there are fewer and fewer undisturbed or unpolluted areas that remain for scientific study and public education.

The North Inlet/Winyah Bay ecosystems, located near Georgetown, SC, have been recognized at the state and national level as sites of particular interest for comparative ecological studies. The North Inlet estuary, an ecosystem which is relatively unperturbed by humans, has been the site of intensive study for 20 years. The Institute of Ecology and the National Science Foundation have given this area a rating of 98% for site quality and the SC Department of Health and Environmental Control designated North Inlet as an Outstanding Resource Waters (ORW), an area possessing unique ecological qualities. In addition, North Inlet is part of the Carolinian-South Atlantic Biosphere Reserve, a part of the United States Man and the Biosphere Program (US MAB). Since 1980, this site has served as the only estuarine site in a network of 18 sites supported by the National Science Foundation's Long-Term Ecological Research Program. In contrast, the nearby Winyah Bay is an estuary which has been subjected to the influence of human activities. It is the connection to the sea of one of the largest watersheds on the east coast south of Chesapeake Bay.

This Reserve is viewed as an excellent site to provide a long-term database for valuable management of coastal resources. Early in the site selection process, other areas (Santee Bay and Port Royal Sound) were considered as possible NERR sites but were eliminated. The Site Selection Committee felt that the comparative study of an undisturbed and a disturbed estuary would provide a unique potential for research and education and would augment the variety of estuarine systems currently part of the NERR System. The South Carolina Attorney General's Office has affirmed that the State has adequate protective control over the Reserve's resources (see Appendix K). This position is based on the existence of a long-term agreement between the University of South Carolina and the Belle W. Baruch Foundation (Appendix A) to manage the uplands and salt marsh portions of the Reserve which are owned by the Foundation. The Foundation has approved the NI/WB NERR project. In addition, state laws provide protection for salt marshes and other lands located in the critical coastal zone area (see Section IV B-Resource Protection Plan for detailed description of laws and their enforcement). The site, which is an excellent example of undeveloped estuary (North Inlet) being located next to a highly developed estuary (Winyah Bay), allows comparative estuarine studies on how natural and disturbed estuarine ecosystems functions and the NERRS was viewed as a compatible tool to provide long-term management and opportunities for comparative research and education programs.

At its meeting of July 21, 1989, the SCCC, on recommendation of the site selection committee, approved the North Inlet/Winyah Bay site for nomination to NERRS. Upon this decision, Council staff, in conjunction with staff from the Belle W.

Baruch Institute, began preparation of the nomination package for submittal to NOAA under signature of Governor Carroll Campbell. On January 24, 1990, Governor Campbell nominated North Inlet/Winyah Bay as a Reserve (Appendix G). NOAA approved the site nomination on March 27, 1990 (Appendix H). In October 1991, a Draft Environmental Impact Statement/Draft Management Plan was published and a public hearing was held in November 1991 to solicit comments. Comments were incorporated in the Final Environmental Impact Statement/Draft Management Plan, published in May 1992.

### **III. MANAGEMENT BACKGROUND**

#### **A. Regional Setting**

The NI/WB NERR is the southernmost estuarine system in the Northern Carolinas section of the Carolinian Biogeographic Classification Scheme. It is unique in a local, regional, and national context. It consists of parts of two estuarine systems, an undisturbed estuary (North Inlet) and portions of an estuary which has been influenced by human activities (Winyah Bay). The North Inlet Estuary represents a discrete, high salinity estuarine system that is surrounded almost entirely (90%) by highlands owned by the Belle W. Baruch Foundation. The wetland portion of the estuary is managed by the Baruch Institute, University of South Carolina, a state agency, and the State of South Carolina. The remaining highlands that are part of the Debordieu Colony, an exclusive residential development, and North Island, owned by the State of South Carolina, managed by the Yawkey Wildlife Center, SC Wildlife and Marine Resources Department, and supported by the Yawkey Foundation, do not border on the core region of the reserve. Winyah Bay is one of the major estuarine ecosystems in the southeastern United States. The entire Winyah Bay watershed is approximately 18,000 square miles. Only the Mud Bay region of Winyah Bay, which interconnects with North Inlet estuary, is included as part of the reserve.

#### **B. Location and Access**

The North Inlet/Winyah Bay site, consisting of a core area and a buffer zone, is located in Georgetown County, SC (Figure 2). The North Inlet Estuary portion of the Reserve is a semi-enclosed body of water surrounded by terrestrial areas (Waccamaw Neck, North Island, and Debidue Island), with a major aquatic connection to the Atlantic Ocean and minor connections to Winyah Bay. Other areas in the Reserve include portions of the wetlands bordering Winyah Bay on the southern side of Waccamaw Neck, including the 1000-Acre Rice Field, and the Marsh Islands, Malady Bush Island, Pumpkinseed-Island, and Ranger Islands.

Access to the Reserve by land is from highway US 17 about 1 mile north of Georgetown. Immediately off the highway is the Nature Center of the Baruch Foundation and the USC Kimbel Living Center. An electric gate near the Nature



Center limits entrance to the main part of the Hobcaw Barony without authorization. Research investigators and official visitors utilizing the Reserve facilities will be permitted entrance. The research facilities are located approximately 2 miles from the entrance gate. Hobcaw Barony is approximately 30 miles south of Myrtle Beach and 50 miles north of Charleston. Major airlines service both cities.

Figure 2. NI-WB Site

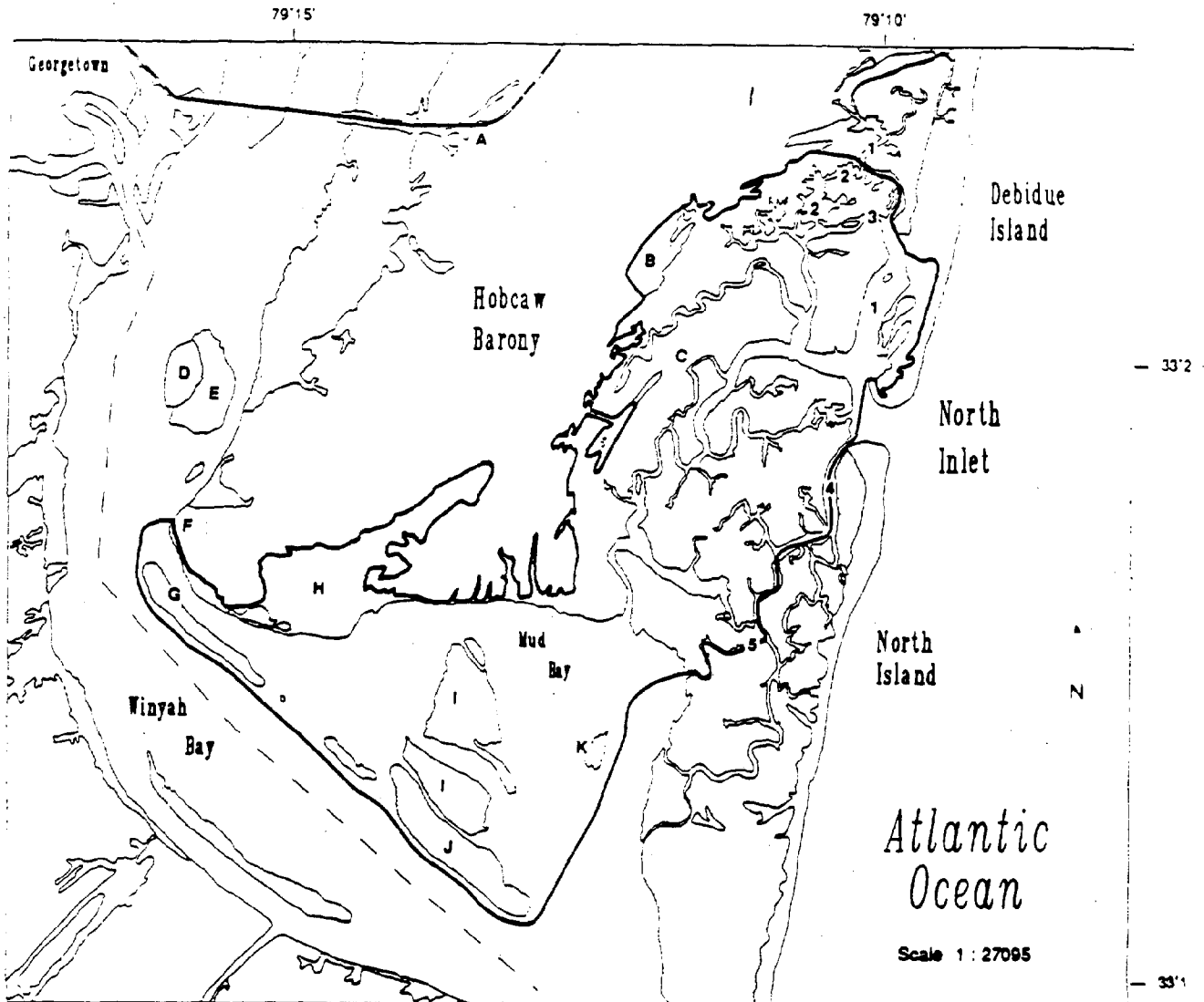


Fig. 2. Map of proposed North Inlet/Winyah Bay NERRS and surrounding area. Marshlands are shaded. Waterways, lands, and sites referenced in the text are designated as follows:

- |   |               |   |  |   |                       |
|---|---------------|---|--|---|-----------------------|
| 1 | Debidue Creek | A | Hobcaw entrance, Bellefield Nature Center, and Kimbel Living and Learning Center | F | Frazier Point         |
| 2 | Bass Hole Bay | B | Field Laboratory complex   | G | Ranger Island         |
| 3 | Cooks Creek   | C | Clambank Landing   | H | 1,000 Acre Rice Field |
| 4 | Jones Creek   |   |  | I | Marsh Islands         |

## C. Environment of the North Inlet/Winyah Bay Estuaries

### 1. General Description

The Reserve has several unique aspects. Most of the undisturbed marsh and adjacent uplands are owned by the Belle W. Baruch Foundation and the State of South Carolina, which have established these lands in perpetuity for conservation and research. In 1980, the North Inlet Estuary was selected as the marine-estuarine site in the National Science Foundation's nationwide Long-Term Ecological Research Program. The portion of North Inlet to be designated as a National Estuarine Research Reserve covers a 3,200 hectare area, with the majority classified as Outstanding Resource Waters (ORW) by the South Carolina Department of Health and Environmental Control (SCDHEC). This special category is for tidal salt waters which constitute an outstanding recreational or ecological resource and will be maintained and protected in its natural condition. The remainder of the areas of North Inlet Estuary is classified Shellfish Harvesting Waters (SFH) by SCDHEC, while the waters directly adjacent to Mud Bay are classified as SB, (no harvesting of clams, oysters, or mussels for human consumption) the same classification as Winyah Bay.

### 2. Hydrology

#### a. North Inlet Estuary

The circulation pattern of North Inlet is tidally dominated. The circulation structure resembles a Pritchards (1955) type D vertically homogeneous estuary, although in several creeks a lateral net circulation exists similar to the type C estuary. The maximum springtide range is 2.5 m and the neap tide range about 1.0 m, the maximum tidal current is 1.7 m/sec with the net currents being as great as 26 cm/sec. There is limited exchange of water between Winyah Bay and North Inlet; the greatest exchange of water occurs between North Inlet Estuary and the Atlantic Ocean through North Inlet. In the mouth of the inlet, salinity varies from 30 to 35 ppt; however, after severe rainstorms the salinity may temporarily drop to 20 ppt. Generally, salinities in all waterways are lowest in winter and spring. Water temperatures range from 3° to 30°C. Detailed analyses of many aspects of the physical oceanography of North Inlet have been published by Dr. B. Kjerfve and his students (see Appendix J for a partial listing of selected papers).

A long-term data base (approximately 11 years) exists which includes continuous recordings of precipitation, wind speed, barometric pressure, solar radiation, water and air temperatures, conductivity, and salinity. A daily water sample is taken from two or more locations and is analyzed for dissolved organic matter, N, P, C, chlorophyll, and particulate N, P, C, PO<sub>4</sub>, NH<sub>4</sub>, and NO<sub>3</sub>/NO<sub>2</sub>. Dr. E. Blood and her associates have published various studies regarding nutrient dynamics in the area (see bibliography of Long-Term Ecological Research publications Appendix J).

There are four distinct watersheds on the adjacent upland area; two drain west into Winyah Bay, one south into Mud Bay (Winyah Bay) and one east into the North Inlet Estuary. Extensive studies on hydrology have been undertaken by Dr. T. Williams and his associates from the Baruch Forest Science Institute of Clemson University. The natural drainage patterns of about 60% of the upland area have been interrupted by manmade ditches and dikes that date back to the rice culture days. All watersheds drain into intertidal areas and therefore are influenced to a certain degree by tidal fluctuations.

b. Winyah Bay Estuary

Winyah Bay is one of the major estuarine ecosystems in the southeastern United States. It is a class B type estuary according to Pritchard's classification (1955). The axis of Winyah Bay is roughly oriented in a northwest-southeast direction. The estuary is narrowest near its confluence with the ocean (1.5 km) and widest in the center (7 km). At the upper end of the bay where the major rivers (Black, Pee Dee, and Waccamaw rivers) converge, the width is about 2 km. Prominent features of Winyah Bay include: long rock jetties which project more than a mile into the ocean from North and South islands, several large islands within the bay, and a large shallow mid-section known as Mud Bay. Winyah Bay has a mean depth of only 15 ft (4.2 m) and many hectares of open waterways are less than 6 ft (2 m) in depth. A ship channel which is maintained at 27 ft (8.2 m) runs along the axis of the bay from the end of the jetties to Georgetown Harbor. Details of the bathymetry of Winyah Bay are available from Coast and Geodetic Survey navigation map No. 787 and several U.S. Army Corps of Engineers documents (e.g., Trawle, 1978).

The entire Winyah Bay watershed is approximately 18,000 square miles. Four major rivers drain into the system. More than 16,000 sq miles of this drainage area is associated with the Pee Dee-Yadkin river system which originates in the Blue Ridge Mountains area of North Carolina. Water from this area flows across the Piedmont region of both North and South Carolina, over the coastal plain of eastern South Carolina, and into Winyah Bay through the Pee Dee River. The Waccamaw River also receives water from the Pee Dee as the poorly defined, shallow, wide, swampy waterways merge upstream of the US Highway 17 bridges. The Black and Sampit rivers drain much smaller watersheds. Other characteristics of these watersheds are given by the Conservation Foundation (1980).

According to Johnson (1972), the freshwater input to Winyah Bay Estuary ranges from 2,000 to about 1,000,000 cubic feet per second (cfs), and mean runoff is approximately 15,000 cfs. Superimposed on this unidirectional freshwater flow toward the ocean is the regular semidiurnal tidal pattern. Mean tidal amplitude is on the order of 1.4 m at the ocean end of Winyah Bay and 1 m at the Sampit River (1.6 m and 1.2 m on spring tides, respectively; Trawle, 1969). A salt wedge effect

occurs as heavier salt water moves up-estuary along the bottom with a flooding tide, even though the overlying fresh water may be flowing toward the ocean. During periods of low freshwater inflow, flooding tides move salt water more than 15 miles upstream of the US Highway 17 bridges, but under average river flow, the penetration is usually within a mile of the bridges. Differences between surface and bottom salinities during these periods may be more than 20 ppt. U.S. Army Corps of Engineers' measurements (Trawle, 1978) indicate that while surface water salinities are usually 29-32 ppt near the ocean entrance during most flow conditions, surface salinities in Georgetown Harbor range from about 0 to 10 ppt. Salinity patterns in the mixing zone between these ends of the system are highly variable as a result of changing freshwater inflow, tidal amplitude, wind conditions, and bottom topography. Further information on the hydrography of Winyah Bay is available in Trawle (1969), Johnson (1970), and Bloomer (1973).

Almost the entire shore of Winyah Bay is vegetated by marshes. Approximately 31,867 acres (12,747 hectares) of marsh are associated with this estuary. More than 77% of these marshes are regularly flushed through tidal action; the remaining 13% are impounded (Tiner, 1977). Some 80% of the marshes are vegetated by freshwater plants while most of the other 20% are inhabited by the brackish water grass Spartina cynosuroides and black rush, Juncus roemerianus. Of the 17 estuarine systems in South Carolina, Winyah Bay is most important in terms of freshwater marshes. In fact, about 35% of the state's freshwater marsh lands occur there (Tiner, 1977). Relatively small stands of salt marsh cordgrass (Spartina alterniflora) occur near the entrance of Winyah Bay, and a narrow band occurs adjacent to major waterways upstream to the middle bay.

Water quality in Winyah Bay is directly influenced by inputs from the extensive Winyah Bay watershed (18,000 square miles) and from the Georgetown area. Georgetown is one of the most extensively developed areas of the Sea Island Coastal Region (Mathews et al., 1980). Winyah Bay has been classified as SB, meaning that its waters are not suitable for harvesting of clams, oysters, or mussels for market purposes or human consumption (South Carolina Department of Health and Environmental Control 1977; South Carolina Pollution Control Authority, 1972). Shellfishing in Winyah Bay has been restricted since 1964 (U.S. Department of Commerce, 1979). It is not the intent, objective nor desire of the NI/WB NERR to restrict the shipping activities of the port of Georgetown. Rather, the traditional and future port activities (i.e., commercial shipping and dredging of channels) in Winyah Bay are expected to be the major focus of comparative research projects with North Inlet.

### 3. Geology

North Inlet waters drain a very large marsh located between Debidue and North islands and the mainland. The mainland consists of Pleistocene Storm Beach

Terrain with ridges oriented in a northeasterly-southwesterly direction. These ridges intersect the Atlantic Ocean at the north end of Debidue Beach. These surficial mainland features are underlain by a complex sequence of older coastal plain sediments, a sequence which is poorly understood in the immediate area at the present time.

Debidue Beach and North Island represent part of a Holocene Barrier Beach System. This system has migrated southward in recent times, with principal evidence here being the major spit along the northern entrance to Winyah Bay, and smaller spit migration land forms along the northern border of North Inlet.

North Inlet drains numerous tidal creeks, and two of these extend back through the marsh to lie in close proximity to the Pleistocene mainland. The creeks are very shallow in depth, never exceeding 30 ft below mean sea level, and commonly showing floors which are occupied by sand bars. The marsh areas are underlain by silts and clays which extend an unknown depth below the surface.

Relief is generally flat; the western third of the peninsula has the most relief with bluffs adjacent to Winyah Bay as high as 15 m. Geologically, Winyah Bay represents a drowned river basin and receives water from an extensive drainage basin (see previous description).

#### 4. Climate

The climate is temperate or subtropical with air and water temperatures ranging from -13°C to +41°C and 3°C to 30°C , respectively. Winter temperatures are highly variable but generally mild. Ice occasionally forms on high marsh pools, but snow is a rare event. Rainfall is about 45 inches (114 cm) per year. Daytime temperatures are usually above 20°C from May through November.

#### 5. Living Resources

The Reserve includes a range of habitats ranging from salinity-dominated freshwater wetlands to ocean-dominated salt marshes. In addition, a series of habitats extending from the open ocean across a barrier island and an extensive salt marsh to the uplands are included. Island habitats which are used as bird nesting sites, as well as a portion of barrier island, are to be part of the reserve.

Since 1969, numerous studies have been conducted on the ecology of the North Inlet system; however, fewer studies exist for the Winyah Bay portion of the proposed estuarine reserve. To date, there are 951 publications representing marine and coastal studies completed by Baruch Associates (see Appendix J); many deal exclusively with the North Inlet-Winyah Bay system. Extensive faunal species lists and distribution information has been developed (see Zingmark, 1978; Fox and

Ruppert, 1985; Ogburn et al., 1988) and much of the phytoplankton, macroalgae, marsh plants, zooplankton, and meiofauna has been identified (see papers in Appendix E and Zingmark, 1978). The area includes many commercial and recreational species of fish and shellfish. A variety of resident and migratory birds inhabit this estuarine system (see Bildstein publications in Appendix J). A detailed characterization of the existing literature on the physical, chemical, and biological conditions of Winyah Bay and North Inlet Estuary is available (Blood and Vernberg, 1992).

a. Ecological Setting

All major temperate coastal habitats are represented within the Reserve. The North Inlet high salinity marsh-estuary has a semidiurnal tide with maximum amplitude of 2.2 m, a temperature range of 4°C to 32°C, and salinities which are usually greater than 28 ppt in the major waterways. Wetland habitats include exposed and sheltered sandy beaches; intertidal mudflats and oyster beds submerged algae beds; sand, shell, and mud benthic habitats; rock jetties; and rookery islands. More than 1,200 ha of brackish and freshwater marshes, which were formerly cultivated ricefields, border Winyah Bay.

b. Biotic Setting

Estuarine and salt marsh habitats are dominated by Spartina, Juncus, and Salicornia. Over 160 species of macroinvertebrates have been identified, including the typical fiddler crabs, blue crabs, oysters, ribbed mussels, mud flat snails, hermit crabs, and polychaetes. About 120 species of fish and 130 species of algae are found in the diverse waters of the region. The open dunes have at least 24 species of higher plants, including sea oats, Spartina patens, Panicum, and Iva.

The upland and freshwater biotic components consists of longleaf pines, turkey oak and live oak understories, sweetgum, loblolly pine, laurel oak, red maple, waxmyrtle, fetterbush, dwarf palmetto, bald cypress, water tupelo, red maple, sweetbay and red bay, live oak, eastern red cedar, yaupon, sea oats, american beach grass, wax myrtle, alligator weed, sedges, false nettle, and water pennywort.

All of the above communities are inhabited by relatively abundant populations of white-tailed deer, feral hogs, raccoons, squirrels, foxes, alligators, wood and white ibis, osprey, bobcats, songbirds, and red-cockaded woodpecker, waterfowl, and shore birds.

c. Biological Components

**Macrophyte**

North Inlet

The entire North Inlet Estuary has approximately 52 km<sup>2</sup> of salt marsh of which 49.1 (86%) was classified as low marsh and the remaining 2.9 km<sup>2</sup> (13%) is high marsh. Low marsh areas were dominated by Spartina alterniflora while the high marsh community contained a mix of species including Spartina alterniflora (smooth cordgrass), Juncus roemerianus (black needlerush), Borrchia frutescens (Sea oxy-eye), Distichlis spicata (Salt grass), Spartina patens (marsh-hay cordgrass), Fimbristylis spadicea salt marsh fimbristylis, Salicornia spp. (glassworts), Iva frutescens (marsh elder), and others (not identified in publication). Most, but not all of the North Inlet system, is included in the Reserve.

Winyah Bay

The entire Winyah Bay system has an extremely diverse plant community arising from the broad range of salinities which occurs in the estuary. Freshwater marshes comprised 90.6 km<sup>2</sup> (81%), brackish marshes 19.7 km<sup>2</sup> (18%), and salt marshes less than 1% (0.8 km<sup>2</sup>) of the total 127.3 km<sup>2</sup> marsh habitat in Winyah Bay. Marshes affected by tides (111.1 km<sup>2</sup>) are 87% of the marsh area. Not all of Winyah Bay is part of the Reserve.

Low marsh is dominated by Spartina alterniflora (smooth cordgrass), with Juncus roemerianus (black needlerush), Borrchia frutescens (sea ox-eye), Distichlis spicata (salt grass), Spartina patens (marsh-hay cordgrass), Fimbristylis spadicea (salt marsh fimbristylis), Salicornia spp. (glassworts), Iva frutescens (marsh elder), and Limonium spp. (sea lavender) in the high marsh.

The brackish marsh species include giant cordgrass, Juncus roemerianus (black needlerush), Scirpus robustus (salt marsh bulrush), Scirpus americanus (common three-square), Scirpus validus (soft-stem bulrush), Typha latifolia (broadleaf cattail), Typha glauca (blue cattail), Pontedaria cordata (pickerel-weed), Sagittaria sp. (arrowhead), Hymenocallis crassifolia (spider-lily), Spartina cynosuroides (salt reedgrass), Phragmites communis (reed), and Peltandra virginica (arrow-arum).

In low salinity brackish marshes, Spartina cynosuroides (salt reedgrass) occurs. Giant cutgrass (Zizaniopsis miliacea) is a common plant in fresh-water marshes along with Pontedaria cordata (pickerel-weed), Cladium jamaicense (sawgrass), Impatiens capensis (jewel-weed), Sium suave (water parnsnip, and Polyfonum spp. (smart weeds).



No biomass, productivity, or areal extent of individual species have been documented for Winyah Bay marsh vegetation.

## Phytoplankton

### North Inlet

Phytoplankton have been sampled at a number of locations in North Inlet Estuary and 229 species have been identified. The phytoplankton community was composed of 201 diatoms, 23 dinoflagellates, 1 silicoflagellate, 3 naked flagellates, and 1 cyanophyte. Neritic species were more prevalent than oceanic species. Freshwater forms were negligible. Freshwater forms were negligible.

Standing crop estimates from cell counts have been made for stages of the tide, seasonally, and during different years.

In addition, annual phytoplankton production has been found to vary from 178 g C/m<sup>2</sup>/yr to 409 g C/m<sup>2</sup>/yr. Annual phytoplankton production varied spatially with lowest production at Clambank and increasing southward to Winyah Bay or eastward to the plume outside North Inlet. Exchanges with Winyah Bay and the coastal ocean indicated a net phytoplankton import to North Inlet from these sources. Total phytoplankton production generally followed the annual temperature cycle ranging from a low in November to high in August. Similar seasonal patterns were observed in Winyah Bay.

### Winyah Bay

Only two studies on phytoplankton biomass have been conducted in Winyah Bay. In general, higher chlorophyll *a* concentrations were detected in surface waters. River sources for chlorophyll *a* dominated in the summer and oceanic sources dominated in the winter. Spatial differences were observed in Winyah Bay. Chlorophyll *a* declined with increasing salinity indicating a river source for phytoplankton within Winyah Bay.

## Benthic Microalgae

Studies on benthic microalgae are limited. No studies were conducted on microalgae in Winyah Bay. In North Inlet Estuary only production estimates were available. No explicit studies were conducted on community composition in North Inlet Estuary. Benthic microalgae production during 1973-1975 was 2.5 times greater than phytoplankton production for that same period. Mean annual abundance of benthic diatom cells at a mud site located in Bread and Butter Creek was  $21.0 \times 10^6$  ( $\pm 7.6 \times 10^6$ ) diatoms/10 cm<sup>2</sup> and  $5.39 \times 10^6$  ( $\pm 2.44 \times 10^6$ ) diatoms/10 cm<sup>2</sup> at a sand site in Debidue Creek. Bimodal seasonal abundance at the mud site peaked in

February-March and July-August. Diatom abundance at the sand site had one peak in July-August.

### **Benthic Macroalgae**

Studies on benthic macroalgae were conducted only in North Inlet Estuary. Benthic macroalgae have been studied in several locations in North Inlet. Fourteen species were identified, with five species dominating the community. Benthic macroalgae dominated during the winter months and were a significant source of energy and carbon during that period. For the major species the average ash-free dry weight/m<sup>2</sup> was 2.59 (0.5 - 7.08 g afdw/m<sup>2</sup>) and had an average caloric content of 2.78 K cal/g afdw.

The spatial and temporal macroalgae distribution in North Inlet has been evaluated: 54 species of macroalgae belonging to Chlorophyta (18 species), Phaeophyta (8 species), and Rhodophyta (28 species), were identified. North Inlet was not an important boundary for the distribution of species on the East Coast because none of the species were either at their northern or southern limit. The greatest number of species occurred within North Inlet and declined toward Winyah Bay. Both species composition and production varied with substratum type. Species numbers were greatest during the winter with peak reproductive activity occurring in the spring. Eighty-four percent of the macroalgal production occurred between December and April, with one third of the production occurring in March.

### **Benthic Infauna**

#### Winyah Bay

Benthic infauna were highly diverse in Winyah Bay. Twelve stations were sampled in Winyah Bay and 16,281 infaunal individuals representing 154 taxa were found. Polychaetes represented 35% of the species. Amphipods (20 species), pelecypods (16 species), decapods (13 species), gastropods (7 species), isopods (7 species), and echinoderms (5 species) together with polychaetes accounted for 85% of the total taxa. Pelecypods numerically dominated and also accounted for a much greater fraction (71%) of the total individuals sampled. Polychaetes were in the next most abundant (8%), followed by amphipods (5%) and gastropods (1%). All remaining infauna accounted for less than 10% of the individuals.

Species diversity varied considerably throughout Winyah Bay with the highest diversity occurring at the most seaward sand stations. The lowest diversity occurred at the southern entrance to Winyah Bay adjacent to South Island due to the dominance of one species. Mid-bay stations had fairly high diversity due to even distribution of individuals among the euryhaline marine and estuarine endemic species. No seasonal data were available for benthic infauna within Winyah Bay. With a given

sampling area, diversity, number of species, and species richness were generally greatest during the summer. Differences among species and sites were observed in this pattern. As an example, of the three most abundant species only one exhibited significant seasonal differences.

#### North Inlet

Published benthic studies were primarily focused on the meiofauna rather than the macrofauna component sampled in Winyah Bay. Detailed information is available on physiology of specific meiofauna, reproductive periodicity, life history patterns, secondary production, spatial heterogeneity, and the influence of physical factors (e.g., water current) on meiofauna distribution and resuspension.

Macrofaunal invertebrates sampled seasonally on an intertidal sandbar were dominated (70% of total number of individuals) by two species of haustoriid amphipods (Acanthohaustorius millsii and Pseudohaustorius caroliniensis). Of the 56 species, ten species accounted for 95% of the total number of individuals. These species included deposit-feeding polychaete worms, omnivore amphipods, gastropod, and a suspension-feeding bivalve. Seasonal changes were controlled by the population dynamics of these dominant species.

Meiofaunal community structure varied little with habitat within North Inlet. Meiofauna were dominated by nematodes, copepods, and polychaetes which composed greater than 90% of the fauna at most sites. Nematodes were the most dominant organisms, comprising greater than 70% of the abundance. Copepods were the second most abundant meiofaunal component. Of the two cyclopid and 19 harpacticoid species, eight comprise 97% of the fauna. Distinct seasonal abundance peaks occurred from the later summer to late fall.

#### **Epibenthic Fauna**

##### Winyah Bay

The number of epibenthic species sampled by Hinde *et al.* (1981) in Winyah Bay was relatively low; only 83 epifaunal or partly epifaunal macroinvertebrate species were found for the 12 sites. Cnidarians and arthropods accounted for the largest number of species (21 each), followed by mollusks (15) and bryozoans (12). The species collected were not unique to Winyah Bay and were common to abundant in other estuaries in South Carolina. Although estuarine epifaunal invertebrates were strongly influenced by substratum and hydrography, several species were fairly ubiquitous in Winyah Bay.

Allen *et al.* (1982, 1984), using an epibenthic sled, collected more than 200 species from 14 sites sampled in Winyah Bay. Organisms considered benthic

(mollusks, polychaetes, bryozoans, other invertebrates) and soft-bodied invertebrates (chaetognaths, medusae, ctenophores) often dominated the collections but were not enumerated in this study. At most stations densities were generally 10 organisms/m<sup>3</sup> to 100 organisms/m<sup>3</sup>. The Pee Dee River had the highest average density (31/m<sup>3</sup>) primarily due to the occurrence of high densities of amphipods during the summer and fall. Lowest densities (5/m<sup>3</sup>) occurred in the remaining river stations and upper bay where salinity fluctuations were the greatest. Middle bay stations generally had the highest densities; lower bay stations had intermediate densities. Fifteen species of decapod shrimp larvae were collected including the penaeids, stomatopods, sergestids, sicyonids, palaemonids, and alpheids. Shrimp larvae average 1/m<sup>3</sup>, with higher densities in the upper bay and river stations. At least seven species of anomuran and 14 species of brachyuran crabs were collected. The lower bay station had the highest density of crabs at 1.3/m<sup>3</sup>. All other stations had densities of 0.3/m<sup>3</sup> or less. Fish larvae and eggs representing over 50 species were identified. The densities of fish larvae were greater in the mud bay and lower bay area (1-2.5/m<sup>3</sup>). Densities at No Man's Friend and South Jones creeks were higher than most Winyah Bay stations. All other stations in Winyah Bay had much lower densities. Fish larvae were most abundant in May (2.7/m<sup>3</sup>), lower densities occurred in March (1.3/m<sup>3</sup>), and less than 0.2/m<sup>3</sup> was observed during other months. The highest density was sampled in May at Mud Bay (16/m<sup>3</sup>). River densities were usually less than 1/m<sup>3</sup> and no larval fishes were collected in January. Highest numbers, in general, occurred in the middle bay in the spring.

## **Planktonic Communities**

### North Inlet

Zooplankton have been sampled at various locations in North Inlet. Mean total zooplankton density was 9,257/m<sup>3</sup> and the total standing crop was 16,178  $\mu$ g dry wt/m<sup>3</sup>. Differences in both total zooplankton numbers and biomass varied concurrently among stations. Copepods, including larval states, were a dominant category, comprising 64-69% of total zooplankton numbers and biomass. Comparisons of major species of copepods and their reproductive periodicities suggested that North Inlet Estuary fauna were most closely allied with Florida waters. South Carolina may represent a transition zone between North-Temperate, Mid-Atlantic, and tropical waters of Florida and the Caribbean. The most common meroplankton were barnacle nauplii (*Cirripedia*), with other important groups including bivalves, gastropods, and polychaete larvae. Crab and shrimp zoea were distinctly seasonal in abundance. Major peaks in zooplankton density occurred in summer with maximum numbers of individuals and biomass.

## Winyah Bay

Only two studies have been conducted on zooplankton in Winyah Bay (Allen *et al.*, 1982, 1984). Upper bay stations were characterized by low and variable salinities (0.0 - 19.0‰) while lower stations were characterized by higher salinities (2.0 - 35.2 ‰). Zooplankton abundance in Winyah Bay averaged 10,831/m<sup>3</sup>. Total zooplankton densities were generally lower in the riverine stations with annual means ranging from approximately 6,000/m<sup>3</sup> to 9,000/m<sup>3</sup>. With the exception of the Esterville Plantation site, zooplankton densities in Winyah Bay were generally between 10,000/m<sup>3</sup> to 13,000/m<sup>3</sup>. The most oceanic station had the highest average density of zooplankton. The zooplankton community in Winyah Bay was dominated by relatively few copepods and meroplanktonic species. Stations generally and similar dominant species during a given month. Copepods comprised at least 50% of the total zooplankton throughout the year. Total copepods ranged from 53% (Sampit River) to 95% (Pumpkinseed) to total zooplankton.

Five copepod species (*A. tonsa*, *P. crassirostris*, *P. coronatus*, *E. acutifrons*, and *Q. colcarva*) were year-round residents and accounted for 86% of the copepod catch. *Acartia tonsa* dominated the Winyah Bay system, accounting for 60% of all zooplankton collected and 73% of all copepod species. Larval stages of barnacles were the most abundant meroplankton category. Crab zoeae and polychaete larvae were common at all stations. In contrast, bivalve larvae were rare at the riverine and mid bay stations.

## **Nektonic Communities**

### North Inlet

North Inlet Estuary has a diverse fish fauna with over 100 species identified. Fish populations have been sampled in a number of habitats in North Inlet Estuary since 1969. Total species collected ranged from 16 in a short-term study to 96 in a multiyear survey. Overall dominant species included: *Anchoa mitchilli* (bay anchovy), *Menidia menidia* (Atlantic silverside), *Brevoortia tyrannus* (Atlantic menhaden), *Fundulus majalis* (striped killifish), *Leiostomus xanthurus* (spot), *Fundulus heteroclitus* (striped killifish), *Alosa aestivalis* (blueback herring), *Anchoa hepsetus* (striped anchovy), *Dorosoma petenense* (threadfin shad), *Mugil cephalus* (striped mullet), and *Mugil curema* (white mullet). More than 95% of species sampled were represented by larval and juvenile life stages, with 29% of the species reproducing in the estuary. Six fish species (spot, mullet, *Myrophis punctatus* (speckled worm eel), *Lagodon rhomboides* (pinfish), *Paralichthys* spp. (flounders), and *Micropogonias undulatus* (Atlantic croaker)) comprised 99.3% of the larval fish captured. Species richness or diversity indices correlated with the temperature cycle and both species richness and diversity were higher during the summer months and lower during the winter months. The influx of warm-water species (e.g., spot, white mullet, silver perch, and

anchovies) and emigration with decreasing temperature were distinctive features of the annual cycle. Lack of correlation between numbers of individuals and temperature resulted from the clumped distribution of schooling fishes, such as spot mummichogs, and Atlantic silverside, and seasonal variability in catch efficiency.

Blue crabs were a significant component of the overall nekton, rankings sixth in overall abundance. Crab abundance was highly variable with the lowest numbers generally occurring during the winter and highest during the summer. Both brown and white shrimp arrived as postlarvae during the spring (brown) and early summer (white) and migrated to the ocean from September to December. Late spawned shrimp overwintered in the estuary but the majority migrated to deeper coastal areas. Pink shrimp were the least common penaeids in North Inlet Estuary, but occurred year-round as juveniles and adults. Pink shrimp were most abundant in the spring while brown and white shrimp were most abundant during the summer months.

#### Winyah Bay

Fish fauna in Winyah Bay Estuary were diverse with up to 75 species collected. Relatively few species (< 10) generally dominated more than 95% of the catch. Only one study has assessed the spatial distribution of fishes in Winyah Bay. In general, stations with the highest and most variable salinities had the highest number of individuals and species, while stations with the lowest and most stable salinities had the lowest numbers of species and individuals. The number of species was greatest in the lower bay channel and mid bay in the western channel. The lower bay stations included many stenohaline and euryhaline species such as Atlantic croaker, hogchoaker, and the weakfish. Although these species occurred throughout the bay, they were most numerous at the lower bay stations.

Species richness and abundance were lower during the winter and highest during the fall. Numbers of fish species positively correlated with bottom temperature and salinity and negatively correlated with oxygen and depth. Numbers of individual fish were positively correlated with bottom temperature and salinity and negatively correlated with oxygen.

Most of the numerically dominant species were seasonal inhabitants with restricted distribution. Biomass and population densities were highest at stations in the lower bay channel and mid bay near Pumpkinseed Island during the fall and mid bay western channel during the summer. The total catches of fishes, density, and biomass were lower during the winter period. Winter catches were dominated by Atlantic menhaden (Brevoortia tyrannus) and Atlantic croaker or white catfish. In the spring, numbers of individuals and species increased, but stenohaline marine species were not very abundant and were patchy in their distribution. Catches were dominated by Atlantic croaker and hogchoaker. With the influx of transient euryhaline

species (such as Atlantic croaker and weakfish) during the spring to late summer, the diversity and abundance increased, peaking during the fall months.

Although decapod crustaceans were not as abundant (by weight or numbers) as fishes, significant populations exist in Winyah Bay. Penaeid shrimp (Penaeus setiferus, P. duorarum, P. aztecus, and Trackypenaeus constrictus) were numerically dominant, comprising 50% to 53% of the decapod catch; Penaeus setiferus alone comprised - 42%. Portunidae was the most diverse family (eight species) and ranked second by numbers and first by weight. Portunidae comprised 85% of the decapod biomass with blue crabs contributing approximately 74% of the total decapod catch biomass. Blue crabs were found throughout the Winyah Bay system during the entire year with catches greatest from September to December.

#### D. Socioeconomic Features

##### Cultural and Historical Resources

Hobcaw Barony has a rich history. There is strong evidence indicating that an early Spanish settlement was located on the Barony in 1526. For various reasons, the Spanish left in 1527. By the 17th century English influence had spread from Virginia, and in 1718 King George II granted the Hobcaw Barony to Lord Carteret. This area became well-known for rice culture and the general region of Georgetown County was one of the richest areas in the colonies. On the Barony is located remnants of a colonial fort and cemetery, remains of three slave villages, and old cemeteries. Artifacts of early Indian settlements are found throughout the area. The King's Highway, which was the coastal road from Wilmington, NC, to Charleston, SC, crosses the property; George Washington used this road in 1791. In more recent time, Mr. Bernard Baruch, famous financier and advisor to presidents, purchased land in 1905 and 1907 which comprises the present 17,500 acres tract known as the Hobcaw Barony. During Mr. Baruch's ownership, many famous world leaders visited the Barony, including President Roosevelt and Sir Winston Churchill. Ownership of the Barony was transferred to Belle Baruch, Mr. Baruch's daughter, and when she died in 1964, the property was included as part of the newly established Belle W. Baruch Foundation.

#### E. Traditional Reserve Uses

##### 1. Research and Education

The North Inlet Estuary/Winyah Bay site serves as a research and instructional facility for the Belle W. Baruch Institute for Marine Biology and Coastal Research of The University of South Carolina. It functions as a national and international site for estuarine and coastal research and education.

Since 1969, a comprehensive research program ranging from studies of molecules to ecological landscapes has evolved. The research approach has developed from quantifying various physical, chemical, and biological components and interactions between these components, to incorporating exchange of substances across ecosystem boundaries and exchanges between different subsystems. Initial research efforts emphasized wetland and estuarine processes, but studies have expanded to encompass an entire coastal landscape, from ocean to diverse upland and freshwater habitats. There is also a continuing emphasis on molecular and organismic studies.

Undergraduate, graduate, and post-graduate instruction has been given at Hobcaw Barony. In 1980, the Baruch Institute, USC, established a Continuing Education Program at its field site in Georgetown to serve area residents and visitors. This program has included short courses for children and adults, public lectures and forums, and marine science workshops and courses for teachers. Additional public education activities are conducted at the site through the Bellefield Nature Center, a part of the Belle W. Baruch Foundation. The Nature Center is open to visitors 6 days a week and contains aquaria; exhibits featuring coastal life, ecology and research conducted on-site; and audiovisual programs that are shown daily. In addition, the Nature Center also conducts field studies of salt marsh, forest, and freshwater habitats on the property and brings nature programs to local schools.

Although significant progress has been made in developing broad-based monitoring, research, and education programs, a distinct need exists to improve and expand the program to educate more people about the cultural, economic, and ecological values of our coastal area and to develop a more comprehensive scientific basis to deal with the ever-increasing environmental pressure resulting from continuing growth in the coastal zone.

## 2. Recreation

Until the Foundation was established and universities started research and educational programs on Hobcaw, the Barony was exclusively for the private use of the Baruch family.

Traditional public uses of the site will not be altered. The tidal waters are open under state and Federal jurisdiction and used by the public for boating, fishing, wildlife observation, swimming and recreational harvesting of oysters and clams. Traditional uses of Winyah Bay permitted by state and Federal agencies will continue, including existing shipping channels.

Hobcaw Barony is a designated wildlife refuge, hence, no hunting or trapping is allowed on the upland portions of the property. However, seasonal hunting on the marshlands for waterfowl and rails in the tidal waterways of the Reserve is a legal



activity, regulated by State laws, and will not be altered. This activity does not take place in areas of the Reserve that will conflict with other traditional activities such as fishing and swimming.

### 3. Residential

At present, Hobcaw House is operated as a historical house - museum; however, Bellefield House is the residence of Miss Ella Severin, a trustee of the Foundation. There are five other residences on the property used by resident research, security, and forestry personnel. Dormitory facilities for approximately 80 persons are available for visiting scientists and students.

### 4. Industrial and Port Related

No industrial activities occur or are allowed on Hobcaw Barony, although designated dredge spoil sites have existed elsewhere on B.W. Baruch Foundation uplands bordering Winyah Bay since 1968; these sites are not part of the Reserve. It is not the intent, objective nor desire of the NI/WB NERRS to interfere with the use of these spoil sites by the South Carolina State Ports Authority. The shipping lanes adjacent to the southwestern border of the Winyah Bay portion of the Reserve are used extensively for activities related to industries located in Georgetown, as well as import/export activities centered at the Port of Georgetown. Industries located in Georgetown which are dependent upon the continued use of the Port include Georgetown Steel, International Paper, Santee Cement and AKZO Salt, all of which are important to the local and regional economy. In addition, future potential long-term Port users and transit-type cargoes under long-term contracts may consist of lumber, ore, scrap metals and general cargo which have been handled in the past. In order to maintain the shipping channel at the authorized depth, the U.S. Army Corps of Engineers must dredge the channel on a regularly scheduled basis. The creation of the Reserve will not alter the current or future use of any of these areas designated for dredged spoils.

The Reserve Management Plan does not call for a change from existing or traditional uses of the areas of the Reserve. It is not the intent, goal nor desire of the Reserve to restrict shipping and dredging activities of the Port of Georgetown which provide a major portion of Georgetown's industrial-based economy. The NI/WB NERR is unique in the U.S. in that no other NERR is located in such close proximity to Federally maintained shipping channels. One of the objectives of the Reserve is to study the relationship between natural ecosystems and these shipping/industrial activities in order to establish an information base for the wise management and coexistence of both in the future. Hence the establishment of the Reserve would not limit the maintenance of existing shipping channels.

#### **IV. THE MANAGEMENT PLAN**

This Final Management Plan establishes goals, program and facility needs as well as administrative framework policies and timetables to meet the goals. The Plan is flexible and allows for review and revision for improving the Program. The overall philosophy of this Management Plan is to guide the development of a coordinated program of research, education, and resource protection within the North Inlet/Winyah Bay Reserve for balancing two key variables: setting of attainable goals and objectives and enhancing resource protection of the estuarine environment.

##### **A. Boundaries and Land Acquisition Plan**

###### **1. General Context for Management**

According to the Coastal Zone Reauthorization Act of 1985, as amended, the protection and management of resources are not meant to be ends in themselves but rather are intended to support the research mission. Within this context, it should be stressed that resource protection cannot be viewed as an independent program area. All aspects of reserve management will contribute to the resource protection effort. However, the most effective mechanisms for long-term protection or control is the State control of the key land and water areas of the Reserve property either through fee simple ownership or conservation easements.

The North Inlet system offers outstanding examples of coastal wetland habitats that have been subjected to a minimum of human disturbances. In contrast, the neighboring Winyah Bay has been subjected to various industrial, residential, commercial, shipping, and dredging activities in addition to receiving drainage waters from vast regions of North and South Carolina. Together these two estuaries present an excellent opportunity to compare and contrast ecosystem responses of an undisturbed estuary with those of a disturbed system. Differences in the salinity regimes and associated flora and fauna between the North Inlet Estuary and sections of Winyah Bay also provide opportunities to conduct comparative research regarding ecosystem structure and fisheries habitat utilization.

###### **2. Assessment of Boundaries**

Boundaries for the North Inlet/Winyah Bay Reserve must include "an adequate portion of the land and water areas of the natural system to approximate an ecological unit and to ensure effective conservation" (15 CFR 921.11(c)(3)). These areas must be discrete enough to be effectively managed, but large enough to make long-term research possible. To help focus management efforts, site boundaries encompass two zones; key land and water areas (core areas) and buffer zones.

NOAA's Guidelines for Establishing Proposed Boundaries for National Estuarine Reserves define core areas as areas which contain "critical estuarine ecological units for research purposes, encompassing a full range of significant physical, chemical and biological factors contributing to the diversity of fauna, flora and natural processes occurring within the estuary." The core area is "so vital to the functioning of the estuarine ecosystem that it must be under state control sufficient to ensure the long term viability of the reserve for research on natural estuarine processes. [These areas] should encompass resources that are representative of the total ecosystem which, if compromised, could endanger the research objectives of the reserve." A buffer zone is defined as an "area adjacent to or surrounding the core and on which the integrity of the core depends. This area protects the core and provides additional protection for estuarine dependent species." It may include an area for research and education facilities.

a. Key Land and Water Areas (Core)

Site surveys have been conducted to establish proposed boundaries for the NI/WB site. The original boundary lines as described in the nomination document have been changed based on recommendations made by: advisory committee, NOAA, site property owners, and public comments. Management and acquisition strategies, including an MOU with the SC Coastal Council (Appendix B) and Tripartite Agreement with the Baruch Foundation (Appendix A), establish adequate state control to provide long-term protection for reserve resources within these boundaries. The state Attorney General's office has affirmed that the State has adequate control over the key land and water areas - state laws provide protection for salt marshes and other lands located in the critical coastal zone area (see Section IV B-Resource Protection Plan for detailed description of laws and their enforcement). The Attorney General's position is further based on the existence of a long-term agreement between the University of South Carolina and the Belle W. Baruch Foundation (Appendix A) to manage the uplands and salt marsh portions of the Reserve which are owned by the Foundation. No expenditure of Federal and state funds will be required for acquisition. No condemnation procedures will be used.

The North Inlet/Winyah Bay Reserve boundaries are indicated on Figure 2. The northern boundary of the North Inlet Estuary portion of the Reserve begins in the northwest at the upper edge of the marsh abutting the uplands of the property of the Belle W. Baruch Foundation immediately west of the confluence of Bass Hole Bay and Debidue Creek. From this point the northern boundary is Debidue Creek east to where Cooks Creek enters Debidue Creek, then the boundary line extends east to Debidue Island. The eastern border extends southward along Debidue Island to North Inlet, then continues down Jones Creek to Haulover Creek where the boundary line follows Haulover Creek to Mud Bay. The boundary line then extends southward and east of the marsh land into Mud Bay past Pumpkinseed Island to a point 150 yards north of the existing shipping channel.

The southern boundary extends westward from this point, paralleling a line which crosses the southern end of the island complex of Malady Bush Island-Marsh Islands and Ranger Island at the mean low water mark, a line north of the existing shipping channel. West of Ranger Island the boundary line continues north to Frazier Point

The landward boundary on the North Inlet segment of the reserve is the uppermost reaches of existing Spartina alterniflora and includes the highlands surrounding the Baruch Institute, USC, laboratory complex and the Clambank Landing portions of Goat Island. The landward boundary on the Mud Bay segment of Winyah Bay is the dominant wetlands vegetation. In addition the uplands associated with the Kimbel Living Center and managed by the Baruch Institute are part of the reserve. It is estimated that the core area occupies approximately 9,000 acres.

b. Buffer Zone

The buffer zone between the core area of wetlands and the upland forested ecosystem is that ecotone region of transitional vegetation (approximately 50 m wide, approximately 80 acres) between the dominant marsh grasses and the forest vegetation. Portions of Debidue Island, marshlands immediately adjacent to the northern boundary line, the waters of the Atlantic Ocean adjacent to the mouth of North Inlet, North Island (part of the Yawkey Wildlife Center, SC Wildlife and Marine Resources Department and owned by the State of South Carolina) which is south of North Inlet and east of south Jones Creek, and the waters of Winyah Bay north of the ship channel form the outer boundary of the buffer zone. These waters are subject to state and Federal environmental protection laws and regulations. Aquatic areas within the Reserve can be reached by boat via tidal waters which are part of the public domain.

3. Acquisition of Land

No acquisition of land is being proposed at present. However, if additional parcels are identified such as the Nature Center, or the rice fields along Winyah Bay, it would be possible to adjust the Reserve's priorities to consider adding to the Reserve as required by NOAA regulations and the Baruch Foundation approval for the expansion. Through a long-term agreement with the Baruch Foundation, the Baruch Institute manages the portion of the Foundation's lands to be included in the Reserve and the State owns the remaining areas of the Reserve. The Trustees of the Baruch Foundation have approved the Institute's participation in the NERRS program by letter vote after presentation of the Draft Management Plan at their December 7, 1990, meeting. This approval is in accordance with the Tripartite Agreement (Appendix A). In allowing the Institute to participate in this program, the Foundation

understands the long-term commitment to the NERRS program which is consistent with the Foundation goal of establishing its marshlands in perpetuity for marine studies.

**B. Resource Protection Plan**

**1. Rationale and Goals**

The health, productivity, and integrity of the estuarine reserve resources must be protected in order to provide a stable environment for research and education programs which are used to address coastal management issues. The goals of resource protection are to protect the natural status of the ecosystem(s) of the Reserve.

**Specific goals are:**

- o Identifying priority resources, gathering baseline information on them, and establishing them as indicators of change.
- o Developing facilities and equipment as necessary to aid in research.
- o Seeking agreements with research organizations to facilitate and augment research projects.
- o Assisting in the collections of important baseline data to use in monitoring differences over time and for making comparisons with other areas.
- o Preserving estuarine ecosystems for continuous future use as natural field laboratories where information essential to coastal management decisions can be gathered and disseminated.
- o Ensuring a stable environment for research through long-term protection of estuarine areas, including open water and transitional area wetlands.
- o Protecting natural, pristine estuarine sites for education and interpretation programs.
- o Protecting the habitats of estuarine wildlife as an integral part of the natural system.
- o Controlling access to Hobcaw Barony in accordance with the Tripartite Agreement between the USC Institute, Clemson University and the Foundation.

- o Preventing degradation of the Reserve by outside activities.
- o Coordinating activities with the Baruch Foundation, local, state and Federal authorities.

## **2. General Policy Areas**

Resource protection will rely on the tripartite agreement between the Foundation, USC, and Clemson University as well as a number of existing Federal, state and local laws and regulations, enforced by regulatory agencies and Reserve and Baruch Foundation staff. It is also the responsibility of reserve staff to be knowledgeable of and involved with land use issues in the vicinity of the Reserve.

The NERRS regulations allow for multiple uses of reserves to the degree compatible with each reserve's management plan and consistent with the mission and goals of the NERRS. Traditional existing activities in the NI/WB NERRS will continue at levels currently permitted under local and state laws (see Section III E for details on uses). It is not the intent, objective nor desire of the NI/WB NERRS to restrict in any manner the legal traditional uses of public waterways that are currently under state and Federal jurisdiction and included in the Reserve. The Baruch Foundation will continue to regulate activities on its private property which is also included in the Reserve.

### **Specific objectives are to:**

- o Coordinate with existing surveillance and enforcement activities provided by the Belle W. Baruch Foundation, state and Federal agencies, and establish a mechanism to increase resource protection, when necessary;
- o Provide for adequate public participation as a means to promote compatible uses of the Reserve and awareness of the need to protect sensitive resources; and
- o Rehabilitate Reserve habitats where necessary to restore natural bio-diversity and prevent further degradation of resources.

Research is one of the primary goals of the Reserve, and it is given highest priority in the Management Plan. Sometimes the success of a research project depends on the study site remaining undisturbed. To prevent trampling or other unnatural physical disturbances, the researcher may request that signs requesting avoidance of the study area be posted. The request would be made to the Reserve Manager and reviewed by the Advisory Committee. Typically, study plots are small and located in infrequently visited or remote areas so that public travel or access

patterns would not be disturbed. An information program will be initiated to inform the public about the importance of the research sites.

### 3. Management of the NERR Site Through the South Carolina Coastal Management Program

The purposes of Act 123 of the 1977 South Carolina General Assembly were to "establish the South Carolina Coastal Council and provide for its powers and duties for the protection and improvement of coastal tidelands and wetlands under a coastal zone management plan; provide for enforcement of policies of the Council and penalties for violations; and authorize legal proceedings for the determination of tideland properties." Act 123, better known as the South Carolina Coastal Management Act, was implemented in accordance with the Federal Coastal Zone Management Act as amended (P.L. 92-583, 94-370) and a subsequent coastal zone management program was developed and approved by the U.S. Secretary of Commerce in 1979 which met the requirements of 15 CFR part 923 (Federal Register, March 1, 1978). The South Carolina Attorney General's office has affirmed that the State has adequate protective control over the NI/WB NERR (see Appendix K and page 7 for details).

The Council will serve as the fiscal agent in acquiring funds from NOAA and will provide increased surveillance and enforcement to ensure compliance with the Coastal Zone Management Act and the Reserve Management Plan. The Council will also serve on the Reserve's Advisory Committee and provide input into identifying coastal research needs.

#### a. Management of the Critical Areas

The South Carolina Coastal Management Act defines the critical area as all coastal waters, tidelands, beaches, and primary ocean front sand dunes within the coastal zone of the State. A permit is required for any activity which impacts a critical area; in order to receive a permit the activity must be evaluated in accordance with a strict set of policies and regulations. In summary the policies for wetland areas prohibit the permanent alteration of productive salt, brackish, or freshwater wetlands unless there is an overriding public interest, no feasible alternatives, and all environmental impacts are minimized. Regulated activities include not only major activities, such as dredging or filling, but also activities such as pipelines, powerlines, docks, piers, intake structures and many others. Tables 1, 2, and 3 provide a listing of all activities which are governed by specific coastal zone management policies.

With the exception of the high ground portion of the few scattered islands located in Winyah Bay proper, the entire core area of the North Inlet/Winyah Bay NERR site is classified as critical area. Any activity which occurs in the core area

of the Reserve will be regulated by permit through the South Carolina Coastal Zone Management Program.

b. Management of Upland Areas (Non-critical area)

Both the Federal Coastal Zone Management Act and the South Carolina Coastal Management Act require consistency of all direct and regulated State and Federal activities which occur in the designated coastal zone of South Carolina. In South Carolina the coastal zone includes the entirety of all eight coastal counties which border the Atlantic Ocean. Therefore, any activity which requires a state or Federal permit must undergo a coastal zone management consistency determination by the South Carolina Coastal Council before the permit can be issued by the issuing State or Federal agency (Table 2). The policies utilized to make a consistency determination are similar to those required for critical areas.

Federal regulations (15 CFR 930) establish a review procedure with Federal agencies. The Council has a memorandum of agreement with all regulatory state agencies that establishes a consistency determination review procedure. State permits which are reviewed for coastal zone management consistency are included in Table 3 along with the responsible agency.

SCCC has implemented its full authority in the South Carolina coastal zone through a system of "networking" activities, whereby cooperation has been developed between SCCC and other state agencies. Seventeen (17) state agencies exercise some authority over: (1) the use of coastal resources, (2) specific areas in the coastal zone, or (3) activities in the coastal zone (Table 1). This authority is granted by the statutes of South Carolina, most of them enacted prior to the Coastal Management Act.



Table 1. Summary of "Networking" Activities

AGENCIES WITH PERMITTING OR PLANNING/MANAGEMENT AUTHORITY FOR ACTIVITIES WITH A DIRECT AND SIGNIFICANT IMPACT ACTIVITY	Coastal Council	Aeronautics Comm.	Arch. & Anthropology	Budget & Control Bd.	DHEC	Development Bd.	Forestry Comm.	Highway Dept.	Land Resources	NET	Patriot's Point	Railways Comm.	PSA	PSC	State Housing Auth.	EPA	Water Resources	Wildlife/Marine Res.	LOCAL	FEDERAL
RESIDENTIAL DEVELOPMENT	X			X	X										X				X	X
TRANSPORTATION																				
Ports	X			X												X				X
Roads & Highways	X			X		X		X								X			X	X
Airports	X	X		X		X													X	X
Railways	X			X		X						X				X			X	X
Parking Facilities	X			X	X														X	
COASTAL INDUSTRIES																				
Agriculture	X								X											X
Forestry	X						X													
Mineral Extraction	X			X					X											X
Manufacturing	X				X														X	
Fish & Seafood Processing	X				X													X		
Aquaculture	X			X	X													X		
COMMERCIAL DEVELOPMENT	X			X	X															X
RECREATION & TOURISM																				
Parks	X					X				X	X								X	X
Tourist Attractions	X				X					X	X								X	
MARINE RELATED FACILITIES																				
Marinas	X			X							X					X		X	X	
Boat ramps	X			X							X							X	X	
Docks and piers	X			X					X						X		X			
WILDLIFE AND FISHERIES MAN	X																X	X		
Artificial reefs	X			X														X		
Impoundments	X			X														X		
DREDGING	X			X														X		X
Dredge Material Disposal	X			X														X		X
Underwater Salvage	X		X																	
PUBLIC SERVICES & FACILITIES																				
Sewage treatment	X			X	X														X	X
Solid waste disposal	X				X														X	
Public/Quasi-public buildings	X				X				X	X									X	X
Dams & Reservoirs	X											X								X
Water supply	X				X												X		X	X
EROSION CONTROL	X					X	X								X				X	X
ENERGY ACTIVITIES	X			X	X	X	X					X	X			X		X	X	X

In addition to meeting normal rules and regulations, activities associated with the above permits which result in a land disturbance (i.e., subdivisions, malls, gas stations, etc.) must submit specific plans to address policies and approved guidelines of the Coastal Zone Management Program. These plans must conform to coastal zone policies before any permits can be issued. These plans include:

Stormwater management plan  
Wetland management plan  
Dock master plan (if adjacent to coastal waters)

In reference to the North Inlet/Winyah Bay Reserve, the entire site falls within the coastal zone of South Carolina; therefore, any activity which requires one of the referenced permits must be consistent with the coastal zone management program and the specific policies of the NERRS.

c. Enforcement

Under the South Carolina Coastal Management Act, the South Carolina Coastal Council has responsibility for the protection of coastal tidelands and wetlands. To fulfill its enforcement responsibilities, the Council may impose penalties and may take legal proceedings, as necessary. These responsibilities cover all coastal waters, tidelands, beaches, and primary ocean front sand dunes within the state's coastal zone. Nevertheless, the Reserve Manager has first line of enforcement responsibility for ensuring that all activities conducted within the Reserve conform with NERRS guidelines and the Foundation's rules for resource protection. The Reserve Manager will contact the SCCC, as necessary, and will be a full partner in the review of any permit affecting the Reserve resources.

The South Carolina Coastal Council has an enforcement section of specially trained field biologists to ensure enforcement of the coastal zone management program. Weekly aerial flights and daily routine patrolling by motor vehicle represent the first level of enforcement. The Coastal Council is also in alliance with the S.C. Department of Wildlife and Marine Resources whose conservation officers patrol the waters and land of the coast on a daily basis. Noted violations are reported to Coastal Council enforcement staff who conduct a field inspection; State conservation officers are available for backup if needed. The Council also has a Memorandum of Agreement with the U.S. Army Corps of Engineers to assist in enforcement in freshwater wetland projects requiring coastal zone management consistency certification. Fines for violations of the Coastal Zone Management Act are up to \$1,000 per day.

Enforcement of activities requiring coastal zone consistency certification can generally take place through the agency issuing the permit. The majority of activities require a final Coastal Council sign-off prior to permit issuance; for example, a Coastal Council staff engineer conducts a site inspection to ensure the stormwater system is constructed according to the approved design before the applicant can operate his/her water or wastewater system. This provides a strong incentive to comply with the coastal zone management program.

Additionally, the Coastal Council has an active Beach and Creek Watch program to provide a forum for citizen awareness and violation reporting.

Table 2

Activities Regulated Through Direct Permit  
and/or Consistency Certification by  
The S.C. Coastal Council  
(reference SCCZMP, pp. III-1 - III-74)

Residential Development	Ports
Roads and highways	Airports
Railways	Parking facilities
Agriculture activities	Forestry activities
Mineral extraction	Manufacturing
Fish and seafood processing	Aquaculture
Commercial development	Parks
Commercial recreational	Marinas
Boat ramps	Docks and piers
Wildlife and fishery management activities	Artificial reefs
Dredging	Impoundments
Underwater salvage	Dredge material disposal
Solid waste disposal	Sewage treatment
Dams and reservoirs	Public/quasi-public bldgs.
Erosion control activities	Water supply facilities
Construction in critical areas or wetlands	Energy and related facilities

Table 3

State Agency Permits Subject to  
Coastal Zone Consistency Review by  
The S.C. Coastal Council  
(reference SCCZMP, p. V-5)

- |    |   |   |
|----|---|---|
| 1. | S.C. Aeronautics Commission                         | Certificates of approval for airports and other air traffic facilities.   |
| 2. | S.C. Budget and Control Board                       | Permits for activities below the ordinary high water mark which are within the coastal zone but out of the critical area.   |
| 3. | S.C. Department of Health and Environmental Control | Permits for construction of wastewater treatment facilities or septic tanks of 1500 gallons per day.<br><br>National Pollutant Discharge Elimination System (NPDES) permits.<br><br>Section 401 of the Federal Water Pollution Control Act certification.<br><br>Permits for air emissions.<br><br>Water supply permits.<br><br>Landfill permits.<br><br>Oil and gas facilities registration certificates.<br><br>Underground storage tank permits. |

- |    |   |   |
|----|---|---|
| 4. | S.C. Land Resources Conservation Commission | Mining operations permits.<br><br>Sediment control permits (pending implementation).                              |
| 5. | S.C. Public Service Commission              | Certificates for major utility facilities.  |
| 6. | S.C. Water Resources Commission             | Oil and gas facilities permits.<br><br>Groundwater capacity use area permits.<br><br>Interbasin transfer permits. |

**4. On-Site Management of the Reserve Through the Belle W. Baruch Institute for Marine Biology and Coastal Research**

The Belle W. Baruch Institute for Marine Biology and Coastal Research, University of South Carolina (a state agency), is the on-site management agency for the North Inlet/Winyah Bay Reserve. The Memorandum of Understanding (Appendix B) between SCCC and the Baruch Institute, University of South Carolina, confirms the cooperative nature of the arrangement for on-site management of the Reserve.

The Institute interacts closely with the Belle W. Baruch Foundation in that the Institute has a long-term contract with the Foundation which was approved by the SC Attorney General to manage marine lands belonging to the Foundation. In addition the Foundation has approved the Institute to participate in the NERRS program. The Institute was established in 1969 through the joint action of the Baruch Foundation and the University of South Carolina-Columbia. Estuarine research was initiated in 1969 and a year-round program with a resident staff started in 1972 when the first field laboratory was built. Since 1969 the Institute has administered over \$13 million in grants, contracts, and awards involving multidisciplinary research and education. The Institute is a research branch of the University of South Carolina-Columbia and the Director reports to the Dean of the College of Science and Mathematics. The Institute is funded by state appropriated funds as well as funds from Federal and private sources. The Institute will administer funds provided to the South Carolina Coastal Council by NOAA and from other state sources. Every attempt will be made to obtain additional funds from private sources to enable the Reserve to be as self-sufficient as possible. The personnel associated with the Reserve will be employees of USC. Because the objectives of existing programs are very similar to those of the NERRS program, no major changes in the existing management strategy are planned except for the important addition of Reserve personnel as described

elsewhere in this Management Plan. No new state or Federal regulations are being proposed because existing Federal, state, and Foundation regulations already protect the Reserve.

## **5. Management Policies**

Portions of the Reserve, which are owned by the Baruch Foundation and managed by the Institute, are designated as a wildlife refuge. The Reserve is maintained as a wildlife refuge and a natural field laboratory for research and education/interpretation. The Reserve core area is managed according to specific policies designed to protect the habitat integrity of the site while allowing for continuation of traditional compatible uses. Management of formally protected conservation areas within the buffer zone, such as other areas of Hobcaw Barony, are under the protection of the Baruch Foundation and managed by the Baruch Institute in accordance with the Agreement between the Institute, the Foundation and Clemson University.

### **a. Traditional Uses**

The North Inlet/Winyah Bay area has traditionally been used for boating, fishing, wildlife observation, swimming and recreational harvesting of oysters and clams as permitted by state laws. Seasonal hunting for waterfowl and rails in the tidal waters of the Reserve is a legal activity. Protection of natural habitats and water quality may actually enhance traditional uses by enhancing natural diversity and productivity of Reserve resources. Designation will ensure that the area will be available and protected for future use and enjoyment. Traditional uses of Winyah Bay permitted by state and Federal agencies will continue, including existing shipping channels. Designation of the Reserve does not change the existing laws and regulations concerning these or any other traditional uses of the North Inlet/Winyah Bay. Nor is it within the authority of the Reserve to establish special regulations. It is not the intent or desire of the NI/WB NERR to create special regulations that would limit traditional use in the Reserve or limit public access to the waterways of the Reserve.

Public recreational activities are not allowed on the upland areas of the Hobcaw Barony. Since Hobcaw Barony is a designated wildlife refuge, no hunting or trapping is allowed on the upland portions of the property. However, the tidal waters are open under state and Federal jurisdiction and used by the public for boating, fishing, swimming and recreational harvesting of oysters and clams. However, seasonal hunting on the marshlands for waterfowl and rails in the tidal waterways of the Reserve is a legal activity, regulated by State laws, and will not be altered. This activity does not take place in areas of the Reserve that will conflict with other traditional activities such as fishing and swimming.

(1) **Recreation**

(a) **Hunting**

Hunting in the marshes is allowed in the Reserve subject to state and Federal jurisdiction and no change in existing practices will occur.

(b) **Fishing**

Recreational fishing in tidal waters is currently permitted under state regulation. It is not the intent, objective, nor the desire of the NI/WB NERR to change existing policies. Both recreational and commercial fishing activities are subject to the laws of South Carolina and regulations enforced by the SC Wildlife and Marine Resources Department.

(c) **Shellfishing**

Shellfishing in the Reserve is governed by state rules and regulations which exclude commercial harvesting in North Inlet's tidal waters. State recreational harvesting regulations apply throughout this area. It is not the intent, objective nor the desire of the Reserve to change existing policies.

(d) **Residential**

At present, Hobcaw House is operated as a historical house - museum; however, Bellefield House is the residence of Miss Ella Severin, a trustee of the Foundation. There are five other residences on the property used by resident research, security, and forestry personnel. Dormitory facilities for approximately 80 persons are available for visiting scientists and students.

(e) **Habitat Restoration**

NERRS regulations recognize 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 NERRS, some restorative activities may be permitted in research reserves as specified in their management plan. Generally, restoration for single-species resource management or enhancement is not permissible; restoration must be community or ecosystem oriented.

The areas included within the boundaries of the Reserve are in a high state of ecological quality, therefore no plans have been developed to undertake habitat restoration. Results of research conducted within the Reserve on

relatively pristine areas will be applied to other (disturbed) sites in order to develop a scientific basis for habitat restoration.

(f) Visitor Use/Public Access

Traditional public access policies that pertain to the Belle W. Baruch Foundation's property (Hobcaw Barony) included in the Reserve will be maintained. Currently, public access to the upland portions of the property is restricted. Authorized individuals, including researchers and students, involved in approved projects utilizing the resources of the Reserve can enter through an electrically controlled gate near U.S. 17. Visits by student groups, participants in workshops and symposia, and other special groups can be arranged through formal programs associated with The University of South Carolina or the Belle W. Baruch Foundation. Tours of the Reserve will be coordinated with the Nature Center of the Belle W. Baruch Foundation. The general public can visit the Bellefield Nature Center at the US Highway 17 entrance to Hobcaw Barony (approximately 1 mile north of Georgetown and 8 miles south of Pawleys Island).

Public access to the Reserve will follow existing policies in that the public has access to the North Inlet and Winyah Bay portions of the Reserve by boat, including power boats. According to State and Federal laws no tidal waters can be restricted to public access. The South Carolina Coastal Council reaffirmed this policy on public access in the Reserve in a Resolution passed on December 13, 1991 (Appendix M). Research plots, which will be studied for a finite period of time, will be marked with signs requesting that they not be disturbed by the public.

Access by water to the wetland areas of the Reserve via tidal waters under the jurisdiction of state and Federal agencies, however, is permissible by boat including power boats. Members of the public are able to carry out traditional recreational activities in the tidal waters and marshes, but must adhere to state laws. Thus, traditional uses such as hunting on the marshes, fishing and shellfishing will not be infringed upon by the establishment of NI/WB NERR and people are free to access these areas by water. Traditional public use will be encouraged to the extent that is consistent with Reserve goals and objectives.

No significant increase in the use of the Hobcaw Barony and the proposed Reserve is expected over the usage during 1990 when the education programs of the Foundation and the Baruch Institute served about 35,000 people, including more than 2,900 school children from around the state who participated in field studies of salt marsh, pond and forest ecosystems. Approximately 200 teachers from various school systems participated in workshops presented by staff members. The carrying capacity for visitor use will be determined and any environmental effects of additional visitors will be carefully monitored. Only increases in visitor use which have no effects or only minimal effects on the environment will be permitted.



(g) Cultural and Historical

Hobcaw Barony has a rich history. Cultural resources such as historical and archaeological sites and artifacts will be protected and enhanced. These resources will also be made more available to the public through education programs. Designation of the Reserve will have a significant positive impact on cultural resources.

There is strong evidence indicating that an early Spanish settlement was located on the Barony in 1526. For various reasons, the Spanish left in 1527. By the 17th century English influence had spread from Virginia, and in 1718 King George II granted the Hobcaw Barony to Lord Carteret. This area became well-known for rice culture and the general region of Georgetown County was one of the richest areas in the colonies. On the Barony is located remnants of a colonial fort and cemetery, remains of three slave villages, and old cemeteries. Artifacts of early Indian settlements are found throughout the area. The King's Highway, which was the coastal road from Wilmington, NC, to Charleston, SC, crosses the property; George Washington used this road in 1791. In more recent time, Mr. Bernard Baruch, famous financier and advisor to presidents, purchased land in 1905 and 1907 which comprises the present 17,500-acre tract known as the Hobcaw Barony. During Mr. Baruch's ownership, many famous world leaders visited the Barony, including President Roosevelt and Sir Winston Churchill. Ownership of the Barony was transferred to Belle Baruch, Mr. Baruch's daughter, and when she died in 1964, the property was included as part of the newly established Belle W. Baruch Foundation.

(h) Industrial and Port-Related

No industrial activities occur or are allowed on Hobcaw Barony, although designated dredge spoil sites have existed elsewhere on B.W. Baruch Foundation uplands bordering Winyah Bay since 1968; these sites are not part of the Reserve. It is not the intent, objective nor desire of the NI/WB NERRS to interfere with the use of these spoil sites by the South Carolina State Ports Authority. The shipping lanes adjacent to the southwestern border of the Winyah Bay portion of the Reserve are used extensively for activities related to industries located in Georgetown, as well as import/export activities centered at the Port of Georgetown. Industries located in Georgetown which are dependent upon the continued use of the Port include Georgetown Steel, International Paper, Santee Cement and AKZO Salt, all of which are important to the local and regional economy. In addition, future potential long-term Port users and transit-type cargoes under long-term contracts may consist of lumber, ore, scrap metals and general cargo which have been handled in the past. In order to maintain the shipping channel at the authorized depth, the U.S. Army Corps of Engineers must dredge the channel on a regularly scheduled basis. The creation of the Reserve will not alter the current or future use of any of these areas designated for dredged spoils. The Reserve Management Plan does not call for

a change from existing or traditional uses of the areas of the Reserve. It is not the intent, goal nor desire of the Reserve to restrict shipping and dredging activities of the Port of Georgetown which provide a major portion of Georgetown's industrial-based economy. The NI/WB NERR is unique in the U.S. in that no other NERR is located in such close proximity to Federally maintained shipping channels. One of the objectives of the Reserve is to study the relationship between natural ecosystems and these shipping/industrial activities in order to establish an information base for the wise management and coexistence of both in the future. Hence the establishment of the Reserve would not limit the maintenance of existing shipping channels.

(i) Research and Education

The North Inlet/Winyah Bay Reserve serves as a research and instructional facility for the Belle W. Baruch Institute for Marine Biology and Coastal Research of The University of South Carolina. It functions as a national and international site for estuarine and coastal research and education.

Since 1969, a comprehensive research program ranging from studies of molecules to ecological landscapes has evolved. The research approach has developed from quantifying various physical, chemical, and biological components and interactions between these components, to incorporating exchange of substances across ecosystem boundaries and exchanges between different subsystems. Initial research efforts emphasized wetland and estuarine processes, but studies have expanded to encompass an entire coastal landscape, from ocean to diverse upland and freshwater habitats. There is also a continuing emphasis on molecular and organismic studies.

Undergraduate, graduate, and post-graduate instruction has been given at Hobcaw Barony. In 1980, the Baruch Institute, USC, established a Continuing Education Program at its field site in Georgetown to serve area residents and visitors. This program has included short courses for children and adults, public lectures and forums, and marine science workshops and courses for teachers. Additional public education activities are conducted at the site through the Bellefield Nature Center, a part of the Belle W. Baruch Foundation. The Nature Center is open to visitors 6 days a week and contains aquaria; exhibits featuring coastal life, ecology and research conducted on-site; and audiovisual programs that are shown daily. In addition, the Nature Center also conducts field studies of salt marsh, forest, and freshwater habitats on the property and brings nature programs to local schools.

Although significant progress has been made in developing broad-based monitoring, research, and education programs, a distinct need exists to improve and expand the program to educate more people about the cultural, economic, and ecological values of our coastal area and to develop a more

comprehensive scientific basis to deal with the ever-increasing environmental pressure resulting from continuing growth in the coastal zone.

(j) Present Land Use

The present land uses have been described in the previous section on existing uses. The area included in the Reserve is primarily used for research and education, but the tidal waters are used by the public for recreational purposes as provided by state and Federal law.

(k) Litter

Litter barrels will be provided at the Nature Center that is also the primary point of land access to the site. Periodic litter patrol and dumping of receptacle contents will be accomplished by reserve staff and volunteers. Since visitors will arrive in small controlled group situations, a major problem with litter should not occur. In addition, land access to the site is strictly regulated by gates and fencing installed by the Baruch Foundation.

(l) Construction

Research facilities are available and the Institute is in the process of constructing a new research laboratory to replace the two laboratories destroyed by Hurricane Hugo. At the entrance to the Hobcaw Barony is the Nature Center which is owned and operated by the Belle W. Baruch Foundation and functions as a visitor center. In addition to a reception and display area, a separate classroom building is used for instructional purposes. The adjacent USC Kimbel Living Center, consisting of housing accommodations for 80 persons and a meeting center, is available for workshops, seminars, and visiting groups and researchers. Other facilities contribute to the overall experience of visitors to the site. Examples of these include interpretive exhibits, printed educational materials, a collection of flora and fauna, and a boardwalk.

If NI/WB NERR builds or renovates a structure, development activities will take place on a very small area of land in the least sensitive zone of the reserve. A feasibility study will be conducted to take into account soil suitability, geology, vegetative community development, wildlife use, presence of rare, threatened and endangered species, and historical land use patterns. Land cover and land use categories will be mapped and defined according to suitable uses. The environmental impact of any construction and improvements will be fully assessed as part of a site design plan. Building will be constructed to conform with Federal

(i.e., FEMA) and state regulations. Any necessary permits and agency and Foundation approval will be obtained and applicable state and local guidelines will be followed to avoid environmental damage. Overall, impacts from construction and improvements will be negligible.

(m) **Future Land and Resource Use**

No change in land and resource use is proposed as a result of the creation of the NI/WB NERR, except to strengthen and expand research and teaching facilities and programs to meet future demands. Existing uses of the land and resources by the public will be continued in the Hobcaw Barony, as provided by Baruch Foundation regulations and State law, and in the tidal waters, as provided by State and Federal laws. Traditional uses include sail and power boating, recreational fishing and gathering of shellfish, hunting in marshes, etc., that currently exist as provided for by the above regulations and laws.

(n) **Manipulative Research**

Although no manipulative research projects are planned, it is possible that small scale manipulative studies, limited in nature and to the minimum extent necessary to accomplish the stated research objectives, could be approved but only after a thorough review of the project by the Institute, the SCCC, and NOAA, and after all necessary permits are obtained. Manipulative research activities with a significant or long-term impact on reserve resources require prior approval of the SCCC and NOAA.

Habitat manipulation for resource management purposes is not permitted within reserves, except as allowed for restoration activities consistent with NOAA regulations. An exception may be allowed to this prohibition if NOAA determines that specific manipulative activity is necessary for the protection of public health or the preservation of other sensitive resources which have been listed or are eligible for protection under relevant Federal or state authority (e.g., threatened/ endangered species or significant historical or cultural resources).

**6. General Permits and Licenses**

a. **Existing Permits and Licenses**

Existing requirements for local, state, and Federal permits and licenses will be observed and normal application procedures will be followed.

b. Reserve Research Permits

Scientific permit requests are carefully reviewed through the system now in place in the Institute. The Institute has a permit from the SCWMRD to collect biological samples in the NI/WB region. If new research projects are not covered by this permit, the investigator will have to obtain a special permit from the appropriate governmental agency such as USFWS, and NOAA. Appropriate enforcement personnel will be notified prior to conducting research. Approved permits must be in possession of permittee at all times.

7. Surveillance and Enforcement

The Reserve Manager works cooperatively with SCCC and the Baruch Foundation and SCWMR in surveillance and enforcement activities. The Coastal Environmental Enforcement District (District Nine and District Four) are responsible for enforcing boating laws, enforcement of the Federal Marine Mammal Protection and Endangered Species acts, enforcement of upland game and fish laws, search and rescue mission, etc. within the Reserve area. USFWS special agents also patrol the area for routine law enforcement activities related to Federal statutes such as the Migratory Bird Treaty Act, and the Endangered Species Act. Law enforcement on private lands would remain the responsibility of the Baruch Foundation.

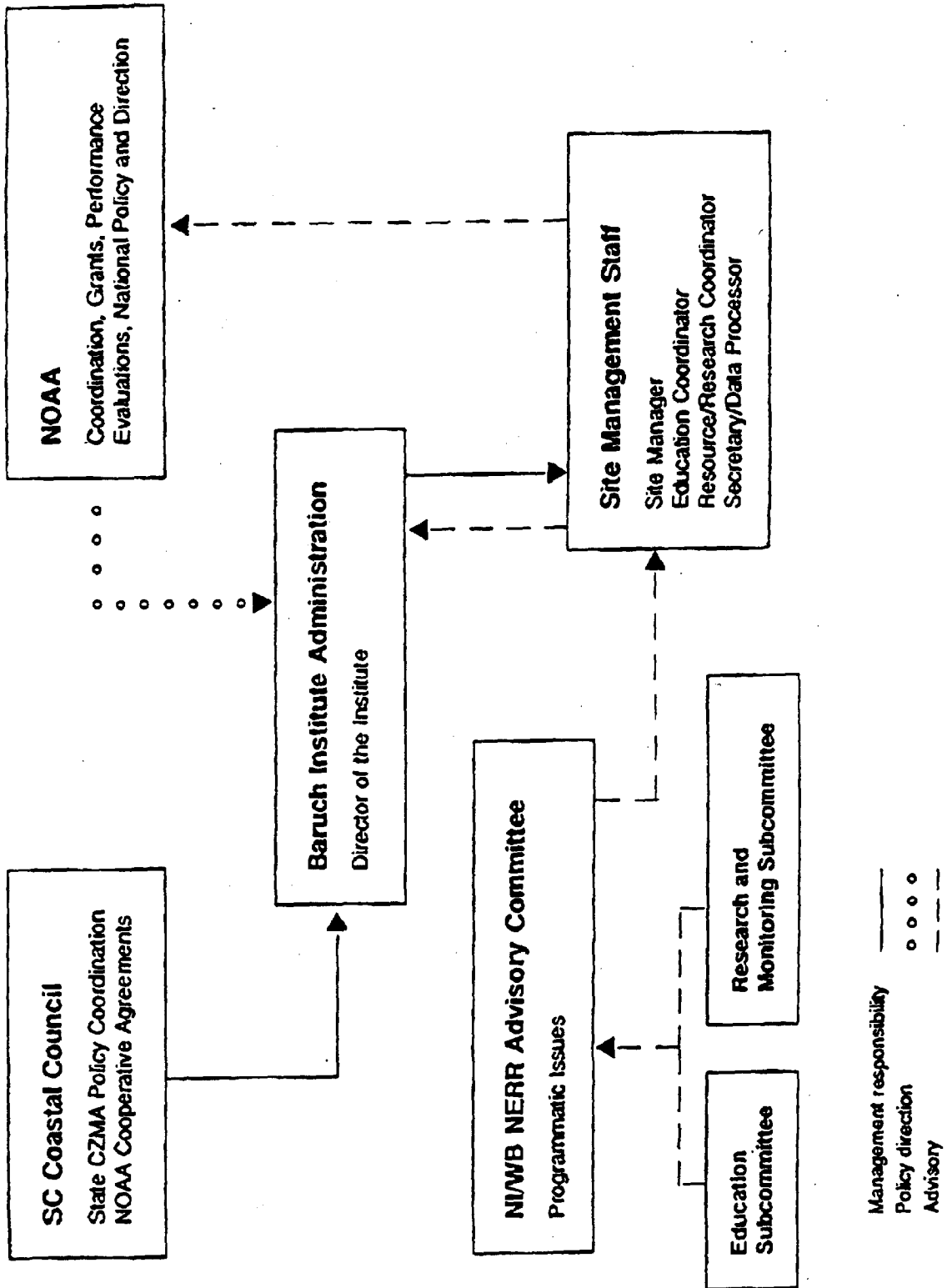
8. Public Education and Information

The North Inlet/Winyah Bay Reserve education program will design brochures, signs, and other instructional materials, as necessary, to communicate information about controlled and allowable activities in the Reserve. Signs to identify the Reserve as part of the National Estuarine Research Reserve System will be posted in strategic locations. Reserve staff and volunteers will play an important role through personal contact and information exchange in developing a positive and preventive approach to resource protection.

C. Administrative Plan

The following administrative plan for the Reserve recognizes the need for cooperation and coordination to achieve effective management. The administrative plan for the Reserve will ensure that the functions required to implement this Plan - research and education activities, and resource protection, are coordinated with the appropriate agencies, organizations, groups and individuals presently active within the area. Figure 3 outlines the management structure for the Reserve.

Figure 3. NI/WB Management Structure



## 1. Administrative Framework for the Reserve

Although the South Carolina Coastal Council is the designated State agency to administer programs and receive fiscal awards under the Federal Coastal Zone Management Act, the Council chooses not to be involved in direct land acquisition and management. Therefore, the Council has designated the Belle W. Baruch Institute for Marine Biology and Coastal Research, a state agency and an arm of the University of South Carolina, as the management agency for the NI/WB Reserve. Under contract with the Council and in cooperation with NOAA, the Institute will be responsible for development and implementation of the Management Plan and day-to-day operation of the Reserve. The Council will serve as the fiscal agent in acquiring funds from NOAA and will provide increased surveillance and enforcement to ensure compliance with the Coastal Zone Management Act and the NI/WB NERR Management Plan. The Council will also serve on the Reserve's advisory committee and provide input into identifying coastal research needs.

The Baruch Institute of the University of South Carolina (USC) is uniquely qualified to manage the North Inlet/Winyah Bay Reserve. The Institute is well known for its studies on long-term ecological research. For the past twelve years the National Science Foundation has funded the Baruch Institute program as part of the LTER network of national sites. In addition, a well-established educational program exists. A continuing education program associated with both the Belle W. Baruch Foundation's Nature Center and USC involved approximately 35,000 persons in 1990, and the Marine Science Program (BS, MS, Ph.D) is ranked fourth in the country.

The Belle W. Baruch Foundation was established in 1964 "for the purposes of teaching and/or research in forestry, marine biology, and the care and propagation of wildlife and flora and fauna in South Carolina, in connection with colleges and/or universities in the State of South Carolina". A Tripartite Agreement between the Foundation, the University of South Carolina, and Clemson University, which was approved by the South Carolina Attorney General in 1975 established a formal long-term agreement for management of the Hobcaw Barony and states that its purpose and programs are to preserve and conserve the ecological and environmental qualities of its property and to preserve its historical value (see Appendix A for a copy of this agreement).

The Baruch Institute of the University of South Carolina is responsible for the marsh-marine portion on the Hobcaw Barony and it is these lands which form part of the Reserve.

In keeping with the spirit of the Tripartite Agreement both universities and the Foundation have made long-term commitments to the existing programs. For

example, the University of South Carolina has expended \$3.2 million for a dormitory-meeting center/laboratory complex and is funding an extensive teaching and long-term research program that is heavily dependent on the availability of Hobcaw Barony.

## **2. Reserve Staffing**

An adequate staff is essential to meeting the research, education, and other objectives of the NI/WB NERR. Staffing requirements described in the administration section will be fulfilled according to the proposed five year staffing plan, as outlined in Table 4. Much of this may depend on the availability of Federal funding and approval for hiring personnel. However, the state is committed to providing support personnel contingent upon appropriation (i.e., Reserve manager, Education Coordinator and Research/Resource Coordinator). All staff members will be employees of USC, and will be hired according to established university/state policies. The Reserve Manager will report directly to the Director of the Institute; the Research/Resource Coordinator and Education Coordinator will report directly to the Reserve Manager.

### **a. Reserve Manager**

The Reserve Manager will be the principal administrator of the Reserve and will be responsible for ensuring that the NERRS policies and regulations contained in the Management Plan are followed. This individual, who will be employed and supervised by the Baruch Institute, USC, will report directly to the Institute Director. To meet Reserve user needs, assure Reserve resource protection, and to secure long-term operation funding, the Reserve Manager will:

- o     Oversee the development and implementation of resource management, research and monitoring, and education programs for the Reserve.
- o     manage the Reserve's program on a day-to-day basis.
- o     represent the Reserve program and its policies in public hearings and meetings where appropriate.
- o     act as liaison with local, state, and Federal agencies and other interested groups to improve cooperation and coordination in implementing the North Inlet/Winyah Bay Management Plan.
- o     coordinate the NI/WB Reserve programs with SC Coastal Council on all activities affecting the Reserve and maintain day-to-day liaison with NOAA/SRD staff, as needed.



- o coordinate with NOAA staff on program management, cooperative agreement, award preparation for operation and management, education, monitoring, research, etc. funding from Federal sources to SCCC.
- o develop resource protection guidelines and policies for the Reserve as new issues arise, and present them to the Advisory Committee.
- o direct and coordinate with NOAA any changes in the Management Plan.
- o act as staff support to the Reserve's Advisory Committee.
- o serve as principal contact for the North Inlet/Winyah Bay NERR program, represent the program in public relation and media contacts, and make presentations to local officials, environmental organizations, and others.
- o monitor day-to-day operations of the Reserve program and progress of research and education plans.
- o oversee any changes in Reserve boundaries with advice and consent of Baruch Institute Director.
- o assume responsibilities for other staff positions until filled.
- o oversee other staff members when hired.
- o prepare required reports (e.g., quarterly, semi-annual and annual reports for NOAA and other funding sources).
- o supervise Reserve staff.
- o coordinate Reserve research activities (visiting and collaborating scientists) with existing research programs and facilities.

Depending on funding availability, the approach to other staffing needs will be to provide financial support for expansion of certain existing programs within the Institute. The Institute, and its Field Laboratory are already involved in estuarine education and research (i.e., tours, field trips, seminars, workshops, and teacher training). Reserve funding will be used to support and build on this experience and expertise rather than to duplicate any of these efforts. In addition to the Reserve Manager, two key administrative members are the Research Resource Coordinator and the Education Coordinator.

**b. Research/Resource Coordinator**

A Research/Resource Coordinator will be hired to implement and coordinate the research and monitoring program component of this Management Plan. Specific responsibilities include to:

- o coordinate with the Reserve Manager in the development and implementation of the Reserve research plan.
- o provide staff support for the research and monitoring advisory subcommittee.
- o assist the Reserve Manager and participating agencies in preparing and updating an annual list of priorities for research and monitoring at the Reserve.
- o coordinate the review of priorities for research and monitoring by the Research and Monitoring Advisory Subcommittee.
- o issue requests for proposals for North Inlet/Winyah Bay NERR-funded research and monitoring projects and initiate a peer review process for proposals received. Assist NOAA in the review of NOAA-funded proposals, as needed.
- o evaluate the results of the peer review process for North Inlet/Winyah Bay NERR-funded research and make recommendations to the Reserve Manager and Research and Monitoring Advisory Subcommittee.
- o serve as liaison with the scientific community, promote data utilization, and act as primary contact for scientists performing research within the Reserve.
- o coordinate research activities within the Reserve and communicate with other NERR sites and the ACE Basin NERR education and volunteer programs.
- o actively promote use of North Inlet/Winyah Bay Reserve as a site for conducting research and monitoring activities.
- o conduct research and monitoring activities.
- o pursue additional (outside) funding sources for research and monitoring in the Reserve.

- o assist in the training of volunteers, research assistants, and interns; monitor/evaluate their performance.
- o recommend locations for research and monitoring stations within the Reserve and provide technical advice, logistical support and assistance to scientists in conducting research and monitoring activities, as available.
- o develop additional research guidelines and policy statements as new issues arise and present them to Research and Monitoring Advisory Subcommittee for appropriate actions.
- o visit the Reserve on a regular basis and keep field journal and photographic records of ongoing research activities.

c. Education Coordinator

The Education Coordinator is responsible for implementing and coordinating the education program component of this Management Plan. Specific responsibilities are to:

- o develop and coordinate education program activities that are consistent with the goals and objectives of the Reserve and NERRS.
- o evaluate the effectiveness of the education program and modify activities accordingly.
- o monitor and adjust education program activities as necessary to assure that they do not negatively impact the research and management goals of the Reserve.
- o coordinate reserve education activities with education program activities of the Bellefield Nature Center, operated by the Belle W. Baruch Foundation.
- o conduct periodic needs assessments to determine new areas for program development.
- o assist in the establishment of and serve as a liaison to the Education Advisory Subcommittee.
- o assist in the establishment and coordination of a Volunteer Program.

- o assist in the development of grant proposals to support the continuation and expansion of the education program.
- o coordinate activities with NOAA (SRD) national education program coordinator.

The Research/Resource Coordinator and Education Coordinator report directly to the Reserve Manager.

In addition to these three positions a Secretary-Data Processor will be hired to handle the various secretarial tasks associated with the Reserve, and assist the existing data management program with those topics relating to the Reserve's activities. The Secretary-Data Processor will be responsible to the Reserve Manager. As the program develops, the need for additional personnel will be evident. It is anticipated that a Research Technician(s) will be needed to assist in field studies and monitoring of living resources and of physical/chemical/geological factors.

### **3. Advisory Committee Roles and Responsibilities**

An Advisory Committee will be established which will have one member selected (except as noted) from the following agencies and local interest groups:

- o the Belle W. Baruch Foundation
- o the marine scientific community (2)
- o the education community (2)
- o management of harbor-related industries (2)  
to be selected from local industries such as Georgetown Steel, International paper, Santee Cement, AKZO Salt, 3V. Chemicals, Santee Cooper Winyah Generating Station, and American Cyanamid Co.
- o labor from harbor-related industries (2)
- o representative of the Georgetown Sportfishing Association
- o Georgetown County Chamber of Commerce
- o South Carolina State Ports Authority
- o an environmental interest group
- o the League of Women Voters

- o a Debordieu Colony land owner
- o the Yawkey Wildlife Center, SC Wildlife and Marine Resources Department
- o the Waccamaw Regional Planning Office
- o the Belle W. Baruch Forestry Institute, Clemson University
- o the Georgetown County Council
- o the Georgetown City Council
- o representative of SC Sea Grant Consortium
- o representative from SC Waterfowl Association
- o general public (2)
- o any others deemed appropriate by the Nominating Committee

In addition, a representative of the SC Coastal Council, NOAA (SRD), and the Dean of the College of Science and Mathematics, USC, will serve as ex-officio, non-voting members. The Director of the Baruch Institute, USC, will serve as chairperson and will vote in case of ties.

The activities of the Advisory Committee will include:

- o Advising the Reserve Manager on matters of policy relating to planning and operation of the Reserve;
- o Assisting in seeking support for the research and educational programs and other financial matters;
- o Assisting in the preparation of any periodic summary or annual reports on the operations of the Reserve;
- o Representing the interests of the users of the Reserve, its neighbors, and the users of information and educational materials generated by the Reserve; and
- o Reviewing, monitoring, and advising on specific program activities to be conducted in the Reserve to ensure that they are consistent with the goals and objectives set forth in the Management Plan.

The Advisory Committee will have regular meetings at least twice a year which will be open to the public and will be announced through the local media at least two weeks in advance. The Reserve Manager and appropriate Institute personnel will serve as staff to the Committee. Special meetings may be called by the chairperson and/or upon the request of five committee members. The committee members will receive four weeks written notice of regular meetings and two weeks written notice of special meetings.

A Nominating Committee, consisting of the Reserve Manager, Education Coordinator, Chairman of the Georgetown County Council, President of the Debidue Property Owners Association, Executive Director of the Georgetown Chamber of Commerce, Superintendent of The Georgetown County School System, President of the Georgetown Sportfishing Association, and Director of USC Field Laboratory, will submit a list of potential Advisory Committee members to the Chairperson of the SC Coastal Council for action. Appointments to the Advisory Committee will be for one year with a limit of three successive reappointments. Upon the advice of the Advisory Committee, the Chairperson will appoint additional subcommittees. Initially a Research and Monitoring Subcommittee and Education Subcommittee will be established.

a. **Research and Monitoring Subcommittee**

The Research and Monitoring Subcommittee will consist of appropriate Advisory Committee members and other technical representatives from the scientific and academic communities. The Subcommittee will advise the full Committee on research and monitoring activities within the reserve and will be responsible for the following:

- o Reviewing and approving priorities for research and monitoring projects;
- o Reviewing research and monitoring proposals and interim and final research and monitoring reports;
- o Monitoring and advising on local issues and new opportunities for cooperative research and monitoring; and
- o Evaluating overall progress toward achieving research and monitoring priorities and adjusting long-term direction accordingly.

b. **Education Subcommittee**

The Education Advisory Subcommittee will be composed of appropriate Advisory Committee members and representatives from area institutions of education,

state agencies involved with education, and others. This subcommittee will be responsible for the following:

- o Review and approval of the list of annual priorities for education and interpretation activities for the Reserve;
- o Review of education proposals and design proposals for all education and interpretive facilities, displays, media curriculum, training programs, etc., and monitor progress of specific activities to ensure that they are consistent with the goals of the Reserve Program and this Management Plan; and
- o Evaluation of progress toward achieving priorities for education and interpretation and adjustment of long-term priorities accordingly.

#### 4. Volunteer Programs

A Volunteer Program will be developed to provide opportunities for interested members of the public to interact more closely with both the education and research activities of the Reserve. A properly organized volunteer program will be an asset to the North Inlet/Winyah Bay Reserve, a valuable experience for the volunteer and an opportunity for direct community involvement. The most obvious benefit would be an increase in manpower for the Reserve at minimal cost. Volunteers supplement paid staff and often permit expansion of services that would not otherwise be possible. A volunteer program can also effectively transfer information on the value of estuaries to the general public and elected officials. Properly trained volunteers carry their knowledge and enthusiasm to a portion of the general public that the scientist or Education Coordinator cannot reach.

The Education Volunteer Program will be coordinated with the Bellefield Nature Center administration and supervised by the Reserve Education Coordinator. The Research Volunteer Program will also be administered by the Research/Resource Coordinator and will be consistent with policies of the Baruch Foundation. A limited number of volunteers (to be approved by the Baruch Foundation) will be involved in the program. Education program volunteers will be particularly useful in greeting visitors and answering questions at the Nature Center and Kimbel Center, thus allowing NI/WB NERR staff members to conduct more programs in the field.

The duties of the Education and Research Volunteer coordinators include: preparation and planning, recruitment and placement, orientation, training and supervision, record keeping, recognition and program evaluation. The coordinators will report directly to the Reserve Manager and will be located at the Reserve headquarters.

Prior to initiating any volunteer program, those responsible for establishing the program should have a thorough knowledge of the Reserve's needs and priorities in order to define objectives for volunteer services and volunteer opportunities and requirements. Administrative support should be obtained and Reserve staff should be involved in generating ideas and identifying appropriate volunteer tasks.

Suitable program assignments should be identified for volunteers and specific job descriptions should be prepared. Job descriptions should be written to include: job responsibilities, necessary qualifications, amount of time required per week or month, name and phone number of supervisor and training time requirements. Orientation is the responsibility of the Volunteer Coordinators and will include:

- o Information about the Reserve and its structure;
- o Information on the general purpose, objectives, and philosophy of the Reserve;
- o A clear explanation of the volunteer's commitment to the Reserve, her/his supervisor, etc.;
- o Information as to how the specific program assignment relates to the overall function of the Reserve; and
- o An orientation manual covering the North Inlet/Winyah Bay Reserve Volunteer programs should be prepared and issued to volunteers.

The Volunteer Program needs care and periodic examination. Program objectives, training materials, methods, and accomplishments should be critically examined. Most importantly, the staff should frequently evaluate its goals, the goals for the Volunteer program and its methods for attaining these goals.

## **5. Relationship with Existing Administrative Programs**

### **a. Other Agencies/Organizations**

Although the Institute will manage the Reserve, interactions with state regulatory agencies (i.e., SC Wildlife and Marine Resources Department and the SC Department of Health and Environmental Control) will be maintained to ensure protection of the Reserve. In addition to interactions with state regulatory agencies, the Baruch Institute, USC, has an agreement with the Belle W. Baruch Foundation to manage the marsh-marine portions of Hobcaw Barony included in the Reserve under the terms of a Tripartite Agreement which exists between the Belle W. Baruch Foundation, The University of South Carolina, and Clemson University. This agreement describes the role of the two universities in managing the lands associated with the



Hobcaw Barony. None of the lands managed by Clemson University are included in the Reserve. The trustees of the Foundation have established most of the terrestrial habitats adjoining the western border of North Inlet and much of the land bordering the Mud Bay section of the Reserve as an area for systems ecology research.

b. SC Wildlife and Marine Resources Department, Division of Marine Resources (SCWMR)

The Division of Marine Resources is responsible for the conservation and orderly development of the state's marine resources through planning, research, management, and public education. The Division also has the primary responsibilities for management and development of commercial and recreational fisheries in the coastal area, including the regulation and control of commercial fishing seasons (areas and equipment), management of public shellfish grounds, and records of fisheries statistics. The Division is also active in environmental and ecological concerns, especially those which impact coastal fisheries habitats.

c. SC Department of Health and Environmental Control (SCDEC)

The goal of the SCDHEC Shellfish Sanitation Program in South Carolina is to ensure that shellfish and the areas from which they are harvested meet the health and environmental quality standards provided by Federal and state regulations, laws, and guidelines. Additionally, the Department promotes and encourages coastal quality management programs consistent with protected uses established through the state water classifications and standards program.

d. Belle W. Baruch Institute Forest Science Institute of Clemson University

The Belle W. Baruch Forest Science Institute was established to implement an agreement between the Belle W. Baruch Foundation and Clemson University to accomplish the objectives of The Belle W. Baruch Foundation and of Clemson University relative to education and research in forestry and closely related sciences. Although Clemson has no management jurisdiction over the Reserve, it is responsible for maintenance of Hobcaw Barony except for the USC Field Laboratory. The Reserve will interact with Clemson in matters of mutual interest, as is the current practice.

e. Others

Over the course of time, the Reserve Management will interact with other local, state, Federal, and private organizations in respect to management activities.

**6. Five-Year Activities Plan**

Implementation of the major program development activities, including hiring of staff and initiation of programs for research, monitoring, education, and volunteer activities will begin following Reserve designation and will be phased-in over a five-year period according to a prescribed schedule of activities shown in Table 4.

**Table 4. Five Year Activities Plan for  
North Inlet/Winyah Bay National Estuarine Research Reserve**

Program Year	Program Needs*	Major Program Development Activities
0 (Predesignation)		<ul style="list-style-type: none"> <li>• DEIS/DMP completed</li> <li>• DMP Advisory Committee</li> <li>• Some coordination of research projects</li> <li>• Some coordination of education projects</li> <li>• Receive comments on DEIS/DMP; then work to complete DEIS/DMP and FMP</li> </ul>
1	Reserve Manager (1) Clerical worker (.25) Education Coordinator (.7) Research Coordinator (1)	<ul style="list-style-type: none"> <li>• Appoint Advisory Committee</li> <li>• Increase coordination of education program with Nature Center</li> <li>• Increase coordination of research/monitoring programs with ongoing research</li> <li>• Initiate monitoring and baseline inventory programs</li> <li>• Integrate data management system with LTER data management system</li> <li>• Develop brochures</li> <li>• Staff participation in research and education workshops</li> <li>• Initiate intersite cooperative programs</li> <li>• Planning for second year</li> </ul>
2	Reserve Manager (1) Clerical worker (1) Education Coordinator (1) Research Coordinator (1) Research Specialist (1)	<ul style="list-style-type: none"> <li>• Continue coordination of site education programs as they develop</li> <li>• Increase coordination of research/monitoring/baseline inventory with ongoing non-NOAA programs</li> <li>• Develop year round monitoring/baseline inventory studies</li> <li>• Expand research program</li> <li>• Increase research and education workshops</li> <li>• Conduct evaluation of facilities</li> <li>• Planning for third year</li> </ul>
3	Fully Staffed Reserve Manager (1) Clerical worker (1) Education Coordinator (1) Research Coordinator (1) Research Specialist (1) Education Specialist (.5) Education Volunteer Coordinator (.25) Research Volunteer Coordinantor (.25)	<ul style="list-style-type: none"> <li>• Continuation of research, education, monitoring, and baseline inventory activities</li> <li>• Planning for fourth year</li> </ul>
4	Fully Staffed	<ul style="list-style-type: none"> <li>• Continuation of established programs</li> <li>• Planning for fifth year</li> </ul>
5	Fully Staffed	<ul style="list-style-type: none"> <li>• Continuation of established programs</li> <li>• Program review by external committee</li> <li>• Planning for sixth year</li> </ul>

#### **D. Facilities Development Plan**

Funding is provided by NOAA and matched by the state for the construction or renovation of a visitor center, research facility, education center, or other improvements associated with research, education, and access to reserve sites. Facilities and improvements must be located within the boundaries of the designated research reserve. Major construction projects (i.e., buildings) require the preparation of architectural and engineering plans and state approval of capital outlay proposals. Funding for planning and developing architectural and engineering plans for buildings may come from initial acquisition and development grants which are awarded after approval of the DEIS/DMP (i.e., in the predesignation phase). Funds for constructing buildings come from acquisition and development grants which are awarded after approval of the final management plan. Minor construction activities that aid in implementing portions of the management plan (such as nature trails, boardwalks, boat ramps) do not require architectural or engineering plans. Funding for planning and constructing nature trails, boardwalks, boat ramps, and other minor improvements can be awarded under initial acquisition and development grants as well as under later acquisition and cooperative agreements.

#### **Goal of the North Inlet/Winyah Bay Facility Development Program**

The goal of the NI/WB NERR Facility Development program is to provide the necessary facilities for research and educational activities. Although research and educational facilities are presently available, the Reserve will seek funds to provide new facilities as they are needed to update and/or expand to meet new demands. These facilities should not interfere with the natural appearance of the site.

##### **1. Facilities**

Research facilities in the Reserve are temporarily housed in trailers but the Institute is in the process of constructing a new 16,000 sq ft research laboratory to replace the two laboratories destroyed by Hurricane Hugo. These facilities will be constructed to conform with Federal Emergency Management Act (FEMA) regulations. FEMA is providing partial funding for these buildings.

This facility will have space for administrative offices, the computer center, teaching and continuing education rooms, chemical laboratories, 13 laboratories for visiting and resident scientists, seminar/library room, balance room, museum, and common equipment room. At the entrance to the Hobcaw Barony and adjacent to the NI/WB Reserve is the Nature Center, which is owned and operated by the Belle W. Baruch Foundation and functions as a visitor center. In addition to a reception and display area, a separate classroom building is used for instructional purposes. The adjacent USC Kimbel Living Center, that is part of the Reserve, consists of housing accommodations for 80 persons and a meeting center. It will also be used for

Reserve exhibits and displays, workshops, seminars, and for visiting groups and researchers.

## **2. Location of Reserve Visitor Center/Headquarters**

The NERRS regulations require that final selection of a site for facilities such as the Visitor Center appear in the Management Plan. During the preparation of this Plan, a number of locations were considered as alternatives for the center. However, serious discussions have been confined to the Kimbel Center.

The Visitor Center for the NI/WB NERR will be located in the Kimbel Center, located at the entrance to the Hobcaw Barony. Activities at the Visitor Center will be closely coordinated with the personnel of the Baruch Foundation located in the nearby Bellefield Nature Center.

The headquarters of the NI/WB NERR will be located in offices in the new laboratory located on the edge of North Inlet. This facility will serve to centralize Reserve activities with those of the NI/WB project involving all participants (i.e., USC personnel, visiting scientists and students, visitors, representatives of various agencies, and the Baruch Foundation). The continuing education office will be located in the new laboratory.

## **3. Staffing Requirements**

Initially four positions will be required to begin the basic programs at the Reserve: Reserve Manager, Research/Resource Coordinator, Education Coordinator, and Secretary/Data Processor. The duties and responsibilities of the first three positions were described earlier in the Management Plan. The Secretary/Data Processor, who will be responsible to the Reserve Manager, will handle the various secretarial tasks associated with the program and assist the existing data management program with those topics relating to the Reserve's activities. As the program develops, the need for additional personnel will be evident. It is anticipated that as the program develops and funding becomes available a Research Technician(s) will be added to assist in field studies and monitoring of living resources and of physical/chemical/ geological factors. Additionally, an Education Specialist will be needed to further coordinate and implement the Reserve's education program; Volunteer Coordinators will be necessary to develop and implement the Reserve's Education and Research Volunteer programs.

## **4. Facility Requirements**

Other facilities contribute to the overall experience of visitors to the site. Examples of these include interpretive exhibits, a collection of flora and fauna, and a boardwalk.

In the future as the program expands, the need for additional facilities will be assessed. Construction or expansion of facilities within the Reserve will be conducted only upon approval of NOAA, the Belle W. Baruch Foundation, the University of South Carolina and with any necessary Federal and State permits or agency approvals. If additional parcels are identified to be included within the boundaries of the Reserve, such as the Nature Center and/or the rice fields along Winyah Bay, this would be done in accordance with NOAA regulations and with the approval of the Baruch Foundation. Through a long-term agreement with the Baruch Foundation, the Baruch Institute manages the portion of the Foundation's lands to be included in the Reserve and the State owns the remaining areas of the Reserve.

## **5. Trails and Observation Platforms**

Interpretive trails are already in existence on Hobcaw Barony and under the management of the Nature Center. In addition, a boardwalk over a section of the marsh exists within the Reserve. From the boardwalk can be observed various marsh organisms and vegetation. Some of these will allow access for the physically handicapped. At several locations, wildlife observation platforms and/or blinds will be installed.

The main function of these facilities will be to:

- o Maintain pedestrian access within the Reserve to minimize impact of visitor use on sensitive resource areas;
- o Reduce conflict among various Reserve users, such as interpretation, research and traditional activities;
- o Contribute to the education/interpretation plan as outlined in the Management Plan

## **E. Research and Monitoring Plan**

### **1. General Context for Management**

The research and monitoring program will rely on the results of scientific research to achieve an understanding of the entire estuarine system and its watershed. The goal of the Research and Monitoring Plan is to utilize the Reserve for long-term studies to gain a better scientific understanding of natural and human processes occurring within the estuaries and to develop information for the use of coastal decision-making agencies. National and state agencies responsible for management and protection of coastal environments and resources are aware of the potential for increasing human-induced stress in our coastal ecosystems. Some programs have been initiated or proposed to address aspects of the enormous and complex problems associated with intense coastal development. For example, EPA has

a program involving the Great Lakes and certain large estuarine systems, and recently initiated the Environmental Monitoring and Assessment Program. In addition, NOAA has started a Coastal Ocean Program. However, a recent study of marine coastal environmental protection by the National Research Council emphasized that a close link must exist between monitoring (constant measuring of environmental parameters) and research programs (determination of processes, mechanisms, predictive models, etc.) in order to produce information which is essential for interpreting monitoring results by environmental regulatory agencies. The NI/WB Reserve will help fill this void.

Despite past efforts, little attention has been specifically directed to long-term ecosystem-level studies dealing with southern coastal aquatic systems and the interaction between uplands and these aquatic systems. A significant data gap exists in understanding the interactive relationship of the stress created in these ecosystems by the growing human activity in the coastal regions of the southeastern U.S. In the southern region of the United States there are few large estuarine systems -- most of the estuaries and freshwater systems are relatively small and are surrounded by extensive wetlands. For example, there are over 320 small, high salinity creeks, inlets, and estuaries between Cape Fear, NC, and Cape Canaveral, FL. Nearly half occur in South Carolina. Approximately 500,000 acres of wetlands are found in the coastal region of South Carolina, and the southeastern sector of the United States has a large percentage of the nation's coastal wetlands. Much of the present development of coastal areas is occurring and is predicted to continue to occur on highlands adjacent to these estuarine and freshwater systems. There is a need for a holistic, ecological, landscape-level approach involving the integrative analysis of the status and stress levels of southeastern coastal ecosystems. Coordination of research projects oriented toward this approach is of paramount importance in order both to understand the influences of human activities and inputs on diverse coastal systems of the southeast and to develop the ability to anticipate or predict potential problems associated with these activities and inputs.

To adequately study complex coastal systems impacted by society requires a level of integration and organization not traditionally found in universities, which tend to be organized according to traditional disciplines. Because of the nature of research funding, most projects usually involve one or a few investigators working on one facet of a broader question. Traditionally, formal institutional mechanisms do not exist which allow integration of studies and a continuity of research themes. Frequently, valuable data from single-investigator-oriented research is lost because of the lack of a long-term data management system. The Baruch Institute, USC, has more than 20 years of experience with multidisciplinary, multi-investigator research projects. It has developed the facility and administrative structure to conduct research at this level. The research/monitoring program will not duplicate past or present research projects. Research on southeastern ecosystems will be more cost-efficient and scientifically

effective with the proposed NI/WB NERR, as opposed to individual research projects. The NI/WB NERR Research and Monitoring Plan has the following goals and objectives:

**a. Goals**

- o provide a rapid and efficient means of disseminating new knowledge related to coastal ecosystems (by means of public presentations, publications, information transfer to Reserve education programs etc.),
- o respond in setting research priorities to accommodate either external individual grants or in-house research programs,
- o provide a collaborative environment which would foster multidisciplinary as well as multi-institutional projects,
- o provide an additional level of quality assurance at all stages of research performance,
- o channel scientific information (through technical reports, presentations, etc.) to NOAA, other Federal and state agencies, environmental groups, the public, and the press so that research findings can be utilized in a practical manner, and
- o have a long-term, holistic perspective and focus on fundamental problems facing southeastern US coastal ecosystems.

Knowledge of how ecosystem processes function on a long-term basis in an unperturbed system is important in assessing the impact of human activities. Long-term comparative studies are essential to delineate between interannual variation in system responses due to natural variability (i.e., a prolonged cold spell or a drought) and variation resulting from human perturbation. These important scientific data are extremely limited and their scarcity has hampered regulatory/management agencies in assessing environmental impacts. North Inlet Estuary is an ideal site to use as a standard against which to compare other coastal systems: (1) it is relatively free of human-influenced disturbances, (2) it has been studied for 22 years, the last 12 years as part of the NSF program on Long-Term Ecological Research, (3) an extensive data base exists to study ecosystem processes, and (4) the Baruch Institute Field Laboratory and resident staff are located there.

**b. Objectives**

- o establish and manage the areas of the Reserve for long-term use as natural field laboratories by state, local and private organizations, while



maintaining traditional uses of the Reserve by individuals and various groups;

- o conduct both state-of-the-art and basic environmental research which will provide both significant information to the public, scientific, and regulatory communities and a data base for use in long-term and interdisciplinary studies;
- o enhance the scientific understanding of southeastern estuarine ecosystem processes and functions which can then be used for planning and standard-setting by reserve managers and coastal decision-makers;
- o provide education and experience to young scientists considering environmental careers by utilizing volunteers to achieve research goals.

These objectives will be met by the Reserve staff promoting:

- o long-term baseline studies to characterize flora and fauna within the Reserve and to gain an understanding of the ecological interrelationships between organisms and their environments;
- o a better understanding of tributary water quality conditions, particularly spatial and temporal dynamics, requirements for growth and survival of living resources, and contribution and effects of point and non-point source pollution;
- o a better understanding of physical processes operating within the estuary, such as tidal influence, circulation dynamics, freshwater inflow, stratification patterns, and sediment dynamics;
- o the Reserve as a site for estuarine research by providing essential services and facilities;
- o studies that make effective use of past research and address data gaps in the Reserve's information base; and
- o the effective use and communication of research results.

## **2. Research and Monitoring Priorities**

### **a. North Inlet/Winyah Bay NERR Research Priorities**

Establishment of the NI/WB NERR will create a long-term opportunity for temporal and spatial sampling in wetlands, upland, and open water estuarine habitats,

as well as a greater opportunity for the development and use of new observational and analytical techniques in protected estuarine subsystems. NI/WB NERR sponsored research will be directed toward: (1) water management, (2) soil management, (3) nutrients and other chemical inputs, (4) coupling of primary and secondary productivity and 5) estuarine fishery habitat requirements. General research priorities include:

- o ascertaining which ecological resources are at risk and what level of human-induced stress exists in two southeastern coastal ecosystems, and developing accurate and sensitive bio-markers of pollutant exposure;
- o determining the condition of two southeast coastal ecosystems, and how they change (i.e., developing baseline characteristics that define a healthy, low stressed coastal ecosystem for comparisons with more polluted, highly stressed coastal ecosystems as regards organismal physiology, end point indicators, population and ecosystem structure, and determining the classes and specific types of anthropogenic activities and inputs which characterize and lead to unhealthy, stressed coastal ecosystems); and
- o formulating specific computer models for predicting the effects of long-term, indirect and direct exposures to pollutants and other human activities in two southeastern coastal ecosystems (i.e., the coordination of exposure and effects studies under both laboratory and field conditions, using cornerstone species, to characterize real effects of pollutants at the ecosystem level, and determining how accurately end point indicators, bio-markers, and physiological measurements in cornerstone species can be extrapolated to meaningful effects at the ecosystem level).

**(1) Initial Short-Term Research Priorities**

- o analysis of living resource data sets;
- o stock assessments;
- o evaluation and analysis of monitoring capabilities, oyster production and diseases;
- o salinity and circulation patterns;
- o nutrient levels in marsh areas versus nutrient levels in open water;
- o land use patterns; and sublethal responses to toxin.

Research priorities include providing support facilities to conduct research, including advanced analytical chemical equipment (particularly for identification of organic and metallo-organic compounds); remote sensing; and automated data analysis technologies. Sometimes the success of a research project depends on the study site remaining undisturbed. To prevent trampling or other unnatural physical disturbances, the researcher may request that signs requesting avoidance of the study area be posted. The request would be made to the Reserve Manager and reviewed by the Advisory Committee. Typically, study plots are small and located in infrequently visited or remote areas so that public travel or access patterns would not be affected.

(2) Longer Term Research Priorities

- o improved understanding of structure and function of coastal habitats (i.e., emergent saline marshes, tidal freshwater habitats, non-vegetated wetlands, benthic habitats, oyster reefs);
- o impacts of modification of coastal and contiguous habitats; water column processes (i.e., plankton communities, inorganic nutrient cycling, replenishment and storage, micro-circulation, and interactions among main stem and adjacent water bodies);
- o toxins;
- o genetic variability and structure of organisms within NI/WB NERR;
- o watershed processes (i.e., transport, fate and processing of dissolved and particulate material);
- o effects of land-use activities;
- o ground water contribution, including spatial and temporal input and outflows; chemical characteristics, extent and magnitude of pesticide, nutrient, and other pollutant contamination;
- o impact on sediment-water column pollution interactions;
- o methods to reduce ground water pollution;
- o impacts of population growth development;
- o temporal and spatial variability in the use of marsh tidal creek ecosystems as nursery areas;

- o wetland formation and production relative to sea-level rise; archaeological studies;
- o loss of wetlands habitat and mitigation approaches;
- o buffering effect of wetlands on sediment and heavy metal/toxic chemical loads; basic marsh processes such as accretion and erosion;
- o effects of human water activities on shorelines;
- o buffering effects of wetlands on flooding and erosion;
- o wetland production relative to sea-level rise; and
- o plant community succession

Although no manipulative research projects are planned, it is possible that small-scale manipulative studies, limited in nature and to the minimum extent necessary to accomplish the stated research objectives, could be approved but only after a thorough review of the project by the Institute, the SCCC, and NOAA, and after all necessary permits are obtained. Manipulative research activities with a significant or long-term impact on Reserve resources require prior approval of the SCCC and NOAA.

Habitat manipulation for resource management purposes is not permitted within reserves, except as allowed for restoration activities consistent with NOAA regulations. An exception may be allowed to this prohibition if NOAA determines that specific manipulative activity is necessary for the protection of public health or the preservation of other sensitive resources which have been listed or are eligible for protection under relevant Federal or state authority (e.g., threatened/endangered species or significant historical or cultural resources).

**b. NERRS National Research Priorities**

In addition to research activities described above, program-wide research priorities have been developed for the NERR System for Fiscal Years 1993-2002. Research at the NI/WB NERR will be planned and proposals submitted which will be part of these priorities. These research priorities are:

- |               |   |
|---------------|---|
| FY 1993, 1994 | Non-point source pollution (non-focused or non-identifiable sources of pollution inputs and alterations within watersheds). |
| FY 1995, 1996 | Habitat restoration (restoration of coastal habitats that have been altered by anthropogenic activities and/or inputs).     |

- |               |   |
|---------------|---|
| FY 1997, 1998 | Alterations in habitat utilization by coastal biota (exotic species, commercial species, non-commercial species).   |
| FY 1999, 2000 | Alterations in water circulation, transportation and quality (tidal exchange, freshwater diversion, hydrological budgets, ground water intrusion, biotic species transportation). |
| FY 2001, 2002 | Anthropogenic inputs and activities (focused and identifiable - i.e., dredge spoils, HAZMAT, recreational uses, commercial uses).   |

**c. Monitoring Program Priorities**

The NI/WB NERR monitoring program will consist of a three-phase approach as follows:

**(1) Phase I**

Environmental Characterization, which involves literature review and/or field research to acquire all available information on hydrology, geology, water chemistry, water quality, biological resources, and the problems and issues confronting the reserve environment;

**(2) Phase II**

Site Profile, which involves a synthesis of information gathered to provide an overall picture of the reserve in terms of its resources, issues, management constraints, and research needs;

**(3) Phase III**

Procedures and Requirements, which involves identifying parameters to be measured, procedures to be used (criteria for measurements, quality control, and standard procedures where they already exist), sampling strategy for selected parameters (spatial and temporal intervals), storage and retrieval of data (reporting, formatting, and analytical requirements), manpower requirements, logistics, and cost; and

**(4) Phase IV**

Implementation which involves pilot projects and, upon successful evaluation, full-scale monitoring of selected parameters.

The NI/WB NERR phased monitoring program will be integrated with the South Carolina Department of Health and Environmental Control (SC DHEC) and South

Carolina Wildlife and Marine Resources (SCWMR) monitoring program for water quality, living marine resources, toxic chemicals, and other parameters. It will also be integrated with other monitoring programs conducted by Federal agencies including NOAA and EPA.

At present monitoring of numerous environmental parameters are routinely done with funds provided by the National Science foundation and NOAA. The parameters measured include: continuous recording of precipitation, wind speed, barometric pressure, solar radiation, and water temperature and conductivity; daily water sample taken and analyzed for nutrients and chlorophyll; monthly measurement of Spartina production; and biweekly measurement of zooplankton, mobile epibenthos, meiobenthos, macrobenthos and water column macro-organisms. The NI/WB NERR monitoring program would augment this existing activity and if the NSF and NOAA funding is discontinued, the Reserve effort would take over the entire sampling program consistent with the availability of funds.

Specific means for incorporating program elements into existing and new monitoring programs will be developed. The Reserve Manager will work to incorporate the following elements into all monitoring programs:

- o hypothesis testing
- o relationship to management issues
- o quality assurance/quality control
- o means of determining program effectiveness
- o periodic review
- o data management and analysis
- o publication of data

The North Inlet/Winyah Bay NERR will submit an annual report to NOAA as required by NERRS Regulations at 15 CFR 921.40. The report will include a description of overall program successes and accomplishments, references to the Reserve Management Plan, and, as appropriate, the work plan for the coming year. The first report will cover the 12-month period following receipt of operations funding, and will be submitted within three months after the end of that period. In addition, North Inlet/Winyah Bay NERR shall arrange for the periodic NOAA evaluation visits and public meetings as required and described in NERR regulations at 15 CFR 921.40.

### **3. North Inlet/Winyah Bay NERR Policies and Procedures for Research**

#### **a. General Policies**

Research opportunities at NI/WB NERR are available to qualified scientists and students affiliated with a college, university or school; non-profit, non-academic research institutions (e.g., research laboratory, independent museum, professional society); profit organizations; or state, local or Federal government agencies.

Research opportunities will be available to all applicants without regard to manner of funding. Support may come through South Carolina state agencies, the NOAA Office of Ocean and Coastal Resource Management (OCRM), NOAA Sea Grant, the Environmental Protection Agency, NSF, and other sources. Researchers may apply to do research at any time; however, scientists seeking financial support from NOAA/OCRM must follow NOAA's research and monitoring guidelines.

All research proposals will be evaluated by the Research/Resource Coordinator and Reserve Manager for consistency with NI/WB NERRS goals, and by the Baruch Foundation and the USC to ensure that the proposed research will not interfere with other research at the Reserve. No proposed research at the Reserve will be approved unless it is consistent with the Tripartite Agreement discussed earlier. Projects would be selected based on their importance to coastal zone management issues, scientific/educational merit, and technical approach. Other project selection criteria include: the environmental consequences of the project; immediacy of need; and the proposed project's relationship to other available information and studies.

Activities permitted in the core area are limited to research activities which do not manipulate habitats except in rare instances where small-scale manipulative studies, with limited scope and clearly stated research objectives, may be approved after thorough review by the Institute, the SCCC and NOAA. Manipulative research activities may be permitted in the buffer zone of the Reserve as long as they address identified research or management needs. Any research activities which, in the estimation of the State and NOAA, may result in impacts on Reserve resources or habitats, require prior approval of the State and private property owners.

To assist new researchers at the reserve, information packets will be available from the Reserve Manager. These packets will contain background information pertaining to the Reserve and an area map designating Reserve boundaries. New researchers will also be given a tour of the Reserve area to gain familiarity with the research surroundings and general location.

Research, monitoring and education projects will receive first priority within the Reserve boundaries. Traditional uses of public areas will continue as currently regulated under Federal, state, or local authority. The Reserve Manager is responsible for carefully balancing uses of the reserve to ensure that the objectives of the reserve

program are protected and sustained. The power of the Reserve Manager needed to meet other specified management responsibilities will not in any way be diminished by the NI/WB NERR research and monitoring plan.

The NI/WB NERR Research/Resource Coordinator and the Reserve Manager are responsible for coordinating all research and monitoring activities for the Reserve. To facilitate this, NOAA will maintain close contact with these individuals who will keep NOAA informed of the progress of NOAA-funded researchers. The NI/WB NERR Reserve Manager will maintain regular communication with the researchers. He/she will aid in coordinating research activities in the Reserve and, when possible, will aid in fulfilling the needs of the researchers.

To achieve the NERRS goals of (1) "making available information necessary for improved understanding and management of estuarine areas" and (2) "enhancing public awareness and understanding of the estuarine environment", NOAA-funded research will be available to the general public and researchers will be requested to provide a presentation on their research findings at regularly scheduled meetings.

The NI/WB NERR requests that researchers provide the Reserve Manager with quarterly progress reports, a final report, and an abstract and one copy of any publications resulting from any research at the Reserve. The final report will include an abstract, a literature review, methods, analyses, results, and conclusions. It will include a summary of the gathered data and a list of the analyses completed. In addition to a final report, the researcher will keep the Reserve Manager updated on the progress of the project by means of quarterly written progress reports. These presentations will help to achieve the Reserve's goal of providing information necessary for improved understanding and management of estuarine systems to coastal decision-makers and the public. Records, data, reports, publications, and other relevant materials will be kept at the NI/WB NERR. Research information will also be forwarded to NOAA, which will act as a central clearinghouse and the center of the information network of the National Estuarine Research Reserve System.

**b. Procedures for NOAA-Funded Research**

Proposals requesting funds from NOAA will be evaluated using established NERRS guidelines. In order to qualify for NOAA funding, NI/WB Reserve research proposals must address one or more of the NERRS National Research Priorities and fulfill the requirement of the appropriate Request for Proposal. NOAA funds are awarded on a competitive basis and proposals will be competing with other research proposals in reserves throughout the National Estuarine Research Reserve System.

Funding for national research priorities in the Reserve is available through NOAA on a competitive basis to qualified researchers and must be matched equally by the recipient according to current NERRS regulations. An annual announcement of research opportunities, reflecting priority needs and levels of funding, will be



distributed. This announcement will include: (a) specific statements about the types of research that will be funded including the national research priorities set by NOAA; (b) clear and specific guidelines for preparation; (c) clear statements on procedures and criteria used in proposal review; (d) level of funding; and (e) a schedule of the proposed process. The distribution list will include local, state, and regional entities covering all eligible potential applicants. Also, a research prospectus will be provided to potential researchers, including basic information on reserve resources, unusual features, support facilities and a listing of research reports from the NI/WB NERR.

The NI/WB Reserve will work closely with NOAA staff to develop and assess National Research Priorities. NOAA will also be involved with the Reserve through research funding and proposal evaluation. The Reserve Manager will communicate with other reserve managers and will work with NOAA and other reserve managers to establish a national information exchange network.

**c. Recruitment of Researchers**

Recruitment of researchers is important to build the NI/WB NERR data base and to establish the sites as long-term natural field laboratories. Recruitment of researchers with an established interest and capability will be one of the functions of the Research/Resource Coordinator. Recruitment strategies will include:

- o coordination through scientific/technical advisory committees;
- o participation of NI/WB NERRS staff in research symposia, conferences and workshops;
- o intern programs for graduate students or upper division college students; and
- o annual announcements of research opportunities in scientific association newsletters, meetings and through NOAA's Sanctuaries and Reserves Division.

**d. Data Management**

Data from the NI/WB NERR will contribute to the national network long-term study to monitor the status and trends of estuarine ecosystems. Data from the National Estuarine Research Reserve System makes a substantial contribution to the understanding of long-term ecological effects on estuaries and is useful in predictive trend analysis of ecological stresses. The coordinated research network aids greatly in understanding the theoretical and practical aspects of conservation and coastal resources management. The Baruch Institute has developed the Baruch Data

Management System (BDMS) as an integral component of all research projects involving North Inlet and Winyah Bay. The NI/WB Reserve Research and Monitoring Program will be incorporated into the BDMS.

North Inlet has pioneered efforts within the Long-Term Ecological Research (LTER) Network funded by the National Science Foundation to develop efficient techniques for design, management, and analysis of long-term ecological data sets (Michener *et al.*, 1985; Michener, 1986; Edwards & Coull, 1987; Michener *et al.*, 1987; Michener & Haddad, in press). These efforts have led to collaborative research projects with the U.S. Soil Conservation Service, National Marine Fisheries Service, U.S. Geological Survey, and the Environmental Protection Agency. Hundreds of database requests have been satisfied, providing data for undergraduate and graduate research projects, intra- and intersite collaborative research, and state (S.C. Water Resources Commission, S.C. Land Resources Commission, S.C. Coastal Council) and Federal agencies (NOAA/National Weather Service, U.S. Geological Survey, and NASA). North Inlet is one of four LTER sites serving as a testing and development facility for Khoros software (an ecological data analysis package developed at the University of New Mexico).

The BDMS is staffed by two technical specialists; S. Chapal manages the biological data sets and serves as System Administrator; D. Taylor has primary responsibility for the physical and chemical data sets and maintains the meteorological stations. Data archival and security, documentation, QA/QC, data entry facilitation, communication, maintenance, training, and consulting are key elements of the BDMS.

Data entry activities include development of full screen entry programs, hardware (including routine maintenance and testing) and software support for automated data acquisition systems, and supervision of data entry personnel. QA/QC includes activities routinely associated with data entry. Numerous QA/QC checks are built into the data entry programs and automated data acquisition software. Procedures identify equipment malfunctions and flag incorrect field type (e.g., alphabetic value other than 'F' or 'M' for sex), etc. Additional QA/QC programs which employ checksum, graphical and statistical techniques for identification of potential outliers have been developed for all core LTER data sets.

Optimal data archival and security procedures are followed throughout the process from data collection to analysis. All field and laboratory data sheets are photocopied and the originals are stored in flame-proof cabinets. Raw data are routinely backed up onto floppy disks. The entire database is archived on optical storage devices at the coast and at the Columbia LTER office. Database security includes redundant weekly backup, password protection, and user account and data

access administration by BDMS personnel. The fact that no data were lost as a result of Hurricane Hugo attests to the success of our archival and security protocols.

The BDMS supports two levels of documentation. Level 1 documentation is accessible via internet, BITNET, or hard copy and contains general information (title, investigators, abstract, keywords, etc.) about the project or experiment which generated a particular data set. Level II documentation, also available in electronic or hard copy versions, contains the detailed information necessary for secondary users to access and utilize the data, and fully understand the conditions under which the data set was generated. Any individual or institution may access data sharing; all data are considered non-proprietary two years after incorporation into the BDMS. A database usage log is maintained to track usage of LTER data sets. Historically, the meteorological data has been the most frequently accessed; up to 68 database requests in a single year.

As a result of the Technological Supplements, significant progress has been made in enhancing BDMS capabilities. Installation of SUN workstations, optical disk storage systems, and networking capabilities at both the field laboratory and the main campus serve to enhance compatibility with other LTER sites, facilitate local archival and data access, and promote intra- and intersite communication and data sharing.

e. Information Management

Information gathered in NI/WB NERR research and monitoring and the management implications of this information will be made available to decision-makers and the public in understandable forms (i.e., in laymen's language - not scientific jargon) through public forums, etc.

Both NOAA and NI/WB NERR will:

- o encourage the dissemination of research results. Methods will include journal articles in the peer-reviewed literature.
- o presentations at professional societies; and
- o special symposia arranged by NOAA or reserves, often in association with other meetings such as the biennial meetings of the Estuarine Research Federation or Coastal Zone Managers.

Additional avenues of information exchange will include:

- o distribution of a summary of research at the Reserve, workshops, conferences and teach-ins at the Reserve;

- o a NI/WB NERR brochure, distributed with an annual call for proposals at appropriate conferences and other events; press releases to local media
- o articles in journals of local organizations;
- o direct mailings to state and local decision-makers; and
- o regular contact with representatives of other state and Federal agencies, local government agencies, and planning boards.

f. **Research/Monitoring Coordination**

The Research/Resource Coordinator will not only provide leadership in coordinating ongoing research at the Reserve but will interact with the Baruch Institute's research efforts funded by various sources. Coordination is fundamental to avoid duplication of efforts and to provide a basis for the development of integrative research/monitoring initiatives. The Research/Resource Coordinator will meet regularly with the Reserve subcommittee on Research and Monitoring, NOAA personnel, and Baruch Institute researchers. She/he will be in contact with other NERR sites in order to stimulate comparative research involving more than one site. At present, many investigators and graduate students from various institutions and agencies are involved in research in the North Inlet/Winyah Bay region. Effort will be made by the Coordinator to interact with these investigators. Interaction activities will take place through formal local meetings, at NERRA meetings, at regional and national meetings, and by personal communication via electronic mail, telephone, or letters.

F. **Education and Interpretation Plan**

Education/interpretation will serve as the integrator for all functions of the NI/WB NERR. As the general public becomes more aware of how an estuarine system functions and why it is such an important natural resource, the more likely they are to support the reserve and other estuarine protection programs. A well-planned education/interpretation program will create a constituency for the Reserve and bring about positive attitudes and values in the user community.

The program will focus on the values of the NI/WB estuaries and their wise use. The Reserve is an ideal setting for interpreting estuarine food webs, general biological principals and coastal processes. Opportunities exist for focusing on the national significance of the NI/WB site. It is also an appropriate place to learn about Federal and state endangered and threatened species. Overall, the program content will be broad-based, dealing with general concepts and specific issues related to reserve management.

## **1. Goals and Objectives**

One of the primary goals of the NI/WB NERR is to enhance public awareness, understanding, and wise use of estuarine resources in the North Inlet and Winyah Bay estuaries. Specific objectives are to:

- o promote knowledge of the Research Reserve, its resources, and its programs as well as knowledge of broader coastal issues and concerns related to estuarine management and protection;
- o collaborate with other organizations to provide educational and interpretive services at this site;
- o disseminate information gained from research on the Reserve to public audiences, including government officials, planners, and other decision-makers.
- o provide opportunities for teacher training, student projects, internships, and assistantships where enrollees work jointly with scientists, gain field experience, and learn about the importance of research results;
- o enhance interest in and commitment to South Carolina estuaries and their tributaries through volunteer programs and personal contact with reserve resources;
- o provide for traditional uses of Reserve sites as provided by state and Federal law.
- o broaden public support for the Reserve by continuing on-going programs suited to visitors of diverse interests, ages, and backgrounds.

## **2. Assessment and Priorities**

After evaluation of education programs already in place listed in Appendix I and in the assessment matrix (Table 5), the priorities listed in Table 6 were identified. Although our existing education programs are broadly based, limitations of staff and resources have hindered the realization of our potential. Depending on future funding, we plan on implementing these priority activities. A timetable for implementation of the priorities is outlined in Table 7.

Table 5. ASSESSMENT MATRIX

<u>EDUCATION INTERESTS</u>	<u>LIVING RESOURCES</u>	<u>ESTUARINE PROCESS</u>	<u>PEOPLE IN THE RESERVE</u>
Students, Elementary through High School Teachers Non-School Youth and Leaders Special Needs	<ul style="list-style-type: none"> <li>• USC Sea Grant<sup>1</sup> PEP<sup>2</sup> Minority Program<sup>3</sup></li> <li>• Audubon</li> </ul>	<ul style="list-style-type: none"> <li>• USC Sea Grant<sup>1</sup> PEP<sup>2</sup> Minority Program<sup>3</sup></li> <li>• Baruch Foundation</li> </ul>	<ul style="list-style-type: none"> <li>• USC PEP<sup>2</sup> Sea Grant<sup>1</sup></li> <li>• Baruch Foundation<sup>5</sup></li> </ul>
Adult Students	<ul style="list-style-type: none"> <li>• Baruch Foundation<sup>4</sup></li> </ul>	<ul style="list-style-type: none"> <li>• NSF<sup>6</sup></li> </ul>	
<u>USER INTERESTS</u>	<ul style="list-style-type: none"> <li>• NSF<sup>6</sup></li> </ul>		
Local Citizens Other SC Residents Historical Conservation Recreation <sup>1</sup>	<ul style="list-style-type: none"> <li>• USC PEP<sup>2</sup> Friends of Institute<sup>7</sup> Baruch Foundation</li> </ul>	<ul style="list-style-type: none"> <li>• USC PEP<sup>2</sup> Friends of Institute<sup>7</sup> Baruch Foundation<sup>5</sup></li> </ul>	<ul style="list-style-type: none"> <li>• USC PEP<sup>2</sup></li> <li>• Baruch Foundation<sup>5</sup></li> </ul>
<u>REGULATORY/LAND USE INTERESTS</u>			
Realtors Developers Town & Local Officials State & Federal Agencies	<ul style="list-style-type: none"> <li>• USC PEP<sup>2</sup> Friends of Institute<sup>7</sup></li> <li>• NOAA<sup>8</sup></li> </ul>	<ul style="list-style-type: none"> <li>• USC PEP<sup>2</sup></li> <li>• NSF<sup>6</sup></li> </ul>	<ul style="list-style-type: none"> <li>• State of SC Coastal Program<sup>9</sup></li> </ul>
<u>TRADITIONAL USER GROUPS</u>			
Boaters Sportsmen Recreational Fishermen Tourists	<ul style="list-style-type: none"> <li>• USC PEP<sup>2</sup></li> </ul>	<ul style="list-style-type: none"> <li>• NOAA<sup>8</sup></li> </ul>	<ul style="list-style-type: none"> <li>• USC PEP<sup>2</sup></li> </ul>

The format of the matrix is modified from James Dobbin Associates' work on Channel Island National Marine Sanctuary Management Plan. The category Living Resources includes the flora and fauna found in the Reserve; Estuarine Process details the physical and ecological processes of the estuary, (i.e., hydrology, soils and energy flow in the estuary); and People in the Reserve includes prehistoric cultures, recent history, and human use of the Reserve today.

TABLE 5. ASSESSMENT MATRIX (Contd)

ASSESSMENT MATRIX FOOTNOTES

<sup>1</sup>Funds from SC Sea Grant Consortium supported development of K-12 programs for teachers.

<sup>2</sup>USC's Public Education Program in conjunction with the Belle W. Baruch Foundation served 35,000 people in 1990.

<sup>3</sup>Funds granted to USC from the Moore Foundation supported programs in marine science for minority students.

<sup>4</sup>The Audubon Society has an annual bird count on the Hobcaw Barony.

<sup>5</sup>The Baruch Foundation sponsored a continuing education program which in conjunction with USC attracted 35,000 people in 1990.

<sup>6</sup>The National Science Foundation supported a program in marine science for minority students.

<sup>7</sup>Friends of the Institute supported programs geared to user interests.

<sup>8</sup>NOAA support program on impact of urbanization on coastal systems including importance to regulatory process.

<sup>9</sup>SC Coastal Council sponsors programs on issues related to coastal management.

Table 6. EDUCATION PRIORITIES

PRIORITIES	AUDIENCE	METHOD OF IMPLEMENTATION
Establish information clearinghouse/resources file at visitor/education site	General public/education interests/government agencies	Continue to improve interagency communication and information exchange through Reserve's advisory committee
Develop a variety of promotional materials including: <ul style="list-style-type: none"> <li>. brochures</li> <li>. regular news releases in local papers</li> <li>. a Reserve newsletter</li> <li>. interpretive posters</li> <li>. slide presentations</li> </ul>	General public especially landowners, fishermen, developers, local officials	Work in cooperation with information personnel in SC Coastal Council, SC Sea Grant Consortium, USC, etc.
Encourage and expand current programs	Nonschool youth leaders, USC (students, docents, researchers), private organizations, government agencies	Develop MOA's where appropriate (i.e., Sea Grant)
Develop a series of evening programs and/or day-long conferences for the public on topics relating to coastal issues	Users of estuary, local/state officials, realtors and developers, and other SC residents	Reserve staff with assistance of SC Coastal Council, USC Center for Environmental Policy and representatives of advisory committee to "host" series
Develop educational programs, designed primarily for teachers' training, which take participants out to various sites; implement "researcher -in-the-schools" program in area high schools, as follow-up, invite qualified students to assist researcher	Teachers and High School Students	Reserve staff in cooperation with NSF, Department of Education, other groups/organizations; or other appropriate researchers to help develop a series of presentations
Provide a historical overview of the region's development, especially the interaction of people and resources	General Public/No Specific Audience	Cooperation of USC Institute of Archaeology



Table 7. IMPLEMENTATION OF NI/WB EDUCATION PROGRAMS/ACTIVITIES

	EDUCATION OUTREACH	ON-SITE
First Year	<ul style="list-style-type: none"> <li>. Provide general public with material</li> <li>. Expand exhibits</li> <li>. Research and information collection on history of region</li> <li>. Begin interpreting Reserve environment</li> <li>. Develop brochures</li> </ul>	<ul style="list-style-type: none"> <li>. Develop interpretative signs</li> <li>. Conduct field trips</li> </ul>
Second Year	<ul style="list-style-type: none"> <li>. Develop living resource inventory of Reserve area</li> <li>. Print material on history of region</li> </ul>	<ul style="list-style-type: none"> <li>. Expand short course offerings</li> <li>. Implement teacher training</li> <li>. Develop curriculum materials for teachers</li> <li>. Expand public lecture series</li> </ul>
Third Year	<ul style="list-style-type: none"> <li>. Develop series of video tapes</li> <li>. Displays of history of region</li> <li>. Set up guidelines for researcher-in-the-school program</li> </ul>	<ul style="list-style-type: none"> <li>. Coordinate programs for youth groups</li> <li>. Expand teacher training program</li> </ul>
Fourth Year	<ul style="list-style-type: none"> <li>. Implement researcher-in-the-school program</li> </ul>	
On-going	<ul style="list-style-type: none"> <li>. Involve docents in research</li> <li>. Provide speakers and printed material to local residents</li> <li>. Incorporate Reserve information into hunter and aquatic classes</li> <li>. Publish a newsletter at regular intervals</li> </ul>	

### **3. General Context for Management**

The NI/WB Reserve includes both the marsh/marine part of the 17,500-acre wildlife refuge (Hobcaw Barony), which was set aside in perpetuity by the late Belle W. Baruch for the purposes of research and education, and the public waterways of North Inlet Estuary and Mud Bay. Establishment of the Reserve on this site is consistent with Belle Baruch's Will and provides a unique opportunity for exchange of information between scientists and public audiences. A delicate balance must be struck to maintain the special research integrity of the site while providing opportunities for people to see and learn from the research program. Extreme care will be taken to develop an education program that is sensitive to and protects the significant research value of the Reserve. A number of policies and areas for education program development are outlined which should complement the research and management goals of the Reserve.

### **4. General Policies**

Several policies will guide the development of the education program:

- o Only educational activities which will have no negative impacts on the Reserve environment and its research projects will be implemented. Activities will be discontinued or changed if, after review by the site management team, the Advisory Committee and the Belle W. Baruch Foundation Trustees, they are found to conflict with this policy.**
- o Much of the content for the programs will be based on the findings from research at the North Inlet-Winyah Bay Reserve and other NERR sites. Findings will be shared with general audiences and specific target groups such as teachers, K-12 students, policy-makers, and community leaders.**
- o Reserve educational activities will be coordinated with and complement the Public Education Program of the Belle W. Baruch Foundation, administered through the Bellefield Nature Center. The Nature Center currently sponsors a diverse program that focuses on several ecosystems in the coastal plain of South Carolina. The Reserve's educational program will expand offerings in subjects pertaining to estuaries and coastal zone management.**
- o The Reserve's education program will also be coordinated with other local and state organizations that are involved with coastal education programs.**

## **5. Interpretive Themes and Messages**

Our understanding of estuaries changes as new information is added to the relatively young field of estuarine research. Consequently, themes and messages for program content need to be flexible and sensitive to new discoveries about estuaries. Fortunately, North Inlet Estuary has been studied fairly intensively over the past decade, providing a foundation for supporting some initial themes and messages that will be incorporated into the education program:

- o Estuaries are complex ecosystems that are intricately linked to neighboring landward and seaward ecosystems.
- o Complex interactions, involving nutrient cycling, water movements, and energy flows through food webs contribute to the dynamic functioning of estuaries.
- o Estuaries serve important functions as nurseries for fish and shellfish, as feeding and nesting areas for birds, and as buffers from storms.
- o People are members of the estuarine ecosystem and also affect its functioning through interactions with the system.
- o The North Inlet-Winyah Bay National Estuarine Research Reserve serves an important role as a site for research, management, and education about estuaries.

Specific examples that relate to these themes will be incorporated into program activities and materials. In addition, Table 8 visually depicts themes and messages for interpretive displays which are consistent with those emphasized at other NERRS.

## **6. Printed and Audiovisual Materials**

Brochures, special publications, and a regular newsletter are planned to promote knowledge of the Reserve, its resources, and its program, and to disseminate information gained from research to public audiences. A general brochure about the Reserve, its goals, and opportunities available for researchers and the public, will be one of the first materials developed. It will be consistent with the "common look" site brochure developed by NOAA, SRD. The Baruch Institute currently publishes the newsletter, "TIDINGS," which is distributed to members of Friends of the Baruch Institute. Research, education and management activities of the Reserve program will be featured in this established newsletter. In addition to the mailings to members, copies of the newsletter will be disseminated to interested people upon request,

including visitors to the Bellefield Nature Center. Special publications on selected topics will be developed as needs are identified. Effort will be made to print these publications on recycled paper.

Table 8. Themes and Messages for Reserve Interpretation.

Orientation

<u>What is the Reserve?</u>	<u>How to Get There</u>	<u>What to Do There</u>	<u>Method of Communication</u>
<ul style="list-style-type: none"> <li>. Definition</li> <li>. It is different from or similar to a park; A preserve?</li> <li>. How big is it?</li> <li>. What does it include?</li> <li>. What are its boundaries?</li> <li>. Uniqueness of the North Inlet</li> </ul>	<ul style="list-style-type: none"> <li>. What are the major access points?</li> <li>. Where can I park?</li> <li>. Where are the trailheads?</li> </ul>	<ul style="list-style-type: none"> <li>. What can I expect to see?</li> <li>. What can I do?</li> <li>. What are the best places and times?</li> <li>. What can I not do?</li> <li>. What other information is available?</li> </ul>	<ul style="list-style-type: none"> <li>. Brochures</li> <li>. Maps</li> <li>. Press Releases</li> <li>. Newsletters</li> </ul>

Living Resources

<u>Vegetation</u>	<u>Invertebrates and Fishes</u>	<u>Birds and Mammals</u>	<u>Method of Communication</u>
<ul style="list-style-type: none"> <li>. Salt marsh vegetation and upland communities/mud flats/ intertidal areas</li> <li>. How do communities here differ from other salt marshes</li> <li>. Examples of species adaptation to estuarine environment (tolerances, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>. Species associated with various habitats</li> <li>. Intertidal invertebrates identification</li> <li>. Salt marsh insects</li> <li>. Estuarine fish</li> </ul>	<ul style="list-style-type: none"> <li>. Waterfowl and shorebird identification</li> <li>. Protected species</li> <li>. Species life history and special adaptations of salt marsh species</li> </ul>	<ul style="list-style-type: none"> <li>. On-site exhibits, tours</li> <li>. Multi-media presentations</li> <li>. Fact sheets</li> <li>. Appreciated field guides</li> </ul>

Estuarine Process

<u>Hydrology</u>	<u>The Soil Environment</u>	<u>Energy</u>	<u>Method of Communication</u>
<ul style="list-style-type: none"> <li>. What are the watersheds</li> <li>. How does the flow regime vary seasonally? Annually?</li> <li>. Saltwater and freshwater balance</li> <li>. Watershed changes and system response</li> </ul>	<ul style="list-style-type: none"> <li>. What are the different soil environments?</li> <li>. Soil salinities</li> <li>. Sedimentation</li> </ul>	<ul style="list-style-type: none"> <li>. Basic food webs</li> <li>. Unique aspects of primary productivity (detritus-algae)</li> <li>. Changes in energy flow</li> </ul>	<ul style="list-style-type: none"> <li>. Maps (i.e. relief)</li> <li>. Research abstracts</li> <li>. Computer simulation</li> <li>. Curriculum materials</li> </ul>

People in the Reserve

Prehistoric Cultures

- . What evidence is there of past cultures depending on reserve resources
- . Were there different cultures in the area? Did these change with time?

Recent History

- . Early history and nearby settlements
- . Changing land uses in the past centuries
- . Agricultural development in the estuary
- . Historical floods and drought

Human Use of the Reserve Today

- . The value of multiple compatible use (possibilities/ threats of change)
- . Agriculture today
- . Estuarine Research
- . Birding in the Reserve
- . Canoeing, fishing, hunting, boating
- . Resources study, photography
- . History of wise use

Method of Communication

- . Lecture series
- . Curriculum materials
- . Rotating exhibits

Management of the System

The National Estuarine Research Reserve System

- . Who administers the program?
- . What are the other estuarine research reserves in the South Atlantic? In the US?
- . Why do we have reserves?
- . Who is the Reserve Manager?

Coordinated Management

- . Who owns the Reserve?
- . What do the various public agencies do?
- . What is being done now to better manage the Reserve (i.e. resource protection)?
- . What kind of research is taking place in the estuary?
- . Why is land being acquired?
- . How is everything coordinated?

What Visitors Can Do to Help

- . Participating in visitor surveys and monitoring projects
- . Providing comments on exhibits and tours
- . Following regulations
- . Letting others know about the Reserve
- . Brochures

Method of Communication

- . Brochures
- . Guided Tours
- . Newsletters
- . Volunteer Group

Instructional materials for teachers are also planned to complement teacher training activities and field study programs for school classes. The Bellefield Nature Center currently provides information to teachers participating in its field study and outreach programs. These materials provide background information on the subjects, pre- and post-visit activities, and lists of resource materials. Additional instructional materials will be developed for the Nature Center and the Kimbel Center to increase the learning experiences of teachers and students who participate in new programs developed for the Reserve.

In addition to printed materials, audiovisual presentations will be created for use at the Nature Center, the Kimbel Center, and in outreach programs. A video program about the Reserve and its activities would be very beneficial in expanding public awareness and understanding of estuaries and the value of research at the reserve site. The program would be shown on a regular schedule to visitors of the Centers and would also be available on a loan basis to interested schools, civic groups, or other organizations. Slide presentations are another medium that will be developed to further people's understanding of estuaries. The slide shows would be available to staff members who will make presentations at meetings of interested groups.

#### **7. Exhibits, Signs and Promotional Materials**

The Bellefield Nature Center currently houses a variety of exhibits pertaining to the history and ecology of the wildlife refuge, Hobcaw Barony, and the research activities of the Baruch Institute of Clemson University and the University of South Carolina. Additional interpretive displays that relate specifically to estuaries and the goals and programs of the Reserve, will be developed at the Nature Center and Kimbel Center. A portable exhibit about the Reserve is also planned which can be taken to professional meetings and festivals to help promote the site to a wide spectrum of people.

The Reserve will also be promoted through distribution of the general brochure described in the printed materials section. In addition, NI/WB NERR signs identifying the Reserve and the appropriate supporting agencies will help draw public attention to the special designation of the site. A sign will be constructed and placed near the highway entrance to the property and other smaller signs are planned to help identify the Reserve from the water.

#### **8. Program Activities and Services**

Many of the education program goals will be achieved through program activities and services provided to general audiences and specific target groups. The Reserve's education program will build on and expand upon successful activities and services already in place through the Belle W. Baruch Foundation's Bellefield Nature

Center and the University of South Carolina's Continuing Education Program (see Appendix I for summary of 1990 activities). In addition, there will be a maximum effort made for interaction with education programs at other NERR sites.

The Baruch Foundation currently provides a very popular field study program for school groups. Thousands of students each year participate in the program and learn about one or more of the coastal ecosystems on the property. Salt marshes are one of the systems covered in the field study program. As funds become available to increase staff for the field study program, more salt marsh studies can be scheduled.

A wider selection of short courses dealing with estuaries will also be offered for members of the public and educators. Some of the topics for future short courses include, but are not limited to, coastal birds; fishes; life in the pluff mud; oysters and clams, shrimps, crabs and other crusty creatures; coastal photography; historical uses of estuaries; and coastal management. Teachers may elect to take the courses to receive credit towards re-certification.

Special college-credit workshops and courses for teachers are also planned to provide teachers with information and field and classroom experiences pertaining to estuaries and coastal zone management. These programs will be designed to provide teachers with the information and skills needed to lead their students in studies of salt marshes anywhere in the state without the help of an outside resource person.

Public lectures and forums that address topics and issues of current public interest and concern will also be continued and expanded at the Reserve site. These programs will be designed to provide factual information on various aspects of the issues so that people can make informed decisions.

Guided tours of the property are presently conducted on a weekly basis for interested members of the public and tours of the Reserve will be incorporated. Information about the research and educational activities of the Reserve will also be built-into this tour led by Nature Center employees. This information will be easy to insert since the tour includes stops along marsh areas to be designated in the Reserve.

The education program, in addition to field studies, tours, short courses, teacher workshops and public forums conducted on-site, will encompass outreach efforts into surrounding communities. The successful school "Outreach Program" of the Bellefield Nature Center brings hands-on nature experiences into local classrooms. This program will be expanded to include more offerings pertaining to estuaries. Teacher information packets will be developed to enhance these programs. Reserve scientists and other staff members will also present programs at meetings of area



organizations upon request. In addition, efforts will be made to assist outside tour guides in the area with up-to-date information about the Reserve and the area's rich coastal resources that they can incorporate into their guided programs.

The Nature Center does not currently have a volunteer program. Volunteer programs will be developed to provide opportunities for interested members of the public to interact more closely with both the education and research activities of the Reserve. The education volunteer program will be coordinated with the Nature Center administration and supervised by the Reserve Education Coordinator. The research volunteer program will also be administered by the Research/ Resource Coordinator and will be consistent with policies of the Baruch Foundation. A limited number of volunteers (to be approved by the Baruch Foundation) will be involved in the program. Education program volunteers will be particularly useful in greeting visitors and answering questions at the Nature Center and Kimbel Center, thus allowing Reserve staff members to conduct more programs in the field.

A student internship program will also be implemented, as funds become available, in order to complement the education program. Student interns would become involved in and assist with on-going education programs as well as the development of printed educational materials and exhibits.

#### 9. Public Access and Recreation

Traditional public access policies and recreational activities that pertain to the Belle W. Baruch Foundation's property (Hobcaw Barony) included in the Reserve will be maintained. Currently, public access to the upland portions of the property is restricted. Authorized individuals, including researchers and students, involved in approved projects utilizing the resources of the Reserve can enter through an electrically controlled gate near U.S. 17. Visits by student groups, participants in workshops and symposia, and other special groups can be arranged through formal programs associated with The University of South Carolina or the Belle W. Baruch Foundation. Tours of the site will be coordinated with the Nature Center of the Belle W. Baruch Foundation. The general public can visit the Bellefield Nature Center at the US Highway 17 entrance to Hobcaw Barony (approximately 1 mile north of Georgetown and 8 miles south of Pawleys Island).

Access by water to the wetland areas of the Reserve via tidal waters under the jurisdiction of state and Federal agencies is permissible by boat including power boats. Members of the public are able to carry out traditional recreational activities in the tidal waters and marshes, but must adhere to state laws. Thus, traditional uses such as hunting on the marshes, fishing and shellfishing will not be infringed upon by the

establishment of NI/WB NERR and people are free to access these areas by water (see section II A and III B for description of traditional uses). Traditional public use will be encouraged to the extent that is consistent with Reserve goals and objectives.

**10. Coordination of Education Efforts**

**a. Coordination with Existing Programs**

The Education Coordinator will interact with education programs existing in the public and private school systems, Coastal Zone Education Center, S.C. Aquarium, etc. The Reserve will work with these groups and organizations in a supporting role. Within the Reserve, the results of research will be incorporated in the education program and potential research questions raised by the public will be transmitted to the Research/Resource Coordinator.

A special effort will be made to coordinate educational activities with the ACE NERR located south of Charleston, South Carolina.

**b. Coordination with NERRS**

Newsletters, special events and other news at the NI/WB NERR will be distributed to other NERR staff throughout the U.S. Information will be provided on a regular basis to NOAA. The Reserve Manager and/or Education Coordinator will communicate directly and frequently with NOAA and attend NERR Manager meetings and the annual NERRA conference.

**c. Coordination with Other Agencies**

Efforts will also be made to coordinate with other agencies, groups and programs on educational projects. Examples of these groups include other state agencies, Sea Grant, USFWS, NOAA/NMFS, Georgetown County Chamber of Commerce, S.C. Marine Education Association, etc.

**G. Public Access Policy**

**1. Policy**

Public access to the Reserve will follow existing practices in that the public has access to the North Inlet and Winyah Bay portions of the Reserve by boat, including power boats. According to Federal and State laws, no tidal waters can be restricted to public access. Currently, public access to the uplands portions of the property, including areas included in the Reserve boundaries is restricted.

## **2. Current and Proposed Land Use Policy**

Traditional public access policies that pertain to the Belle W. Baruch Foundation's property (Hobcaw Barony) included in the Reserve will be maintained. Currently, public access to the upland portions of the property is restricted. Authorized individuals, including researchers and students, involved in approved projects utilizing the resources of the Reserve can enter through an electrically controlled gate near U.S. 17. Visits by student groups, participants in workshops and symposia, and other special groups can be arranged through formal programs associated with The University of South Carolina or the Belle W. Baruch Foundation. Tours of the site will be coordinated with the Nature Center of the Belle W. Baruch Foundation. The general public can visit the Bellefield Nature Center at the US Highway 17 entrance to Hobcaw Barony (approximately 1 mile north of Georgetown and 8 miles south of Pawleys Island).

## **3. Current and Proposed Wetland/Navigable Water Use Policy**

Public access to the Reserve will follow existing policies in that the public has access to the North Inlet and Winyah Bay portions of the Reserve by boat, including power boats. According to State and Federal laws no tidal waters can be restricted to public access. The South Carolina Coastal Council reaffirmed this policy on public access in the Reserve in a Resolution passed on December 13, 1991 (Appendix M). Research plots, which will be studied for a finite period of time, will be marked with signs requesting that they not be disturbed by the public.

Access by water to the wetland areas of the Reserve via tidal waters under the jurisdiction of state and Federal agencies is permissible by boat including power boats. Members of the public are able to carry out traditional recreational activities in the tidal waters and marshes, but must adhere to state laws. Thus, traditional uses such as hunting on the marshes, fishing and shellfishing will not be infringed upon by the establishment of NI/WB NERR and people are free to access these areas by water. Traditional public use will be encouraged to the extent that is consistent with Reserve goals and objectives.

**V. LIST OF PREPARERS**

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For more information see *Publications of the Belle W. Baruch Institute for Marine Biology and Coastal Research 1969 - 1989* which contains citations of 750 papers published by Baruch Institute personnel.

APPENDIX A  
Tripartite Agreement



STATE OF SOUTH CAROLINA )  
 )  
COUNTY OF )

AGREEMENT

THIS AGREEMENT made this 22 day of February  
1975, among THE BELLE W. BARUCH FOUNDATION (the "Foundation"),  
CLEMSON UNIVERSITY, and the UNIVERSITY OF SOUTH CAROLINA,

WITNESSETH:

WHEREAS, the FOUNDATION owns over 16,000 acres of maritime  
properties in Georgetown County, South Carolina, and is a charitable organiza-  
tion declared exempt from Federal income taxation by an Internal Revenue  
Service ruling dated December 24, 1964, and an operating foundation by an  
Internal Revenue Service ruling dated January 17, 1973;

WHEREAS, the FOUNDATION was created pursuant to the last will  
and testament of Belle W. Baruch, (which will was duly admitted to probate by  
the Surrogate's Court of the County of New York, State of New York), the  
pertinent provisions of said will, (a copy of which is annexed hereto) stating as  
follows:

\*\*\*To invest and reinvest the trust property, and, in perpetuity,  
to collect the income therefrom, and, after paying to the Trustees  
such commissions for the administration of the Trust as are  
allowable under the laws of the State of South Carolina, and such  
other expenses of the administration of the Trust, and other proper  
legitimate expenses, to use said net income for the purposes of  
teaching and/or research in forestry, marine biology, and the care  
and propagation of wildlife and flora and fauna in South Carolina,  
in connection with colleges and/or universities in the State of  
South Carolina. The college or colleges or universities in South  
Carolina, and the teaching and research for the charitable uses  
and purposes above set forth in this Article shall be selected  
from time to time by the Trustees, or a majority of those serving  
at any time. The Trustees, in addition to all other powers given  
under this Will, are authorized to pay all or part of the expenses  
of teaching and/or research in connection with any college or  
colleges and/or universities in South Carolina selected by the  
Trustees, which will, as a part of its research or educational  
program, assist in the carrying out of the educational and  
charitable uses and purposes of this Trust\*\*\*

\*\*\*I definitely wish the house at Hobcaw to be used as a laboratory  
for the teaching and/or research in forestry and/or marine life in  
connection with a college or university in the State of South Carolina.

\*\*\*I specifically empower my said Trustees to keep, maintain and  
improve any lands or building that may be a part of the corpus  
of the TRUST, and to make such additions and permanent improve-  
ments to the property as will increase its productivity and its useful-  
ness for the charitable purposes of this Foundation Trust\*\*\*

and

WHEREAS, an agreement was entered into between the FOUNDATION and CLEMSON UNIVERSITY on November 14, 1968, designed to implement a program developed by the FOUNDATION in conjunction with the UNIVERSITY and pursuant to which CLEMSON UNIVERSITY has furnished professional advice to the FOUNDATION with respect to the scientific management of forested lands, beach areas, and aquatic environments, and the operation and management thereof in their use as a research and teaching facility; assembled data with respect to trees and vegetation, and the succession and interaction of plant and wildlife populations; made studies of soil types, insects and diseases; developed and implemented programs of research on forestry; and conducted biological investigations of the FOUNDATION'S property; and

WHEREAS, an agreement was entered into on March 22, 1972, between the FOUNDATION and the UNIVERSITY OF SOUTH CAROLINA, designed to implement a program developed by the FOUNDATION in conjunction with the UNIVERSITY and pursuant to which the UNIVERSITY OF SOUTH CAROLINA has furnished professional advice to the FOUNDATION with respect to the preservation of marsh and estuarine areas and the operation and management thereof in their use as a research facility; made studies on the functioning of high salinity marshes; developed programs of research in marine biology; and erected a laboratory for the conduct of such research on the FOUNDATION'S property; and

WHEREAS, the FOUNDATION has reviewed with CLEMSON UNIVERSITY and the UNIVERSITY OF SOUTH CAROLINA the desirability of a long-range joint program directed towards the coordination of activities and procedures of the UNIVERSITIES and FOUNDATION in inter-related spheres of interest and pursuit with a view to assuring the preservation and conservation of the ecological and environmental qualities of the FOUNDATION'S property and the preservation of its historical value as a whole; and

WHEREAS, in recognition of the identity of the interests of the FOUNDATION and the UNIVERSITIES as state universities in the preservation and conservation in perpetuity for the benefit of the State of South Carolina and the public of the valuable resources of the FOUNDATION'S property, the FOUNDATION has concentrated and is desirous of continuing to concentrate its available funds towards

this objective and special research and teaching projects in forestry, marine biology and the care and propagation of wildlife and flora and fauna in the State of South Carolina it conducts on its property; and

WHEREAS, in recognition of the value to the public of the coordination of the activities of the FOUNDATION, and the UNIVERSITIES, and their continuance, the FOUNDATION has determined that its purposes would be furthered by the operation, management, and use of its property as provided for in this agreement.

NOW, THEREFORE, in consideration of the mutual agreements contained herein, the parties hereto hereby agree as follows:

1. Use of Property

Subject to the terms and conditions of this agreement, the FOUNDATION shall from time to time with the aid and consultation of CLEMSON UNIVERSITY and the UNIVERSITY OF SOUTH CAROLINA, delineate by zones depicted on appropriate maps the specific areas within the FOUNDATION'S property which the UNIVERSITIES can manage and use in conjunction with the FOUNDATION. Delineation of these areas may be changed or modified in accordance with Article 19 of this agreement and in such manner as shall seem to the FOUNDATION most appropriate for the achievement of its goals, but such delineation shall be made only after the UNIVERSITIES have each had opportunity to relate to the FOUNDATION both the status of their research activities and the nature of and extent of any increases or decreases they may wish to seek in the scope of their activities or responsibilities, or which may be necessitated by change of circumstances.

Subject to the terms and conditions of this agreement, and for the purpose of conducting a joint project with the FOUNDATION, the FOUNDATION shall permit CLEMSON UNIVERSITY to use and occupy in conjunction with the FOUNDATION, the areas within the portion of the FOUNDATION'S property herein described as the FOREST-MARINE AREA at the locations marked in green on the map of the FOUNDATION'S property attached hereto as Exhibit "A." The FOUNDATION, subject to the terms and conditions of this agreement, shall further permit CLEMSON UNIVERSITY, to use and occupy the building on the FOREST-MARINE AREA provided for its resident director, and the building provided on such area for its resident forester,

and other buildings on such area as the FOUNDATION may designate, and to use the equipment, furniture, furnishings and other personal property of the FOUNDATION located therein or used in connection therewith provided, however, that the UNIVERSITY OF SOUTH CAROLINA in accordance with use plans developed by CLEMSON UNIVERSITY in coordination with the UNIVERSITY OF SOUTH CAROLINA and the FOUNDATION, shall have the right to conduct meetings, discussions, seminars, exhibitions, and other such activities at Hobcaw House, and for such purposes also to use the equipment, furniture, furnishings and other personal property of the FOUNDATION located therein or used in connection therewith in such manner as shall not interfere with the effective use and maintenance thereof by CLEMSON UNIVERSITY. CLEMSON UNIVERSITY shall have the responsibility for initiating the consultations necessary for development of a coordinated plan for the use of Hobcaw House, and the UNIVERSITY OF SOUTH CAROLINA and the FOUNDATION shall be responsible for making timely responses to the initiatives of CLEMSON UNIVERSITY in this regard; and CLEMSON UNIVERSITY shall have the discretion to resolve schedule conflicts in such manner as in its judgment shall seem most reasonable in effecting the purposes of this agreement but in each instance shall coordinate its decision with the FOUNDATION.

CLEMSON UNIVERSITY, subject to the terms and conditions of this agreement shall with the FOUNDATION use the FOREST-MARINE AREA, and shall use and occupy the said buildings provided for its resident director and its resident forester, shall use and occupy Hobcaw House and other buildings designated by the FOUNDATION in accordance with the terms stated above and shall use the said equipment, furniture, furnishings and other personal property of the FOUNDATION located therein or used in connection therewith, and shall use and occupy the portion of the boat building in MARSH-MARINE AREA now in use and occupied by it, in accordance with the terms stated below, exclusively for the purposes enumerated in this agreement, such use and/or occupancy to be conducted in a manner serving and in furtherance of the FOUNDATION'S purposes and programs to preserve and conserve the ecological and environmental qualities of its property (of which the FOREST-MARINE AREA forms a part) and the preservation of its historical value.

Subject to the terms and conditions of this agreement, the FOUNDATION shall permit the UNIVERSITY OF SOUTH CAROLINA to use and occupy, in conjunction with the FOUNDATION, the areas within the portion of the FOUNDATION'S property herein described as the MARSH-MARINE AREA at the locations marked in blue on the map of the FOUNDATION'S property attached hereto as Exhibit "A." The UNIVERSITY OF SOUTH CAROLINA, in conjunction with the FOUNDATION, shall also have the use of and shall occupy the marine biology laboratory building and other buildings as the FOUNDATION may designate on the MARSH-MARINE AREA and shall also use and occupy the boat building on the MARSH-MARINE AREA; provided, however, that CLEMSON UNIVERSITY shall continue to have the use and occupancy of the portion of said boat building on the MARSH-MARINE AREA which is now in use and occupied by it, and provided further that such use and occupancy of the boat house by CLEMSON UNIVERSITY shall not interfere with the effective use hereof by the UNIVERSITY OF SOUTH CAROLINA. The UNIVERSITY OF SOUTH CAROLINA, subject to the terms and conditions of this agreement, shall, with the FOUNDATION, use the MARSH-MARINE AREA, and shall use and occupy the marine biology laboratory building situated on such area and other buildings as the FOUNDATION may designate and shall use and occupy the boat building thereon (other than the portion of such boat building now in use and occupied by CLEMSON UNIVERSITY), exclusively for purposes enumerated in this agreement, such use and/or occupancy to be conducted in a manner serving and in furtherance of the FOUNDATION'S purpose and programs to preserve and conserve the ecological and environmental qualities of its property (of which the MARSH-MARINE AREA forms a part) and the preservation of its historical importance.

CLEMSON UNIVERSITY shall have, in conjunction with the FOUNDATION, the custody and use of maintenance and safety equipment of the FOUNDATION located on or within the FOREST-MARINE AREA or used in connection with maintenance of roads, buildings and equipment. CLEMSON UNIVERSITY shall also have, in conjunction with the FOUNDATION, the use of boat landings, docks, piers, boats and other transportation equipment and maintenance and safety equipment of the FOUNDATION located on or within the MARSH-MARINE AREA in connection with the performance

by it of its obligations under this agreement in respect to roads and land areas within the MARSH-MARINE AREA;

The UNIVERSITY OF SOUTH CAROLINA shall, in conjunction with the FOUNDATION, have the use of boat landings, docks, piers, boats and other transportation and safety equipment of the FOUNDATION located on or within the MARSH-MARINE AREA in connection with the performance by it of its obligations under this agreement in respect to areas within the MARSH-MARINE AREA; provided, however, that CLEMSON UNIVERSITY, in accordance with use plans developed by the UNIVERSITY OF SOUTH CAROLINA in coordination with CLEMSON UNIVERSITY and the FOUNDATION, shall have the right to use the boat landings, docks, piers, boats and other transportation equipment of the FOUNDATION located on the MARSH-MARINE AREA; in such manner and at such times as shall not interfere with the effective use thereof by the UNIVERSITY OF SOUTH CAROLINA. The UNIVERSITY OF SOUTH CAROLINA shall have the responsibility for initiating the consultations necessary for development of a coordinated plan for the use of these facilities and CLEMSON UNIVERSITY and the FOUNDATION shall be responsible for making timely responses to the initiatives of the UNIVERSITY OF SOUTH CAROLINA in this regard, and the UNIVERSITY OF SOUTH CAROLINA shall have the discretion to resolve schedule conflicts in such manner as in its judgment shall seem most reasonable in effecting the purposes of this agreement but in each instance shall coordinate its decision with the FOUNDATION.

Access roads and water routes to and within the FOREST-MARINE AREA and the MARSH-MARINE AREA and parking sites within such areas (except parking sites for buildings in use or occupied by the resident director and resident forester of CLEMSON UNIVERSITY and for the marine biology laboratory building in use and occupied by the UNIVERSITY OF SOUTH CAROLINA), shall be used in common by the UNIVERSITIES and the FOUNDATION; provided, however, that CLEMSON UNIVERSITY, in consultation with the UNIVERSITY OF SOUTH CAROLINA and the FOUNDATION, shall have the authority to regulate traffic so as to ensure the efficient maintenance of facilities and a minimum of traffic conflicts for efficient and safe use of the properties, and the UNIVERSITY OF SOUTH CAROLINA shall have comparable authority and responsibility with respect to water routes.

The FOUNDATION may from time to time grant easements and other rights to others over the FOREST-MARINE AREA and/or MARSH-MARINE AREA and may make such additional uses of the FOREST-MARINE AREA and MARSH-MARINE AREA as in each case shall not interfere with the effective use of the same by the UNIVERSITIES for the purposes enumerated in this agreement. Any such use of FOREST-MARINE AREA and/or MARSH-MARINE AREA by the FOUNDATION shall be subject to safety regulations prepared by the UNIVERSITIES and approved by the FOUNDATION as provided in Article 2 of this agreement.

The boundaries of the FOREST-MARINE AREA and the MARSH-MARINE AREA, determined by the FOUNDATION in consultation with the UNIVERSITIES, shall at all times encompass not less than the entire acreage of the FOUNDATION'S property. Any contiguous property hereafter acquired by the FOUNDATION shall, if the FOUNDATION in its sole discretion so determines, be added to either area and shall be subject to the terms and conditions of this agreement. (It is recognized that a portion of the FOUNDATION'S property is subject to the legal life tenancy granted to Miss Ella A. Severin by the will of Belle W. Baruch, and that no provisions of this agreement shall in any wise affect such legal life tenancy.)

### 2. Safety Regulations

Each UNIVERSITY shall prepare and submit for approval by the FOUNDATION comprehensive safety regulations appertaining to its area(s) of responsibility. These shall include, without being limited to, fire rules and precautions, emergency warning systems, communication procedures, admission restrictions, permits and identification badges. Regulations on road use, speed limits, traffic control and their enforcement, shall be the responsibility solely of CLEMSON UNIVERSITY. Enforcement of safety regulations with respect to the use of water routes shall be the responsibility solely of the UNIVERSITY OF SOUTH CAROLINA.

### 3. Protection of Property

It is recognized by the parties to this agreement that the primary value of the FOUNDATION'S property is the availability of the diverse environmental and ecological characteristics of the FOREST-MARINE and MARSH-MARINE AREAS, with their wildlife populations, for the purposes of teaching and research.

Therefore, it is essential that these physical qualities be conserved and preserved in such a manner as to offer the widest range of benefits from use of the property for teaching and/or research in forestry and marine biology, and the care and propagation of wildlife and flora and fauna in perpetuity. In the event any activity shall be engaged in on the FOREST-MARINE AREA and/or MARSH-MARINE AREA that adversely affects the teaching and research values of the FOUNDATION'S property, the UNIVERSITIES shall take such steps as are necessary to cause the cessation of such activity or to compel its discontinuance and to prevent its recurrence.

UNIVERSITIES shall attempt to secure assistance and services available from law enforcement officials of the state, local and federal governments for the protection of the FOUNDATION'S property.

UNIVERSITIES shall cooperate with the FOUNDATION, upon its request, in attempting to have its properties declared a sanctuary both state and federal, and otherwise affording to FOUNDATION'S property the protection provided by conservation and similar laws.

#### 4. Operations and Activities

CLEMSON UNIVERSITY, in accordance with its past practice, shall continue to provide professional advice to the FOUNDATION with respect to the scientific management of the FOREST-MARINE AREA, and the operation thereof in its use as a research facility, and, in accordance with programs and policies heretofore and hereafter initiated and/or approved by the FOUNDATION, shall continue, in conjunction with the FOUNDATION, to conduct research and provide teaching in forestry and the care and propagation of wildlife, flora and fauna within the FOREST-MARINE AREA, as depicted on the map attached hereto as Exhibit "A." and to develop and implement management concepts and procedures within the FOREST-MARINE AREA.

The UNIVERSITY OF SOUTH CAROLINA, in accordance with its past practice, shall continue to provide professional advice to the FOUNDATION with respect to the preservation of the MARSH-MARINE AREA and the operation thereof in its use as a research facility, and in accordance with programs and



policies heretofore and hereafter initiated and/or approved by FOUNDATION, shall continue, in conjunction with the FOUNDATION, to conduct research and provide teaching in marine biology and the care and propagation of wildlife, flora and fauna within the MARSH-MARINE AREA, as depicted on the map attached hereto as Exhibit "A," and to develop and implement management concepts and procedures within the MARSH-MARINE AREA.

All activities conducted by the UNIVERSITIES on the FOUNDATION'S property and all decisions of the UNIVERSITIES which involve the conservation, preservation or use of the FOUNDATION'S property must be approved by the FOUNDATION in advance.

After consultation with and the approval of the FOUNDATION, each of CLEMSON UNIVERSITY and the UNIVERSITY OF SOUTH CAROLINA shall:

(i) Conduct special seminars, lectures and symposia within its field of interest for scientists and advanced students.

(ii) Engage in teaching and research programs determined to be of value in carrying out the purposes of this agreement.

(iii) Each of CLEMSON UNIVERSITY and the UNIVERSITY OF SOUTH CAROLINA shall provide the FOUNDATION with progress and completion reports on approved proposals; prepare timely technical, administrative, and financial reports on its activities for the FOUNDATION and application of funds received from the FOUNDATION not less frequently than annually; furnish the FOUNDATION copies of project outlines, completed reports, and articles and other material appearing in scientific journals and other publications with respect to the progress and results of research and other activities supported through this agreement.

All activities of the UNIVERSITIES listed above, including all research, teaching, etc., shall be for the purpose of preserving and conserving the ecological and educational qualities of the FOREST-MARINE and MARSH-MARINE AREAS for teaching and research in forestry and the care and propagation of wildlife, flora and fauna within the FOREST-MARINE AREA and in marine biology and the care and propagation of wildlife, flora and fauna within the MARSH-MARINE AREA.

5. Disbursement of Income - Contribution of Funds

After reviewing the proposals for research projects, teaching and other activities made by the UNIVERSITIES to the FOUNDATION, and after allocating to the UNIVERSITIES funds required for maintenance and upkeep of the FOUNDATION'S property, the FOUNDATION shall determine which portion of its income for the year will be used to support such research, teaching and other activities of the two UNIVERSITIES and will notify the UNIVERSITIES as to the funds available to them.

The FOUNDATION shall make no distribution of income for teaching or research purposes during the term of this agreement which are independent of the teaching and research programs of the UNIVERSITIES conducted in conjunction with the FOUNDATION.

6. Maintenance, Repairs and Taxes

Except as otherwise provided herein, CLEMSON UNIVERSITY shall keep and maintain in good order and repair and in safe condition all buildings, roads, vehicle entries, drives and parking areas, boat landings, docks, piers, boats and other transportation equipment and maintenance equipment of the FOUNDATION. The costs of maintaining aforementioned buildings, roads, capital improvements; costs of maintenance, repair, and replacement of service vehicles used jointly by all parties or for general maintenance of the property; and costs of taxes, shall be paid by the FOUNDATION. CLEMSON UNIVERSITY, in consultation with the UNIVERSITY OF SOUTH CAROLINA and the FOUNDATION, shall prepare and submit to the FOUNDATION prior to the beginning of each fiscal year a budget estimate of the costs for the forthcoming year for the expenditures defined in this Article.

The UNIVERSITY OF SOUTH CAROLINA shall, except as otherwise required by this Article of CLEMSON UNIVERSITY, keep and maintain the interior areas of the marine biology laboratory building in use and occupied by it in the MARSH-MARINE AREA, and the fixtures and appurtenances thereto, and any equipment or other personal property of the FOUNDATION located therein or used in connection therewith in good order and repair and in safe and clean condition and shall further keep and maintain in good order and safe condition, free from obstruction, the entry, drive, and parking areas of the building.

7. Alterations and Improvements

Recognizing that future building and expansion may be necessary to carry out effectively the purposes of the UNIVERSITIES and the FOUNDATION, neither UNIVERSITY shall make any alterations, installations, additions or

improvements on, in or to FOREST-MARINE AREA and MARSH-MARINE AREA, including any buildings, structures or improvements now or hereafter erected thereon, and the fixtures and appurtenances thereto, without the FOUNDATION'S prior written consent, nor shall either UNIVERSITY demolish any part thereof or remove any equipment, furniture, furnishings or other personal property of the FOUNDATION, without the FOUNDATION'S prior written consent.

All buildings, structures and improvements now or hereafter erected on FOREST-MARINE AREA and MARSH-MARINE AREA, and the fixtures and appurtenances thereto, shall be part of the realty and freehold, and shall not be removed by either UNIVERSITY, without the prior written consent of the FOUNDATION (The movable scientific, research, office and other equipment and the movable furniture and furnishings of each UNIVERSITY, however, shall remain its property at all times and may be removed prior to or at the expiration of the term hereof. Any damage to the FOUNDATION'S property in the course of such removal by either UNIVERSITY of its movable property shall be repaired by the UNIVERSITY concerned at its sole expense and cost. Maintenance, repair transportation and safety equipment purchased by or through either UNIVERSITY with funds provided by the FOUNDATION and at the FOUNDATION'S specific request or with its approval, shall be deemed property of the FOUNDATION.)

Neither UNIVERSITY shall have any power to do any act or make any contract which may create or bind the FOUNDATION for any lien, mortgage or other encumbrance upon FOREST-MARINE AREA and/or MARSH-MARINE AREA, or upon any part thereof or upon the estate of FOUNDATION therein.

### 3. Utilities and Services

Each UNIVERSITY shall pay or cause to be paid all charges for utilities and services (including but without being limited to heat, electric current or power, pump and well, septic tank, telephone and refuse removal), furnished to the occupants of any building, structure or improvement exclusively occupied by it, and the FOUNDATION shall not supply or be responsible or liable for any such utilities or services.

9. Laws and Orders

The UNIVERSITIES, and each of them, shall promptly observe and comply with all present or future laws, ordinances, orders, rules, requirements, and regulations of each and every governmental and lawful authority having jurisdiction over all or any part of FOREST-MARINE AREA and/or MARSH-MARINE AREA, and of the Fire Department, Board of Fire Underwriters and/or similar body exercising functions over the same, and of all insurance companies writing policies covering the same or any part thereof.

10. Fire

In case of fire and damage caused thereby to any building, structure, or improvement, the FOUNDATION (except as herein otherwise provided) shall repair the same, or the part thereof damaged, with reasonable diligence. Due allowance shall be made, however, for any delay which may be caused in connection with the adjustment of fire insurance or by reason of governmental regulations, accidents or other causes beyond the FOUNDATION'S control. If the damage or destruction shall affect the whole of FOREST-MARINE AREA and/or MARSH-MARINE AREA or shall in the sole judgment of the UNIVERSITY concerned be deemed so extensive that the UNIVERSITY concerned cannot reasonably continue the conduct of its activities thereon, then this agreement and the term hereof shall cease and terminate as to such UNIVERSITY upon the date of such damage or destruction; if, however, only a part of FOREST-MARINE AREA and/or MARSH-MARINE AREA shall be so damaged or destroyed as to be rendered unusable, and the part not so affected shall be sufficient to permit the UNIVERSITY concerned reasonably to continue the conduct of its activities, or if any building or improvement shall be so damaged or destroyed that the FOUNDATION shall decide not to repair or shall decide to demolish the same, then in either such event, such UNIVERSITY may elect to terminate this agreement by giving FOUNDATION notice of such intention, in which case this agreement shall terminate as to such UNIVERSITY upon the expiration of the time fixed in such notice, or if the UNIVERSITY concerned shall not elect

to so terminate this agreement, this agreement shall continue in full force and effect as to the part of the area concerned remaining usable by such UNIVERSITY.

11. Condemnation or Taking

If during the term of this agreement, the whole of FOREST-MARINE AREA and/or MARSH-MARINE AREA shall be taken for any public or quasi-public use under any statute, by right of eminent domain or if a part thereof shall be so taken and the part not so taken is insufficient, in the sole judgment of the UNIVERSITY concerned, for the reasonable continuance of its activities thereon, then in such event, this agreement and the term hereof shall cease and terminate as to such UNIVERSITY on the date when possession by eminent domain shall be taken. If only part of FOREST-MARINE AREA and/or MARSH-MARINE AREA shall be so taken and the part not so taken shall be sufficient for the reasonable continuance of activities thereon by the UNIVERSITY concerned, then such UNIVERSITY may nevertheless elect to terminate this agreement by giving the FOUNDATION notice of such intention, in which case this agreement shall terminate as to such UNIVERSITY upon the expiration of the time fixed in such notice; or if the UNIVERSITY concerned shall not elect to so terminate this agreement, this agreement shall continue in full force and effect as to such UNIVERSITY and as to the part of FOREST-MARINE AREA and/or MARSH-MARINE AREA without affecting such UNIVERSITY'S obligations and privileges under this agreement.

In no event shall the UNIVERSITIES or either of them have any claim against the FOUNDATION by reason of any taking by eminent domain as aforesaid of FOREST-MARINE AREA and/or MARSH-MARINE AREA or any part thereof, nor shall the UNIVERSITIES or either of them have any claim to the amount of any portion thereof that may be awarded as damages or paid as a result of such taking; provided, however, that each UNIVERSITY shall be entitled to receive any part of such damages which is reasonably attributable to the interruption of research or teaching projects in existence, or for which start-up costs have been incurred. Subject to this proviso, each UNIVERSITY hereby assigns to the FOUNDATION any and all other rights or interests of such UNIVERSITY in and to any and all amounts awarded or paid by reason or as a result of such taking.

12. Termination

(a) This agreement may be terminated by mutual agreement among the parties hereto, or as to either UNIVERSITY, by agreement between such UNIVERSITY and the FOUNDATION.

(b) In the event of any failure by the FOUNDATION to perform any of its obligations under this agreement, which failure shall continue uncorrected for a period of twenty (20) days after notice thereof and which shall not be caused directly or indirectly, by governmental regulations, accidents or causes beyond the FOUNDATION'S control, either UNIVERSITY may elect to terminate this agreement by giving the FOUNDATION notice of such intention, and upon the expiration of the time fixed in such notice, this agreement shall cease and terminate as to such UNIVERSITY.

(c) The FOUNDATION may upon five (5) days notice to the UNIVERSITY concerned, terminate this agreement and the term hereof as to such UNIVERSITY upon or at any time after the happening of one or more of the following events:

Failure by such UNIVERSITY to perform any of its obligations under Article 1 hereof, under Article 3 hereof, under Article 4 hereof, under Article 5 hereof, under Article 6 hereof, under Article 8 hereof, under Article 9 hereof, and under classes (a) and (b) of Article 16 hereof, which failure and its effects shall continue uncorrected for a period of twenty (20) days after the FOUNDATION shall have given such UNIVERSITY notice thereof; provided that if such failure and its effects cannot with due diligence be corrected within twenty (20) days after such notice and if such UNIVERSITY shall promptly commence and shall thereafter diligently proceed to take all action reasonably required to correct the same, then such period shall be extended to forty (40) days.

(d) In case of the termination of this agreement as to only one UNIVERSITY, the rights and obligations of such UNIVERSITY under this agreement (in respect to the use or occupancy of property, the payment of funds and otherwise) shall become those of the other UNIVERSITY if accepted by the other UNIVERSITY.

(e) Upon the effective date of the termination of this agreement, whether by the FOUNDATION and/or the UNIVERSITIES or either of them, or by reason of extensive damage or destruction by fire, or upon the expiration of the term of this agreement, the UNIVERSITY concerned shall have the right to terminate long-term research projects in a reasonable period of time but shall immediately cease all short-term research and terminate its occupancy of FOREST-MARINE AREA and/or MARSH-MARINE AREA and of every building, structure, and improvement

thereon, and its use of equipment, furniture, furnishings, and other personal property of the FOUNDATION, and shall at its sole expense and cost, promptly remove from the FOREST-MARINE AREA and/or MARSH-MARINE AREA all movable equipment and furniture and furnishings put in by it at its sole expense and cost and repair any and all damage done to the FOREST-MARINE AREA and/or MARSH-MARINE AREA by reason of such removal; however, the UNIVERSITY concerned shall retain the right to re-enter the property solely for the purposes of completing the orderly termination of long-term research projects, providing it notifies the FOUNDATION prior to entry and specifies the length of time and area in which it will be conducting necessary tasks. Also, the UNIVERSITY concerned shall have the right to publish all data collected at the time of termination and any additional data collected in the process of orderly terminating long-term research.

13. Consultation

The UNIVERSITIES shall consult with the FOUNDATION with respect to the use of FOREST-MARINE AREA and MARSH-MARINE AREA, and shall keep the FOUNDATION advised of their respective activities thereon and such matters as may reasonably be expected to affect the interests of the FOUNDATION. Either of the UNIVERSITIES shall have the right to release general information to the public concerning their research and educational programs on FOUNDATION property to scientific and lay publications and to advertise for legitimate purposes so long as such information does not contain opinions or statements concerning the policy or the operations of the FOUNDATION or contain information which would in any way impair or threaten to impair the value of the FOUNDATION'S properties, or which would in any way jeopardize or threaten to jeopardize the FOUNDATION'S status as an operating foundation described in Section 4942 or as an organization exempt from Federal Income Taxation under Section 501(c) (3) of the Internal Revenue Code of 1954, or any successor to said section. Any release of material

either printed, written, or oral by the UNIVERSITIES which contains information that relates to the policies of the FOUNDATION or might be detrimental to the FOUNDATION as described within this Article must have written approval by the FOUNDATION before such information can be released. If either UNIVERSITY fails to adhere to the policy of advertising and publicity described in this Article, the FOUNDATION, at its discretion, may terminate the agreement with the UNIVERSITY concerned according to Article 12 hereof.

#### 14. General Restrictions

The UNIVERSITIES and each of them shall not use FOREST-MARINE AREA and/or MARSH-MARINE AREA for any purpose, or permit any condition or activity thereof: (a) which has not been authorized by this agreement in accordance with its terms and approved by the FOUNDATION, (b) which is prohibited under any applicable law, ordinance, order, rule, requirement or regulation of any governmental or lawful authority having jurisdiction over, or similar body exercising functions over the FOUNDATION or UNIVERSITIES, (c) which is detrimental to the interests of the FOUNDATION, (d) which interferes or conflicts with any purpose of the FOUNDATION, or (e) which interferes with the value of the FOUNDATION'S property as a whole. The existence of detriment referred to in (c) of this Article and the existence of interference or conflict referred to in (d) and (e) of this Article shall be determined solely by the FOUNDATION.

Moreover,

(i) No part of the property or any use thereof or of any funds received or payable under this agreement shall inure or be payable to any private shareholder or individual or otherwise to or for any purpose which is not an exempt purpose within the meaning of Section 501 (c) (3) of the Internal Revenue Code of 1954, as now in force or hereafter amended, and which is further not exclusively within the scope of the exempt purposes of the FOUNDATION as an organization described in said section.

(ii) No part of the property or the use thereof or any funds, materials or services contributed by the FOUNDATION under this agreement shall be used directly or indirectly for the carrying on of propaganda or otherwise attempting to influence legislation or to influence the outcome of any specific public election or for any partisan political activity or to further the election or defeat of any candidate for public or political party office.



or otherwise for the participation in or intervention (including publishing or distributing of statements) in any political campaign on behalf of any candidate for public office.

(iii) No person in the United States shall, on the ground of race, creed, sex, color, or national origin, be excluded from participation in, be denied any benefits of, or be subject to discrimination in the performance of this agreement.

(iv) There shall be no religious worship, instruction or proselytization as part of or in connection with the performance of this agreement.

15. No Assignment

Neither UNIVERSITY shall assign, mortgage or encumber any interest herein granted without the prior written consent of the FOUNDATION in each instance.

16. Governing Law

This agreement shall be governed by and construed in accordance with the laws of the State of South Carolina which are applicable to the FOUNDATION'S real property situated in such state. It is understood, however, that the Trustees of the FOUNDATION are subject to the jurisdiction of the Surrogate's Court of the County of New York, and that this agreement is subject to approval by such Court should the Trustees of the FOUNDATION determine at any time that such approval should be obtained.

17. Term of Agreement

The term hereof shall commence on February 22, 1975, and shall continue for a period of twenty-five (25) years and end on February 22, 2000 /1/9\_\_, unless sooner terminated as provided in this agreement.

13. Rulings and Determinations

If any party hereto shall determine at any time to seek a ruling or other determination by the Internal Revenue Service or by any court, governmental or lawful authority with respect to the effect of this agreement or of the performance of any obligation imposed by this agreement upon the tax liability or tax exempt status of such party, notice of such intention shall be given to each other party hereto and each such other party, at its sole expense and cost, shall cooperate with and shall assist the party seeking such ruling or determination, such cooperation and assistance to include, without limitation, assistance in the preparation of any statement, description or portion thereof which shall be deemed necessary by the

party seeking such ruling or determination and which shall deal with the activities of each other party hereto or any other matter of which each such party shall have special knowledge.

19. Changes in Agreement

This agreement contains the entire agreement between the parties hereto with respect to the subject matter hereof. Accordingly, the prior agreements between the FOUNDATION and CLEMSON UNIVERSITY, and the FOUNDATION and the UNIVERSITY OF SOUTH CAROLINA of November 14, 1968 and March 22, 1972, respectively, will terminate and cease to be in effect and be replaced by this agreement as of the effective date hereof. Neither this agreement nor any provision hereof may be changed, amended, modified, waived, discharged or terminated except by an instrument in writing signed by the parties hereto.

If as a result of any tax ruling, determination, or advice issued to or obtained by the FOUNDATION, from the Internal Revenue Service or any judicial determination obtained by the FOUNDATION, this agreement or any provision hereof shall in the opinion of counsel for the FOUNDATION require modification in order to conform to such ruling or determination, the parties hereto agree to enter into and execute such modifications for such purpose. In the event that counsel for both UNIVERSITIES shall disagree with counsel for the FOUNDATION as to the need for, or the terms of, or the extent of any modification of the agreement, the parties shall submit the matter to the Attorney General of South Carolina for his opinion, which opinion shall be binding upon the parties.

20. (a) No delay or omission by any party hereto to exercise any right or power accruing upon any noncompliance or default by any other party with respect to any of the terms hereof shall impair any such right or power or be construed to be a waiver thereof. No waiver by any party hereto of any of the covenants and agreements hereof to be performed by any other party shall be construed to be a waiver of a succeeding default or breach thereof or of any other covenants or agreements herein contained.

(b) No termination of this agreement shall discharge, release or in any way affect any liability or obligation of any party hereto which shall have

accrued or which may accrue, in whole or in part, by reason of any such termination or of any matter which shall have occurred prior to such termination.

(c) This agreement shall bind and inure to the benefit of the parties hereto and their respective successors and, except as otherwise provided herein, their assigns.

(d) Headings or captions are for purposes of convenience in reference only and shall not limit, describe or otherwise affect any of the terms hereof.

(e) Addresses:

THE BELLE W. BARUCH FOUNDATION  
Bellefield Plantation  
Georgetown, South Carolina 29440

CLEMSON UNIVERSITY  
Clemson, South Carolina 29631

UNIVERSITY OF SOUTH CAROLINA  
Columbia, South Carolina 29208

IN WITNESS WHEREOF, this agreement has been duly executed as of the day and year first above mentioned in the State of South Carolina.

THE BELLE W. BARUCH FOUNDATION

/s/	<u>Ella A. Severin</u>	Trustee
		Trustee
/s/	<u>H. M. Arthur</u>	Trustee
/s/	<u>Leonard T. Scully</u>	Trustee
/s/	<u>E. Craig Wall, Sr.</u>	Trustee
		Trustee

CLEMSON UNIVERSITY

By: /s/ Robert C. Edwards  
President

UNIVERSITY OF SOUTH CAROLINA

By: /s/ William H. Patterson  
President

ATTORNEY GENERAL OF SOUTH CAROLINA

By: /s/ Daniel R. McLeod

Memorandum of Understanding  
between  
The Belle W. Baruch Foundation  
Clemson University  
The University of South Carolina

The Trustees of The Belle W. Baruch Foundation, the President of Clemson University, and the President of the University of South Carolina have on February 22, 1975 signed an Agreement establishing a tripartite working relationship among the two Universities and the Foundation toward joint efforts in teaching and research in Forestry, Marine Biology, and the care and propagation of wildlife, flora and fauna of South Carolina.

When the agreement was signed, certain operational procedures were left to be arranged under a separate Memorandum of Understanding. Therefore, it is understood and agreed that:

Receipts from FOREST-MARINE AREA

The proceeds from harvesting operations within the FOREST-MARINE AREA shall be allocated by the FOUNDATION to CLEMSON UNIVERSITY to be used for scientific management of the FOREST-MARINE AREA.

Receipts from the MARSH-MARINE AREA

The proceeds of harvesting operations in the MARSH-MARINE AREA shall be allocated by the FOUNDATION to the UNIVERSITY OF SOUTH CAROLINA to be used for scientific management of the MARSH-MARINE AREA.

Notification and Request for State Funding

On July first of each year, the FOUNDATION will notify each UNIVERSITY of the amount of funds it estimates will be distributed from its net income to each UNIVERSITY for the fiscal year beginning on the following July first. This will enable each UNIVERSITY to include in its normal budgetary submission to the General Assembly a request for such additional funds as are considered necessary for carrying out its programs. The FOUNDATION will be notified by the UNIVERSITIES of the amount of state support granted by the legislature as soon as the General Appropriation Bill passes each year.

Thousand-Acre Marsh

In the area known as Thousand-Acre Marsh, neither UNIVERSITY shall initiate projects within the marsh directly affecting the marsh or adjacent forest areas without prior written concurrence of the other UNIVERSITY.

IN WITNESS WHEREOF, this Understanding has been duly executed  
as of the 14<sup>th</sup> day of JULY, 1975.

CLEMSON UNIVERSITY

By: Robert C. Thomas  
President

UNIVERSITY OF SOUTH CAROLINA

By: Robert M. Smith  
President

THE BELLE W. BARUCH FOUNDATION

By: Ella A. Severin  
Elaine Washburn  
Harry M. Allen  
John J. Carter

# The Belle W. Baruch Foundation

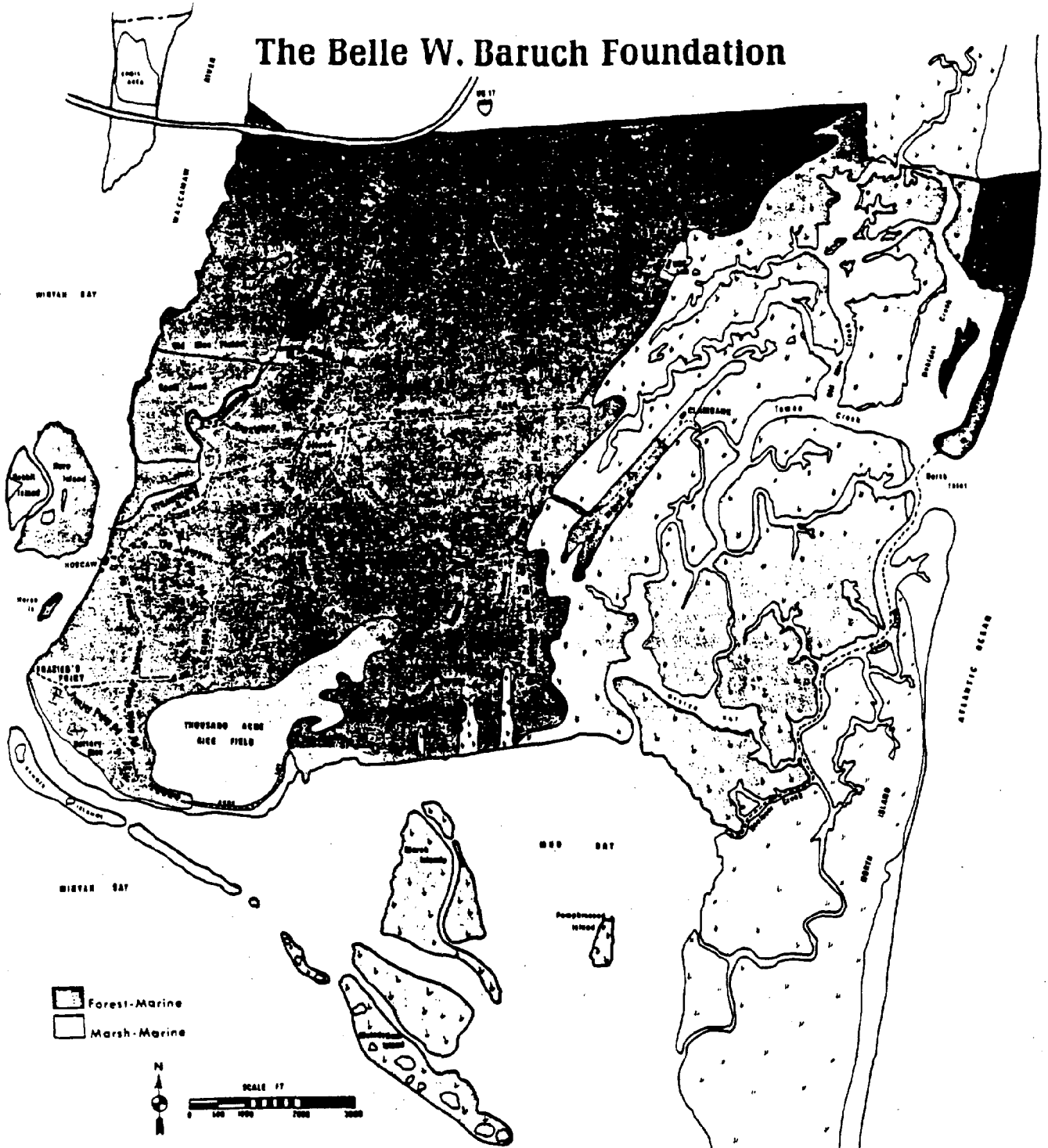


Figure 5. Property of Belle W. Baruch Foundation. The Marsh-Marine Area is managed by the Baruch Institute, USC and is part of the NI/WB NERR. The Forest-Marine Area is managed by Clemson University.

APPENDIX B

Memoranda of Understanding

APPENDIX B

Memorandum of Understanding  
Between  
The State of South Carolina  
and  
The National Oceanic and Atmospheric Administration  
Concerning the  
Establishment and Administration  
of the North Inlet-Winyah Bay  
National Estuarine Research Reserve

Memorandum of Understanding  
Between  
The State of South Carolina  
and  
The National Oceanic and Atmospheric Administration  
Concerning the  
Establishment and Administration  
of the North Inlet/Winyah Bay  
National Estuarine Research Reserve

WHEREAS, the State of South Carolina has determined that the waters and related coastal habitats of North Inlet and a portion of Winyah Bay provide unique opportunities to study natural and human processes occurring within estuarine ecosystems; and

WHEREAS, it is the finding of the State of South Carolina that the resources of North Inlet and portions of Winyah Bay and the values they represent to the citizens of South Carolina and the United States will benefit from the management of North Inlet/Winyah Bay as part of the National Estuarine Research Reserve System; and

WHEREAS, the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce has concurred with that finding and pursuant to its authority under Section 315 of the Coastal Zone Management Act of 1972, as amended, (CZMA), 16 U.S.C. 1461 and in accordance with implementing regulations at 15 CFR 921.30, may designate North Inlet/Winyah Bay as a National Estuarine Research Reserve System in South Carolina; and

WHEREAS, the South Carolina Coastal Council (Council) is the Governor's designee under Section 315 of the Federal Coastal Zone Management Act and the recipient state entity in matters concerning all programs and financial awards authorized under the CZMA and the implementing regulations, and is responsible for ensuring compliance with the rules and regulations of such law in South Carolina as authorized in the South Carolina Coastal Zone Management Program (Section 48-39-50 (B), Code of Laws of South Carolina, 1976, as amended); and

WHEREAS, the Belle W. Baruch Institute for Marine Biology and Coastal Research, University of South Carolina (Institute) is the agency designated by the South Carolina Coastal Council in the North Inlet/Winyah Bay National Estuarine Research Reserve System Management Plan (Management Plan) as being responsible for managing the North Inlet/Winyah Bay National Estuarine Research Reserve System in South Carolina and acknowledges the need and requirement for continuing State-Federal cooperation in the long-term management of the site in a manner consistent with the purposes sought through its designation.

NOW, THEREFORE, in consideration of the mutual covenants contained herein it is agreed by and between the State of South Carolina and NOAA, effective on the date of the designation of North Inlet and portion of Winyah Bay as the North Inlet/Winyah Bay National Estuarine Research Reserve as follows:



## ARTICLE I: STATE-FEDERAL ROLES IN RESERVE MANAGEMENT

- A. The Council, serving as the grants award office for the State of South Carolina under Section 315 of the CZMA, and responsible for compliance with the rules and regulations of the South Carolina Coastal Zone Management Program, shall:
1. In cooperation with the Institute, apply for such funds authorized under Section 315 of the CZMA for acquisition, development, operation and management, research, monitoring, and education in accordance with the Management Plan and annual work plan. The funds received by the Council for these purposes, with the exception of acquisition, shall be contracted to the Institute for Management Plan implementation with the exception of an amount not to exceed ten (10) percent of basic operating funds to be retained by the Council for administrative and enforcement costs as documented in the annual work plan. Land acquisition in the event of boundary expansion, will be handled by the Council with no administrative costs and all lands and properties will be deeded directly to the Institute, University of South Carolina.
  2. Ensure the Management Plan and annual work plan are consistent with the South Carolina Coastal Zone Management Program.
  3. Provide increased surveillance and monitoring to ensure protection of the Reserve and enforcement of the rules and regulations of the South Carolina Coastal Zone Management Program.
- B. The Institute, serving as the managing agency for the Council to implement the Management Plan, shall be the principal contact with NOAA for the State of South Carolina in all matters concerning the Reserve, with the exception of fiscal awards, and will serve to ensure that the Reserve is managed in a manner consistent with the goals of the National Estuarine Research Reserve System and the management objectives of the Management Plan. The Institute's responsibilities for the Management Plan implementation will include the following:
1. Effect and maintain a process for coordinating and facilitating the roles and responsibilities of all local, state, and federal agencies involved in the management of the Reserve, including but not limited to:
    - a. Enforcement programs regulating water quality, fish and wildlife habitat protection, sport and commercial fisheries, and non-consumptive recreational activities;
    - b. The on-site administration of facilities, programs, and tasks related to Reserve management;
    - c. Activities and programs conducted pursuant to the State's Federally-approved coastal zone management program; and

- d. Research and educational agenda developed and implemented in accordance with corresponding elements of the Management Plan;
  - e. Subject to appropriation, provide support for three positions (including the Reserve Manager, Research/Resource Coordinator and Education Coordinator) within five years.
  - f. Seek State and other funding for operations, management, and development of the Reserve, and for acquisition in the event of boundary expansion; and
  - g. Seek State and other funding for research, monitoring, and education programs at the Reserve.
2. In cooperation with the Council, prepare and submit to NOAA for approval an operational strategy which in coordination with the Management Plan describes how the State of South Carolina intends to meet its long-term commitment to the management of the Reserve. The strategy, at a minimum, will describe the following:
- a. Specific mediation procedures and resolution mechanisms, developed jointly with the Sanctuaries and Reserves Division (SRD) of NOAA, for reaching mutually acceptable solutions for correcting or avoiding conflicts requiring action under the CZMA and regulation;
  - b. The procedures developed in accordance with SRD guidelines and proposed by the State as a means for prescribing contingency responses to emergency conditions that exceed routine Management Plan implementation; and
  - c. The Management Plan's continuing functioning as a vehicle for carrying out the mission of the national program, i.e., (i) how the State intends to coordinate Reserve management with its coastal resource management decision-making process; (ii) the anticipated work program, priorities, and sources of funding for ensuring the continued maintenance of the Reserve, and (iii) the means relied upon by the State to assure NOAA that real property acquired with Federal Funds for the purposes of the Reserve will continue to be used in a manner consistent with 15 CFR 921;
3. Serve as principal negotiator on issues involving proposed boundary changes and/or amendments to the Management Plan;
4. Submit periodic reports and an annual report as required to the Council and NOAA on the Reserve describing the program and fiscal performance in Management Plan implementation in accordance with 15 CFR 921.40(e), and a detailed work program for the following year of operations, including budget projections and research efforts;

5. Respond to NOAA's requests for information and to requests to evaluate findings made pursuant to Section 312 of the CZMA; and
  6. In the event that it should become necessary, based on findings of deficiency, serve as the point-of-contact in conjunction with the Council for the State of South Carolina in actions involving the possible withdrawal of Reserve designation, as provided at 15 CFR 921.41 and 15 CFR 921.42.
- C. The Sanctuaries and Reserves Division (SRD), Office of Ocean and Coastal Resource Management (OCRM), will serve to administer the provisions of Section 315 of the CZMA to ensure that the Reserve is managed in accordance with the goals of the National Estuarine Research Reserve System and the Management Plan. In carrying out its responsibilities, SRD will:
1. Subject to appropriation, provide financial assistance to the Council, consistent with 15 CFR 921 for acquisition, development, management and operation of the Reserve;
  2. Subject to appropriation, provide financial assistance to the state on a competitive basis for research, monitoring and education programs at the Reserve;
  3. Serve as the point-of-contact for NOAA in discussions regarding applications for any financial assistance received by the State under Section 315 of the CZMA, including any and all performance standards, compliance schedules, or Special Award Conditions deemed appropriate by NOAA to ensure the timely and proper execution of the proposed work program;
  4. Participate in periodic evaluations scheduled by OCRM in accordance with Section 312 of the CZMA to measure the State's performance in Management Plan implementation and its compliance with the terms and conditions prescribed in financial assistance awards granted by NOAA for the purposes of the Reserve and advise appropriate OCRM staff of existing or emerging issues which might affect the State's coastal zone management program; and
  5. Establish an information exchange network cataloging all available research data and educational material developed on each site included within the National Estuarine Research Reserve System.

**ARTICLE II: REAL PROPERTY ACQUIRED FOR THE PURPOSES OF THE RESERVE**

The State of South Carolina agrees to the conditions set forth at 15 CFR 921.21(e) which specify the legal documentation requirements concerning the use and disposition of real property acquired for Reserve purposes with Federal funds under Section 315 of the CZMA.

**ARTICLE III: PROGRAM EVALUATION**

- A. OCRM will schedule periodic evaluations of the State's and Institute's performance in meeting the conditions of such awards, progress in


implementing the Management Plan, and meeting the provisions of this MOU. Where findings of deficiency occur, NOAA may initiate action in accordance with the designation withdrawal procedures established at 15 CFR 921.41 and 921.42.

- B. OCRM will continue to evaluate, pursuant to Section 312 of the CZMA and the corresponding provisions of 15 CFR 921, the Institute's and the Council's performance in implementing the Management Plan and developing strategy committing the State and the Institute in the long-term management of the North Inlet/Winyah Bay Reserve. Where findings of deficiency occur, NOAA may initiate action in accordance with designation withdrawal procedures established at 15 CFR 921.42.


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

\_\_\_\_\_  
Trudy Coxe  
Director  
Office of Ocean and Coastal  
Resource Management  
National Oceanic and Atmospheric  
Administration  
U.S. Department of Commerce

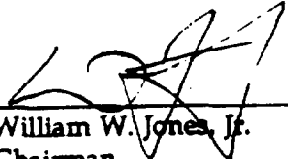
\_\_\_\_\_  
Date

  
\_\_\_\_\_  
H. Wayne Beam, PhD  
Executive Director  
South Carolina Coastal Council

8-14-92  
\_\_\_\_\_  
Date

  
\_\_\_\_\_  
Bill Harrigan  
Acting Chief  
Sanctuaries and Reserves Division  
Office of Ocean and Coastal  
Resource Management  
National Oceanic and Atmospheric  
Administration  
U.S. Department of Commerce

8/28/92  
\_\_\_\_\_  
Date

  
\_\_\_\_\_  
William W. Jones, Jr.  
Chairman  
South Carolina Coastal Council

8/14/92  
\_\_\_\_\_  
Date

*Ardis M. Savory*

Ardis M. Savory  
Associate Vice Provost  
Office of Sponsored  
Programs and Research  
University of South Carolina

8/7/92

Date

*F. John Vernberg*

F. John Vernberg, PhD  
Director  
Baruch Institute  
University of South Carolina

8/6/92

Date

*John M. Palms*

John M. Palms, PhD  
President  
University of South Carolina

8/12/92

Date

\_\_\_\_\_  
Witness

\_\_\_\_\_  
Date

APPENDIX C

National Estuarine Research Reserve Program Regulations

# **federal register**

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Monday  
July 23, 1990

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**Part II**

**Department of  
Commerce**

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**National Oceanic and Atmospheric  
Administration**

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**15 CFR Part 921**

**National Estuarine Reserve Research  
System Program Regulations; Interim  
Final Rule**

**DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric**  
**Administration**

15 CFR Part 921

(Docket No. 70874-0133)

**National Estuarine Reserve Research**  
**System Program Regulations**

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

**ACTION:** Interim final rule.

**SUMMARY:** The regulations revise existing rules for national estuarine reserves in accordance with the Coastal Zone Management Reauthorization Act of 1985 (title IV, subtitle D, Pub. L. 99-272) and recommendations contained in the U.S. Department of Commerce, Office of Inspector General Report No. F-726-5-010, "Opportunities to Strengthen the Administration of the Estuarine Sanctuary Program." Effective with the signing of Public Law 99-272 on April 7, 1986, the name of the Estuarine Sanctuary Program changed to the National Estuarine Reserve Research System Program; estuarine sanctuary sites are now referred to as national estuarine research reserves. These regulations revise the process for designation of research reserves. Greater emphasis is placed on the use of reserves to address national estuarine research and management issues, and to make maximum use of the System for research purposes through coordination with NOAA and other Federal and state agencies which are sponsoring estuarine research. Additional emphasis is also given to providing financial assistance to states to enhance public awareness and understanding of estuarine areas by providing opportunities for public education and interpretation. The regulations provide new guidance for delineating reserve boundaries and new procedures for arriving at the most effective and least costly approach to acquisition of land. Clarifications in the total amount of financial assistance authorized for each national estuarine reserve, and criteria for withdrawing the designation of a reserve, have also been added.

**DATES:** *Effective Date:* These interim final regulations are effective July 23, 1990.

*Comments:* Comments are invited and will be considered if submitted on or before September 21, 1990.

**ADDRESSES:** Mr. Joseph A. Uravitch,  
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**SUPPLEMENTARY INFORMATION:**

**I. Authority**

This notice of interim final rulemaking is issued under the authority of section 315(a) of the Coastal Zone Management Act of 1972 as amended, 16 U.S.C. 1461 (the Act). The National Estuarine Reserve Research System has been operating under regulations published June 27, 1984 (49 FR 26510).

**II. General Background**

On October 28, 1988 (53 FR 43816) NOAA published proposed regulations for continued implementation of the National Estuarine Reserve Research System (NERRS) Program pursuant to section 315 of the Act, 16 U.S.C. 1461. Written comments were accepted until December 30, 1988. These comments have been considered in preparing these final regulations. A summary of the significant changes to the proposed regulations is presented below.

These interim final regulations establish the Program's mission and goals and revise procedures for selecting, designating and operating national estuarine research reserves.

**III. Changing the Name and Emphasis of the Program**

The 1985 Coastal Zone Management Act and its amendments established the National Estuarine Reserve Research System (System). The System consists of (1) each estuarine sanctuary designated prior to April 7, 1986 which is the date of enactment of the Coastal Zone Management Reauthorization Act of 1985, and (2) each estuarine area designated after the Act. The term estuarine sanctuary no longer appears in regulations; the term research reserve or reserve appears in its place.

The Mission Statement for the System is much the same as for the National Estuarine Sanctuary Program which existed prior to the 1985 amendments. However, the goals for the National Estuarine Reserve Research System stress the use of reserve sites for promotion and coordination of estuarine research on a national level as the highest priority and reason for establishing the System. The protection and management of estuarine areas and resources are clearly intended to

support the research mission, not as ends in themselves. Consultation by the Secretary with other Federal and state agencies to promote use of one or more reserves within the System by such agencies when conducting estuarine research is also a clearly defined goal of the System. The regulations also emphasize the use of a reserve's natural resources and ecology to enhance public awareness and understanding of estuarine areas, and to provide suitable opportunities for public education and interpretation. This education goal has been elevated to become one of the essential criteria for designation of a reserve.

**IV. Revision of the Procedures for Selecting, Designating and Operating National Estuarine Research Reserves**

(A) *Revision of Designation Criteria.* The Coastal Zone Management Reauthorization Act of 1985 established, for the first time, statutory criteria for designating an area as a national estuarine research reserve. An area may be designated by the Secretary of Commerce as a national estuarine research reserve if:

(1) the Governor of the coastal state in which the area is located nominates the area for that designation; and

(2) the Secretary finds that:

(A) the area is a representative estuarine ecosystem that is suitable for long-term research and contributes to the biogeographical and typological balance of the System;

(B) the law of the coastal State provides long-term protection for reserve resources to ensure a stable environment for research;

(C) designation of the area as a reserve will serve to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation; and

(D) the coastal State in which the area is located has complied with the requirements of any regulations issued by the Secretary to implement this section.

Some of these criteria for designation are either new or substantially more specific than those contained in the former regulations. For example, under these regulations the Governor of a coastal state must nominate an estuarine area for designation, and findings are required that the law of the coastal state provides long-term protection for reserve resources to ensure a stable environment for research and that designation of the area will serve to enhance public awareness and understanding of estuarine areas. The criteria in the existing regulations have been revised accordingly.



(B) *Revision of Site Criteria and Procedures.* The criteria for selecting an estuarine area for designation as a national estuarine research reserve have been expanded to provide guidance for determining boundaries for the proposed site. The Office of Inspector General Report No. F-726-5-010 criticized the lack of specific guidelines for setting limits on boundaries around estuarine sanctuaries to ensure that only land essential to the mission of the program be included inside the sanctuary. References in the existing regulations to ensure that the boundaries encompass an adequate portion of the key land and water areas of the natural system to approximate an ecological unit are too vague, particularly since terms are not defined. The proposed regulations define key land and water areas as a "core area" within the reserve which is so vital to the functioning of the estuarine ecosystem that it must be under a level of control sufficient to ensure the long-term viability of the reserve for research on natural processes. The determination of key land and water areas must be based on scientific knowledge of the area. The concept of a "buffer" zone to protect the core area and provide additional protection for estuarine-dependent species has also been defined in the regulations. The buffer zone may include an area necessary for facilities required for research and interpretation, and additionally, to accommodate a shift of the core area as a result of biological, ecological or geomorphological change which reasonably could be expected to occur. States will be required to use scientific criteria to justify the boundaries selected for a proposed site.

The information requirements for NOAA approval of a proposed site under existing regulations were confusing and now have been clarified.

NOAA has recognized the need to conduct studies to develop a basic description of the physical, chemical, and biological characteristics of the site. As a result, states may now be eligible for Federal funding of these studies after NOAA approval of a proposed site.

(C) *Management Plan Development.* Once NOAA approves the proposed site and decides to proceed with designation, the state must develop a draft management plan. The contents of the plan, including the memorandum of understanding (MOU) between NOAA and the state, are specified in the regulations. The acquisition portion of the plan has been greatly expanded to implement recommendations in the Office of Inspector General Report No. F-726-5-010. It is proposed that states

be required to justify the use of fee simple acquisition methods and make greater use of non-fee simple methods to conserve expenditure of funds. For each parcel, both in the core area and the buffer zone, states must determine, with appropriate justification (1) the minimum level of control(s) required, (2) the level of existing state control, and (3) the level of additional state control(s) required; states must also examine all reasonable alternatives for attaining the additional level of control required, perform a cost analysis of each, and rank, in order of cost, the alternative methods of acquisition which were considered. The cost-effectiveness assessment must also compare short-term and long-term costs. The state shall give priority consideration to the least costly method(s) of attaining the minimum level of long-term control required, which is sufficient to meet the statutory requirement that "the law of the coastal state provides long-term protection for reserve resources to ensure a stable environment for research. See 16 U.S.C. § 1461(b)(2)(B).

(D) *Financial Assistance Awards for Site Selection and Post Site Selection.*

The first of five types of awards under the National Estuarine Reserve Research System is for site selection and post-site selection, which includes preparation of a draft management plan (including MOU) and the collection of information necessary for preparation of the environmental impact statement. The maximum total Federal share of these awards has been raised to \$100,000 as described in § 921.16. Of this amount, up to \$25,000 may be used to conduct the site selection process as described in § 921.17. After NOAA's approval of a proposed site and decision to proceed with the designation process, the state may expend (1) up to \$40,000 of this amount to develop the draft management plan and collect information for preparation of the environmental impact statement; and (2) up to the remainder of available funds to conduct studies to develop a basic description of the physical, chemical, and biological characteristics of the site.

(E) *Financial Assistance Awards for Acquisition, Development, and Initial Management.* The regulations divide eligibility for financial assistance awards for acquisition and development into two phases. In the initial phase, states are working to meet the criteria required for formal research reserve designation, i.e., establishing adequate state control over key land and water areas in accordance with the draft management plan and preparing a final management plan. In this predesignation

phase, funds are available for acquiring interest in land, which is the primary purpose of this award, and for minor construction (e.g., nature trails and boat ramps), preparation of architectural and engineering plans and specifications, development of the final management plan, and hiring a reserve manager and other staff as necessary to implement the NOAA approved draft management plan.

The length of time for this initial phase of acquisition and development may be up to three years. After the site receives Federal designation as a national estuarine research reserve, the state may request additional financial assistance to acquire additional property interests (e.g., for the buffer zone), for construction of research and interpretive facilities, and for restorative activities in accordance with the approved final management plan.

The Coastal Zone Management Reauthorization Act of 1985 specifies that the amount of financial assistance provided with respect to the acquisition of land and waters, or interests therein, for any one national estuarine research reserve may not exceed an amount equal to 50 per centum of the costs of the lands, waters, and interests therein or \$4,000,000, whichever amount is less.

The amount of Federal financial assistance provided under the regulations for development costs directly associated with major facility construction (i.e., other than land acquisition) for any one national estuarine research reserve must not exceed 50 per centum of the costs of such construction or \$1,500,000, whichever amount is less.

(F) *Financial Assistance Awards for Operation and Management.* The amount of Federal financial assistance available to a state to manage the reserve and operate programs consistent with the mission and goals of the National Estuarine Reserve Research System has been raised from \$50,000 to \$70,000 for each twelve month period. Up to ten per cent of the total award (Federal and state) each year may be used for construction-type activities.

(G) *Financial Assistance for Research.* The Coastal Zone Management Reauthorization Act of 1985 specifically affects the conduct of the System's research program by establishing the requirement for developing Estuarine Research Guidelines for the conduct of research within the system and specifying what these guidelines shall include. The legislation also requires the Secretary of Commerce to require that NOAA, in conducting or supporting estuarine

research, give priority consideration to research that uses reserves in the System, and that NOAA consult with other Federal and state agencies to promote use of one or more reserves by such agencies when conducting estuarine research.

The research guidelines, which are referred to in the regulations, but are not part of them, state that NOAA will provide research grants only for proposals which address research questions and coastal management issues that have highest national priority as determined by NOAA, in consultation with prominent members of the estuarine research community.

One significant addition to the regulations is that research awards are available on a competitive basis to any coastal state or qualified public or private person, thus making it possible for public or private persons, organizations or institutions to compete with coastal states and coastal state universities for NOAA research funding to work in research reserves.

(H) *Financial Assistance for Monitoring.* The Coastal Zone Management Reauthorization Act of 1983 authorizes the award of grants for the purposes of conducting research and monitoring. While objectives in estuarine research and estuarine monitoring are mutually supportive, monitoring is generally designed to provide information over longer time frames and in a different spatial context. Consequently a separate subpart addressing specifically the development and implementation of monitoring projects has been included in the regulations.

(I) *Financial Assistance Awards for Interpretation and Education.* The Coastal Zone Management Reauthorization Act of 1985 authorizes the award of grants for the purposes of conducting educational and interpretive activities. To stimulate the development of innovative or creative interpretive and educational projects and materials which will enhance public awareness and understanding of estuarine areas, the regulations provide for funds to be available on a competitive basis to any coastal State entity. These funds are provided in addition to any other funds available to a coastal state under these regulations.

Categories of potential educational and interpretive projects include:

(1) Design, development and distribution/ placement of interpretive or educational media (*i.e.*, the development of tangible items such as exhibits/ displays, publications, posters, signs, audio-visuals, computer software, and maps, which have an educational or

interpretive purpose, and techniques for making available or locating information concerning reserve resources, activities, or issues);

(2) Development and presentation of curricula, workshops, lectures, seminars, and other structured programs or presentations for on-site facility or field use;

(3) Extension/outreach programs; or

(4) Creative and innovative methods and technologies for implementing interpretive or educational projects.

Interpretive and educational projects may be oriented to one or more research reserves or the entire System. Those projects which would benefit more than one research reserve, and, if practical, the entire National Estuarine Reserve Research System, shall receive priority consideration for funding.

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

NOAA received comments from 16 sources. Reviewers included Federal and state agencies, academic institutions, and the National Estuarine Research Reserve Association. The comments of the National Estuarine Research Reserve Association (NERRA) are a summary of comments submitted to NERRA by most of the managers of the existing and proposed national estuarine research reserves. All comments received are on file at the Marine and Estuarine Management Division, Office of Ocean and Coastal Resource Management and are available at that office for review upon request. Each of the major issues raised by the reviewers has been summarized and NOAA's responses are provided under the relevant subheading in this section.

#### General:

Three reviewers recommended that more emphasis be placed on developing an information network among research reserves and between research reserves and research and educational groups and institutions. Two of these reviewers noted the absence in the proposed regulations of a paragraph which had addressed this subject in the existing regulations (49 FR 26502, June 27, 1984). The deleted paragraph concerned the development and Federal administration of a research and education information exchange network for the System.

*Response:* NOAA agrees. The section referring to information exchange between NOAA and the Reserves has been reinstated in § 921.1(h).

#### Specific:

##### *Section 921.1—Mission, Goals, and General Provisions*

*Proposed § 921.1(c)*—One reviewer suggested the deletion of the first sentence of this provision which states, "National estuarine research reserves shall be open to the public." This reviewer noted that in multiple component reserves some components may not be appropriate for general public access; either because of the purpose or emphasis of management at that site (*e.g.*, research) or due to the limited interest which the managing entity has in the component (*e.g.*, a conservation easement which does not provide for unlimited public access). This reviewer expressed concern that state denial of general public access at such components of a reserve could be challenged on the basis of this provision.

*Response:* Consistent with the goal of the National Estuarine Reserve Research System to "enhance public awareness and understanding of the estuarine environment and provide suitable opportunities for public education and interpretation," public access should be allowed to the greatest extent possible permitted under State and Federal law within national estuarine research reserves. However, the statement, "National estuarine research reserves shall be open to the public", does not require that all components of a multi-component reserve or the entire area within the boundaries of a single component reserve be open to the general public unconditionally. The last sentence of § 921.1(c) reads, "Consistent with resource protection and research objectives, public access may be restricted to certain areas within a research reserve." Where unconditional public access is not consistent with resource protection and research objectives as stated in the approved management plan (*e.g.*, public access would interfere with reserve research or is likely to diminish the value of reserve resources for future research) it must be limited accordingly. Just as certain areas are identified in reserve management plans as being more or less sensitive to public access impacts in single component reserves, the same is true of components in multi-component reserves. Frequently in management plans for multi-component reserves one or more components will be identified as those for which the relative management emphasis will be public education and interpretation. Similarly, other components are identified as those

which emphasize research and resource protection.

*Proposed § 921.1(d) and § 921.1(e)*—Seven reviewers commented on these provisions. These comments ranged from one sentence requesting clarification to approximately six pages of comments dedicated to these provisions alone. These comments also ranged from expressing concern or objection regarding the proposed limitations on habitat manipulation to suggesting a more restrictive approach.

One reviewer expressed strong support for an outright prohibition on habitat manipulation, whether for management or research, except for restoration activities where such restoration can avoid long-term adverse impacts. Another reviewer commented extensively on this provision, expressing strong objections to a prohibition on habitat manipulation activities for management purposes. This reviewer stated that the "preservation" of a habitat requires active management involving habitat manipulation.

One reviewer requested clarification of the difference between restoration activities and habitat manipulation for research or management purposes. One reviewer suggested criteria for assessing the degree of "manipulation" a proposed research project may involve. One reviewer requested clarification of the intent of this provision and how it may apply to: (1) actions necessary to protect public health; (2) protection of existing species; and (3) allowance for restorative activities for historical preservation. One reviewer stated that whatever type of habitat manipulation determined allowable by NOAA, day-to-day site management decisions are best made by the professional staff of each reserve.

One reviewer requested clarification of the intent of this provision and of the differences between habitat manipulation for research, habitat manipulation for management, and habitat manipulation for restoration. This same reviewer stressed the primary importance of the ecological and representative integrity of a reserve.

*Response:* The mission of the National Estuarine Research System, as stated in § 921.1(e), "is the establishment and management, through Federal-state cooperation, of a national system of estuarine research reserves representative of the various regions and estuarine types in the United States" (emphasis added). The first Secretarial finding required for designation of an estuarine area as a national estuarine reserve under section 315(b)(2)(A) of the Act, 16 U.S.C. 1461(b)(2)(A), is that "the area is a

*representative estuarine ecosystem that is suitable for long-term research and contributes to the biogeographical and typological balance of the System"* (emphasis added).

The primary intent of § 921.1(d) and § 921.1(e) is to restrict and allow activities involving habitat manipulation to the degree necessary to ensure that reserves are, and continue to be, *representative estuarine ecosystems*. It is this mission, and requirement of the statute, that the System goals of § 921.1(b) are meant to support. This mission, and requirement of the statute, is the foundation upon which the System is built, the primary basis on which estuarine areas are selected and designated as reserves, and the underlying principle with which all other aspects of reserve development and operation must be consistent. As one reviewer stated, in no case should the ecological or representative integrity of a reserve be comprised.

Habitat manipulation activities conducted for a purpose other than (1) restoring the representative integrity of a reserve or (2) estuarine research, are not consistent with this requirement of the statute or the mission of the System. A reasonable limitation on the nature and extent of habitat manipulation activities conducted as a part of estuarine research is necessary to ensure that the representative integrity of a reserve is protected. Likewise, reasonable exceptions to these limitations on habitat manipulation activities are appropriate for reasons of public health and the protection of other sensitive resources (e.g., endangered/threatened wildlife and significant historical and cultural resources). If habitat manipulation is determined to be necessary in such a case, then such activities should be limited so as not to significantly impact the representative and ecological integrity of the reserve.

Contrary to the assertion of one reviewer, the intent of designating and managing a research reserve is not to "preserve" that particular habitat in a stasis condition. Estuarine ecosystems are naturally dynamic habitats which we have yet to fully understand. NOAA's intent in designating estuarine areas as national estuarine research reserves is to protect the representative character of each individual reserve and thereby establish a national system of estuarine areas representative of the biogeographic regions and estuarine types of the United States. These representative estuarine research reserves then provide opportunities for long-term research, education, and interpretation.

Generally, it is NOAA's belief that, given the less-than-perfect state of knowledge regarding both the functioning of estuarine ecosystems and the effects of natural and anthropogenic change that manipulation should be carefully limited within estuarine research reserves. Outside the context of a carefully planned, and peer-reviewed, research or restoration activity, NOAA believes that habitat manipulation for management purposes involves a significant risk to the representative integrity and character of a national estuarine research reserve. As a result, the phrase in the proposed regulations "habitat manipulation for resource management purposes" is intended to mean habitat management for the promotion of a particular species or habitat, or for some purpose other than research involving or restoration of a representative "natural" estuarine ecosystem.

NOAA acknowledges that much research involves some degree of manipulation of the resource(s) and habitat(s) which are the subject of study. In this regard, reserves are not intended to be "control" habitats only, and some degree of habitat manipulation is recognized as an essential aspect of much important estuarine research. However, research activities conducted within a reserve should not involve manipulative activities that, because of their nature or extent, would significantly impair the "natural" representative value (i.e., representative character) of the reserve.

NOAA also acknowledges that restoration efforts may involve extensive habitat manipulation activities. Many estuarine areas have undergone some ecological change as a result of human activities (e.g., hydrological changes, intentional/unintentional species composition changes—introduced and exotic species, etc.). In those areas designated as national estuarine research reserves, such changes may have diminished the representative character and integrity of the site. Where restoration of such degraded areas is determined necessary within this context, such activities must be carefully planned. Much research is necessary to determine the "natural" representative state of an estuarine area (i.e., an estuarine ecosystem minimally affected by human activity or influence). Frequently, such restoration activities provide excellent opportunities for management oriented research.

In response to reviewers requests for clarification and consistent with the response provided above, § 921.1(d) and

§ 921.1(e) have been revised appropriately.

*Proposed § 921.1(f)*—(1) One reviewer recommended that a formula be established that would "pre-determine the minimum level (percentage) of funds that would be set aside within the total [System] budget for specific categories (Research, Education, Monitoring, Operation/Management, Acquisition, and Development)." In addition, this same reviewer recommended that the allocation of acquisition/development funds should be made on the basis of greatest need measured against predetermined criteria.

*Response:* NOAA acknowledges that under certain conditions establishment of predetermined percentages for allocating funds among programmatic categories could provide greater predictability in the distribution of Federal funds among reserves. However, the advantages of such an approach depend on a predictability in both the level of annual appropriations as well as major acquisition and development needs for the Reserve system. The uncertainties in appropriation levels and acquisition needs are sufficient enough to make an allocation formula among the six major funding categories (research, education, monitoring, predesignation, acquisition/development, operations) unfeasible.

NOAA attaches primary importance to long term support for the operational needs at each reserve as described in § 921.32 of these regulations, and to fulfilling the research, education and monitoring objectives of the program, unlimited eligibility for these for the awards.

(2) Four reviewers expressed concern or objection to limiting the funding eligibility of any one reserve under any type of award, particularly operation/management awards. These reviewer's comments ranged from general concern to recommending that all funding caps be removed from all types of awards. These reviewers also stated their general concern regarding a perceived lack of long term Federal financial commitment to the System.

*Response:* Annual appropriations are limited, not unlimited. Funding eligibility limits for each reserve have been established in regulations only where determined appropriate and necessary for the establishment and on-going support of the mission and goals of the System. These regulations establish annual eligibility limits for operations (\$70,000 per year, per reserve) and program-life limits for site acquisition (\$4 million per reserve). Funding eligibility limits have not been established for research, monitoring,

and education grant funds. See subparts F, G, H. Site acquisition limits are statutory. (16 U.S.C. 1461(e)(3)(A))

Funding limits ensure that some funding is available for those types of awards which support most directly the mission and goals of the System (*i.e.*, generally, after designation of a reserve, the competitive awards). As importantly, funding limits are necessary to ensure that available funds are awarded in a relatively fair and proportional manner among national estuarine research reserves. In the absence of such limits, one or a few research reserves could receive the bulk of available funds at the expense of all other reserves. These limits prevent such a substantially disproportionate distribution of limited funding.

At present, some of the existing research reserves in the System are approaching the eligibility limits for acquisition and facility development awards, while most have received less than 50 per cent, and a number less than 25 per cent, of the eligibility limits of these type of awards—a difference between these categories of approximately one to three million dollars. These differences are justifiable on the basis of relative need, reserve size, property values, construction costs, etc. A greater difference in relative allocation of funds between reserves would favor disproportionately some reserves and, as a result, be detrimental to the System as a whole.

Eligibility limits are established for the purposes noted above and not to unreasonably restrict a research reserve from access to available Federal funds. On the basis of NOAA's experience in administering Federal financial assistance for the System and because of comments from many research reserves, the eligibility limit for operation/management awards was raised to a maximum of \$70,000 per site per year. In response to comments on the proposed regulations, the eligibility limit for major facility construction has been raised 50 per cent in these final regulations (see response under proposed § 921.31 below).

*Proposed § 921.1(g)*—One reviewer disagreed with the requirement that land already in a protected status can be included within a reserve only if the managing entity commits to long-term non-manipulative management.

*Response:* NOAA believes this requirement is necessary consistent with the mission and goals of the System. Essentially this same subject is discussed in the response to comments on proposed § 921.1(d) and § 921.1(e). In order to clarify the intent of this provision, NOAA has revised this

sentence to include a reference to the revised § 921.1(d) and § 921.1(e).

#### *Section 921.2—Definitions*

*Proposed § 921.2(b)*—It was noted that the Secretary of Commerce recently delegated authority for matters relating to National Estuarine Research Reserves to the Under Secretary for Oceans and Atmosphere.

*Response:* NOAA agrees with the recommended modification and has changed references from the Assistant Administrator to the Under Secretary throughout.

*Proposed § 921.2(d)*—One reviewer recommended a modification to the second sentence of the definition of estuary to include the term measurably diluted with freshwater rather than minimally diluted.

*Response:* NOAA agrees with the recommended modification the recommended term "minimal" should be the term "measurable". The definition has been changed accordingly.

*Proposed § 921.2(e)*—Five reviewers stated that some confusion has resulted in the reversed order of the terms research and reserve in the name of the System, National Estuarine Reserve Research System, and the name of each individual reserve, national estuarine research reserve.

*Response:* NOAA acknowledges that some confusion has arisen as a result of this difference. However, this is statutory language which only can be changed by amending the Act.

#### *Section 921.4—Relationship to Other Provisions of the Coastal Zone Management Act*

It was noted that the existing program regulations describe this section as "Relationship to other provisions of the Coastal Zone Management Act and to the National Marine Sanctuary Program". Text describing the relationship between the Reserve and Sanctuary Programs was omitted. New marine sanctuaries and estuarine research reserves are being designated in close geographic proximity to one another and therefore improved coordination between the two programs is warranted.

*Response:* NOAA agrees. The revision of the Section heading and text should be adopted and strengthened. The omission of this information from the proposed regulations was an oversight. The Section heading and text have been revised appropriately.

#### *Section 921.10—General*

*Proposed § 921.10(a)*—Five reviewers objected to two or more states which

share a biogeographic region being limited to the development of a single reserve, even if it was a multicomponent reserve with components in each respective state (e.g., Maryland and Virginia in the Chesapeake Bay subregion of the Virginia biogeographic region). These reviewers specifically objected to the eligibility limit on land acquisition funding (see § 921.10(b) and § 921.20) as it applies to any individual reserve, single or multiple component.

**Response:** NOAA agrees. Some of the System's biogeographic subregions are represented by more than one reserve in more than one state. As a result, in the case of a biogeographic region (see Appendix 1) shared by two or more states, each such state should be eligible for Federal financial assistance to establish a national estuarine research reserve within their respective portion of the shared biogeographic region. Section 921.10(a) has been amended to reflect this revision. Because of this revision, the phrase which begins "In the case of a multicomponent national estuarine \* \* \* in § 921.10(a), § 921.31, and § 921.32(c) is no longer necessary and has been deleted.

**Proposed § 921.10(b)**—Two reviewers commented that NOAA should consider a higher eligibility limit or relative greater funding for awards to multicomponent reserves than to single component reserves.

**Response:** NOAA disagrees. Funding for the System is limited. A State elects to establish a multi-component reserve or expand a single component reserve with full knowledge of the identical eligibility limits on any individual reserve, whether single or multiple component. Establishing separate funding eligibility limits for, or disproportionately funding, multicomponent reserves would be likely to have a significant adverse impact on single component reserves and, as a result, the System as a whole. Further, acquisition and development funds are limited by the Act.

#### Section 921.11—Site Selection

**Proposed § 921.11(c)(2)**—One reviewer recommended that the last sentence be revised to eliminate reference to "a natural system."

**Response:** NOAA agrees that a minor revision is necessary to clarify the intent of this sentence. The sentence has been revised in a manner consistent with corresponding clarifying revisions to § 921.1(d) and § 921.1(e).

**Proposed § 921.11(c)(3)**—Three reviewers commented on the concept of "core" and "buffer" areas or zones. Two of these reviewers recommended deleting the concept of a buffer zone.

The remaining reviewer recommended extensive revisions to the subsection to provide guidance on where habitat manipulation would be allowed.

**Response:** After careful review of this subsection, NOAA does not believe that the buffer zone concept should be deleted or that substantive revisions are appropriate. The basic approach presented is sound. A critical concept and distinction between the two areas which may have been overlooked is that key land and water areas ("core") and a buffer zone will likely require significantly different levels of control (see § 921.13(a)(7)). In addition to the basic principles established in the regulations, NOAA has developed more detailed boundary guidance which is available to states attempting to conduct the difficult process of boundary delineation of a proposed site.

**Proposed § 921.11(c)(3)**—One reviewer recommended amending this site selection principle to include "the support of ongoing or planned management activities in nearby estuaries, including those in the National Estuary Program."

**Response:** NOAA considers § 921.11(c)(3) to encompass this concern in that the State is required to demonstrate how the proposed site is consistent with existing and potential land and water uses. Both the designation by NOAA of a reserve under the Act and management plans developed through the National Estuary Program of the U.S. EPA are submitted to the States for a determination of consistency under section 302(c)(1) of the Coastal Zone Management Act of 1972, as amended. NOAA views this mechanism as an effective means for ensuring that resources support and advance the relevant coastal and estuarine management objectives including those of the National Estuary Program. Therefore, § 921.11(c)(3) has been amended to make more specific our intent that the site support estuarine management objectives.

#### Section 921.12—Post Site Selection

**Proposed § 921.12(a)**—Two reviewers recommended a separate type of award for monitoring that would provide long-term support for these activities.

**Response:** NOAA agrees. A new subpart G—Monitoring has been added to the regulations (subparts G and H of the proposed regulations being relettered as subparts H and I, respectively, and the section numbers being renumbered accordingly). Initial funding for basic characterization of the physical, geological, chemical, and biological characteristics of the site will continue to be provided under § 921.12—

Post site selection. In addition, however, under the new subpart G, NOAA may provide financial assistance on a competitive basis for each phase of a monitoring program. These grant awards will be separate from those provided for estuarine research under subpart F.

#### Section 921.13—Management Plan and Environmental Impact Statement Development

**Proposed § 921.13(a)(7)**—Three reviewers provided comment on the acquisition plan guidance of this subsection. Two reviewers requested additional guidance on what constitutes "adequate state control" and commented that the requirement to assess the cost effectiveness of control alternatives is excessively burdensome. The remaining reviewer stated that having four million dollars in funds available for land acquisition is not consistent with the requirement to conduct an assessment of the cost effectiveness of acquisition alternatives.

**Response:** What constitutes "adequate State control" is dependent on site-specific circumstances and requirements. The most efficient use of available acquisition funds can only be ensured through the identification of reasonable control or acquisition alternatives and an assessment of their relative cost and effectiveness. This does not necessarily mean that the least costly option in dollars is the alternative that must be selected. It does mean, however, that all reasonable control alternatives should be thoroughly examined and their relative costs identified. The development of an acquisition plan is an allowable cost (Federal or matching share). Four million dollars is not "available," but is the eligibility limit for land acquisition funds for any one reserve. Regardless of the amount of funding available for land acquisition, a thorough assessment of acquisition alternatives and their cost effectiveness is necessary to ensure responsible and efficient use of Federal grant funds. At a minimum the degree of state control must provide adequate long term protection to ensure for reserve resources a stable environment for research.

**Proposed § 921.13(c)(2)**—One reviewer stated that NOAA's responsibility to make a consistency determination should be made clear early in the regulations.

**Response:** NOAA agrees. A reference to § 921.30(b) has been added to this subsection to clarify NOAA's consistency determination responsibilities early in preparation of the management plan.

**Section 921.20—General**

**Proposed § 921.20**—Two reviewers requested a clarifying revision to the last sentence of this subsection: the addition of the phrase "to a coastal state."

**Response:** NOAA agrees and the section has been revised accordingly.

**Section 921.21(e)—Initial Acquisition and Development Awards**

Two reviewers provided comment on this section. The first reviewer requested clarification that the provision regarding de-designation of a site applies only to properties acquired with Federal funds. The second reviewer stated that the provision to compensate the Federal government for its share of the acquisition cost in the event of de-designation, may be contrary to overall coastal protection objectives because the state may have to sell the property to development interests in order to fully compensate the Federal interest.

**Response:** Regarding the first comment, NOAA does not believe additional clarification is necessary. This subsection states specifically that these provisions apply to "any real property acquired in whole or part with Federal funds . . ." The second commenter acknowledges correctly that these requirements are designed to accomplish the goals of the National Estuarine Research Reserve System and that this provision helps ensure that reserves maintain the standards established for the system and, if they do not, that a percentage of the fair market value is available to other reserves. It should also be noted that these provisions are not new and have been in place since the inception of the Reserve program through grant directives contained in OMB Circular A-102. The provisions in the Reserve regulations are taken directly from the A-102 Circular and apply to all real property acquired in whole or part with Federal funds. It should also be noted that there are other alternatives aside from sale of the property. In the event of de-designation the state may retain title or transfer title to the Federal government. In these instances it is likely that the resources of the reserve could continue to be protected. While none of these alternatives are inexpensive they do, as noted by the commenter, help ensure that the site continues to be managed and maintained in conformance with research reserve goals and objectives.

**Section 921.30—Designation of National Estuarine Research Reserves**

**Proposed § 921.30(a)**—Two reviewers provided comments on the designation criteria listed in this subsection. One reviewer recommended a change in (a)(4) at variance with the Act. The other reviewer recommended an addition to the designation findings to include a requirement that, in the case of a State which contains, in whole or part, a national estuary program convened pursuant to section 320 of the Clean Water Act, suitable consideration has been given to integration of research and public education programs of the estuarine research reserve and the national estuary program. It has also been noted that the final management plan as the governing document for subsequent operations and management of the reserve should contain the signed designation findings. Subpart (a) of this section should also be revised to show that the Under Secretary is responsible for designation of reserves in accordance with the delegation of that authority from the Secretary of Commerce.

**Response:** The terms for designation of a National Estuarine Research Reserve are set forth in the statute. NOAA agrees that research and education programs should be integrated between the Environmental Protection Agency's National Estuary Program and NOAA's National Estuarine Research System. This effort has already been initiated through a memorandum of understanding between the programs at the National level and is being pursued at the local level, where appropriate. Therefore, NOAA believes it does not require restatement in the program regulations. However, NOAA agrees that the management plan should contain the findings of designation and the regulations should show that the Under Secretary is responsible for designation. The regulations have been revised accordingly.

**Section 921.31—Supplemental Acquisition and Development Awards**

**Proposed § 921.31**—Four reviewers expressed concerns that the eligibility limit of \$1,000,000 in Federal financial assistance for facility construction may not be adequate to meet anticipated long term needs and should be increased or eliminated.

**Response:** NOAA agrees. The eligibility limit for facility construction has been increased 50 percent to \$1,500,000.

**Section 921.32—Operation and Management: Implementation of the Management Plan**

**Proposed § 921.32(a-d)**—Seven reviewers objected to the eligibility limit on operations and management awards. They noted that the statute contains no provision for withdrawal of Federal support for continued operation of the reserves. The termination of Federal support for the individual sites is viewed as a lack of Federal commitment to the long-term maintenance of a representative system of estuarine research and education sites.

**Response:** The Reserve Program was designed and continues to be a State-Federal partnership. The key to this partnership is the requirement that NOAA share with the State reserve program the financial needs associated with site designation, land acquisition, research, education and operations.

As discussed previously, appropriate eligibility limits ensure that funding is available for competitive research education and monitoring awards. If, as some reviewers suggested, NOAA removed the annual monetary ceiling for operations and other awards, an inequitable and disproportionate distribution of the limited funds for the program could result. Annual operational eligibility limits in addition to ensuring the availability of funds for competitive projects provide a stability and even distribution among designated and developing reserves. Consequently NOAA is retaining the eligibility limit of \$70,000 for operations and management per site per year.

NOAA concurs with the reviewers' assertion that the statute does not direct the Federal Government to abandon its support and financial commitment to reserve operations at the conclusion of a prescribed period of time or when an arbitrary cumulative funding ceiling for Federal support of operations has been met. By imposing a fixed duration for Federal support of Reserve operations NOAA may undermine its ability to participate effectively with the Reserve system to address coastal and estuarine management issues of national significance. The previously proposed three year support per position allocated through a \$420,000 operations ceiling also established a complex and burdensome administrative process which is further complicated when allocated among Reserves which have already received operations support, and the newly designated sites which have yet to receive such support. To simplify, streamline and improve NOAA's effectiveness in support of

Reserve operations, the three year restriction and other references to cessation of Federal support for operations and management at the reserves have been removed throughout the regulations.

*Section 921.33—Boundary Changes, Amendments to the Management Plan, and Addition of Multiple-site Components*

*Proposed § 921.33(c)*—One reviewer recommended deletion or substantial modification of this subsection to recognize the State's right and ability to appropriately plan and legislate its legal charge—the research reserve. In summary, this reviewer objected to NOAA's approval authority/ requirement for activities discussed in this subsection. The reviewer suggested that it should be sufficient if the State provides NOAA an opportunity for review and comment on proposed changes.

*Response:* NOAA disagrees. NOAA is responsible for Federal oversight of the System and each designated research reserve. As long as a State wishes for a reserve to remain a part of the System and to retain Federal designation, NOAA will continue to require Federal approval of changes in that research reserve's boundaries and management.

*General*

*Proposed § 921.40, § 921.41, and § 921.42*—Several reviewers recommended clarification of the criteria to be used during performance evaluations. Performance criteria should clearly state what constitutes adequate or inadequate performance. One commenter provided a list of items suggested for inclusion in an evaluation. Three reviewers made suggestions on the composition of the evaluation team recommending non-Federal and private individual participation while another commenter suggested the regulations indicate criteria for choosing the members of the evaluation team. Finally a recommendation was offered that the evaluation stress integration of the Reserve program with other state coastal/research programs and that the regulations provide for other dispute resolution mechanisms short of litigation.

*Response:* The periodic evaluation of a national estuarine research reserve is central to NOAA's ability to ensure that reserve operation and management is being conducted in a manner fully consistent with program goals and objectives as defined in section 315 of the Act, 16 U.S.C. 1461, and its implementing regulations. The criteria for an evaluation corresponds directly

with the program goals as specified in § 921.1 of these regulations. The five goals described in this section are nearly identical to the criteria proposed by one commenter. The commenter added cost-effectiveness in using Federal funds as an additional criteria which, while not directly stated as a program goal in the regulations is implicit in any evaluation of efficient management of the total reserve program.

It is not feasible to establish a checklist for any evaluation to predetermine what constitutes adequate versus inadequate performance. Each reserve has very unique administrative structures, environmental resources, and corresponding management needs. NOAA views the evaluation process to be a highly collaborative effort with the State such that the evaluation can be used to focus on particular and specific problem areas. It is not appropriate to attempt to construct a litmus test for inadequate or adequate performance which could reasonably anticipate the substantial variety of issues that are addressed in the evaluation process. NOAA would be justifiably criticized for applying an artificial measure against unique and site-specific circumstances.

NOAA agrees with the comments made regarding participation of other officials in the evaluation process. Such officials provide recommendations to NOAA on specific issues in the evaluation. To ensure that Reserve personnel are directly involved in selection of the evaluation team, § 921.40(c) has been revised to indicate that NOAA will consult with and request recommendations from the Reserve on the appropriate non-NOAA participants prior to the evaluation.

The recommendation that the evaluation examine coordination between the Reserve program and other coastal research efforts is fully consistent with NOAA objectives for the evaluation process and is currently considered under Reserve program criteria to "promote Federal, State, public and private use of one or more reserves within the System when such entities conduct estuarine research." NOAA however, does not agree with the comment that other dispute resolution mechanisms should be devised short of litigation in the event of an unfavorable evaluation that may lead to withdrawal of designation. The provisions contained in both § 921.41 and § 921.42 provide a lengthy and elaborate process for addressing major differences between the NOAA and the Reserve relative to suspension of financial assistance or withdrawal of designation. This process is expressly designed to avoid litigation

on these issues. Therefore, NOAA does not agree that additional mechanisms for dispute resolution are warranted.

*Proposed § 921.40(e)*—Two reviewers recommended a ninety-day requirement for State submittal of an annual report instead of sixty days.

*Response:* NOAA agrees. Section 921.40(e) has been revised accordingly. NOAA also notes that this section indicates that inadequate annual reports will trigger a full scale performance evaluation. This provision is no longer needed since § 921.32 has been changed to provide long term eligibility for operations support. Evaluations consequently will be conducted generally at least every 3 years. The statement has therefore been deleted.

*Section 921.50—General*

*Proposed § 921.50(a)*—Four reviewers commented on this subsection. Three reviewers recommended that research funded under this subpart be allowed in an area larger than the boundaries of the research reserve. One of these reviewers also recommended that the managing entity of the reserve approve all research prior to NOAA funding. One reviewer expressed concern that funding eligibility is tied to NOAA approval of a final management plan.

*Response:* NOAA agrees that greater flexibility should be provided for the area in which federally funded research under this subpart may be conducted. The regulations have been revised to allow research activity in the immediate watershed of the reserve while still requiring the majority of funded activities to be conducted within the boundaries. NOAA also agrees that the managing entity of the reserve should directly indicate approval or disapproval of proposed research project. Currently each reserve is requested to review and assign priority to research projects proposed for the reserve. If a reserve does not approve of a particular project that information should be expressed directly to NOAA.

NOAA agrees that its review and approval of state submitted final management plans should be as expeditious as possible. However, consistent with NOAA's responsibility to ensure that reserve management is conducted in accordance with the mission and goals of the System, the need for an approved final management plan to qualify for NOAA funded research remains.

*Section 921.51—Estuarine Research Guidelines*

*Proposed § 921.51*—Five reviewers recommended that NOAA provide, at

minimum, a more detailed and specific description of the Estuarine Research Guidelines in the regulations. One reviewer objected to NOAA's role in establishing the research priorities for funding under this subpart.

*Response:* NOAA disagrees. Section 315 of the Act requires NOAA to develop guidelines, not regulations, for the conduct of research within the System. A basic description of these guidelines is provided in both the Act and the regulations. Including the guidelines themselves, or a more detailed and specific description of these guidelines, in the regulations would severely limit flexibility in their implementation. NOAA publishes the guidelines annually in the Federal Register and intends to continue to improve these guidelines within the relatively comprehensive standards of the Act. NOAA develops general research priorities on an annual basis in consultation with the estuarine research and resource management community. The agency foresees no advantage to including more specificity or detail than necessary in the Program regulations. The financial support provided under this subpart for Research is administered by NOAA. As a result, NOAA, in consultation with prominent members of the estuarine research community, will continue to determine research priorities for this funding.

#### Subpart G—Interpretation and Education

##### Section 921.60—General

*Proposed § 921.60(a)*—Two reviewers objected to the requirement that interpretive and education projects be conducted within the research reserve.

*Response:* NOAA did not intend to limit funding under this Subpart to activities conducted entirely within the boundaries of a research reserve, and has revised the statement to clarify the intent.

*Proposed § 921.60(b)*—One reviewer suggested NOAA require that all applications for interpretation and education awards be approved by the state.

*Response:* NOAA agrees that applications under this subpart should have the support of the state managing entity. The regulations have been revised accordingly.

##### Section 921.71—Allowable Costs

*Proposed § 921.71(e)(2)*—Two reviewers objected to a one year time limit prior to pre-acquisition being imposed on the allowability for state match of state lands already in a fully-protected status. The commenters noted

that properties included within NERR boundaries, particularly the core area, will be subject to restricted uses, and these uses will be subject to NOAA approval (e.g., research, construction, education). Since these properties add real value to the NERR System, but have diminished use for other purposes, they should be allowable as state match. These reviewers therefore recommended elimination of a one-year time limit.

*Response:* This provision has been adopted in the past to ensure that lands included within the Reserve system are acquired consistent with the purposes and objectives of the Reserve system and, as required by section 315(e)(3)(A) of the Act, to assure that the state has matched the amount of financial assistance provided by the Federal Government for the acquisition of land for a reserve. However, NOAA agrees that the imposition of a one-year time limit may not be the most effective or appropriate method to achieve this purpose. We have therefore eliminated this provision from the regulations and instead allow inclusion of land and submerged lands already in the states' possession as state match irrespective of the date obtained by the state. However, calculation of the amount eligible as match for existing state owned lands will be made by an independent appraiser who will consider the value for match purposes of these lands by calculating the value of benefits foregone by the state, in the use of the land, as a result of new restrictions that may be imposed by Reserve designation.

*Proposed § 921.71(e)(4)*—One reviewer recommended elimination or simplification of the matching share criteria for research awards.

*Response:* The matching share requirement cannot be eliminated because it is required by statute. However, the matching share criteria has been simplified to be consistent with the provisions to § 921.50(a) of subpart F.

#### VI. Other Actions Associated With the 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 the ability of

United States based enterprises to compete with foreign based enterprises in domestic or export markets.

These rules amend existing procedures for identifying, designating, and managing national estuarine research reserves in accordance with the Coastal Zone Management Reauthorization Act of 1985. They will not result in any direct economic or environmental effects nor will they lead to any major indirect economic or environmental impacts.

(B) *Regulatory Flexibility Act Analysis.* A Regulatory Flexibility Analysis is not required for this rulemaking. The regulations set forth procedures for identifying and designating national estuarine research reserves, and managing sites once designated. These rules do not directly affect "small government jurisdictions" as defined by Public Law 96-354, the Regulatory Flexibility Act, and the rules will have no effect on small businesses.

(C) *Paperwork Reduction Act of 1980.* This rule contains collection of information requirements subject to Public Law 96-511, the Paperwork Reduction Act (PRA), which have already been approved by the Office of Management and Budget (approval number 0648-0121). Public reporting burden for the collections of information contained in this rule is estimated to average 2.012 hours per response for management plans and related documentation, 1.25 hours for performance reports, and 15 hours for annual reports and work plans. These estimates include the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of these collections of information, including suggestions for reducing this burden, to Richard Roberts, Room 1235, Department of Commerce, Washington, DC 20230, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503. ATTN: Desk Officer for NOAA.

(D) *Executive Order 12612.* These interim final rules do not contain policies which have sufficient Federalism implications to warrant preparation of a Federalism Assessment pursuant to Executive Order 12612. However, the provisions of the rules setting forth what a state must do or agree to do in order to qualify for the various types of Federal financial assistance available under the rules have been reviewed to ensure that the



rules grant the states the maximum administrative discretion possible in the administration of the National Estuarine Reserve Research System policies embodied in the qualification requirements. In formulating those policies, the NOAA worked with affected states to develop their own policies with respect to the use of National Estuarine Research Reserves. To the maximum extent possible consistent with the NOAA's responsibility to ensure that the objectives of the National Estuarine Reserve Research System provisions of the Coastal Zone Management Act are obtained, the rules refrain from establishing uniform national standards. Extensive consultations with state officials and organizations have been held regarding the financial assistance qualifications imposed. Details regarding awards of financial assistance have been discussed above under the heading "REVISION OF THE PROCEDURES FOR SELECTING, DESIGNATING AND OPERATING NATIONAL ESTUARINE RESEARCH RESERVES" and are not repeated here. Likewise comments from the states regarding qualifications and responses and changes to the regulations regarding same were set forth under the heading SUMMARY OF SIGNIFICANT COMMENTS ON THE PROPOSED REGULATIONS AND NOAA'S RESPONSES. It should be noted that some of the states commented in opposition to conditions or language required by law or by Office of Management and Budget Circular A-102. NOAA does not have the discretion to change such language or conditions.

(E) *National Environmental Policy Act*. NOAA has concluded that publication of these interim final rules does not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, an environmental impact statement is not required.

(F) *Administrative Procedure Act*. These interim final regulations are effective July 23, 1990. To the extent that these regulations relate to grants and cooperative agreements the requirements of the Administrative Procedure Act 5-U.S.C. 553 do not apply. To the extent that any substantive provision does not involve grants or cooperative agreements no useful purpose would be served by delaying the effective date for 30 days. No rights of the participants in this Federal program will be adversely affected by immediate implementation. To the contrary state recipients of financial assistance through this program have

submitted program applications that anticipate immediate implementation of these regulations. Public comments on these interim final regulations are invited and will be considered if submitted on or before September 21, 1990.

#### List of Subjects in 15 CFR Part 921

Administrative practice and procedure. Coastal zone. Environmental impact statements. Grant programs—Natural resources. Reporting and recordkeeping requirements. Research.

(Federal Domestic Assistance Catalog Number 11.420, National Estuarine Reserve Research System)

Dated: July 10, 1990.

Virginia K. Tippie,

*Assistant Administrator for Ocean Services and Coastal Zone Management*

For the reasons set forth in the preamble, 15 CFR part 921 is revised to read as follows:

### PART 921—NATIONAL ESTUARINE RESERVE RESEARCH SYSTEM REGULATIONS

#### Sec.

##### Subpart A—General

- 921.1 Mission, goals and general provisions.
- 921.2 Definitions.
- 921.3 National Estuarine Reserve Research System biogeographic classification scheme and estuarine typologies.
- 921.4 Relationship to other provisions of the Coastal Zone Management Act.

##### Subpart B—Site Selection, Post Site Selection and Management Plan Development

- 921.10 General.
- 921.11 Site selection.
- 921.12 Post site selection.
- 921.13 Management plan and environmental impact statement development.

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

- 921.20 General.
- 921.21 Initial acquisition and development awards.

##### Subpart D—Reserve Designation and Subsequent Operation

- 921.30 Designation of National Estuarine Research Reserves.
- 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.

##### Subpart E—Performance Evaluation and Withdrawal of Designation

- 921.40 Evaluation of system performance.
- 921.41 Suspension of eligibility for financial assistance.
- 921.42 Withdrawal of designation.

#### Sec.

##### Subpart F—Research

- 921.50 General.
- 921.51 Estuarine research guidelines.
- 921.52 Promotion and coordination of estuarine research.

##### Subpart G—Monitoring

- 921.60 General.

##### Subpart H—Interpretation and Education

- 921.70 General.
- 921.71 Categories of potential interpretive and educational projects; evaluation criteria.

##### Subpart I—General Financial Assistance Provisions

- 921.80 Application information.
- 921.81 Allowable costs.
- 921.82 Amendments to financial assistance awards.

##### Appendix I to Part 921—Biogeographic Classification Scheme

##### Appendix II to Part 921—Typology of National Estuarine Research Reserves

Authority: Sec. 375, Public Law 92-583, as amended; 86 Stat. 1280 (16 U.S.C. 1461).

##### Subpart A—General

#### § 921.1 Mission, goals and general provisions.

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

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

(1) Ensure a stable environment for research through long-term protection of estuarine reserve resources;

(2) Address coastal management issues identified as significant through coordinated estuarine research within the System;

(3) Enhance public awareness and understanding of the estuarine environment and provide suitable opportunities for public education and interpretation;

(4) Promote Federal, state, public and private use of one or more reserves within the System when such entities conduct estuarine research; and

(5) Conduct and coordinate estuarine research within the System, gathering and making available information necessary for improved understanding and management of estuarine areas.

(c) National estuarine research reserves shall be open to the public to

the extent permitted under State and Federal law. Multiple uses are allowed to the degree compatible with the research reserve's overall purpose as provided in the management plan (see § 921.13) and consistent with paragraphs (a) and (b) of this section. Use levels are set by the individual state and analyzed in the management plan. The research reserve management plan shall describe the uses and establish priorities among these uses. The plan shall identify uses requiring a state permit, as well as areas where uses are encouraged or prohibited. Consistent with resource protection and research objectives, public access may be restricted to certain areas within a research reserve.

(d) Habitat manipulation for research purposes is allowed consistent with the following limitations. Manipulative research activities must be specified in the management plan, be consistent with the mission and goals of the program (see paragraphs (a) and (b) of this section) and the goals and objectives of the affected research reserve, and be limited in nature and extent to the minimum manipulative activity necessary to accomplish the stated research objective. Manipulative research activities with a significant or long-term impact on reserve resources require the prior approval of the state and the National Oceanic and Atmospheric Administration (NOAA). Manipulative research activities which can reasonably be expected to have a significant adverse impact on the estuarine resources and habitat of a reserve, such that the activities themselves or their resulting short- and long-term consequences compromise the representative character and integrity of a reserve, are not allowed. Habitat manipulation for resource management purposes is not permitted within national estuarine research reserves, except as allowed for restoration activities consistent with paragraph (e) of this section. NOAA may allow an exception to this prohibition if manipulative activity is necessary for the protection of public health or the preservation of other sensitive resources which have been listed or are eligible for protection under relevant Federal or state authority (e.g., threatened/endangered species or significant historical or cultural resources). If habitat manipulation is determined to be necessary for the protection of public health or the preservation of sensitive resources, then these activities shall be specified in the Reserve Management Plan and limited to the reasonable alternative which has the least adverse and shortest term impact on the

representative and ecological integrity of the reserve.

(e) Under the Act an area may be designated as an estuarine reserve only if the area is a representative estuarine ecosystem that is suitable for long-term research. Many estuarine areas have undergone some ecological change as a result of human activities (e.g., hydrological changes, intentional/unintentional species composition changes—introduced and exotic species). In those areas proposed or designated as national estuarine research reserves, such changes may have diminished the representative character and integrity of the site. Although restoration of degraded areas is not a primary purpose of the System, such activities may be permitted to improve the representative character and integrity of a reserve. Restoration activities must be carefully planned and approved by NOAA through the Reserve Management Plan. Historical research may be necessary to determine the "natural" representative state of an estuarine area (i.e., an estuarine ecosystem minimally affected by human activity or influence). Frequently, restoration of a degraded estuarine area will provide an excellent opportunity for management oriented research.

(f) NOAA may provide financial assistance to coastal states, not to exceed 50 percent of all actual costs or \$4 million whichever amount is less, to assist in the acquisition of land and waters, or interests therein. NOAA may provide financial assistance to coastal states not to exceed 50 percent of all actual costs for the management and operation of, and the conduct of educational or interpretive activities concerning, national estuarine research reserves (see subpart I of this part). NOAA may provide financial assistance to any coastal state or public or private person, not to exceed 50 percent of all actual costs, to support research and monitoring within a national estuarine research reserve. Five types of awards are available under the National Estuarine Reserve Research System Program. The predesignation awards are for site selection, draft management plan preparation and conduct of basic characterization studies. Acquisition and development awards are intended primarily for acquisition of interests in land and construction. The operation and management award provides funds to assist in implementing the research, educational, and administrative programs detailed in the research reserve management plan and is reflective of the joint State-Federal partnership in the preservation and

protection of estuarine resources. The research and monitoring awards provide funds to conduct estuarine research and monitoring within the System. The educational and interpretive award provides funds to conduct estuarine educational and interpretive activities within the System.

(g) Lands already in protected status managed by other Federal agencies, state or local governments, or private organizations can be included within national estuarine research reserves only if the managing entity commits to long-term non-manipulative management consistent with paragraphs (d) and (e) of this section in the reserve management plan. Federal lands already in protected status cannot comprise the key land and water areas of a research reserve (see § 921.11(c)(3)).

(h) 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 research reserve system. As part of this role, NOAA will ensure that information and ideas from one reserve are made available to others in the system. The network will enable reserves 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.

#### § 921.2 Definitions.

(a) *Act* means the Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1451 *et seq.* Section 515 of the Act, 16 U.S.C. 1461, establishes the National Estuarine Reserve Research System.

(b) *Under Secretary* means the Under Secretary for Oceans and Atmosphere, U.S. Department of Commerce, 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 these regulations the term also includes Puerto Rico, the Virgin Islands, Guam, the Commonwealth of the Northern Mariana Islands, the Trust Territories of the Pacific Islands, and American Samoa (see 16 U.S.C. 1453(4)).

(d) *Estuary* means that part of a river or stream or other 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 with measurable freshwater influence and having unimpaired connections with the open sea, and estuary-type areas of the Great Lakes and their connecting waters. See 16 U.S.C. 1453(7)).

(e) *National Estuarine Research Reserve* means an area that is a representative estuarine ecosystem suitable for long-term research, 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, and which is set aside as a natural field laboratory to provide long-term opportunities for research, education, and interpretation on the ecological relationships within the area (see 16 U.S.C. 1453(8)) and meets the requirements of 16 U.S.C. 1461(b). This includes those areas designated as national estuarine sanctuaries under section 315 of the Act prior to the date of the enactment of the Coastal Zone Management Reauthorization Act of 1985 and each area subsequently designated as a national estuarine research reserve.

**§ 921.3 National Estuarine Reserve Research System biogeographic classification scheme and estuarine typologies.**

(a) National estuarine research reserves 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 Reserve Research System includes at least one site from each region. The estuarine typology system is utilized to ensure that sites in the System reflect the wide range of estuarine types within the United States.

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

(c) The typology system is presented in Appendix II to this part.

**§ 921.4 Relationship to other provisions of the Coastal Zone Management Act.**

(a) The National Estuarine Reserve Research System is intended to provide information to state agencies and other entities involved in addressing coastal management issues. 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 Reserve Research System (see § 921.2(c)).

(b) For purposes of consistency review by states with a federally approved coastal zone management program, the designation of a national estuarine research reserve is deemed to be a Federal activity, which, if directly affecting the state's coastal zone, must be undertaken in a manner consistent to the maximum extent practicable with the approved state coastal zone program as provided by section 1456(c)(1) of the Act, and implementing regulations at 15 CFR part 930, subpart C. In accordance with section 1456(c)(1) of the Act and the applicable regulations NOAA will be responsible for certifying that designation of the reserve is consistent with the State approved coastal zone management program. The State must concur with or object to the certification. It is recommended that the lead State agency for reserve designation consult at the earliest practicable time, with the appropriate State officials concerning the consistency of the proposed national estuarine research reserve.

(c) The National Estuarine Reserve Program will be administered 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. 1431-1445), also administered by NOAA. Title III authorizes the Secretary of Commerce to designate discrete areas of the marine environment as marine sanctuaries to protect or restore such areas for their conservation, recreational, ecological, historical, research, educational or esthetic values. National marine sanctuaries and estuarine research reserves may not overlap, though they may be adjacent.

**Subpart B—Site Selection, Post Site Selection and Management Plan Development**

**§ 921.10 General.**

(a) A state may apply for Federal financial assistance for the purpose of site selection, preparation of documents specified in § 921.13 (draft management plan and environmental impact statement (EIS)) and the conduct of research necessary to complete basic characterization studies. The total Federal share of this group of pre-designation awards may not exceed \$100,000, of which up to \$25,000 may be used for site selection as described in § 921.11. Federal financial assistance for preacquisition activities under § 921.11 and § 921.12 is subject to the total \$4

million for which each reserve is eligible for land acquisition. In the case of a biogeographic region (see Appendix I to this part) shared by two or more states, each state is eligible for Federal financial assistance to establish a national estuarine research reserve within their respective portion of the shared biogeographic region. Financial assistance application procedures are specified in subpart I of this part.

(b) In developing a research reserve program, a state may choose to develop a multiple-site research reserve reflecting a diversity of habitats in a single biogeographic region. A multiple-site research reserve also allows the state to develop complementary research and educational programs within the individual components of its multi-site research reserve. Multiple-site research reserves are treated as one reserve in terms of financial assistance and development of an overall management framework and plan. Each individual site of a proposed multiple-site research reserve shall be evaluated both separately under § 921.11(c) and collectively as part of the site selection process. A state may propose to establish a multiple-site research reserve at the time of the initial site selection, or at any point in the development or operation of the estuarine research reserve, even after Federal funding for the single site research reserve has expired. If the state decides to develop a multiple-site national estuarine research reserve after the initial acquisition and development award is made for a single site, the proposal is subject to the requirements set forth in § 921.33(b). However, a state may not propose to add one or more sites to an already designated research reserve if the operation and management of such research reserve has been found deficient and uncorrected or the research conducted is not consistent with the Estuarine Research Guidelines in accordance with the provisions of subparts E and F of this part. In addition, Federal funds acquisition of a multiple-site research reserve remains limited to \$4,000,000 (see § 921.20). The funding for operation of a multiple-site research reserve is limited to \$70,000 per year (see § 921.32(c)) and preacquisition funds are limited to \$100,000 per reserve.

**§ 921.11 Site selection.**

(a) A state may use up to \$25,000 in Federal funds to establish and implement a site selection process which is approved by NOAA.

(b) In addition to the requirements set forth in subpart I of this part, 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 contribution to the biogeographical and typological balance of the National Estuarine Reserve Research System. NOAA will give priority consideration to proposals to establish reserves in biogeographic regions or subregions that are not represented in the system (see the biogeographic classification scheme and typology set forth in § 921.3 and appendices I and II to this part);

(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 must be a representative estuarine ecosystem and should, to the maximum extent possible, be an estuarine ecosystem minimally affected by human activity or influence (see § 921.1(e));

(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. Research reserve boundaries must encompass the area within which adequate control has or will be established by the managing entity over human activities occurring within the reserve. Generally, reserve boundaries will encompass two areas: key land and water areas (or "core area") and a buffer zone. Key land and water areas and a buffer zone will likely require significantly different levels of control (see § 921.13(a)(7)). The term "key land and water areas" refers to that core area within the reserve that is so vital to the functioning of the estuarine ecosystem that it must be under a level of control sufficient to ensure the long-term viability of the reserve for research on natural processes. Key land and water areas, which comprise the core area, are

those ecological units of a natural estuarine system which preserve, for research purposes, a full range of significant physical, chemical and biological factors contributing to the diversity of fauna, flora and natural processes occurring within the estuary. The determination of which land and water areas are "key" to a particular reserve must be based on specific scientific knowledge of the area. A basic principle to follow when deciding upon key land and water areas is that they should encompass resources representative of the total ecosystem, and which if compromised could endanger the research objectives of the reserve. The term "buffer zone" refers to an area adjacent to or surrounding key land and water areas and essential to their integrity. Buffer zones protect the core area and provide additional protection for estuarine-dependent species, including those that are rare or endangered. When determined appropriate by the state and approved by NOAA, the buffer zone may also include an area necessary for facilities required for research and interpretation. Additionally, buffer zones should be established sufficient to accommodate a shift of the core area as a result of biological, ecological or geomorphological change which reasonably could be expected to occur. National estuarine research reserves may include existing Federal or state lands already in a protected status where a net benefit can be enhanced. However, NOAA will not approve a site for potential national estuarine research reserve status that is dependent primarily upon the inclusion of currently protected Federal lands in order to meet the requirements for research reserve status (such as key land and water areas). Such lands generally will be included within a research reserve to serve as a buffer or for other ancillary purposes:

(4) The site's suitability for long-term estuarine research, including ecological factors and proximity to existing research facilities and educational institutions;

(5) The site's compatibility with existing and potential land and water uses in contiguous areas as well as approved coastal and estuarine management plans; 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

being considered for selection as a potential national estuarine research reserve. After the local government(s) and affected landowner(s) 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.

(e) A state request for NOAA approval of a proposed site (or sites in the case of a multi-site reserve) must contain a description of the proposed site in relationship to each of the site selection principles (§ 921.11(c)) and the following information:

(1) An analysis of the proposed site based on the biogeographical scheme/typology discussed in § 921.3 and set forth in appendices I and II to this part;

(2) A description of the proposed 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. Copies of all correspondence, including contact letters to all affected landowners must be appended;

(4) A list of all sites considered and a brief statement of the basis for not selecting the non-preferred sites; and

(5) A nomination of the proposed site(s) for designation as a National Estuarine Research Reserve by the Governor of the coastal state in which the area is located.

#### § 921.12 Post site selection.

(a) At the time of the state's request for NOAA approval of a proposed site, the state may submit a request for up to \$40,000 of the total \$100,000 allowed for pre-designation funds to develop the draft management plan and for the collection of the information necessary for preparation of the environmental impact statement. At this time, the state may also submit a request for the remainder of the pre-designation funds for research necessary to complete a basic characterization of the physical, chemical and biological characteristics of the site approved by NOAA. The state's request for these post site selection funds must be accompanied by the information specified in subpart I of this part and, for draft management plan

development and environmental impact statement information collection, the following programmatic information:

(1) A draft management plan outline (see § 921.13(a) below); and

(2) An outline of a draft memorandum of understanding (MOU) between the state and NOAA detailing the Federal-state role in research reserve management during the initial period of Federal funding and expressing the state's long-term commitment to operate and manage the national estuarine research reserve.

(b) The state is eligible to use the funds referenced in § 921.12(a) after the proposed site is approved by NOAA under the terms of § 921.11.

**§ 921.13 Management plan and environmental impact statement development.**

(a) After NOAA approves the state's proposed site, the state may request to use additional predesignation funds for draft management plan development and the collection of information necessary for the preparation by NOAA of the environmental impact statement. The state shall develop a draft management plan, including an MOU. The plan will set out in detail:

(1) Research reserve 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 education/interpretive plan;

(5) A plan for public access to the research reserve;

(6) A construction plan, including a proposed construction schedule, general descriptions of proposed developments and preliminary drawings, if appropriate. Information should be provided for proposed minor construction projects in sufficient detail to allow these projects to begin in the initial phase of acquisition and development. If a visitor center, research center or any other facilities are proposed for construction or renovation at the site, or restorative activities which require significant construction are planned, a detailed construction plan including preliminary cost estimates and architectural drawings must be prepared as a part of the final management plan; and

(7) An acquisition plan identifying the ecologically key land and water areas of the research reserve, ranking these areas according to their relative importance, and including a strategy for

establishing adequate long-term state control over these areas sufficient to provide protection for reserve resources to ensure a stable environment for research. This plan must include an identification of ownership within the proposed research reserve boundaries, including land already in the public domain; the method(s) of acquisition which the state proposes to use—acquisition (including less-than-fee simple options) to establish adequate long-term state control; an estimate of the fair market value of any property interest—which is proposed for acquisition; a schedule estimating the time required to complete the process of establishing adequate state control of the proposed research reserve; and a discussion of any anticipated problems. In selecting a preferred method(s) for establishing adequate state control over areas within the proposed boundaries of the reserve, the state shall perform the following steps for each parcel determined to be part of the key land and water areas (control over which is necessary to protect the integrity of the reserve for research purposes), and for those parcels required for research and interpretive support facilities or buffer purposes:

(i) Determine, with appropriate justification, the minimum level of control(s) required (e.g., management agreement, regulation, less-than-fee simple property interest (e.g., conservation easement), fee simple property acquisition, or a combination of these approaches;

(ii) Identify the level of existing state control(s);

(iii) Identify the level of additional state control(s), if any, necessary to meet the minimum requirements identified in (a)(7)(i) of this section;

(iv) Examine all reasonable alternatives for attaining the level of control identified in (a)(7)(iii) of this section, and perform a cost analysis of each; and

(v) Rank, in order of cost, the methods (including acquisition) identified in paragraph (a)(7)(iv) of this section.

An assessment of the relative cost-effectiveness of control alternatives shall include a reasonable estimate of both short-term costs (e.g., acquisition of property interests, regulatory program development including associated enforcement costs, negotiation, adjudication, etc.) and long-term costs (e.g., monitoring, enforcement, adjudication, management and coordination). In selecting a preferred method(s) for establishing adequate state control over each parcel examined under the process described above, the

state shall give priority consideration to the least costly method(s) of attaining the minimum level of long-term control required. Generally, with the possible exception of buffer areas required for support facilities, the level of control(s) required for buffer areas will be considerably less than that required for key land and water areas. This acquisition plan, after receiving the approval of NOAA, shall serve as a guide for negotiations with landowners. A final boundary for the reserve shall be delineated as a part of the final management plan:

(8) A resource protection plan detailing applicable authorities, including allowable uses, uses requiring a permit and permit requirements, any restrictions on use of the research reserve, and a strategy for research reserve 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;

(10) A proposed memorandum of understanding (MOU) between the state and NOAA regarding the establishment and development of the national estuarine research reserve, and expressing a long-term commitment by the state to maintain and manage the research reserve in accordance with section 315 of the Act 16 U.S.C. 1461, and applicable regulations. 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 and operation of the national estuarine research reserve. The MOU shall be signed prior to research reserve 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; and

(11) If the state has a federally approved coastal zone management program, documentation that the proposed national estuarine research reserve is consistent to the maximum extent practicable with that program. See § 921.4(b) and § 921.30(b).

(b) Regarding the preparation of an environmental impact statement (EIS) under the National Environmental Policy Act on a national estuarine research reserve 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.

(c) 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 15 days prior to the meeting. The state shall be responsible for publishing a similar notice in the local media.

(d) NOAA will publish a Federal Register notice of intent to prepare a draft EIS. 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 national estuarine research reserve. The hearing will be held no sooner than 15 days after appropriate notice of the meeting has been given in the principal news media and in the Federal Register by NOAA and the state, respectively. After a 45-day comment period, a final EIS will be prepared by NOAA.

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

##### § 921.20 General.

The acquisition and development period is separated into two major phases. After NOAA approval of the site, draft management plan and draft MOU, and completion of the final EIS, a state is eligible for an initial acquisition and development award(s). In this initial phase, the state should work to meet the criteria required for formal research reserve designation: e.g., establishing adequate state control over the key land and water areas as specified in the draft management plan and preparing the final management plan. These requirements are specified in § 921.30. Minor construction in accordance with the draft management plan may also be conducted during this initial phase. The initial acquisition and development phase is expected to last no longer than three years. If necessary, a longer time period may be negotiated between the state and NOAA. After research reserve designation, a state is eligible for a supplemental acquisition and development award(s) in accordance with § 921.31. In this post-designation acquisition and development phase,

funds may be used in accordance with the final management plan to construct research and educational facilities, complete any remaining land acquisition, and for restorative activities identified in the final management plan. In any case, the amount of Federal financial assistance provided to a coastal state with respect to the acquisition of lands and waters, or interests therein, for any one national estuarine research reserve may not exceed an amount equal to 50 percent of the costs of the lands, waters, and interests thereon or \$4,000,000, whichever amount is less. The amount of Federal assistance for development and construction activities is \$1,500,000.

##### § 921.21 Initial acquisition and development awards.

(a) Assistance is provided to aid the recipient in:

- (1) Acquiring a fee simple or less-than-fee simple real property interest in land and water areas to be included in the research reserve boundaries (see § 921.13(a)(7); § 921.30(d));
- (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 research reserve designation, initial management costs, e.g., for implementing the NOAA approved draft management plan, preparing the final management plan, hiring a reserve manager and other staff as necessary and for other management-related activities. Application procedures are specified in subpart I of this part.

(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, or for proposed restorative activities, 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 during the initial acquisition and development phase. 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) through (c) of this section, construction projects, to be funded in whole or in part under an acquisition and development award(s), may not be initiated until the research reserve receives formal designation (see § 921.30). This requirement has been adopted to ensure that substantial progress in establishing adequate state control over 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 establishing adequate state control/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) For any real property acquired in whole or part with Federal funds for the research reserve the state shall execute suitable title documents to include substantially the following provisions, or otherwise append the following provisions in a manner acceptable under applicable state law to the official land record(s):

(1) Title to the property conveyed by this deed shall vest in the [recipient of the award granted pursuant to section 315 of the Act, 16 U.S.C. 1461 or other NOAA approved state agency] subject to the condition that the designation of the [name of National Estuarine Reserve] is not withdrawn and the property remains part of the federally designated [name of National Estuarine Research Reserve].

(2) In the event that the property is no longer included as part of the research reserve, or if the designation of the research reserve of which it is part is withdrawn, then NOAA or its successor agency, after full and reasonable consultation with the State, may exercise the following rights regarding the disposition of the property:

(i) The recipient may 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;

(ii) If the recipient does not elect to retain title, the Federal Government may either direct the recipient 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 (after deducting actual and reasonable

selling and repair or renovation expenses, if any, from the sale proceeds), or direct the recipient to transfer title to the Federal Government. If directed to transfer title to the Federal Government, the recipient shall be entitled to compensation computed by applying the recipient's percentage of participation in the cost of the original project to the current fair market value of the property:

(iii) 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 Department of Commerce Regulations in 15 CFR part 24, and Uniform Relocation Assistance and Real Property Acquisition for Federal and Federally assisted programs in 15 CFR part 11.

(f) Upon instruction by NOAA, provisions analogous to those of § 921.21(e) shall be included in the documentation underlying less-than-fee-simple interests acquired in whole or part with Federal funds.

(g) Federal funds or non-Federal matching share funds shall not be spent to acquire a real property interest in which the State will own the land concurrently with another entity unless the property interest has been identified as a part of an acquisition strategy pursuant to § 921.13(7) which has been approved by NOAA prior to the effective date of these regulations.

(h) Prior to submitting the final management plan to NOAA for review and approval, the state shall hold a public meeting to receive comment on the plan in the area affected by the estuarine research reserve. NOAA will publish a notice of the meeting in the Federal Register. The state shall be responsible for having a similar notice published in the local media.

#### Subpart D—Reserve Designation and Subsequent Operation

##### § 921.30 Designation of National Estuarine Research Reserves.

(a) The Under Secretary may designate an area as a national estuarine research reserve pursuant to section 315 of the Act, if based on written findings the state has met the following requirements:

(1) The Governor of the coastal state in which the area is located has nominated the area for designation as a national estuarine research reserve;

(2) The area is a representative estuarine ecosystem that is suitable for long-term research and contributes to the biogeographical and typological balance of the System;

(3) Key land and water areas of the proposed research reserve, as identified

in the management plan, are under adequate state control sufficient to provide long-term protection for reserve resources and to ensure a stable environment for research;

(4) Designation of the area as a reserve will serve to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation;

(5) A final management plan has been approved by NOAA and contains the signed copy of the designation findings;

(6) An MOU has been signed between the state and NOAA ensuring a long-term commitment by the state to the effective operation and implementation of the national estuarine research reserve; and

(7) The coastal state in which the area is located has complied with the requirements of these regulations.

(b) NOAA will determine whether the designation of a national estuarine research reserve in a state with a federally approved coastal zone management program directly affects the coastal zone. If the designation is found to directly affect the coastal zone, NOAA will make a consistency determination pursuant to section 307(c)(1) of the Act, 16 U.S.C. 1456, and 15 CFR part 930, subpart C. See § 921.4(b). The results of this consistency determination will be published in the Federal Register when a notice of designation is published. See § 921.30(c).

(c) NOAA will cause a notice of designation of a national estuarine research reserve to be placed in the Federal Register. The state shall be responsible for having a similar notice published in the local media.

(d) The term "state control" in § 921.30(a)(3) does not necessarily require that key land and water areas be owned by the state in fee simple. Acquisition of less-than-fee-simple interests (e.g., conservation easements) and utilization of existing State regulatory measures are encouraged where the state can demonstrate that these interests and measures assure adequate long-term State control consistent with the purposes of the research reserve (see also § 921.13(a)(7); § 921.21(g)). Should the state later elect to purchase an interest in such lands using NOAA funds, adequate justification as to the need for such acquisition must be provided to NOAA.

##### § 921.31 Supplemental acquisition and development awards.

After national estuarine research reserve designation, and as specified in the approved management plan, the

state may request a supplemental acquisition and/or development award(s) for acquiring additional property interests identified in the management plan as necessary to enhance long-term protection of the area for research and education, for facility construction, for restorative activities identified in the approved management plan, and for administrative purposes. The amount of Federal financial assistance provided for supplemental development costs directly associated with facility construction other than land acquisition (i.e., major construction activities) for any one national estuarine research reserve may not exceed \$1,500,000 and must be matched by the state on a 50/50 basis. Supplemental acquisition awards for the acquisition of lands or waters, or interests therein, for any one National Estuarine Reserve may not exceed an amount equal to 50 percent of the cost of the lands, waters and interests therein or \$4,000,000 whichever amount is less. In the case of a biogeographic region (see Appendix to this part) shared by two or more states, each state is eligible for Federal financial assistance to establish a national estuarine research reserve within their respective portion of the shared biogeographic region. Application procedures are specified in subpart I of this part. Land acquisition must follow the procedures specified in § 921.13(a)(7), § 921.21 (e) and (f) and § 921.31.

##### § 921.32 Operation and management implementation of the management plan.

(a) After the national estuarine research reserve is formally designated, the state is eligible to receive Federal funds to assist the state in the operation and management of the research reserve. The purpose of this Federally funded operation and management phase is to implement the approved management plan and to take the necessary steps to ensure the continued effective operation of the research reserve.

(b) State operation and management of national estuarine research reserve shall be consistent with the mission, and shall further the goals, of the National Estuarine Research Reserve System (see § 921.1).

(c) Federal funds of up to \$70,000 per year, to be matched by the state on a 50/50 basis, are available for the operation and management of the national estuarine research reserve, including the establishment and operation of a basic environmental monitoring program. In the case of a biogeographic region (see appendix I

this part) shared by two or more states, each state is eligible for Federal financial assistance to establish a national estuarine research reserve within their respective portion of the shared biogeographic region (see § 921.10).

(d) Operation and management funds are subject to the following limitations:

(1) No more than \$70,000 in Federal funds may be expended in a twelve month award period (*i.e.*, Federal funds for operation and management may not be expended at a rate greater than \$70,000 per year);

(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.*, \$14,000 maximum per year).

**§ 921.33 Boundary changes, amendments to the management plan, and addition of multiple-site components.**

(a) Changes in research reserve boundaries and major changes to the final management plan, including state laws or regulations promulgated specifically for the research reserve, 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 public comment. Changes in the boundaries of the research reserve 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 and possibly, an environmental impact statement, may be required. Where public notice is required, NOAA will place a notice in the Federal Register of any proposed changes in research reserve boundaries or proposed major changes to the final management plan. The state shall be responsible for publishing an equivalent notice in the local media. See also requirements of § 921.4(b) and § 921.13(a)(11).

(b) As discussed in § 921.10(b), a state may choose to develop a multiple-site national estuarine research reserve after the initial acquisition and development award for a single site has been made. Public notice of the proposed addition will be placed by NOAA in the Federal Register. The state shall be responsible for publishing an equivalent notice in the local media. An opportunity for comment, in addition to the preparation of either an environmental assessment or environmental impact statement on the proposal, will also be required. An environmental impact statement, if required, shall be prepared in

accordance with section § 921.13 and shall include an administrative framework for the multiple-site research reserve and a description of the complementary research and educational programs within the research reserve. 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 multiple-site research reserve, then the state shall develop a revised management plan which, concerning the additional component, incorporates each of the elements described in § 921.13(a). The revised management plan shall address goals and objectives for all components of the multi-site research reserve and the additional component's relationship to the original site(s).

**Subpart E—Performance Evaluation and Withdrawal of Designation**

**§ 921.40 Evaluation of system performance.**

(a) Following designation of a national estuarine research reserve pursuant to § 921.30, periodic performance evaluations shall be conducted concerning the operation and management of each national estuarine research reserve, including the research and monitoring being conducted within the reserve and education and interpretive activities. Evaluations may assess performance in all aspects of research reserve operation and management or may be limited in scope, focusing on selected issues of importance. Performance evaluations in assessing research reserve operation and management may also examine whether a research reserve is in compliance with the requirements of these regulations, particularly whether:

(1) The operation and management of the research reserve is consistent with and furthers the mission and goals of the National Estuarine Reserve Research System (see § 921.1); and

(2) A basis continues to exist to support any one or more of the findings made under § 921.30(a).

(b) Generally, performance will be evaluated at least every three years. More frequent evaluations may be scheduled as determined to be necessary by NOAA.

(c) Performance evaluations will be conducted by Federal officials. When determined to be necessary, Federal and non-Federal experts in natural resources management, estuarine research, interpretation or other aspects of national estuarine research reserve operation and management may be requested by NOAA to participate in

performance evaluations. If other experts are to be included in the evaluation, NOAA will first ask the state to recommend appropriate individuals to serve in that capacity.

(d) Performance evaluations will be conducted in accordance with the procedural and public participation provisions of the CZMA regulations on review of performance at 15 CFR part 928 (*i.e.*, § 928.3(b) and § 928.4).

(e) To ensure effective Federal oversight of each research reserve within the National Estuarine Reserve Research System the state is required to submit an annual report on operation and management of the research reserve during the immediately preceding state fiscal year. This annual report must be submitted within a ninety day period following the end of the state fiscal year. The report shall detail program successes and accomplishments, referencing the research reserve management plan and, as appropriate, the work plan for the previous year. A work plan, detailing the projects and activities to be undertaken over the coming year to meet the goals and objectives of the research reserve as described in the management plan and the state's role in ongoing research reserve programs, shall also be included.

**§ 921.41 Suspension of eligibility for financial assistance.**

(a) If a performance evaluation under § 921.40 reveals that the operation and management of the research reserve is deficient, or that the research being conducted within the reserve is not consistent with the Estuarine Research Guidelines referenced in subpart F of this part, the eligibility of the research reserve for Federal financial assistance as described in these regulations may be suspended until the deficiency or inconsistency is remedied.

(b) NOAA will provide the state with a written notice of the deficiency or inconsistency. This notice will explain the finding, assess the Federal role in contributing to the problem, propose a solution or solutions, provide a schedule by which the state should remedy the deficiency or inconsistency, and state whether the state's eligibility for Federal financial assistance has been suspended in whole or part. In this notice the state shall also be advised that it may comment on this finding and meet with NOAA officials to discuss the results of the performance evaluation and seek to remedy the deficiency or inconsistency.

(c) Eligibility of a research reserve for financial assistance under these regulations shall be restored upon written notice by NOAA to the state



that the deficiency or inconsistency has been remedied.

(d) If, after a reasonable time, a state does not remedy a deficiency in the operation and management of a national estuarine research reserve which has been identified pursuant to a performance evaluation under § 921.40(a), such outstanding deficiency shall be considered a basis for withdrawal of designation (see § 921.42).

#### § 921.42 Withdrawal of designation.

(a) Designation of an estuarine area as a national estuarine research reserve may be withdrawn if a performance evaluation conducted pursuant to § 921.40 reveals that:

(1) The basis for any one or more of the findings made under § 921.30(a) in designating the research reserve no longer exists;

(2) A substantial portion of the research conducted within the research reserve, over a period of years, has not been consistent with the Estuarine Research Guidelines referenced in subpart F of this part; or

(3) A state, after a reasonable time, has not remedied a deficiency in the operation and management of a research reserve identified pursuant to an earlier performance evaluation conducted under § 921.40.

(b) If a basis is found under § 921.42(a) for withdrawal of designation, NOAA will provide the state with a written notice of this finding. This notice will explain the basis for the finding, propose a solution or solutions and provide a schedule by which the state should correct the deficiency. In this notice, the state shall also be advised that it may comment on the finding and meet with NOAA officials to discuss the finding and seek to correct the deficiency.

(c) If, within a reasonable period of time, the deficiency is not corrected in a manner acceptable to NOAA, a notice of intent to withdraw designation, with an opportunity for comment, will be placed in the Federal Register.

(d) The state shall be provided the opportunity for an informal hearing before the Under Secretary to consider NOAA's finding of deficiency and intent to withdraw designation, as well as the state's comments on and response to NOAA's written notice pursuant to § 921.42(b) and Federal Register notice pursuant to § 921.42(c).

(e) Within 30 days after the informal hearing, the Under Secretary shall issue a written decision regarding the designation status of the national estuarine research reserve. If a decision is made to withdraw research reserve designation, the procedures specified in

§ 921.21(e) regarding the disposition of real property acquired in whole or part with Federal funds shall be followed.

(f) NOAA may not withdraw designation of a national estuarine research reserve if the performance evaluation reveals that the deficiencies in management of the site are a result of inadequate Federal financial support.

#### Subpart F—Research

##### § 921.50 General.

(a) To stimulate high quality research within designated national estuarine research reserves, NOAA may provide financial support for research which is consistent with the Estuarine Research Guidelines referenced in § 921.51. Research awards may be awarded under this subpart to only those designated research reserves with approved final management plans with the following exception: NOAA may award research awards under this subpart to reserves without final management plans that have been designated prior to the effective date of these regulations; in the absence of an approved final management plan, however these reserves will be eligible for research awards during only the first two years after the effective date of these regulations. Although this research may be conducted within the immediate watershed of the research reserve, the majority of research activities of any single research project funded under this subpart must be conducted within reserve boundaries. Research funds are primarily used to support management-related research that will enhance scientific understanding of the research reserve ecosystem, provide information needed by reserve managers and coastal management decision-makers, and improve public awareness and understanding of estuarine ecosystems and estuarine management issues. Research projects may be oriented to specific research reserves; however, research projects that would benefit more than one research reserve in the National Estuarine Reserve Research System are encouraged.

(b) Federal research funds under this subpart are not intended as a source of continuous funding for a particular project over time. Research funds may be used to support start-up costs for long-term projects if an applicant can identify an alternative source of long-term research support.

(c) Research funds are available on a competitive basis to any coastal state or qualified public or private person. A notice of available funds will be published in the Federal Register. Research funds are provided in addition

to any other funds available to a coastal state under the Act. Federal research funds provided under this subpart must be matched equally by the recipient, consistent with § 921.81(e)(4) ("allowable costs").

##### § 921.51 Estuarine research guidelines.

(a) Research within the National Estuarine Reserve Research System shall be conducted in a manner consistent with Estuarine Research Guidelines developed by NOAA.

(b) A summary of the Estuarine Research Guidelines is published in the Federal Register as a part of the notice of available funds discussed in § 921.50(c).

(c) The Estuarine Research Guidelines are reviewed annually by NOAA. This review will include an opportunity for comment by the estuarine research community.

##### § 921.52 Promotion and coordination of estuarine research.

(a) NOAA will promote and coordinate the use of the National Estuarine Reserve Research System for research purposes.

(b) NOAA will, in conducting or supporting estuarine research other than that authorized under section 315 of the Act, give priority consideration to research that uses the National Estuarine Reserve Research System.

(c) NOAA will consult with other Federal and state agencies to promote use of one or more research reserves within the National Estuarine Reserve Research System when such agencies conduct estuarine research.

#### Subpart G—Monitoring

##### § 921.50 General.

(a) To provide a systematic basis for developing a high quality estuarine resource and ecosystem information base for national estuarine research reserves and, as a result, for the System, NOAA may provide financial support for monitoring programs. Monitoring funds are used to support three major phases of a monitoring program: studies necessary for comprehensive site description/characterization, development of a site profile, and implementation of a monitoring program.

(b) Monitoring funds are available on a competitive basis to the state agency responsible for reserve management or qualified public or private person or entity designated by the Reserve. However, if the applicant is other than the managing entity of a reserve research (coastal state), that applicant must submit as a part of the application

a letter from the reserve manager indicating formal support of the application by the managing entity of the reserve. Monitoring awards will be made on the basis of a five-year performance period; and with initial funding for a twelve (12) month period; and with annual supplemental funding contingent on performance and appropriations under the Act. Monitoring funds are provided in addition to any other funds available to a coastal state under the Act. Federal monitoring funds must be matched equally by the recipient, consistent with § 921.81(e)(4) ("allowable costs").

(c) Monitoring projects funded under this Subpart must focus on the resources within the boundaries of the research reserve and must be consistent with the applicable sections of the Estuarine Research Guidelines referenced in § 921.51. Portions of the project may occur within the immediate watershed of the Reserve beyond the site boundaries. However, the monitoring proposal must demonstrate why this is necessary for the success of the project.

#### Subpart H—Interpretation and Education

##### § 921.70 General.

(a) To stimulate the development of innovative or creative interpretive and educational projects and materials to enhance public awareness and understanding of estuarine areas, NOAA may fund interpretive and educational activities. Interpretive and educational awards may be awarded under this subpart to only those designated research reserves with approved final management plans with the following exception: NOAA may award research awards under this subpart to reserves without final management plans that have been designated prior to the effective date of these regulations; in the absence of an approved final management plan, however these reserves will be eligible for research awards during only the first two years after the effective date of these regulations.

(b) Educational and interpretive funds are available on a competitive basis to any coastal state entity. However, if the applicant is other than the managing entity of a research reserve, that applicant must submit as a part of the application a letter from the reserve manager indicating formal support of the application by the managing entity of the reserve. These funds are provided in addition to any other funds available to a coastal state under the Act. Federal interpretation and educational funds must be matched equally by the

recipient, consistent with § 921.81(e)(4) ("allowable costs").

##### § 921.71 Categories of potential interpretive and educational projects; evaluation criteria.

(a) Proposals for interpretive or educational projects will be considered under the following categories:

(1) Design, development and distribution/placement of interpretive or educational media (i.e., the development of tangible items, such as exhibits/displays, publications, posters, signs, audio/visuals, computer software and maps which have an educational or interpretive purpose; and techniques for making available or locating information concerning research reserve resources, activities, or issues);

(2) Development and presentation of curricula, workshops, lectures, seminars, and other structured programs or presentations for facility or field use;

(3) Extension/outreach programs; or

(4) Creative and innovative methods and technologies for implementing interpretive or educational projects.

(b) Interpretive and educational projects may be oriented to one or more research reserves or to the entire system. Those projects which would directly benefit more than one research reserve, and, if practicable, the entire National Estuarine Reserve Research System, shall receive priority consideration for funding.

(c) Proposals for interpretive and educational projects in national estuarine research reserves will be evaluated in accordance with criteria listed below:

(1) Educational or interpretive merits;

(2) Relevance or importance to reserve management or coastal decisionmaking;

(3) Educational quality (e.g., soundness of approach, experience related to methodologies);

(4) Importance to the National Estuarine Reserve Research System;

(5) Budget and Institutional Capabilities (e.g., reasonableness of budget, sufficiency of logistical support); and

(6) In addition, in the case of long-term projects, the ability of the state or the grant recipient to support the project beyond this initial funding.

#### Subpart I—General Financial Assistance Provisions

##### § 921.80 Application information.

(a) Only a coastal state may apply for Federal financial assistance awards for preacquisition, acquisition and development, operation and management, and education and interpretation. Any coastal state or

public or private person may apply for Federal financial assistance awards for estuarine research or monitoring. The announcement of opportunities to conduct research in the reserve system appears on an annual basis in the Federal Register. If a state is participating in the national Coastal Zone Management Program, the applicant for an award under section 315 of the Act shall notify the state coastal management agency regarding the application.

(b) An original and two copies of the formal application must be submitted at least 120 working days prior to the proposed beginning of the project to the following address: Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration, Universal Building South, 1825 Connecticut Avenue, NW., Suite 714, Washington, DC 20235. The Application for Federal Assistance Standard Form 424 (Non-construction Program) constitutes the formal application for site selection, post-site selection, operation and management, research, and education and interpretive awards. The Application for Federal Financial 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 (predesignation) of this part, subpart C of this part and § 921.31 (acquisition and development), and § 921.32 (operation and management) as applicable. Applications for development awards for construction projects, or restorative activities involving construction, must include a preliminary engineering report. 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) Written approval from NOAA of the draft management plan for initial acquisition and development award(s); and

(3) A preliminary engineering report for construction projects, or restorative activities involving construction.

##### § 921.81 Allowable costs.

(a) Allowable costs will be determined in accordance with applicable OMB Circulars and guidance

for Federal financial assistance, 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 award period.

(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) General guidelines for the non-Federal share are contained in Department of Commerce Regulations at 15 CFR part 24 and OMB Circular A-110. Copies of Circular A-110 can be obtained from the Marine and Estuarine Management Division, 1825 Connecticut Avenue, NW., Suite 714; Washington, DC 20235. The following may be used in satisfying the matching requirement:

(1) Site Selection and Post Site Selection 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 research reserve boundaries and acquired pursuant to the Act, with other than Federal funds, may be used as match. However, the fair market value of real property allowable as match is limited to the fair market value of a real property interest equivalent to, or required to attain, the level of control over such land(s) identified by the state and approved by the Federal

Government as that necessary for the protection and management of the national estuarine research reserve. Appraisals must be performed according to Federal appraisal standards as detailed in Department of Commerce regulations at 15 CFR part 24 and the Uniform Relocation Assistance and Real Property Acquisition for Federal and Federally Assisted Programs in 15 CFR part 11. The fair market value of privately donated land, at the time of donation, as established by an independent appraiser and certified by a responsible official of the state (pursuant to 15 CFR part 24), may also be used as match. Land, including submerged lands already in the state's possession, may be used as match to establish a national estuarine research reserve. The value of match for these state lands will be calculated by

determining the value of the benefits foregone by the state, in the use of the land, as a result of new restrictions that may be imposed by Reserve designation. The appraisal of the benefits foregone must be made by an independent appraiser in accordance with Federal appraisal standards pursuant to 15 CFR part 24 and 15 CFR part 11. 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 national estuarine research reserve (see also § 921.20). Costs related to land acquisition, such as appraisals, legal fees and surveys, may also be used as match.

(3) Operation and Management Awards. Generally, cash and in-kind contributions (directly benefiting and specifically identifiable to operations and management), except land, are allowable.

(4) Research, Monitoring, Education and Interpretive Awards. Cash and in-kind contributions (directly benefiting and specifically identifiable to the scope of work), except land, are allowable.

#### § 921.82 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 original scope of work, or extension of the performance period must be submitted to NOAA on Standard Form 424 and approved in writing.

#### Appendix I to Part 921—Biogeographic 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 Galveston).
13. Western Gulf (Galveston to Mexican border).

##### *Californian*

14. Southern California (Mexican Border to Point Conception).
15. Central California (Point Conception 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 Demarcation Point).

##### *Insular*

25. Hawaiian Islands.
26. Western Pacific Island.
27. Eastern Pacific Island.

#### Appendix II to Part 921—Typology of National Estuarine Research Reserves

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 research reserves. Priority will be given to important ecosystem types as yet unrepresented in the reserve 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 evergreens 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 exhibit 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*, *Fraxinus*, and *Rosa*.
2. **Southeast Areas:** Floral dominants include *Myrica*, *Baccharis*, and *Ilex*.
3. **Western Areas:** *Adenostoma*, *Arctostaphylos*, 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 serial 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: *Urtica*; 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 piana*, the lichens *Cetraria* and *Cladonia*, and herbaceous plants such as *Potentilla fruticosa* 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 herbaceous, 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 a 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 unicellular algae along with microscopic 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 *Macra*).

**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 carbon. Macrophytes are nearly absent in this ecosystem, although it may be heavily colonized by benthic diatoms, dinoflagellates, filamentous blue-green and green algae, and chemosynthetic 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 *Naasarius*, 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 faunas 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 Latitude:** The communities in this region are reduced in comparison to those of the northern latitudes and possess 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 soft 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 shoreline.

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 shoreline.

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: Aunū 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 endemism, include the mollusks *Theodoxus neglectus* and *T. cariosus*, the small red shrimp *Metabetaeus lobena* and *Halocaridina rubra*, and the fish *Eleotris sandwicensis* and *Kuhlia sandwicensis*. 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 gradation 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 channels.

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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GALLEG CODE 2070-00-0

APPENDIX D

Biogeographic Classification and Typology

Appendix D

Biogeographic Classification and Typology

Biogeographic Classification

Carolinian Region

6. Northern Carolinas

Typology

Class I - Ecosystem Types

Group I - Shorelands

- A. Maritime Forest-Woodland
  - 3. Temperate Deciduous Forest Biome
- B. Coast Shrublands
  - 2. Southeast Areas
- C. Coastal Grasslands
  - 3. Southeast/Gulf

Groups II

- A. Coastal Marshes
- D. Intertidal Beaches
- E. Intertidal Mud and Sand Flats
- F. Intertidal Algal Beds

Group III

- A. Subtidal Hardbottoms
- B. Subtidal Softbottoms
- C. Subtidal Plants

Class II

Group I - Geologic

- A. Basin
  - 2. Sheltered Coast
  - 3. Bay
  - 5. Tidal River
- B. Basin Structure



- 1. Coastal plains estuary
- 3. Bar-bounded estuary

C. Inlet Type

- 2. Restricted
- 3. Permanent

D. Bottom Composition

- 1. Sand
- 2. Mud
- 4. Oyster shell

Group II - Hydrographic

A. Circulation

- 2. Non-stratified

B. Tides

- 2. Semidiurnal

C. Freshwater

- 1. Surface water
- 2. Subsurface water

Group III

A. Salinity

- 1. Positive Estuary

3. Salinity Zones

c. Mixohaline

(1) Mixoeuhaline

(2) Polyhaline

B. pH Regime

- 2. Circumneutral

APPENDIX E

Species List

## Appendix E

### Species List

Over the past 25 years, extensive work on the systematics of the biota of the NI/WB NERR has been carried out, resulting in a number of papers published in various scientific journal. In addition, lists and description of the biota are to be found in the books listed below. Because of the extensive number of species found in this site, we have not listed them here but refer you to these references.

*An Annotated Checklist of the Biota of the Coastal Zone of South Carolina* by Richard G. Zingmark. 1978. 364 pp. University of South Carolina Press, Columbia.

*Seashore Animals of the Southeast* by Edward E. Ruppert and Richard S. Fox. 1988. 429 pp. University of South Carolina Press, Columbia.

*Shallow-Water Marine Benthic Macroinvertebrates of South Carolina: Species Identification, Community Composition and Symbiotic Associations* by Richard S. Fox and Edward E. Ruppert. 1985. 330 pp. University of South Carolina Press, Columbia.

The following is a list of the number of species in the major taxonomic categories.

<u>TAXONOMIC GROUPING</u>	<u>NUMBER OF SPECIES</u>
Mammals (including marine)	74
Phytoplankton	832
Benthic Marine Algae	358
Marine Fungi	14
Vascular Plants	1494
Saltmarsh Vascular Plants	66
Porifera	26
Cnidaria	123
Ctenophora	5
Rhynchozoela	15
Gastrotricha	26
Kinorhynca	5
Nematoda	139
Polychaeta	279
Hirudinea	23
Marine Mollusks	385
Chelicerata	8
Copepoda	68
Cirripedia	27

Amphipoda	152
Isopoda	76
Mysidacea	3
Decapoda	272
Tardigrada	4
Phoronida	6
Bryozoa	42
Entoprata	8
Echinodermata	21
Chaetognatha	12
Hemichordata	2
Chondrichthyes	36
Osteichthyes	344
Turtles	3
Birds	430

APPENDIX F

Ecosystems

## Appendix F

### Ecosystems

Based on the NERRS classification categories, the NI/WB NERR represents a diverse number of ecosystem types. Over the 22 years that the Baruch Institute has been functioning, over 875 papers have been published by Baruch Associates and many of these papers represent studies on some aspect of the NI/WB NERR site. These studies range from the ecosystem level of organization to molecular studies. A few examples of ecological models of the Reserve are represented in Figures 7, 8, and 9. The principal types of ecosystems represented in the Reserve are listed below along with a brief description.

#### Coastal Marshes

Wetland areas dominated by grasses (especially Spartina), sedges, rushes, cattails, and other species. These areas are subjected to semidiurnal tides. This is a dominant ecosystem on the Reserve. High salinity and low salinity marshes occur. This is an important habitat for estuarine and marine species. Salt marshes have an extremely high rate of primary productivity. Carbon produced by Spartina is highly important in the trophic dynamics of estuaries and coastal waters.

#### Intertidal Systems

Various types of intertidal communities are represented in the Reserve, including beaches, mud and sand flats, algal beds, and attached vegetation. Many species are restricted to a specific type of intertidal habitat. This is a dynamic area which is subjected to tidal changes, marked differences in oxygen content, fluctuating thermal regimes, and predation pressures.

Organisms living in these intertidal systems exhibit a wide range of morphological, physiological, behavioral, and genetic adaptations.

#### Submerged Bottoms

A gradient of bottom types ranging from mud to sand to shelly substratum is represented in the Reserve. Different biotic assemblages are associated with each type. In addition to these substrata, a submerged vegetation ecosystem is also present.

## Upland Systems

Coastal grasslands and a limited amount of pine edaphic forest are also included in the Reserve. A number of small islands are located within the boundary of the Reserve. One of these islands, Pumpkinseed Island, is one of the best known nesting sites for coastal birds in the southeast.

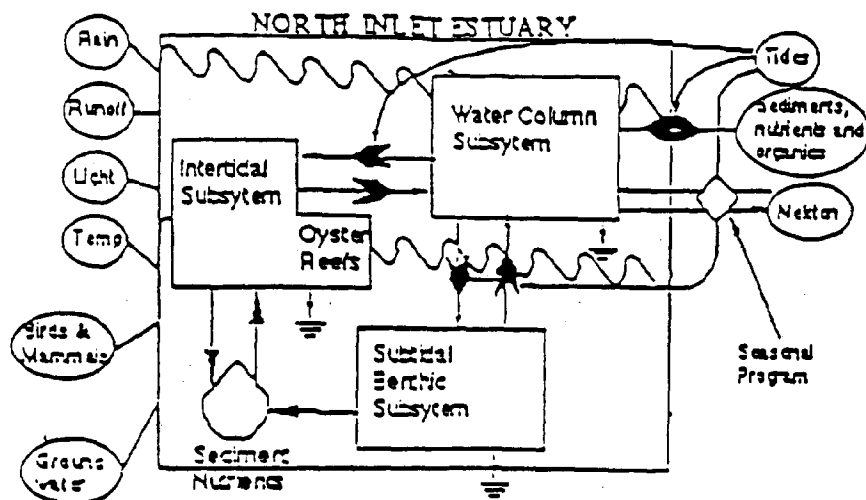


Figure 6. The original North Inlet ecosystem model (Summers and McKellar 1979). This model divides North Inlet into three major subsystems and is still a valid conceptualization. Future enhancements will subdivide this system further by focusing on sediment dynamics, subtidal interactions and plant/animal interactions across subsystems.

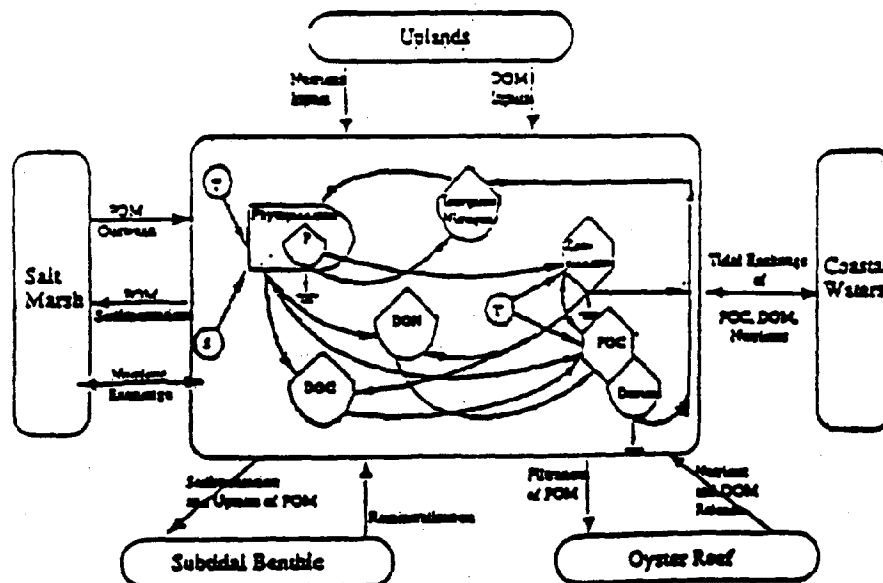


Figure 7. The dynamics of nitrogen and carbon exchange within the tidal creeks of North Inlet were simulated with this model by Childers and McKellar (1987). This model addressed the importance of tidal exchange. Future modeling will emphasize internal exchanges such as, the effects of subtidal remineralization on water column nutrient concentrations and export to marsh and coastal habitats.



# CARBON BUDGET (gC/m<sup>2</sup>/yr)

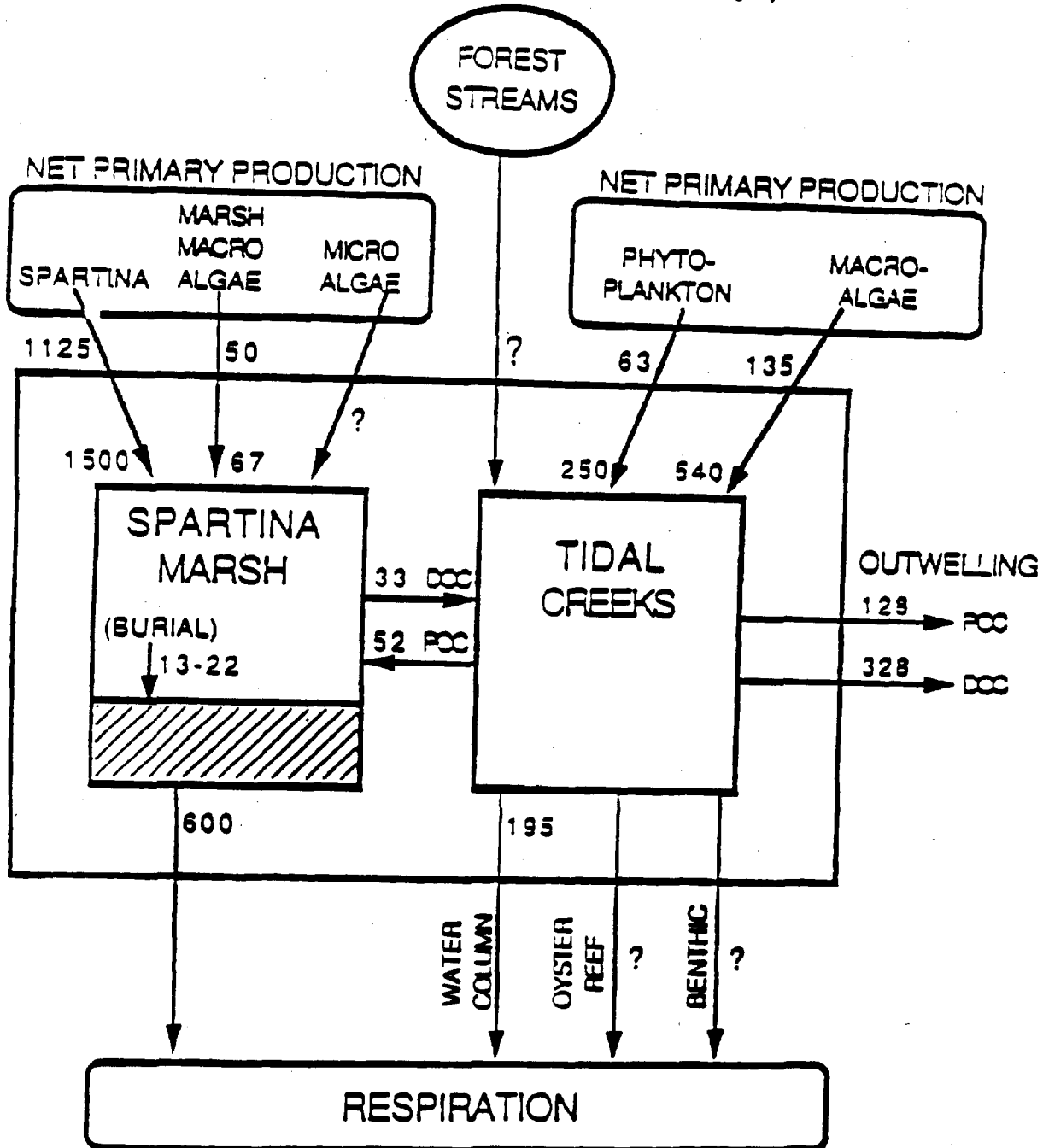


Figure 8. A carbon budget of the North Inlet estuarine system. Values on the outer box are area weighted for the entire marsh-estuarine system. Values on the inner boxes are area weighted for habitat area (i.e., marsh and water column).



**APPENDIX G**  
**Nomination Letter**

Appendix G.

# State of South Carolina

Office of the Governor

CARROLL A. CAMPBELL, JR.  
GOVERNOR

POST OFFICE Box 11369  
COLUMBIA 29211

January 24, 1990

Mr. John Knauss  
Under Secretary of Oceans and  
Atmosphere  
National Oceanic and Atmospheric  
Administration  
Herbert C. Hoover Building, Room 5128  
14th and Constitution Ave., NW  
Washington, D. C. 20230

Dear Secretary Knauss:

On behalf of the State of South Carolina, I am pleased to submit the attached site nominations and applications for preacquisition assistance for the North Inlet - Winyah Bay National Estuarine Reserve Research System (NERRS) and the Ashepoo - Combahee-Edisto (ACE) Basin National Reserve Research System.

Because these two sites represent different biogeographic classification categories, the State of South Carolina is recommending the sites be managed independently. It is my understanding the State of South Carolina is eligible for up to \$50,000 in matching funds for each of the two sites based on proposed changes to your funding regulations.

This effort is the result of a large number of dedicated individuals and organizations from both the private and public sector working together toward common goals. I have personally visited both the North Inlet - Winyah Bay site and ACE site and find them to be of unequalled value due to their pristine quality and diverse and abundant assemblage of natural habitat. The sites should make a significant contribution to the National Estuarine Reserve Research System.

I look forward to your favorable review of this application.

With best regards, I am

sincerely



Carroll A. Campbell, Jr.  
Governor

CACjr/tad

Attachment

**APPENDIX H**  
**NOAA Approval of Nomination**

Appendix H.



UNITED STATES DEPARTMENT OF COMMERCE  
The Under Secretary for  
Oceans and Atmosphere  
Washington, D.C. 20230

MAR 27 1990

Honorable Carroll A. Campbell, Jr.  
Governor of South Carolina  
Columbia, South Carolina 29211

Dear Governor Campbell:

The National Oceanic and Atmospheric Administration (NOAA) has reviewed and approves the proposal to nominate the North Inlet-Winyah Bay and the Ashepoo-Combahee-Edisto (ACE) Basin for inclusion in the National Estuarine Reserve Research System (NERRS). We commend the South Carolina Coastal Council, South Carolina Wildlife and Marine Resources Department and the Belle W. Baruch Institute for Marine Biology and Coastal Resources for developing an excellent nomination report that responds accurately and substantially to each of the review criteria established in the National Estuarine Reserve Research System regulations.

NOAA and South Carolina agree that because the two sites represent different biogeographical classification categories, as identified in the NERRS regulations (Section 921.3), each site will be managed independently. Therefore, each site will be eligible for full Federal funding identified in the regulations.

Included within the site nomination package is an application for Federal assistance to prepare a draft management plan and draft environmental impact statement. NOAA's Marine and Estuarine Management Division is reviewing the application and will work closely with the South Carolina Coastal Council to ensure that the review is conducted in an expeditious and through manner.

I look forward to continued progress in the development of the ACE Basin National Estuarine Research Reserve and the North Inlet-Winyah Bay National Estuarine Research Reserve.

Sincerely,

A handwritten signature in dark ink, appearing to read "John A. Knauss".

John A. Knauss



**APPENDIX I**

**Public Education Program - Summary of 1990 Activities**

Appendix I.

Public Education Program  
Summary of 1990 Activities

The diverse Public Education Program offered through the Belle W. Baruch Foundation's Bellefield Nature Center and the Continuing Education Program of the Baruch Institute, University of South Carolina provides many valuable services to the Georgetown community and the State of South Carolina:

1. In 1990, a record number of 35,000 people were served by the education programs sponsored by the Belle W. Baruch Foundation and the Baruch Institute, University of South Carolina.
2. The effects of Hurricane Hugo on programs were still observed in 1990. Visitation to the Bellefield Nature Center and attendance in some programs were down over 1989, primarily as a result of the depressed tourism economy inflicted by the hurricane. Even so, the Nature Center had 15,445 visitors during 1990 and more than 100 people visited the Center on peak days during the summer months.
3. More than 2,900 school children from around the state participated in field studies of salt marsh, pond and forest ecosystems conducted on the Baruch Foundation's property, Hobcaw Barony, in 1990. This figure is the highest recorded since the Nature Center opened in 1982.
4. More than 2,100 children from Georgetown County schools were served by Nature Center's 1990 Outreach Program.
5. Outreach activities also extended to local civic organizations. Programs were presented to over 220 people at their meetings and another 12,000 people were reached through staff members' participation in community events.
6. The education program has gained statewide recognition for its excellence in teacher education in the area of marine science. During 1990, 46 teachers from Williamsburg and Georgetown Counties participated in graduate level marine science courses at Hobcaw Barony. Another 150 teachers participated in workshops presented by Nature Center staff members.



Table 1

Public Tours of Hobcaw Barony  
1990

<u>Date</u>	<u>Group</u>	<u>Numbers</u>
Thursdays	General Tour - Open to the public	611
1-16	Brunswick Bird Club	13
3-6	John Wesley Methodist Church	14
3-13	Charleston Christian Family	9
3-23	McKissick Museum	14
4-17	Sumter Conservation District	8
5-1	Sumter Conservation District	13
5-8	Tilly Swamp Baptist Church	12
5-11	SC Maps Teachers	40
5-22	St. Lukes Lutheran Church	14
8-31	Extra-General Tour	14
9-7	Extra-General Tour	14
9-11	Extra-General Tour	13
9-18	Newcomers Club	14
9-25	Extra-General Tour	13
9-29	Discovery Place	35
10-30	Watercolors Workshop	14
11-6	Watercolors Workshop	14
11-20	Sea Mist Resort	<u>14</u>
	<b>Total</b>	<b>893</b>

Table 2

Field Studies at the Bellefield Nature Center  
1990

<u>Date</u>	<u>Group</u>	<u>Program</u>	<u>No.</u>
1-8	Manning Middle School	Plantation Heritage	12
2-6	Happy Time Pre-School	Exploring The Nature Center	48
2-26	Waccamaw Elementary - Pawleys Is	Plantation Heritage	25
3-1	Socastee Elementary School	Exploring A Pond Community	28
3-2	Socastee High School	Salt Marsh Ecology	17
3-6	Waccamaw Elementary - Conway	Salt Marsh Ecology	31
3-7	Waccamaw Elementary - Pawleys Is	Plantation Heritage	30
3-9	St. Andrews Catholic School	Plantation Heritage	24
3-10	Girl Scouts, Myrtle Beach	Exploring The Nature Center	20
3-16	Maryville Elementary School	Plantation Heritage	31
3-16	Headstart	Exploring The Nature Center	67
3-20	Maryville Elementary School	Coastal Forest Ecology	29
3-21	Bamberg District #1	Coastal Forest Ecology	16
3-21	Pawleys Island Montessori	Exploring The Nature Center	10
3-22	Andrews Primary	Exploring A Pond Community	24
3-23	Myrtle Beach High School	Coastal Forest Ecology	11
3-28	Waccamaw Elementary - Pawleys Is	Plantation Heritage	30
3-27	McDonald Elementary School	Life In a Forest	26
3-30	Andrews Academy	Exploring A Pond Community	32
3-30	Ferrum College	Careers in Outdoors Ed.	29
3-30	Cub Scouts, Pack 346, Gtwn.	Exploring The Nature Center	12
4-10	Charleston Day School	Exploring A Pond Community	25
4-11	Waccamaw Academy	Coastal Forest Ecology	13
4-12	Charleston Day School	Life In A Forest	30
4-13	Heritage Friendship	Life In A Forest	10
4-17	Waccamaw Elementary - Pawleys Is.	Exploring A Pond Community	29
4-18	Andrews Academy	Life In A Forest	13
4-19	Kensington Elementary School	Exploring A Pond Community	29
4-19	Florence School District #3	Exploring The Nature Center	24

4-20	Waccamaw Elementary - Conway	Exploring A Pond Community	28
4-24	Archibald Rutledge Academy	Exploring A Pond Community	19
4-25	Waccamaw Elementary - Pawleys Is.	Exploring A Pond Community	30
4-26	Waccamaw Elementary - Pawleys Is.	Exploring A Pond Community	30
4-27	Greenwood Elementary	Exploring The Nature Center	62
4-27	Andrews Academy	Coastal Forest Ecology	19
5-1	Deep Creek Elementary Sch.	Exploring The Nature Center	55
5-2	Fleming Middle School	Exploring A Pond Community	55
5-3	Andrews Primary	Exploring A Pond Community	24
5-3	Saluda Elementary	Exploring The Nature Center	25
5-8	Sullivan's Island Elementary	Exploring A Pond Community	27
5-9	Kensington Elementary	Exploring A Pond Community	26
5-11	McDonald Elementary	Exploring The Nature Center	23
5-15	Myrtle Beach Primary	Exploring A Pond Community	23
5-16	Heathwood Hall	Plantation Archeology	64
5-17	Maryville Elementary	Exploring A Pond Community	25
5-21	Kingsree Jr. High School	Exploring The Nature Center	35
5-22	Conway Middle School	Coastal Forest Ecology	21
5-25	Kingsree Jr. High School	Exploring The Nature Center	40
5-25	St. Andrews Catholic School	Coastal Forest Ecology	18
5-28	St. James- Santee Elementary School	Exploring The Nature Center	40
5-30	Conway Christian School	Pond Community/Forest Ecol	35
6-5	Adventure Camp (GC Rec. Dept)	Exploring A Pond Community	27
6/5 -	Lou The Loggerhead Club	Beach Creatures, Reptiles	107
8/21	(Waccamaw House Camp)	Alive, & Backbone	
6-20	Clemson Univ. Graduate School	Belle's Legacy & BNC	14
6-21	USC Coastal Carolina Jr. Scholars	Belle's Legacy & BNC	39
6-25	Chapin Memorial Library	Exploring A Pond Community	33
6-29	Bright Beginnings Day Care	Exploring The Nature Center	18
6-29	L.G. Bahai Institute	Exploring The Nature Center	16
7-31	Marion County Elementary Teachers	Exploring A Pond Community	19
8-1	USC - Coastal Carolina Env. Ed. Class	Salt Marsh Ecology	13
8-11	L.G. Bahai Institute	Exploring The Nature Center	23
9-26	Waccamaw Elementary - Pawleys Is.	Exploring The Nature Center	40
9-26	Waccamaw Elementary - Pawleys Is.	Exploring The Nature Center	30
9-27	Waccamaw Elementary - Pawleys Is.	Salt Marsh Discovery	25

9-29	Parents For the Academ. Gifted	Rocky Intertidal Zone	37
10-3	Mc Donald Elementary School	Exploring A Pond Community	25
10-4	Andrews Primary	Exploring A Pond Community	23
10-5	Archibald Rutledge Academy	Plantation Archeology	17
10-9	Archibald Rutledge Academy	Plantation Archeology	26
10-10	Maryville Elementary	Plantation Archeology	24
10-11	West Conway Middle School	Salt Marsh Ecology	22
10-16	Byrnes Academy	Exploring The Nature Center	10
10-16	Happy Times School	Exploring The Nature Center	51
10-17	Kingstree Jr. High	Salt Marsh Discovery	25
10-23	Waccamaw Elementary - Pawleys Is.	Life In A Forest	26
10-24	Charleston Day School	Exploring A Pond Community	27
10-25	Forestbrook Elementary	Plantation Heritage	25
10-30	Myrtle Beach High School	Salt Marsh Ecology	32
10-31	Leesville High School	Salt Marsh Ecology	12
11-1	Waccamaw Elementary - Pawleys Is.	Exploring A Pond Community	24
11-2	Southside Middle School	Plantation Archeology	15
11-6	Chabad Academy	Life In A Forest	30
11-7	Waccamaw Elementary - Conway	Plantation Heritage	27
11-7	Byrnes Academy	Plantation Heritage	15
11-8	Browns Ferry Elementary	Exploring The Nature Center	65
11-8	C.E. Murray	Plantation Archeology	8
11-9	Andrews Academy	Salt Marsh Ecology	21
11-9	Archibald Rutledge Academy	Salt Marsh Ecology	18
11-13	Lake City Elementary	Salt Marsh Ecology	31
11-15	Pawleys Island Montessori	Salt Marsh Discovery	8
11-16	Jonakin Middle School	Coastal Forest Ecology	28
11-20	Beck Middle School	Plantation Archeology	14
11-21	Maryville Elementary School	Plantation Archeology	27
11-27	Lake City Elementary	Salt Marsh Ecology	31
11-28	St. Andrews	Salt Marsh Discovery	18
11-28	Lake City Elementary	Exploring The Nature Center	21
11-29	Waccamaw Elementary - Pawleys Is.	Life In A Forest	25
11-29	Lake City Elementary	Exploring The Nature Center	18
12-4	Woodland Park School	Life In A Forest	28
11-5	Waccamaw Elementary - Conway	Exploring A Pond Community	30

11-5	Woodland Park School	Life In A Forest	28
12-6	Rosemary Elementary	Exploring The Nature Center	61
12-7	Archibald Rutledge Academy	Coastal Forest Ecology	24
12-7	Woodland Park School	Life In A Forest	25
12-12	Williamsburg Academy	Exploring A Pond Community	35
12-14	Myrtle Beach High School	Salt Marsh Ecology	<u>27</u>
		Total	2937

Table 3

Special Programs At The Bellefield Nature Center  
1990

<u>Date</u>	<u>Program</u>	<u>Number</u>
1/28-2/2	Ecology and History of the SC Lowcountry	29
2-13	Bluebird Houses	8
4-25	Springtime In The Salt Marsh	14
4-28	Hidden Heroes of the Salt Marsh	21
5-16	Gyotaku	25
5-20	Hidden Heroes of the Salt Marsh	20
5-30	Beach Night Life	25
6-19	Nature Walk In The Hobcaw Forest	3
6-20	Reptiles Alive	51
6-26	Nature Walk In The Hobcaw Forest	2
6-27	Beach Creatures	53
6-28	Beach Night Life	25
7-3	Summertime In The Salt Marsh	10
7-5	Pond Life	8
7-11	Whose Got The Backbone?	14
7-17	Nature Walk In The Hobcaw Forest	5
7-18	Reptiles Alive	13
7-23	Hobcaw Open House	93
7-24	Nature Walk In The Hobcaw Forest	10
7-25	Beach Creatures	6
7-30	Beach Night Life	17
8-1	Whose Got The Backbone?	12
8-7	Nature Walk In The Hobcaw Forest	2
8-8	Reptiles Alive	12
8-15	Beach Creatures	18
9-19	Autumn In The Salt Marsh	8
9-27	Beach Night Life	24
10-3	Coastal Birding	14
10-24	Hobcaw's Woods After Hugo	10
11-13	Winter Birds	13
	Total	565

Table 4  
Short Courses  
1990

<u>Course Title</u>	<u>No of Participants</u>
Southern Traditions	21
Life in and Around an Oyster Reef	6
Rice Along the River: Georgetown's Plantation Heritage	37
Migration and Ecology of Songbirds	21
Coastal Ecology Classes for Children (5 sessions)	64
African Influences on Southern Culture	11
Loggerhead Sea Turtles	23
History and Architecture of Downtown Georgetown	7
Light Tackle Fishing in Coastal Waters	14
Managing the Coast for the 90's and Beyond	6
Shelling Along South Carolina Shores	27
	<b>Total</b>
	237

Table 5

Activities and Number of Participants  
1988, 1989, and 1990

<u>Activity</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>
Visitors To Bellefield Nature Center	16,636	17,324	15,445
Field Studies	2,457	2,619	2,937
Public Tours	1,027	775	893
Outreach Program	1,353	2,258	2,121
Special Programs	665	650	565
Speaking Engagements	225	361	223
Events - Festivals	10,000	5,500	12,000
Public Lectures, Seminars, Forums	89	250	115
Short Courses	269	262	237
Teacher Education	<u>138</u>	<u>46</u>	<u>196</u>
Totals	32,859	30,045	34,732



**APPENDIX J**

**Publications**

Appendix J

Publications

Since 1969 891 scientific papers and books have been published by Associates of the Baruch Institute. A complete list of publications is available upon demand. Included below is a partial listing of selective publications resulting from the National Science Foundation funded Long-Term Ecological Research project.

LTERR PUBLICATIONS PUBLISHED OR IN PRESS

(Updated 7/19/91)

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**APPENDIX K**

**Letter from South Carolina Attorney General  
Concerning Protective Control**



September 10, 1991

**SOUTH  
CAROLINA  
COASTAL  
COUNCIL**

Mr. Ole Varmer  
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William W. Jones, Jr.  
Chairman

H. Wayne Beam, Ph.D.  
Executive Director

RE: S.C. N. - Inlet NERR

Dear Mr. Varmer:

Thank you for your memorandum of August 26, 1991, stating the needs of the NOAA in the above referenced matter.

On behalf of the Attorney General's office for the State of South Carolina, I address each of the remaining points of contention:

1. The State of South Carolina has adequate management authority over the areas proposed for the NERR site.

As shown on the attached Exhibit A, the South Carolina Coastal Council, the state agency responsible for overseeing the project, has full authority over the NERR site. (See Section 48-39-10, et seq., Code of Laws for the State of South Carolina, 1976, as amended.) As it relates to the critical area "environment," there is no question that the state has a legal right of access to those areas for purposes of managing the site and enforcing conditions associated with the federal grant. In terms of access by the state and general public to areas owned by the state, there is a general legal presumption that the state owns all lands below mean high water. This ensures access to the tidelands and marshes which predominate the NERR site. Fast lands held by the Baruch Foundation would require permission for ingress and egress. However, the fast lands and highland portions of the site owned by the Baruch Foundation are legally accessible by the state for research and management pursuant to an easement. Attached Exhibit B is an agreement entered into between Belle W. Baruch Foundation and the University of South Carolina on March 22, 1972. By way of this agreement, the University



has the use of such land as may be required to construct a research facility thereon, and the right-of-way and easement for ingress and egress thereto. Additionally, the University has use of such land so long as the lands are being used for research and other educational purposes. It is my opinion, based upon this agreement and upon the Attorney General's letter of November 13, 1987, Exhibit C provided to you by Dr. Vernberg, that the state has sufficient access to the site to ensure research and management envisioned by the NERR project.

2. The University of South Carolina and Baruch Institute are state entities. (See attached Exhibit D.)

Pursuant to state law, the S. C. Coastal Council employs attorneys for the purpose of enforcement of the provisions of the Coastal Zone Management Act. However, these attorneys are controlled by the State Attorney General's office. On behalf of the Attorney General's office, I am authorized to convey to you that the State of South Carolina will provide the necessary legal service to ensure proper management and enforcement of the NERR management plan. Any such legal service will be primarily provided by South Carolina Coastal Council legal staff with support from the Attorney General's office.

With regard to other questions posed to Mr. Snyder, it appears to me that these matters were adequately dealt with in the August 14, 1991, letter from Dr. Vernberg. Please contact my office should this letter be insufficient for your purposes.

Sincerely,

*C. C. Harness, III*

C. C. Harness, III  
General Counsel

0898A(87)

cc: Dr. H. Wayne Beam  
Mr. Christopher L. Brooks  
Ms. Nancy B. Tecklenburg, Esquire  
Mr. Steve Snyder  
Dr. John Vernberg

**APPENDIX L**

**Organizations Endorsing the North Inlet/Winyah Bay Project**

ORGANIZATIONS ENDORSING THE NORTH INLET/WINYAH BAY PROJECT

National Science Foundation

NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center

U.S. Department of Interior

South Atlantic Fishery Management Council

S.C. Wildlife and Marine Resources Department, Nongame and Heritage Trust Section

S.C. Water Resources Commission

S.C. Marine Educators Association

S.C. Sea Grant Consortium

Sierra Club South Carolina Chapter

S.C. Institute of Archaeology and Anthropology

S.C. Environmental Law Project

S.C. Aquarium

S.C. Coastal Conservation League

Nature Conservancy of South Carolina

International Center for Public Health Research, USC, McClellanville, SC

Georgetown County League of Women Voters

College of Charleston, Marine Biology Graduate Program

Friends of the Coast

DeBordieu Property Owners Association, Inc.



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