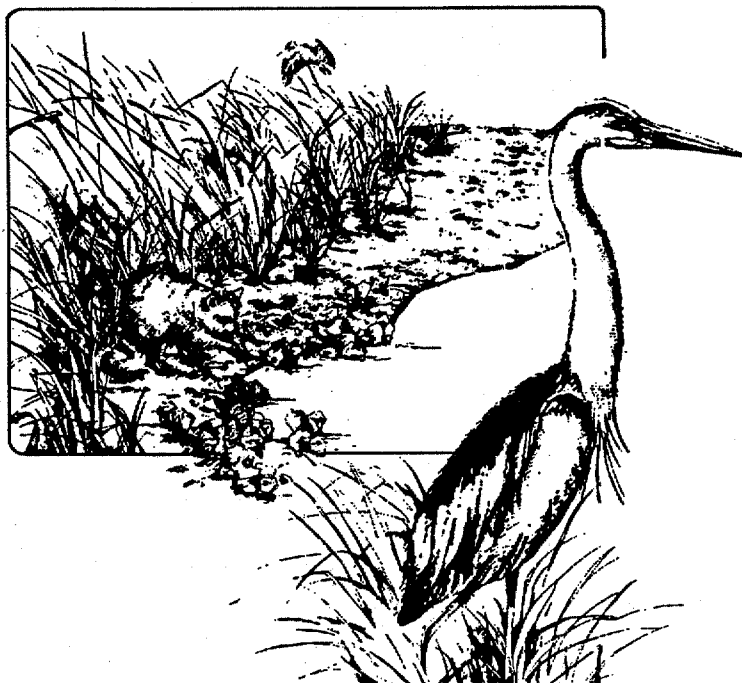


Ashepoo-Combahee-Edisto (ACE) Basin National Estuarine Research Reserve in South Carolina

Final Environmental Impact Statement and Draft Management Plan



National Oceanic and Atmospheric Administration
Office of Ocean and Coastal Resources Management
Sanctuaries and Reserves Division
Washington, D.C. 20235



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

Washington, D.C. 20230

Office of the Chief Scientist

AUG 16 1991

Dear Reviewer:

In accordance with the provision of Section 102(2)(C) of the National Environmental Policy Act of 1969, we are enclosing for your review and consideration the final environmental impact statement/draft management plan prepared by the Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration, Department of Commerce, on the proposed Ashepoo-Combahee-Edisto (ACE) Basin National Estuarine Research Reserve in South Carolina.

The responsible Federal official for this project is John J. Carey, Acting Assistant Administrator for Ocean Services and Coastal Zone Management, National Ocean Service, NOAA. Any written comments or questions you may have should be submitted to the contact person identified below by Monday, September 23, 1991. Also, one copy of your comments should be sent to me in Room 6222, U.S. Department of Commerce, in Washington, DC 20230.

CONTACT PERSON

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Thank you for your cooperation in this matter.

Sincerely,

for/ Donna Whiting

David Cottingham
Director
Ecology and Environmental
Conservation Office



**ASHEPOO-COMBAHEE-EDISTO (ACE) BASIN
NATIONAL ESTUARINE RESEARCH RESERVE
IN SOUTH CAROLINA**

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Final Environmental Impact Statement

and

Draft Management Plan

July 1991

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APR 02 1997

DESIGNATION: Final Environmental Impact Statement

TITLE: Designation of the Ashepoo-Combahee-Edisto (ACE) Basin as a National Estuarine Research Reserve and preparation of a draft management plan.

ABSTRACT: The state of South Carolina proposes the designation of a site in the ACE Basin as a component of the National Estuarine Research Reserve System. The site encompasses approximately 135,554 acres of uplands, wetlands and open waters.

Federal financial assistance for operations, management, and development are requested by the state of South Carolina. These funds accompanied by the required state match will be used for basic program activities, including research and educational projects; construction of trails and boardwalks; expansion and construction of research and interpretive facilities; and for the preparation of a final management plan for the ACE Basin National Estuarine Research Reserve in South Carolina. Appropriate Memorandums of Understanding are under preparation for those portions of the site which are on state government or private property. The reserve will be managed by the South Carolina Wildlife and Marine Resources Department.

Approval of this proposal will allow for the establishment of an estuarine research reserve in South Carolina representing the South Atlantic Subregion of the Carolinian Biogeographic Region. The reserve will be used primarily for research and education purposes, particularly as a tool for improving coastal decision making. No new regulations are proposed as a result of this action. Traditional uses within the reserve boundaries will continue under existing local and state laws and private landowner policies. The educational programs will increase public awareness of estuarine resources and their importance. The research plan will establish a baseline monitoring program for the ACE Basin estuary and encourage research projects consistent with the reserve's role as a natural field laboratory.

Submit any written comments to the contact identified below.

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ACRONYMS

ACE	Ashepoo - Combahee - Edisto Basin
AIWW	Atlantic Intracoastal Waterway
BMPs	Best Management Practices, established by the South Carolina Forestry Commission
CEC	Division of Conservation, Education & Communication, SCWMRD
CFR	The Code of Federal Regulations (CFR) is a codification of the regulations of various federal agencies. The CFR is the basic component of the Federal Register publication system.
COLREGS	Collision Regulations, U.S. Coast Guard
CZMA	Coastal Zone Management Act
DHEC	South Carolina Department of Health & Environmental Control
DMP	Draft Management Plan
DU	Ducks Unlimited, Incorporated
DUF	Ducks Unlimited Foundation, a subsidiary of DU
EIS	Environmental Impact Statement is required by the National Environmental Policy Act of 1969 whenever major federal action may significantly affect the quality of the environment, including the human environment. A draft (DEIS) and a final (FEIS) environmental impact statement are prepared.
GIP	Geographic Information Processing
GIS	Geographic Information System
LED	Law Enforcement Division, SCWMRD
MOU	Memorandum of Understanding
MRD	Marine Resources Division, SCWMRD
NERR	National Estuarine Research Reserve (refers to one reserve, i.e. ACE Basin)

NERRs	National Estuarine Research Reserves
NERRS	National Estuarine Research Reserve System (refers to all Reserves in the U.S. program as an interacting group forming a complex whole)
NFWF	National Fish & Wildlife Foundation
NOAA	National Oceanic and Atmospheric Administration, U.S. Department of Commerce
NWI	National Wetlands Inventory
ORW	Outstanding Recreational or Ecological Resource Waters, DHEC water classifications and standards
SCCC	South Carolina Coastal Council
SCDPRT	South Carolina Department of Parks, Recreation & Tourism
SCFC	South Carolina Forestry Commission
SCR	Seaboard Coastline Railroad Bed, forming the upper western boundary of the proposed ACE Basin NERR
SCS	Soil Conservation Service, U.S. Dept. of Agriculture
SCLRC	South Carolina Land Resources Commission
SCWMRD	South Carolina Wildlife and Marine Resources Department
SFH	Shellfish Harvesting Waters, DHEC water classification and standards
TNC	The Nature Conservancy
USFWS	United States Fish & Wildlife Service, U.S. Dept. of the Interior
WMA	Wildlife Management Area, SCWMRD
WFWF	Division of Wildlife & Freshwater Fisheries, SCWMRD

EXECUTIVE SUMMARY

Section 315 of the Federal Coastal Zone Management Act of 1972 established the National Estuarine Research Reserve System (NERRS), originally called the National Estuarine Sanctuary Program, as a federal/state cooperative venture. Federal matching grants are available to coastal states to develop and manage a national system of estuarine research reserves which are representative of the various regions and estuarine types in the United States. In addition, annual competitive grants 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 NERRS has adopted 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 for the ACE Basin site are shown in Appendix A.

The ACE Basin NERR is being proposed by the South Carolina Wildlife and Marine Resources Department (SCWMRD) in cooperation with the South Carolina Coastal Council (SCCC), the state's lead agency in coastal zone management.

Recently, the SCWMRD and the United States Fish and Wildlife Service (USFWS), along with representatives of the Nature Conservancy (TNC), Ducks Unlimited, Incorporated (DU), other organizations and a private sector of landowners, have recognized the uniqueness of the ACE Basin. The area is about 45 miles southwest of Charleston, South Carolina and encompasses approximately 350,000 acres of undeveloped land and water areas, largely devoted to the forest products industry and wildlife management. The heart of this area is a series of remote coastal islands in southeastern Colleton County, which are accessible only by water. The NERRS was viewed as a compatible tool to provide for habitat protection, long-term management and opportunities for research and education.

Boundaries for the ACE Basin NERR will encompass key land and water areas (or "core area") and a buffer zone. The core area includes Pine, Otter, Ashe, Beet, Boulder, Big, South Hutchinson and Warren Islands for a total of 16,040 acres (2,444 acres of highland and 13,596 acres of marsh). The buffer zone contains 54,801 acres of wetlands, 59,405 acres of open estuarine waters and 5,308 acres of upland (a total of 135,752 acres). To date, five (5) of the eight (8) islands listed as the reserve core area are in fee simple ownership by conservation organizations and were acquired towards their future inclusion into the NERRS. Conservation easements,

management agreements, and other approaches to land stewardship are being negotiated in the buffer zone.

The purpose of the ACE Basin NERR is to establish and manage the site as a natural field laboratory and to develop a coordinated program of research and education for the reserve. Under the preferred alternative, a cooperative management approach will be used, involving SCWMRD, private landowners, local and state government agencies, private organizations and advisory committees. The SCWMRD will continue to serve as the lead management agency.

Reserve staff will include a reserve manager, a research coordinator, an education coordinator and a clerical position. A volunteer coordinator may be added later. SCWMRD will manage the reserve through a cooperative effort within its four functional divisions: Marine Resources; Wildlife and Freshwater Fisheries; Conservation, Education and Communication and Law Enforcement.

In addition, there will be at least one major advisory committee with appropriate sub-committees to serve in an advisory capacity on matters concerning resource protection, research and monitoring and education. The reserve manager will coordinate administrative functions and the various research and education programs at the reserve and act as liaison with the SCCC, NOAA and other NERRs. The research coordinator will coordinate ACE Basin NERR system-wide research and monitoring activities. The education coordinator will coordinate educational and interpretive activities within the reserve.

The reserve research and education programs will gather and make available information useful for improved understanding, appreciation, and management of the ACE Basin estuarine system in general. Reserve activities will augment, not replace, the on-going conservation and management activities on private lands. Facilities will be developed as necessary to aid in research and education and to serve as a focal point for visitors to the reserve.

In addition to the preferred alternative, other alternatives are discussed, including no action/status quo, alternative sites, alternative boundaries, and alternative management strategies. Under the no action alternative, the ACE Basin NERR designation would not be pursued and there would be no change in current management direction or level of management intensity. Several other sites were considered early in the site selection process. However, these were rejected in favor of the ACE Basin NERR site because of its great ecological diversity and pristine environmental characteristics. Alternative boundaries for the reserve are considered; however, the preferred boundaries encompass entire ecological units and thus are the most desirable. Alternative management plan options are considered, including establishing management of the reserve within an agency other than SCWMRD. Since SCWMRD has a long history of land management, estuarine research; fish and wildlife management, and conservation education, it is a logical choice as the lead agency. Another alternative considered was location of the education/visitor center somewhere

other than Bear Island Wildlife Management Area (WMA). Other sites were eliminated because SCWMRD already owns and operates Bear Island WMA, it is large enough to accommodate ancillary facilities development and it is easily accessible by road.

Valuable natural and cultural resources will be protected for long-term research and education by designation of the reserve. Natural resources affected by the proposed action include diverse, highly productive estuarine systems comprised of wetlands, open waters, with salinities ranging from freshwater to sea strength and uplands. Several species of either rare, endangered, or threatened plants and animals occur in the general area of the proposed reserve. In addition to such rich diversity of natural resources the region is also endowed with significant historical and archaeological sites.

Traditional uses in the proposed reserve include commercial and recreational fishing and shellfishing, hunting, trapping, wildlife observation, boating, agriculture and forestry. These activities will continue under present laws and regulations and designation of the ACE Basin NERR will not affect traditional uses.

The environmental consequences of the proposed action are strongly positive. The primary impact will be long-term protection of both natural and cultural resources. No resources will be irreversibly or irretrievably lost. On the contrary, these special 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 proposed action is in accordance with all relevant state, local and federal regulations and is consistent with the objectives of state, local, and federal land use plans, policies and controls for the area under consideration.

I. PURPOSE OF AND NEED FOR ACTION

A. Introduction

The state of South Carolina is proposing to establish a site in the Ashepoo-Combahee-Edisto (ACE) Basin as a component of the National Estuarine Research Reserve System (NERRS). This Final Environmental Impact Statement (FEIS) describes the probable impacts of implementing the management plan for the ACE Basin NERR. The purpose of this action is to designate the site as a natural field laboratory for long-term research, monitoring and education/interpretation. The management plan provides the framework and guidance for future management actions to accomplish the stated goals, objectives and priorities.

There is a great need for this action. Much of South Carolina's coastal zone is experiencing rapid population growth with the attendant demands for residential, commercial and industrial development. These changes cannot take place without some adverse effects on our natural environment in spite of the state's strong and effective coastal zone management program. Due to the immense complexity of the 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 man's activities on their future health and well-being.

Establishment of the ACE Basin NERR will assure the management of this unique estuarine ecosystem for the purposes of research, education, and habitat protection. Results of scientific research and environmental monitoring can be used to further protect and manage South Carolina's rich and diverse coastal environment. Additional benefits of reserve designation will be increased opportunities for educational programs to expand the public's knowledge and awareness of the complex nature of our coastal zone. Protection and management of the ACE Basin NERR is intended to support the research mission and further a major objective of the SCWMRD, protection of estuarine habitat and associated fish and wildlife resources.

B. The National Estuarine Research Reserve System

1. Federal Legislative Authority

The Federal Coastal Zone Management Act (CZMA, P.L. 92-583) was signed into law on October 27, 1972, in response to a growing national concern over intense pressures on the coastal zone of the United States. Congress was alerted to the need for legislation to promote a comprehensive approach to wise management of our coastal zone through three landmark study/reports: OUR NATION AND THE SEA, Stratton Report, January 1969; NATIONAL ESTUARINE POLLUTION STUDY, November 1969; and NATIONAL ESTUARY STUDY, January 1970.

To achieve the national policy of preserving, protecting, developing, and where possible, restoring or enhancing coastal resources, Congress selected the following approach (Section 302(h)):

"The key to more effective protection and use of the land and water resources of the coastal zone is to encourage the states to exercise their full authority over the lands and waters in the coastal zone by assisting the states, in cooperation with Federal and local governments and other vitally affected interests, in developing land and water use programs for the coastal zone, including unified policies, criteria, standards, methods, and processes for dealing with land use decisions of more than local significance."

The Act authorizes a variety of grant-in-aid programs to the states for purposes of:

- developing coastal zone management programs (Sec. 305) - S.C.'s Management Act was signed into law on May 24, 1977;
- implementing and administering coastal management programs that receive Federal approval (Sec.306);
- avoiding or minimizing adverse environmental, social, and economic impacts resulting from coastal energy activities (Sec.309);
- coordinating, studying, planning, and implementing interstate coastal management activities and programs (Sec.309);
- conducting research, study, and training programs to provide scientific and technical support to state coastal zone management programs (Sec. 310); and
- establishing national estuarine research reserves. Funds are available to assist in the acquisition, development, and operation of reserves, and to support education and interpretation activities, and research and monitoring (Sec. 315).

2. National Estuarine Research Reserve System Program

Congress created NERRS under Section 315 of the CZMA (1972) to provide "to coastal states grants of up to fifty percent of the costs of acquisition, development, and operation of estuarine sanctuaries (now called research reserves) for the purpose of creating natural field laboratories to gather data and make studies of the natural and human processes occurring within the estuaries of the coastal zone." Congress stated that research reserves should be:

...natural areas set aside primarily to provide scientists the opportunity to make baseline ecological measurements, essential to many coastal zone management decisions, and prediction of the impact of human intervention. These areas should not be chosen at random, but should reflect regional differentiation and a variety of ecosystems so as to cover all significant natural variation. These areas could be used to monitor vital changes or forecast possible deterioration from anticipated activities. Scientific research and ecological data from these areas could aid significantly in providing a rational basis for intelligent management of the coastal zone (Senate Report 92-753 as in Library of Congress, 1976).

Following passage of the law, NOAA promulgated regulations for NERRS in 1974 (15 CFR Part 921). The regulations were revised in 1984, 1989 and again in 1990. Originally called estuarine sanctuaries, the name was changed to research reserves by Congress in 1985 to emphasize the primary intent of the program (i.e., research and education). **WHILE THE PRIMARY PURPOSES OF RESEARCH RESERVES ARE RESEARCH AND EDUCATION, MULTIPLE USE OF THE AREAS BY THE PUBLIC IS ENCOURAGED. SUCH USES GENERALLY INCLUDE LOW-INTENSITY RECREATION SUCH AS BOATING, FISHING, HUNTING, SHELLFISHING AND WILDLIFE PHOTOGRAPHY AND OBSERVATION. TRADITIONAL USES SUCH AS COMMERCIAL FISHING AND SHELLFISHING ARE ALSO ACCOMMODATED.**

3. Concept of Biogeographic Zones

To ensure that the NERRS includes sites that adequately represent regional and ecological differences, Section 921.3 of the regulation (15CFR Part 921) sets forth a biogeographical classification scheme that reflects regional differences in biogeography. An estuarine typology system, which presents a variety of ecosystem types, is also included (Appendix A). Upon completion, the NERRS will contain representation of the 27 biogeographic regions of the Nation's coastal zone. The proposed ACE Basin NERR is representative of the Carolinian - South Atlantic region. It contains a diverse assemblage of representative outer coastal plain natural communities, including those typically associated with barrier islands, marsh islands and major estuarine rivers. Especially well represented in the proposed ACE Basin site are saltmarsh, brackish and freshwater marsh and maritime forest communities.

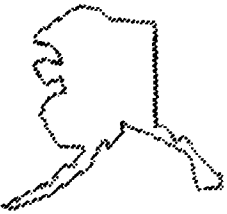
4. Existing National Estuarine Research Reserves

At the present time, 18 reserve sites have been designated (Table 1) across the country (Figure 1).

Table 1. Designated Sites in the NERRS.

<u>RESEARCH RESERVE</u>	<u>BIOGEOGRAPHIC CLASSIFICATION</u>
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 George's, and Somerset Counties	Virginian
Chesapeake Bay, Virginia, (4 components) York, Gloucester, James City, and King William Counties	Virginian
North Carolina (4 components), Brunswick, Carteret, Curriuck and New Hanover Counties	Virginian/ Carolinian
Sapelo Island, McIntosh County, Georgia	Carolinian
Rookery Bay, Collier County, Florida	West Indian
Jabos Bay, Puerto Rico	West Indian
Apalachicola River/Bay Franklin County, Florida	Louisianan
Weeks Bay, Baldwin County, Alabama	Louisianan
Tijuana, 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

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The National Estuarine Reserve Research System

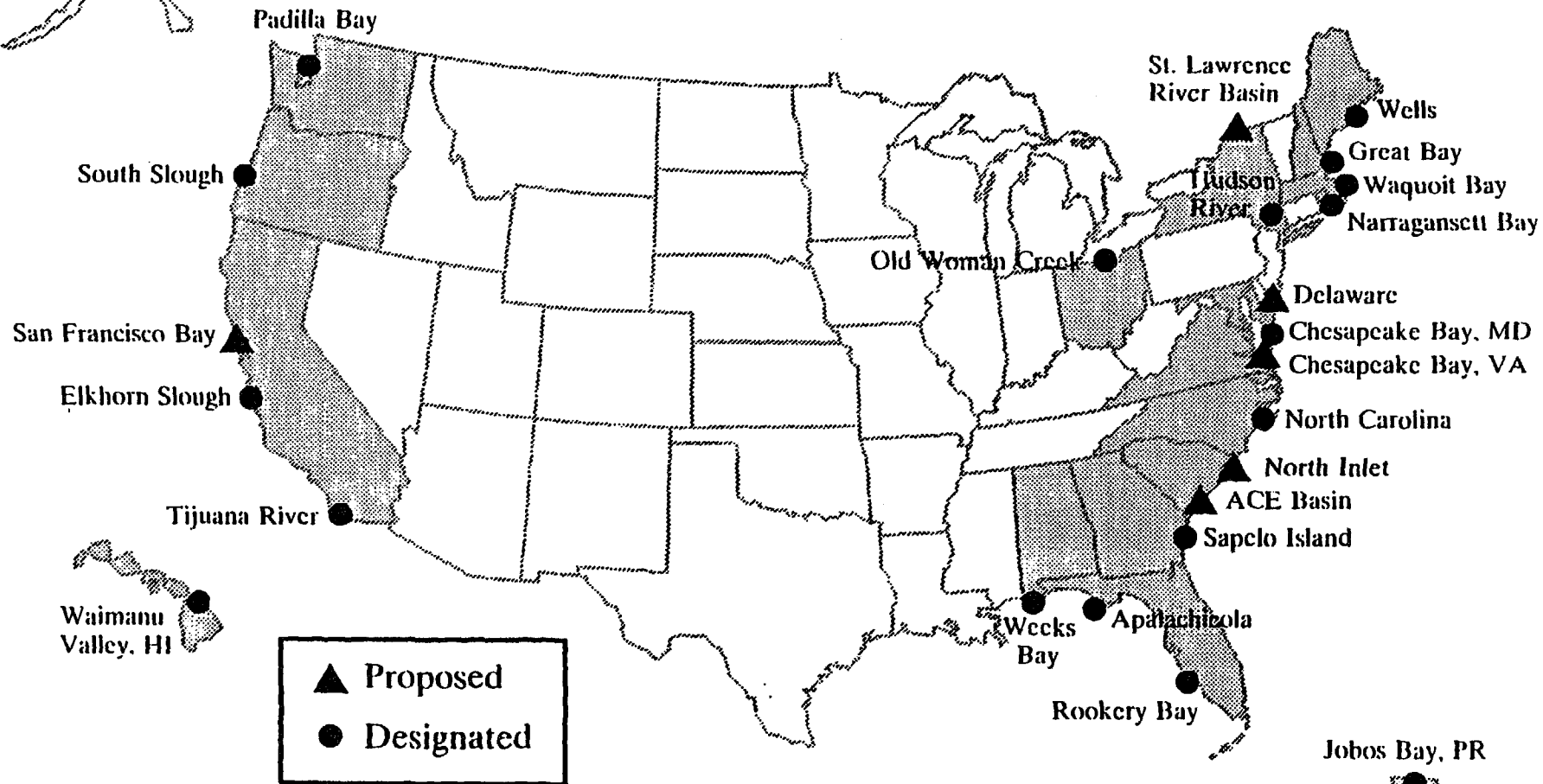


Figure 1. Existing and Proposed National Estuarine Research Reserves in the U. S.

In addition, California-San Francisco Bay (San Francisco Bay), New York-St. Lawrence River Basin (Acadian), Delaware (Virginian), East Coast of Florida, Virginia (Virginian) and South Carolina (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.

5. Funding and Support

Federal funding for NERRs is described in detail below. Briefly, five categories of federal awards are available from NOAA: predesignation awards; acquisition and development awards; operation and management awards; research and monitoring awards; and education and interpretation awards. The amount of federal financial assistance provided may vary according to program areas; most of the federal funds must be matched by the state or other entities.

Federal funding has and will be used for initial operation and staffing of the ACE Basin NERR. The reserve is a cooperative federal-state program. At a minimum, long-term funds must be provided by the state to cover general operating expenses and the salaries of the reserve manager and support staff. The reserve staff will work cooperatively with other agencies to pool resources. Efforts will also be made to obtain outside grants and other sources of program revenue. These include the creation of support groups and endowment funds for the ACE Basin. Support groups have been successfully utilized at other NERRs and may be used as models (e.g. the Friends of the Reserve at the Apalachicola Reserve in Florida, the Elkhorn Slough Foundation at the Elkhorn Slough Reserve in California, and Friends of Jug Bay at JBWS in the CBNERR Maryland).

Predesignation awards are available for site selection and post site selection. Acquisition and development awards are available prior to reserve designation for acquiring interest in land and water areas, performing minor construction, preparing plans and specifications, developing the final management plan, and hiring necessary staff.

After a reserve receives federal designation, a supplemental acquisition and development award is available for acquisition of additional property interests, construction of research and education facilities, and restoration projects. Operation and management awards are available to manage the reserve and operate programs detailed in the management plan. The federal portion of operation and management awards may be used for the support of staff positions.

Research and monitoring awards are available on a competitive basis to conduct estuarine research and monitoring within the NERRS. Any coastal state or qualified public or private person may compete for these awards which are available annually. Financial assistance awards are available for conducting educational and interpretive

activities within the NERRS. These are available annually on a competitive basis to any coastal state entity.

More detailed information on NOAA funding can be found in the Federal Register 15 CFR Part 921 (Appendix B). As CZMA regulations are amended, funding limits and types may change.

6. Federal Role in the NERR after Designation

After designation, NOAA will conduct periodic performance evaluations of the NERR at least once every four years. Evaluations may be conducted more frequently as determined necessary by NOAA. These evaluations are required by Sections 312 and 315 of CZMA and will follow the evaluation 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 NERRS designation regulations, and particularly whether the operations and management of the reserve are consistent with and further the mission and goals of NERRS.

Federal officials will conduct the performance evaluations. When necessary, NOAA may request federal and non-federal experts to participate in the evaluation. Performance evaluations will be conducted in accordance with procedural and public participation provisions of CZMA regulations. The state must submit a report on operation and management of the reserve to NOAA annually.

If performance evaluations reveal that the operation and management of the reserve is deficient or the research is inconsistent with NERRS research guidelines, 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.

C. The ACE Basin NERR

1. Background

The ACE Basin NERR is being proposed by the SCWMRD in cooperation with the SCCC, the state's lead agency in coastal zone management.

Recently, the SCWMRD and the USFWS, along with representatives of TNC, DU, other conservation organizations and a private sector of enthusiastic landowners have recognized the uniqueness of the ACE Basin. The area is about 45 miles southwest of Charleston, South Carolina (Figure 2) and encompasses approximately 350,000 acres of undeveloped land and water areas, largely devoted to the forest products

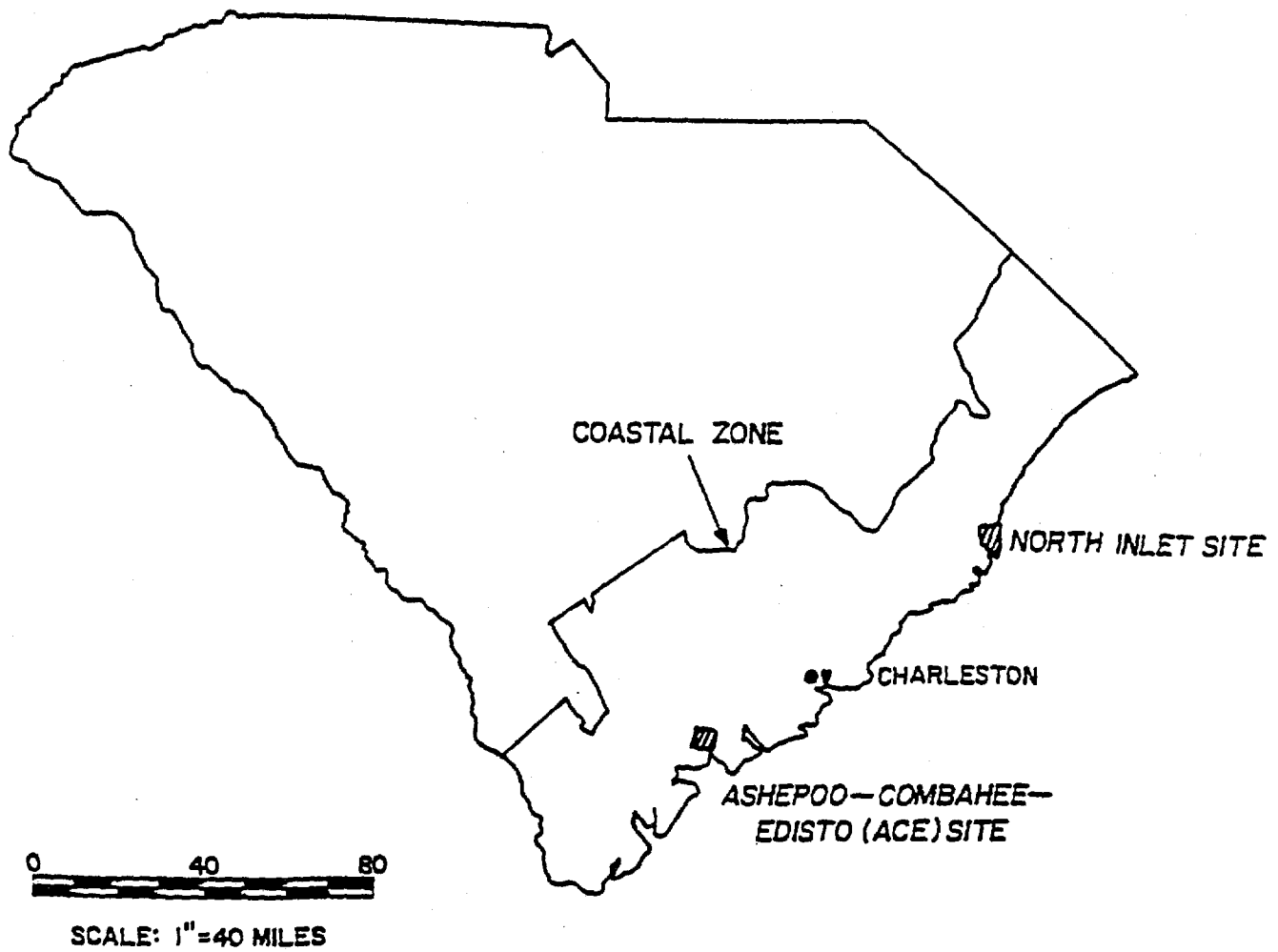


Figure 2. Location map for proposed NERRS sites in South Carolina.

industry and wildlife management. The heart of this area is a series of remote coastal islands in the lower basin, which are accessible only by water. The NERRS was viewed as a compatible tool to provide long-term management and opportunities for research and education. Early in the site selection process, other areas (e.g. Port Royal Sound, Calibogue Sound, North Edisto River and the Santee Delta) being considered as possible NERR sites were eliminated. The Site Selection Committee felt that the uniqueness and value of the ACE Basin site could favorably compare with any site currently being managed in the NERRS.

2. Site Selection Process

On October 29, 1988, the S.C. NERRS Site Selection Advisory Committee was appointed by Senator John C. Hayes, III, Chairman of the SCCC.

The purpose of the committee was to consider potential NERR sites in South Carolina and to make a recommendation to the SCCC of one or more sites for inclusion in the national system. Staff of the SCCC served as staff to the Committee.

At an organizational meeting on November 14, 1988, the committee appointed two subcommittees to study two potential sites - the ACE Basin, which had been recommended by Governor Carroll Campbell, and the North Inlet-Winyah Bay site, an area which had been considered in the past as a potential reserve site. At the next meeting on February 6, 1989, both sub-committees gave reports on their respective sites. The sub-committee reports indicated both sites appeared to meet criteria for the NERRS Program and public comments should be sought. The Site Selection Advisory Committee voted to approve the sub-committees' reports for both the ACE Basin and North Inlet-Winyah Bay sites and moved to proceed with obtaining public comment.

A public meeting on the ACE Basin site was held on April 10, 1989, in Walterboro, South Carolina. Reaction from the public was generally mixed. Concern was expressed over management of the potential NERRS site to the exclusion of the general public from gaining access to marshes and waterways. A public hearing on the North Inlet-Winyah Bay site on May 17, 1989, in Georgetown, South Carolina, revealed public concern about a possible impact on the shipping industry as well as public access. On July 17, 1989, the site selection committee voted unanimously to recommend to the SCCC that both sites be nominated for inclusion in the NERRS. The committee also recommended that all public concerns must be thoroughly addressed during development of a management plan. At its meeting of July 21, 1989, the SCCC, on recommendation of the site selection committee, approved the ACE Basin site and the North Inlet-Winyah Bay site for nomination to NERRS. Upon this decision, Council staff, in conjunction with staff from the South Carolina Wildlife and Marine Resources Department and Belle W. Baruch Institute, began preparation of the nomination package for submittal to NOAA under signature of Governor

Campbell. On January 24, 1990, Governor Carroll Campbell nominated the ACE Basin and North Inlet-Winyah Bay as separate NERR sites (Appendix C) because each site is located in a different biogeographic region (Figure 2).

3. Site Selection Criteria

Nomination of these sites was made only after a thorough review of site evaluation criteria and the input of coastal scientists, state and local officials, affected landowners and the general public. Site selection criteria included:

- a. **Biogeographical Representation** - whether the site represents the ecological conditions of the biogeographic zone of the Carolinian-South Atlantic Sub-Region in which it is found, fills a void in biogeographic representation in the state of S.C. and does not duplicate biogeographic representation in the Region;
- b. **Ecosystem Representation** - whether the site encompasses an entire ecological unit, represents a significant component of the coastal ecosystem in light of the types of geomorphic features and biotic communities which are found in the state's coastal zone, fills a void in ecosystem representation in the state, and does not duplicate ecosystem representation in the Region;
- c. **Ecological Characteristics** - whether the areas's ecological characteristics contribute substantially to the quality of the estuarine environment through its biological productivity, diversity of flora and fauna, and other demonstrated ecological values and functions;
- d. **Naturalness** - whether the site is relatively unaffected by past and present human activities and approximates a natural ecological unit where ecosystem processes can be studied in an undisturbed setting;
- e. **Research Potential** - whether the site provides a natural field laboratory, has a history of research use or is desirable for use as a research site, and is important for addressing fundamental ecological questions and local coastal resource problems;
- f. **Educational Opportunities** - whether the site is accessible and provides opportunities for educational and interpretive programs which are compatible with the research reserve character as a natural field laboratory; and
- g. **Management Considerations** - whether the site is available for incorporation into the NERRS (i.e., landowner's willingness), can be protected under some type of formal mechanism (conservation easement, long-term management agreement, MOU, or fee simple acquisition), is of adequate size to assure effective protection from activities outside its boundaries, and will provide a stable environment for research and educational activities.

NOAA approved the site nomination on March 27, 1990 (Appendix C). This approval moved SCCC into the next phase of the designation process for the ACE Basin NERR: preparation of a DEIS and draft management plan (DMP). NOAA awarded SCCC \$50,000 in federal pre-designation funds to complete the DEIS/DMP, FEIS/DMP and site characterization for the ACE Basin site. The state is providing the required match through SCWMRD and SCCC.

II. ALTERNATIVES (INCLUDING THE PROPOSED ACTION)

The action under consideration by NOAA is a proposal from the State of South Carolina to establish a NERR in the ACE Basin, consisting of approximately 69,000 acres of wetlands, 59,000 acres of open water and 7,752 acres of uplands and lying within the boundaries of Beaufort, Colleton and Charleston counties.

This section considers a number of reasonable alternatives which were analyzed during development of this document. The "preferred alternative" is the one SCWMRD believes would fulfill its statutory mission and responsibilities in the ACE Basin. It has been developed in detail as the proposed management plan, giving consideration to economic, environmental, traditional uses and other factors. The "no action" alternative proposes that the ACE Basin site not be designated as a NERR and there is no change from current management direction or level of management intensity. Other alternatives discussed include boundary modifications, additional sites and different management options.

A. Preferred Alternative

1. Land Acquisition Plan

a. General Context for Management

According to the Coastal Zone Reauthorization Act of 1985, 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 protection effort. However, the most effective mechanism for long-term protection or control is the acquisition of key properties through fee simple ownership or conservation easements.

The reserve contains a unique array of ownerships. Unlike many coastal areas where the ownership pattern is diverse and highly fragmented, the ACE Basin site has a relatively small number of owners with large undeveloped land holdings (see Appendix D). There are about twenty five (25) key landowners with large plantations along the rivers. Historically, these landowners have practiced good stewardship and maintained a strong conservation ethic in management of these properties.

Continuing the present level of protection and land management ethics over the long-term is dependent on fostering land protection efforts and providing adequate public participation as a means of promoting compatible uses of the reserve. This can be accomplished through: 1) fee title acquisition, 2) gift or donation; and 3) lease, easement or cooperative management agreements with private landowners. Under this action plan, all land acquisition will be performed in accordance with federal laws and regulations for real estate acquisition, including independent appraisals. Property will be acquired only from those private landowners willing to participate in the program. There will be no condemnation.

b. Assessment of Boundaries

Boundaries for the ACE Basin NERR 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" (Federal Register, Vol. 53, No. 209, Section 921.11). 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 area) and a buffer zone.

NOAA's Guidelines for Establishing Proposed Boundaries for National Estuarine Research 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.

(1). Key Land and Water Areas (Core)

The proposed core area of the ACE Basin NERR consists of a series of remote coastal islands in southeastern Colleton County, which are accessible only by water. These are Pine, Otter, Ashe, Beet, Bolders, Big, Warren and South Hutchinson islands (Figure 3). The total core area (16,040 acres) encompasses approximately 2,444 acres of highland and 13,596 acres of marsh.

The core area is bounded on the east by Otter and Pine islands, both of which have beaches fronting on St. Helena Sound. Fish Creek separates the two islands and drains a large expanse of salt marsh bounded to the east by the South Edisto River

Figure 3. Area Map Showing Eight (8) Islands Proposed for Acquisition In Core Area.



and to the west by the Ashepoo River.

To the northwest of this easternmost marsh island complex lie the remaining islands in the core area; South Hutchinson, Ashe and Beet, Bolders, Warren and Big. These are also marsh islands consisting of low Pleistocene beach ridge remnants comprising the upland portions surrounded by estuarine tidal marshes. The Ashepoo River bounds Hutchinson Island to the east and north. Although both Hutchinson and Ashe islands face south on St. Helena Sound, neither have beaches as do Otter and Pine. Rock Creek separates Hutchinson Island from Ashe and Beet islands that lie in the central portion of the core.

Excavated portions of the Atlantic Intracoastal Waterway (AIWW) bisect Hutchinson Island and separate the marshes of Ashe Island to the South and Beet Island to the north. Beet Island is bounded to the west by the New Chehaw River and Rock Creek to the north and east. Bolders Island lies to the north of Beet Island between the Ashepoo River to the east and the New Chehaw River to the west. Warren and Big islands form the westernmost boundary of the core area. They are both located between the New and Old Chehaw River, Big to the north and Warren to the south.

(2). Buffer Zone

The buffer zone of the ACE Basin NERR occupies approximately 119,514 acres. There are 54,801 acres of wetlands, 59,405 acres of open waters and 5,308 acres of upland within the buffer zone. Generally, the buffer zone includes all state-owned bottoms, open waters and wetlands, extending up to and including the critical area as defined in the South Carolina Coastal Management Act (Act 123 of the 1977 South Carolina General Assembly). It excludes uplands and wetlands now held in private ownership, unless otherwise specified in the FEIS/DMP.

The seaward boundary of the buffer zone is marked by an artificial line, the "COLREGS" line, lying between the headlands of Edisto Beach and Hunting Island (Figure 4). The northeastern boundary includes the marshes of South Edisto River draining the western side of Edisto Island and the following tidal stream systems: Big Bay Creek, St. Pierre Creek (Fishing, Store and Bailey Creeks), North Creek and that portion of the Atlantic Intracoastal Waterway (AIWW) connecting the Dawhoo River to the South Edisto. All of Jehossee Island and further north along the South Edisto to the abandoned Seaboard Coastline Railroad (SCR) bed forms the northeast corner.

The alignment of the abandoned SCR, running approximately in a southwestern direction, is a persistent dominant feature, and serves as the northern boundary up to the crossing at the Combahee River. The zone includes the entire width of the Combahee River floodplain, with Wimbee Creek as the westernmost boundary (Figure 5). Downstream of the former railroad alignment, the western boundary follows

ASHEPOO-COMBAHEE-EDISTO (ACE) BASIN NATIONAL ESTUARINE RESEARCH RESERVE

SITE BOUNDARIES

- /// BEAR ISLAND WMA
- ≡ NERR BUFFER AREA
- /// NERR CORE AREA

1. ASHE
2. BEET
3. BIG
4. BOLDERS
5. PINE
6. OTTER
7. S. HUTCHINSON
8. WARREN

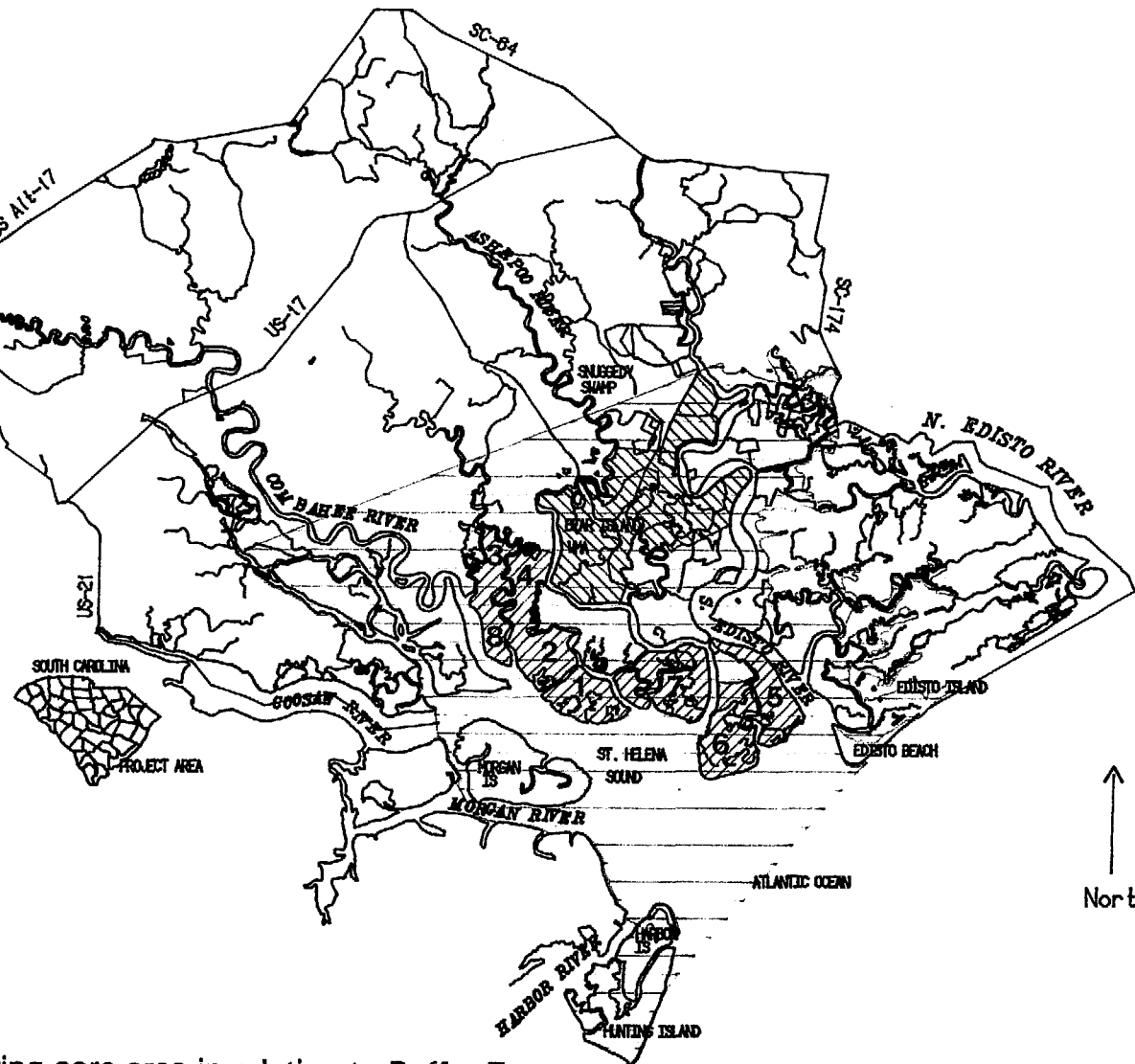


Figure 4. Descriptive map showing core area in relation to Buffer Zone.



Figure 5. Aerial view of the old SCR bed intersecting Wimbee Creek and forming the northern boundary of the NERR buffer zone.

Wimbee Creek (including the Williman Islands) into Bull River and across the lower Coosaw River into Morgan River (including Morgan Island).

The buffer zone then follows Morgan River out into St. Helena Sound across the mouth of Jenkins, Village and Coffin Creeks, and then southeastward along the shore of St. Helena Island to Harbor River. The boundary crosses Harbor River at the U.S. Highway 21 bridge to Harbor Island, including all of the marshes but excluding the upland now held in private ownership. The boundary then continues southeast across Johnson Creek, again following U.S. Highway 21, and onto Hunting Island. There, the entire area of marsh and upland owned by the state of South Carolina and managed by the Department of Parks, Recreation, and Tourism (SCDPRT) is included. The southern terminus of the COLREGS line ends at Hunting Island, thus closing the boundary of the buffer zone. At the easternmost point of the buffer zone, on Edisto Island, the marsh and upland similarly owned by the state and managed by SCDPRT as Edisto Beach State Park is also included as are all wetlands and critical areas up to Highway 174.

The buffer zone boundaries were drawn, not only as a matter of convenience based on land marks or features readily identifiable on maps, aerial photos and ground truth observations, but also on the following: 1) the buffer is large enough to accommodate continuation of traditional uses and to provide additional protection to estuarine-dependent species; 2) it will ensure the long-term viability of the reserve for research on natural processes; 3) it includes an area large enough to adequately accommodate facilities required for research and interpretation and, if necessary, to handle a shift of the reserve core area as a result of biological, ecological or geomorphological changes; and 4) it represents one of the largest undeveloped complexes of wetlands and upland habitat on the Atlantic Coast and is nationally recognized as a unique natural resource area.

Bear Island, an 12,055 acre SCWMRD Wildlife Management Area, is an important component of the buffer zone. It will play a vital role in the overall function of the reserve. Other State-owned lands within the buffer zone include the Edisto Beach State Park and Hunting Island State Park, both managed by the SCDPRT. Other uplands may be incorporated into the buffer zone as negotiations are made with those private landowners wishing to participate in the ACE Basin project.

As new data are acquired on the reserve, a better understanding will be gained on the role and characteristics of buffer areas and the relationship between sensitive estuarine resources and upstream habitats. Such information may indicate a need to change the proposed NERR boundaries, either to include new land areas or remove areas currently within the proposed boundaries. In any event, opportunities for public comment will be provided when changes are proposed.

C. Acquisition Strategy

Acquisition of the eight (8) islands in the proposed core area is top priority in gaining adequate control over key land and water areas in the reserve. This may be accomplished in the following approach:

- . Fee title Acquisition
 - Ashe Island
 - Beet Island
 - Otter Island
- . Donation and/or Gift
 - Warren island
 - Big Island
- . Memorandum of Understanding
 - Bolders Island
- . Conservation Easement and/or Management Agreement
 - Pine Island
 - South Hutchinson Island

It should be stressed once again that property will be acquired only from those private landowners willing to participate in the program. There will be no condemnation of land.

(1). Fee title Acquisition

(a). Ashe Island (Figure 6) was purchased on February 9, 1990 by TNC from Thomas L. Peebles and Marsha Elaine Peebles Kinghorn for one hundred ten thousand (\$110,000) dollars. Prior to this purchase, the property had been in the same family since May 12, 1735. At which time the property was given a King's grant from King George II to James Crockran.

Ashe Island has an estimated 64.3 acres of high ground and 1,657.7 acres of marsh for a total of 1,722 acres. The property is bounded on the north and east by Rock Creek; on the northwest by Ashepoo/Coosaw Cutoff; on the west by the Coosaw River and on the south by St. Helena Sound. This island is located in the northern portion of St. Helena Sound. Those parts of the island that front the Sound are generally separated from the sound by mud flats, shell flats and oyster banks.

The only access to the island is by boat. The AIWW extends along the northern and northwestern sides of the island. The channel within the AIWW at this point varies in depth from nine (9) feet to thirty eight (38) feet in depth. Rock Creek which

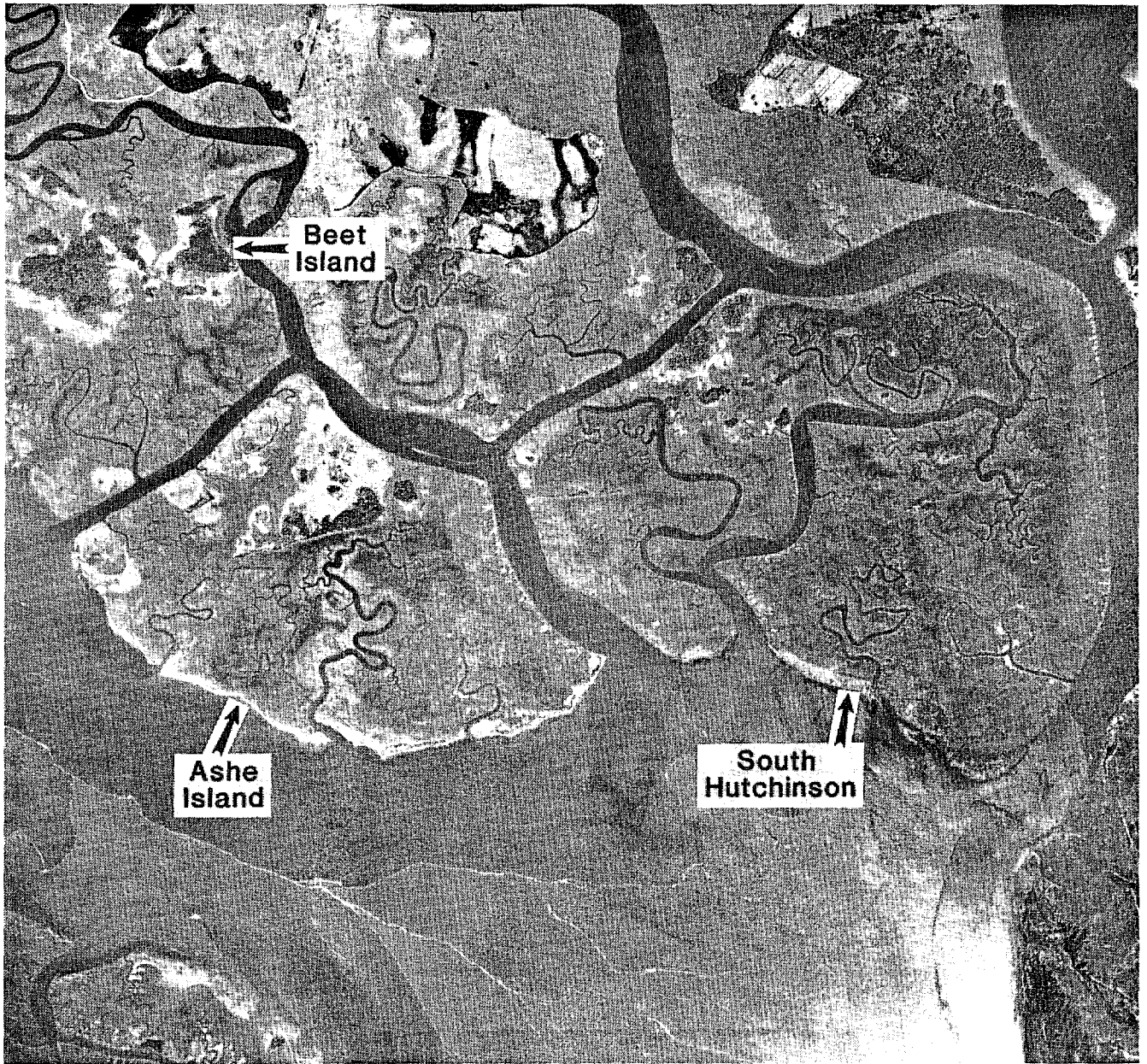


Figure 6. Site-specific view of Ashe, Beet and South Hutchinson Islands.

is a short portion of the AIWW has a relatively deep channel that also varies from nine (9) to thirty eight (38) feet in depth. The channel continues with reasonably good depth into St. Helena Sound. The Coosaw River on the southern side of Ashe Island has good depth and a wide channel. There are four (4) U.S. Army Corps of Engineers disposal areas located along the AIWW and along Rock Creek. These areas are earthen impoundments into which dredge material is pumped from the AIWW. The impoundments were constructed in the marshes of Ashe Island and have considerable vegetation, mostly transitional shrubs.

Access to the highland of Ashe Island is through the marsh only. There is no direct boat access to the main island. There are no improvements on the island.

(b) Beet Island (Figure 6) was acquired by the TNC from Ruth C. Peeples and Catherine Prioleau Ravenel for Four Hundred Thirty Nine Thousand Six Hundred Seventy (\$439,670) dollars. Prior to that time, the last transfer of this property was on September 19, 1956.

Beet Island has approximately three hundred (300) acres of high ground and one thousand three hundred eighty five (1,385) acres of marsh for a total area of one thousand six hundred eighty five (1,685) acres. This island is bounded on the north and east by Rock Creek, on the southeast by Ashepoo/Coosaw Cutoff (AIWW), and on a portion of the west by New Chehaw River which flows into the Combahee and Coosaw rivers. The high land is scattered in several small tracts. The larger of the tracts has direct access to deep water in Rock Creek. The larger portion of Beet Island is surrounded by sand on the western side. On the eastern side, the land area is predominantly marsh. This island is accessible only by boat.

(c) Otter Island (Figure 7) is an outstanding coastal island located on St. Helena Sound at the eastern end of the core area. It consists of eight hundred and six (806) acres of high land and two thousand four hundred twenty six (2,426) acres of marsh for a total of three thousand two hundred and thirty two (3,232) acres. It is bounded on the east by South Edisto River and on the west by Ashepoo River. Otter Island is the most valuable of all the islands proposed in the core area of the reserve. It is owned by Clifton Stevens of the State of New York. To date, official negotiations are not far enough along to discuss specifics of acquisition. Every effort will be made during the pre-designation phase for this project to acquire fee simple ownership of this island. It has already been approved as a high priority area for acquisition in the Heritage Trust Program of South Carolina.

(2) Memorandum of Understanding

(a). Bolders Island (Figure 8) was transferred to the Ducks Unlimited Foundation (DUF) on December 11, 1989 as a gift from Gaylord Donnelley and Dorothy R. Donnelley. This property had last been transferred by Donald J. Garlan, trustee for

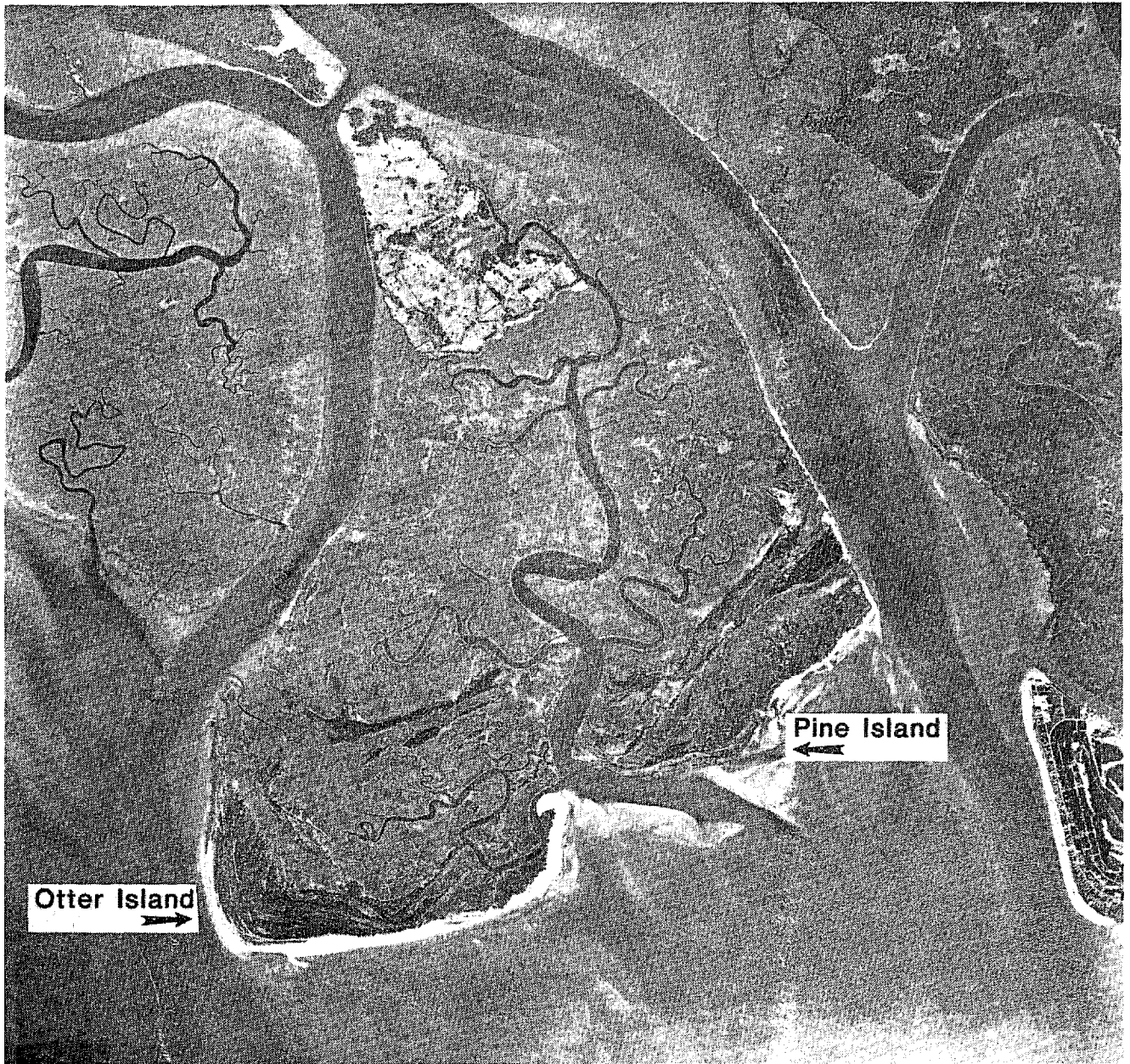


Figure 7. Site-specific view of Otter and Pine Islands.

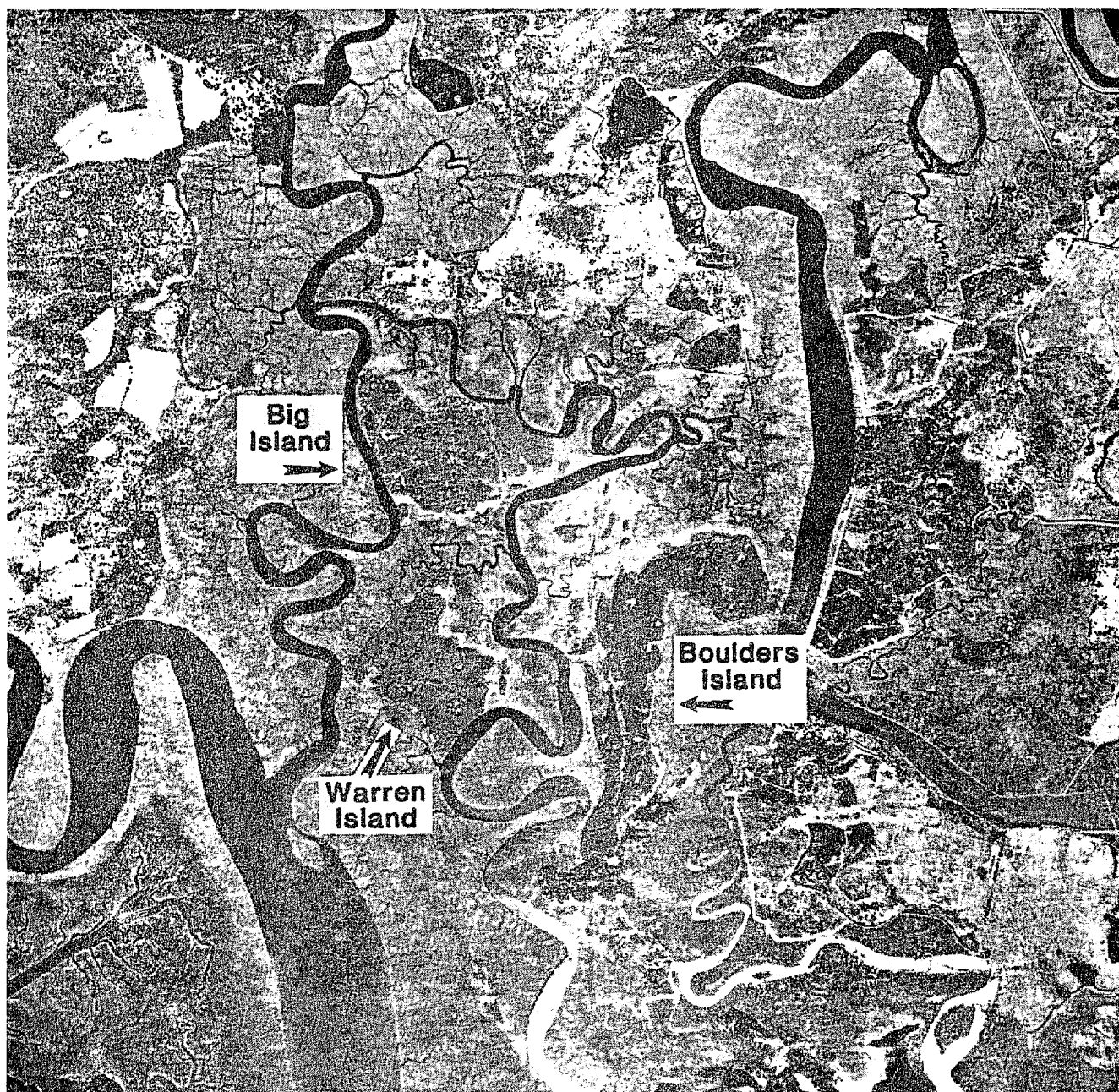


Figure 8. Site-specific view of Bolders, Warren and Big Island.

the Gaylord Donnelley Trust established in 1966, to the Donnelley family. This deed was recorded on November 14, 1989. The property had been held in trust for many years. It was transferred at no consideration. Bolders Island contains six hundred and nine (609) acres of upland and one thousand and forty (1,040) acres of marsh for a total area of one thousand six hundred forty nine (1,649) acres. All of this island will be included in the reserve. It is a long and narrow tract which lies generally in a north-south direction, bounded on the west by New Chehaw River, on the southeast by Rock Creek, on the east by Ashepoo River, and on the north by marsh and unnamed waterways.

The title to Bolders Island will be retained by DUF, but the island will be protected in perpetuity as part of the core area by way of a MOU (Appendix D). The island will be cooperatively managed by SCWMRD and DUF in accordance with the ACE Basin NERR Management Plan.

(3). Donation and/or Gift

(a). Warren and Big Island Complex - these islands (Figure 8) were gifts from TNC to the National Fish and Wildlife Foundation (NFWF) on November 29, 1989. This was also property held in the Donnelley Trust and had been donated to TNC on October 14, 1988. This property had also been held in trust for many years prior to the gift.

Warren Island and Big Island were deeded in one transaction to the NFWF. Warren Island is reported to contain approximately two hundred and forty six (246) acres of high ground and one thousand three hundred and ninety (1,390) acres of marsh for a total of one thousand six hundred and thirty six (1,636) acres. Big Island is reported to contain approximately three hundred and forty (340) acres of high ground and two hundred sixty five (265) acres of marsh for a total area of six hundred and five (605) acres.

These islands are bounded on the west by the Chehaw River and on the east by the New Chehaw River. The northern boundary is a portion of the New Chehaw River. These rivers flow into the Combahee River which forms the balance of the western and southern boundaries of this property. Both Warren Island and Big Island have high ground which is directly accessible to the Chehaw River and a portion of Big Island also has some frontage on the New Chehaw River.

(4). Conservation Easements and/or Management Agreements

(a). Pine Island (Figure 7) is closely associated with Otter Island at the easternmost boundary of the reserve core area and likewise would be a valuable core component. Unlike the other islands, however, Pine Island has a more complex ownership pattern. There are seven (7) parcels of land on the island owned by

different individuals and a corporation (Appendix D). The Chelonia Institute, a private research institution, owns two thousand seven hundred and seventy five (2,775) acres. This organization is currently conducting sea turtle research, primarily on the front beach of Pine Island. The other property owners enjoy the island in its natural state. There are no improvements on Pine Island and it is accessible only by boat. In consideration of the above, a conservation easement with the Chelonia Institute would appear to be an appropriate course of action. Management agreements may be negotiated with those individual owners wishing to participate in the project.

(b). South Hutchinson Island (Figure 6) is also owned by several individuals and would be an ideal component of the core area because of its geographic location and ecological character. The Hutchinson Island Association controls most of the upland portions of this island and its larger counterpart to the north. Both islands are bounded by Ashepoo River to the east and north and Rock Creek to the south and west. The main island to the north is used more extensively for hunting and is under intensive wildlife management. South Hutchinson Island is not under intensive management and contains a large expanse of undisturbed marsh. The island contains three thousand one hundred and twenty three (3,123) acres, most of which is salt marsh. The remaining upland on South Hutchinson would be a minor portion of the overall area. A management agreement with the owners of these uplands would appear to be the most feasible approach in establishing South Hutchinson Island as a component of the core area. However, the owners have not expressed an interest in participating in the NERR at this writing.

d. Schedule and Funding Mechanism

The work schedule presented in Table 2 is based on the assumption of a land acquisition contract award date of September 1, 1991. Following approval of this grant application, SCWMRD will purchase Ashe and Beet Islands from TNC at an estimated cost of \$549,670 (Table 2). State match will come from the appraisal value (\$951,450) of Warren and Big Islands. Title to these unencumbered islands will be transferred from NFWF to SCWMRD prior to any transactions with TNC (Appendix D). Unused portions of the federal grant and state match will be used in acquisition of the remaining islands identified as high priority lands in Table 3.

2. Resource Protection Plan

a. Management of the NERR site through the South Carolina Coastal Zone 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

Table 2. Schedule of Milestones For Land Acquisition and Reserve Designation

<u>Date</u>	<u>Project Month</u>	<u>Milestone</u>
1 July 1991	0	Issue FEIS/DMP; submit land appraisals to NOAA for review; document ownership of lands to be acquired; complete environmental assessment; set closing date on Ash and Beet with TNC; notify NOAA in writing of closing date.
31 July 1991	0	Complete certified land survey description of property to be acquired; show evidence of title insurance and opinion of title for Ashe, Beet, Warren and Big islands.
1 August 1991	0	Consummate transfer of title to Warren and Big islands from NFWF to SCWMRD; Donation to be used as state match.
15 August 1991	0	Draft MOU with DUF for inclusion of Bolders Island into core areas; title remains with DUF; submit MOU to NOAA for review and finalization.
1 September 1991	1	Initiate contract; submit title, deeds, etc. to NOAA for release of federal funds (\$700,000) for the purchase of Ashe and Beet islands.
15 September 1991	1	Begin negotiations with owners of South Hutchinson, Pine and Otter islands.
1 October 1991	2	Draft conservation easements and/or management agreements for South Hutchinson and Pine island; work out details with owners.
15 October 1991	2	Submit easements and agreement to NOAA for review.
1 November 1991	3	Close on the purchase of Ashe and Beet islands with TNC.
15 November 1991	3	Finalize easements for South Hutchinson and Pine Islands.
1 December 1991	4	Continue negotiations with owner of Otter Island; explore alternate funding sources.
15 January 1992	5	Complete draft of Final Management Plan; Submit to NOAA for review.

Table 3. High Priority Lands Proposed For Acquisition in Reserve Core Area.

Name of Tract	Size (Acres)	Appraised Value	Estimated Cost	Type Acquisition Proposed
Ashe Island	1,722	\$296,880	\$110,000	Fee title from TNC to SCWMRD
Beet Island	1,685	\$567,750	\$439,670	Fee title from TNC to SCWMRD
Warren Island*	1,636	\$503,700	Donation	Title transfer from NFWF to SCWMRD
Big Island*	605	\$447,750	Donation	Title transfer from NFWF to SCWMRD
Bolders Island	1,640	\$886,800	-	MOU between DUF and SCWMRD; title to be retained by DUF
Otter Island	3,232	?	?	Fee title from owner to SCWMRD
Pine Island	2,394	-	-	Conservation easement and management agreements
South Hutchinson	3,123	-	-	Conservation easement and management agreements

*To be used as state match

South Carolina Wildlife and Marine Resources Department (SCWMRD)
Ducks Unlimited Foundation (DUF)
The Nature Conservancy (TNC)
National Fish and Wildlife Foundation (NFWF)

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).

(1). 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 (see Appendix E). 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, intact structures and many others.

With the exception of the high ground portion of the islands located in the ACE NERR site, the entire core area is classified as critical area. Any activity which occurs in the critical area of the NERR site will be regulated by permit through the South Carolina Coastal Zone Management Program.

(2). 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 SCCC before the permit can be issued by the issuing State or Federal agency. The policies utilized to make a consistency determination are similar to those required for critical areas. The Council has a memorandum of agreement with all regulatory state agencies that establishes a consistency determination review procedure. Federal regulations (15 CFR 930) establish a review procedure with federal agencies. Permits which are reviewed for coastal zone management consistency include:

Section 404 permits
Section 401 permits
Wastewater permits

Section 10 permits
Coast Guard bridge permits
Water supply permits

Air quality permits	Underground tank permits
Landfill permits	Mining permits
State navigable water permits	Capacity use (wells) permits
Septic tank permits	NPDES permits

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, and dock master plan (if applicable).

In reference to the ACE Basin NERR, the entire site falls within the coastal zone of South Carolina; therefore, any activity which requires one of the above listed permits must be consistent with the coastal zone management program and the specific policies of the NERRS (Appendix E).

(3). Enforcement

The SCCC 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 represents the first level of enforcement. The SCCC is also in alliance with the SCWMRD whose conservation officers patrol the waters and land of the coast on a daily basis. Noted violations are reported to SCCC enforcement staff who conduct a field inspection; State conservation officers are available for backup if needed. Fines for violations are up to \$1,000 per day.

Enforcement of activities requiring coastal zone consistency certification generally takes place through the agency issuing the permit. The majority of activities, however, require a final SCCC sign-off prior to permit issuance; for example, a SCCC 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 SCCC has an active Beach and Creek Watch program to provide a forum for citizen awareness and violation reporting.

The SCCC has implemented its full authority in the coastal zone through a system of "networking", whereby cooperation has been developed between the SCCC and other state agencies. Seventeen (17) state agencies exercise some of authority over: (1) the use of coastal resources, (2) specific areas in the coastal zone, or (3) activities in the coastal zone (Table 4). This authority is granted by the statutes of South Carolina, most of them enacted prior to the Coastal Management Act (Appendix E).

Table 4. Summary of "Networking" Activities.

AGENCIES WITH PERMITTING OR PLANNING/MANAGEMENT AUTHORITY FOR ACTIVITIES WITH A DIRECT AND SIGNIFICANT IMPACT	Coastal Council	Aeronautics Comm.	Arch. & Anthropology	Budget & Control Bd.	DHEC	Development Bd.	Forestry Comm.	Highway Dept.	Land Resources	PRT	Patriot's Point	Railways Comm.	PSA	PSC	State Housing Auth.	SPA	Water Resources	Wildlife/Marine Resources	LOCAL	FEDERAL
ACTIVITY																				
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															
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	
Boat ramps	X			X							X							X	X	
Docks and piers	X			X						X						X				
WILDLIFE AND FISHERIES MAN.	X																X	X		
Artificial reefs	X			X														X		
Impoundments	X			X														X		
DREDGING	X			X																X
Dredge Material Disposal	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

b. Management Policies

The designated ACE Basin NERR will be maintained as open space, fish and wildlife habitat, and a natural field laboratory for research and education/interpretation. The reserve core area will be 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 designated and protected conservation areas within the buffer zone such as Bear Island Wildlife Management Area (WMA) will be managed according to established site-specific management plans. Private lands formally protected through conservation easements, management agreements, etc. in the buffer zone will be managed exclusively according to guidelines established in said agreements. Individuals not participating in the private landowner's initiative will not be subject to policies of this plan.

(1). Traditional Uses

Traditional hunting, trapping, commercial fishing, recreational fishing, shellfishing, etc. will be allowed in accordance with existing laws. Agricultural and silvicultural activities within the proposed reserve will be conducted in accordance with environmentally sound practices and Best Management Practices (BMPs) established by the S.C. Forestry Commission (SCFC).

(2). Fish and Wildlife

Game and non-game species will be managed to preserve the overall health of the various populations within the reserve and to maintain important fish and wildlife habitat. SCWMRD will work cooperatively with private landowners to establish reserve - specific wildlife management plans.

(3). Endangered and/or Threatened Species

Areas within the reserve identified as possessing endangered or threatened species will be managed, according to recommended guidelines, to preserve and protect the species. The presence of an endangered or threatened species shall not necessarily preclude continued or compatible uses of an area. Flora and fauna within boundaries of the reserve will be surveyed and mapped by SCWMRD with assistance of TNC and other cooperating agencies.

(4). Wetlands

All tidal and nontidal wetlands located within or along reserve boundaries will be protected in a natural condition. Wetlands include bogs, swamps, isolated freshwater wetlands and tidal vegetated marshes, tidal and non-tidal impoundments and unvegetated flats. The functional resource values of well-managed

impoundments are recognized in the context of manipulated wetland systems. SCWMRD provides technical guidance to owners of private impoundments so as to enhance related habitat values to waterfowl and other wetland-dependent species. Construction of new impoundments and physical alteration of existing impoundments are regulated through the SCCC. Any such alterations in the NERR will be evaluated under existing authority with careful consideration of effects on the reserve's integrity.

(5). Forest

Timber management on reserve lands should be directed toward development and preservation of significant old growth stands. Disease, insect or exotic plant control, and stand improvement considerations will be controlling factors behind timber harvesting. Any harvesting of timber will be conducted in accordance with guidelines established by SCWMRD and other project cooperators. SCWMRD will work with appropriate state and private concerns in developing an inventory and evaluation of standing timber in the reserve core area and recommending management procedures. Timber management on the reserve will meet or exceed BMPs.

(6). Fire

A fire plan will be developed in cooperation with the SCFC. The plan will take into consideration that fire is a natural process in forest ecology and an invaluable tool in wildlife management practices in this region. Any prescribed burns within the reserve core area will be under the supervision of experienced burners. Plans will also be made to protect structures and other significant resources which are sensitive to fire damage and to protect human safety.

(7). Mining and Excavation

Excavation, mining, or removal of loam, gravel, rock, sand, petroleum, or minerals or alteration of topography shall not be permitted in the reserve core area except as related to the collection of geological and geophysical data. This policy will not affect the ongoing peat-mining operation in Snuggedy Swamp in the buffer zone, which is subject to monitoring and evaluation by the S.C. Land Resources Commission (SCLRC). Soil maps and soil suitabilities will be developed for the proposed reserve in coordination with the Soil Conservation Service (SCS).

(8). Water Quality

There will be no human activities or uses of the reserve core area that are detrimental or adverse to the maintenance, improvement or conservation of existing

surface and ground water supplies and quality. All activities within the reserve must be conducted in compliance with existing state water control quality standards in accordance with the S.C. Department of Health and Environmental Control (DHEC). Water quality will be monitored at appropriate sites.

(9). Air Quality

No industrial activities will be permitted in the reserve that have the potential to cause air pollution which exceeds acceptable air quality standards as determined by DHEC. Prescribed burning of impoundments and uplands within the buffer zone will continue in accordance with existing statewide air quality standards. Air quality will be monitored at appropriate sites in the reserve.

(10). Shorelines

Shorelines in the core area will be preserved in their natural state and existing condition. Restoration of severely eroded shorelines by planting native vegetation will be allowed as applied research. Opposition to existing and/or proposed offsite activities will be considered if such activities may adversely affect existing shorelines and/or water resources within reserve boundaries.

(11). Dredging and Filling Activities

No wetland, pond or waterway shall be filled. Stream beds and channels will be maintained in their existing condition. This will not affect maintenance of the AIWW which runs through a portion of the reserve and has been maintained for decades. Dredge material disposal areas are maintained on Ashe Island by the U.S. Corps of Engineers. Disposal easements are also located in other areas along the AIWW in the buffer zone. Continued use of these sites will not be affected by NERRS designation. However, appropriate public comment will be solicited during the review process. Commercial trawling and shellfish dredging operations in the area will not be affected.

(12). Trash, Rubbish and Waste

No soil, trash, ashes, garbage, hazardous wastes or offensive materials shall be dumped or deposited in the reserve core area. This will not affect the current method of trash collection (e.g. dumpsters) at privately owned sites and state highway rights-of-way in the buffer zone.

(13). Archaeological and Historical Sites and Objects

The proposed reserve will be inventoried to locate sites and objects of prehistoric and/or historic significance as funding allows. Plans including necessary permits for protection of these sites and objects will be prepared through the South Carolina

Department of Archives. Such structures, where practical, will be incorporated into the reserve's interpretive program.

(14). Industrial Activities

No industrial activities shall be conducted in the core area of the research reserve, with the exception of commercial fishing. Industrial forest operations will continue in the buffer area with a recommendation that they meet or exceed BMPs for the state and fall within existing laws governing such practices.

(15). Manipulative Research

In order to preserve and protect the natural integrity of the reserve, no manipulative research activities with a significant or long-term impact on reserve resources will be conducted in the core area. However, habitat manipulation will continue in the buffer area, since control of water levels has been historically used in waterfowl management activities.

(16). Rights-of-Way

Reasonable steps will be taken during the construction and maintenance of all rights-of-way to minimize adverse environmental impacts. All such activity shall comply fully with the terms of permits from appropriate regulatory authorities including, but not limited to the SCCC. The use of herbicides or pesticides in managing rights-of-way will be limited to those circumstances where it is determined that the environmental impact will be less severe than manual or mechanical means. All herbicides and pesticides used will be in compliance with EPA label requirements.

(17). Public Access

Public access to the reserve will be enhanced; allowances will be made for docking facilities to accomodate research and educational activities.

c. General Permits and Licenses

(1). Existing Permits and Licenses

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

(2). Reserve Research Permits

Permits will be issued by SCWMRD for research activities conducted in the reserve. Scientific permit requests will be carefully reviewed through the system now

in place by the Marine Resources Division. Procedures for permit application and reporting are presented in Appendix F. Approved permits must be in possession by permittee at all times while in the reserve and appropriate law enforcement officials must be notified prior to conducting research.

d. Surveillance and Enforcement

The reserve manager will work cooperatively with the Law Enforcement and Boating Division (LED) of SCWMRD in surveillance and enforcement activities. The Coastal Environmental Enforcement District (District Nine) and District Four currently work the reserve area and are responsible for enforcing commercial fishing laws, boating laws, undercover work, enforcement of the federal Marine Mammal Protection and Endangered Species Acts, enforcement of upland game and fish laws, search and rescue missions, etc. USFWS special agents also patrol the area for routine law enforcement activities related to various federal statutes, including the Migratory Bird Treaty Act, the Endangered Species Act, etc. Law enforcement on private lands would remain the responsibility of owners. Most managers of large plantations in the area are trained as Deputy Wildlife Conservation Officers and carry a law enforcement commission through the SCWMRD.

e. Public Education and Information

The ACE Basin NERR education program will design brochures, signs, and other instructional materials, as necessary, to communicate information about controlled and allowable uses in the reserve. Signs to identify the reserve as part of the national system will be posted in strategic locations where problems might occur. Reserve staff and volunteers will play an important role through personal contact and information exchange in developing a positive and preventative approach to resource protection.

3. Administrative Plan

The following administrative framework for the reserve recognizes the need for cooperation and coordination to achieve effective management. The proposed administration for the reserve will ensure that all components of the management plan are coordinated with the appropriate agencies, organizations, groups and individuals presently active within the area. Figure 9 outlines the management structure for the reserve.

a. Administrative Framework

Although the SCCC is the designated State agency to administer programs and receive fiscal awards under the federal Coastal Zone Management Act, the SCCC

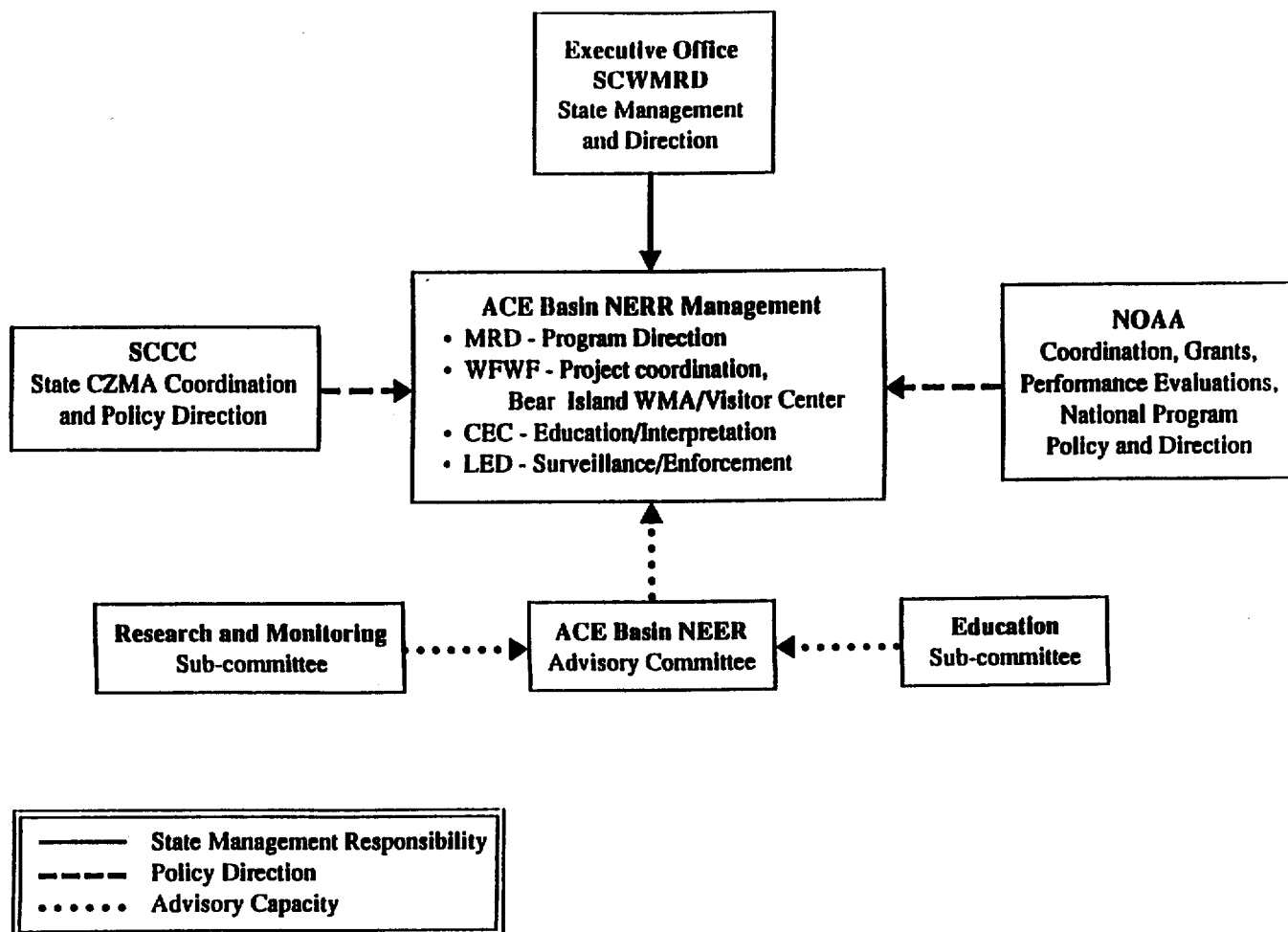


Figure 9. Organizational chart for administration and management of the ACE Basin NERR.

chooses not to be involved in direct management. Therefore, the SCCC has named the SCWMRD as the management agency for the NERR site. Under contract with the SCCC and in cooperation with NOAA, the SCWMRD is responsible for development and implementation of the Management Plan and day-to-day operation of the reserve site. The SCCC 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 Program and the Management Plan. The SCCC will also serve on the reserve's advisory committee and provide input into coastal research needs. SCWMRD is in an unique position to offer a management structure comprised of four functional units (Figure 9) from within the department and include the: Marine Resources Division (MRD); Division Wildlife and Freshwater Fisheries (WFWF); Division of Conservation, Education and Communication (CEC) and Law Enforcement Division (LED).

The overall operation and management of the ACE Basin NERR is the responsibility of the MRD, which was designated back in the 1970's by then Governor Robert McNair as the laboratory for coastal zone research in S.C. MRD, located in Charleston close to the reserve, is one of the largest and most sophisticated marine and estuarine research and management facilities on the East Coast. Staff of the MRD Research Institute includes more than 50 marine scientists, biologists, and technicians housed in a 50,000 sq.ft. cooperative research facility. Members of the scientific staff hold adjunct or research appointments with state colleges and universities and cooperate in marine science education programs at these institutions.

MRD will take the lead role in implementing and coordinating programs for research, monitoring, resource protection and education at the reserve. However, implementation of the management plan requires a cooperative effort among all divisions. WFWF has a long and successful background in land and facilities management. WFWF operates and manages the 12,055 acre Bear Island WMA located within the very heart of the ACE Basin. This Division also has a broad spectrum of ongoing management activities within the reserve and throughout the ACE Basin region. Most recently, WFWF has spearheaded the land acquisition and habitat protection effort in close cooperation with TNC, DU, USFWS and a coalition of private landowners. Four of the eight islands proposed as the reserve core area will be dedicated as Heritage Preserves. The Heritage Trust Program is within WFWF. Therefore, it is important that WFWF take an active role in the ACE Basin NERR and a lead role in the management of upland game, non-game and endangered species, and migratory bird resources.

CEC is nationally recognized for its highly successful information and education program. The ACE Basin NERR will build on this experience and expertise in developing an education/interpretation program through CEC's leadership. CEC will take the lead role in developing a strong educational component of the reserve.

Surveillance and enforcement of the ACE Basin NERR will come under LED which currently has conservation officers from District Nine and District Four working in the ACE Basin region. LED will take the lead role in developing a plan for law enforcement activities in the ACE Basin NERR.

Provisions will be made to accommodate the required staff from each division (see facilities development plan). The reserve manager hired to run the ACE Basin NERR will be a MRD employee and will work out of MRD in Charleston until an onsite facility is constructed. Owners of private property within the ACE Basin NERR boundaries and others interested in the project area will be invited to participate on advisory committees and in volunteer programs. These groups will play an important role in the overall administrative program.

b. Relationship with Existing Administrative Programs

There are a number of existing administrative programs within the general project area under consideration. However, the ACE Basin NERR designation will not affect the overall structure of these programs.

SCDPRT currently manages Edisto Beach State Park and Hunting Island State Park. Both are located in the buffer zone. Edisto Beach State Park covers 1,225 acres of Edisto Island and has more than one-and-one-half miles of sandy beach, 160 to 200 feet wide at low tide. Throughout the park are salt water marshes and creeks. Much of it remains natural, and among the marsh and forest are several environmental observation areas, hiking trails, a playground, a campground, swimming and picnic facilities and vacation cottages. About 250 parking spaces accommodate day-use visitors. The park draws approximately 175,000 to 200,000 persons annually. Primarily because of its isolation, the park is felt to be under-utilized. Hunting Island State Park covers some 5,000 acres and contains approximately four miles of beach front and similar facilities to Edisto Beach State Park. It has 400 parking spaces for day-use visitors and draws nearly one million visitors annually. The overall theme of both Parks fits in extremely well with the ACE Basin NERR concept. This is one of the most successful park systems in the state and NERR designation will only enhance their program currently in place.

The USFWS proposes to acquire approximately 18,000 acres of managed impoundments and valuable wetland habitats for inclusion into the National Wildlife Refuge System. The target area is within the Edisto and Combahee River floodplain of the ACE Basin; however, it is well outside the NERR core area and would not impact reserve activities and vice-versa.

The MRD, SCWMRD, currently administers a shellfish management program in the reserve core area and buffer zone. There are six (6) commercial shellfish culture permit holders (65 acres of intertidal bottoms and 115 acres of subtidal), four (4)

state shellfish grounds (13 acres intertidal and 360 acres subtidal) and two (2) public oyster grounds (1 acre intertidal). The regulation of these resources is under direct supervision of MRD and reserve designation will not change the existing program.

c. Staff Requirements

An adequate staff is essential for meeting the mission, goals and objectives of the ACE Basin NERR. The project will be directed by a reserve manager or program director who would be headquartered at the proposed Bear Island WMA Educational/Visitor Center. The reserve manager would:

- . Represent the reserve program and its policies in public hearings and meetings where appropriate;
- . Act as a liaison for state and federal agencies and other interested groups to improve cooperation and coordination in implementing the ACE Basin NERR Management Plan;
- . Coordinate with NOAA staff on program management, grant preparation for operation, acquisition, etc. funding from federal side to SCCC;
- . Develop resource protection guidelines and policies for the reserve as new issues arise and present them to ACE Basin NERR Advisory Committee;
- . Direct and coordinate with NOAA any changes in the management plan;
- . Prepare required quarterly, semi-annual and annual reports for NOAA and other possible sources for funding;
- . Act as staff support to the reserve's advisory committees;
- . Serve as principal contact for the ACE Basin NERR program, represent SCWMRD in public relation and media contacts, and make presentations to local officials, environmental organizations and others;
- . Monitor day-to-day operation of the reserve program and progress of research and education plans;
- . Oversee facilities development, site selection and changes in reserve boundaries with advice and consent of MRD Director and Executive Director;

- . Assume responsibilities for other staff positions until filled;
- . Oversee other staff members when hired;
- . Coordinate special reserve activities with WFWF, CEC and LED; and
- . Perform additional duties as required.

Depending on funding availability, the approach to other staffing needs will be to provide financial support for expansion of certain existing program areas within MRD and SCWMRD. Inasmuch as MRD and CEC are already involved in estuarine education and research (i.e. tours, field trips, seminars, workshops, and teacher training), reserve funds will be used to support and build on this experience and expertise rather than duplicate any of these efforts. The basic staff needs will include a research coordinator and an education coordinator.

A research coordinator will be appointed from within MRD to implement and coordinate the research and monitoring program component of this management plan. Specific responsibilities will include:

- . Provide staff support for the research and monitoring advisory sub-committee;
- . Assist the reserve manager and participating agencies in preparing and updating an annual list of priorities for research and monitoring at the ACE Basin NERR;
- . Coordinate the review of priorities for research and monitoring by the research and monitoring advisory sub-committee;
- . Issue requests for proposals for ACE Basin NERR funded research and monitoring projects and initiate a peer review process for proposals received. Assist NOAA in the review of NOAA funded proposals when needed;
- . Evaluate the results of the peer review process for ACE Basin NERR funded research and make recommendations to the reserve manager and research and monitoring advisory sub-committee;
- . Serve as liaison with the scientific community, promote data utilization, and act as primary contact for scientists performing research within the reserve;
- . Coordinate research activities within the reserve and communicate with

other NERR sites and the ACE Basin NERR education and volunteer program;

- . Assist in the training of volunteers, research assistants, and interns and monitor/evaluate their performance;
- . Recommend locations for research and monitoring stations within the reserve and provide technical advice and assistance to scientists in conducting research and monitoring as available;
- . Develop additional research guidelines and policy statements as new issues arise and present them to research and monitoring advisory sub-committee for appropriate actions;
- . Visit the reserve on a regular basis and keep field journal and photographic records of ongoing research activities;
- . Coordinate with the reserve manager in the performance of these responsibilities.

The education coordinator will be headquartered at the Bear Island WMA Education/Visitor Center. The education coordinator is responsible for implementing and coordinating the education program component of this management plan. Specific responsibilities are as follows:

- . Provide staff support for the education advisory subcommittee;
- . Assist participating agencies in preparing and updating an annual list of priorities for education, interpretation, and visitor use programs to be developed for the reserve;
- . Issue requests for ACE Basin NERR funded proposals for education, interpretation, and visitor use programs/projects and conduct a peer review process for proposals received;
- . Serve as liaison with the academic community and act as primary contact for educators bringing groups to the research reserve;
- . Coordinate approved education, interpretation, and visitor use activities within the reserve and communicate with other reserve management areas, especially research and volunteer programs;

- . Provide technical advice and assistance, as available, for education and interpretation programs;
- . Train and supervise volunteers who assist in education programs and monitor/evaluate their performance;
- . Keep a photographic record of ongoing education, interpretation, and visitor use activities for use in slide presentations and exhibits;
- . Provide outreach to area schools, colleges, universities, and other environmental education organizations;
- . Make presentations to civic groups, professional societies, and other groups upon request, as available; and
- . Coordinate with the reserve manager in the performance of these responsibilities.

d. Volunteer Program

A properly orchestrated volunteer program could be an asset to the ACE Basin NERR, a valuable experience for the volunteer and an opportunity for direct community involvement. The most obvious benefit would be an increase in manpower 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 specialist cannot reach.

A volunteer coordinator will be responsible for organizing a volunteer program and his/her duties will include: preparation and planning, recruitment and placement, orientation, training and supervision, record keeping, recognition and program evaluation. Direct supervision, however, will not usually be a part of the coordinator's responsibility.

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 secured 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, time required per week or month, name and phone number of supervisor and training time requirements. Orientation is the responsibility of the volunteer coordinator and includes:

- . Information about the NERR and its structure;
- . Information on the general purpose, objectives, and philosophy of the reserve;
- . A clear explanation of the volunteer's obligation to the reserve, his/her supervisor, etc.;
- . Information as to how the specific program assignment relates to the overall function of the reserve; and
- . An orientation manual covering the ACE Basin NERR volunteer program 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.

e. Advisory Committee Roles and Responsibilities

In order to provide for effective coordination and cooperation among all interests involved with the reserve, an ACE Basin NERR Advisory Committee will be established. The Committee will consist of representatives of the following agencies, organizations and special interest groups:

- . The S.C. Coastal Council
- . The Nature Conservancy
- . Ducks Unlimited, Inc.
- . U.S. Fish and Wildlife Service
- . S.C. Land Resources Commission
- . S.C. State Development Board
- . S.C. Water Resources Commission
- . S.C. Department of Parks, Recreation and Tourism
- . S.C. Department of Health and Environmental Control
- . The Commercial Fishing Industry
- . The Scientific Community
- . Environmental Interests Groups
- . Local Landowners
- . Local Colleton Co. Government

- . S.C. Marine Science Museum
- . National Marine Fisheries Service

A representative of NOAA will be included as an ex-officio, non-voting member.

The Advisory Committee will:

- . Advise SCWMRD and reserve manager on matters of policy relating to planning for and operation of the NERR;
- . Provide guidance for establishing priorities for research and education efforts in the ACE Basin NERR and review information and education materials generated by the reserve;
- . Review, monitor and advise 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;
- . Advise on implementation of the acquisition strategy, and review and provide guidance on conservation easements, management agreements, etc.;
- . Review and advise on facilities development to ensure consistency with the management plan; and
- . Represent the interests of users of the reserve and its neighbors.

The ACE Basin NERR Advisory Committee shall conduct regular meetings which will be open to the public. The reserve manager and appropriate SCWMRD personnel will serve as staff to the Committee. A Committee chairman will be named by the Executive Director, SCWMRD and subcommittees for research and education will be appointed by the full committee.

(1) Research and Monitoring Subcommittee

The Research and Monitoring Advisory Subcommittee will consist of appropriate ACE Basin NERR 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:

- . Review and approve priorities for the ACE Basin NERR research and monitoring projects;

- . Review ACE Basin NERR research and monitoring proposals and interim and final research and monitoring reports;
- . Monitor and provide advice on local issues and new opportunities for cooperative research and monitoring; and
- . Evaluate overall progress towards achieving research and monitoring priorities and adjust long-term direction accordingly.

(2) Education Subcommittee

The Education Advisory Subcommittee will be composed of appropriate ACE Basin NERR Advisory Committee members and representatives from area institutions of education, state agencies involved with education, the S.C. Marine Science Museum, and others. This Subcommittee will be responsible for the following:

- . Review and approve the list of annual priorities for education and interpretation activities for the reserve;
- . Review education proposals and design proposals for all educational 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 research reserve program and this management plan; and
- . Evaluate progress towards achieving priorities for education and interpretation and adjust long-term priorities accordingly.

f. Five Year Activities Plan

Implementation of the major program development activities, including staff hiring and initiative of research, monitoring, education, and volunteer programs and facilities development, will begin following reserve designation and will be phased-in over a five year period according to a prescribed schedule of activities (Table 5).

g. Staffing

The staffing requirements described in the administration section will be fulfilled according to the proposed five year staffing plan, as outlined in Table 5. Much of this may depend on the availability of federal funds and approval for hiring personnel. However, the state is committed to providing support personnel (i.e., reserve manager, education coordinator and research coordinator) through existing programs within SCWMD.

Table 5. Five Year Activities Plan For the ACE Basin NERR.

<u>PROGRAM YEAR</u>	<u>STAFFING NEEDS*</u>	<u>MAJOR PROGRAM DEVELOPMENT ACTIVITIES</u>
0 (Predesignation)	Reserve Manager (1) Clerical Worker (.5) *FTE=1	. Complete FEIS/DMP; apply for land acquisition funding; . Complete land acquisition effort for core area; . Complete Final Management Plan; . Form Advisory Committee; and . Coordination of research and education planning.
1	Reserve Manager (1) Clerical worker (1) Education Coordinator (.5) Research Coordinator (.5) Conservation Officer (1)	. Establish priorities for research and education/interpretation program; . Refine and implement Management Plan; . Initiate facilities development plan for education/visitor center (architectural design, working drawings); . Some staff participation in research and education programs; . Begin monitoring and baseline studies; . Begin education trips and training programs; . Install NERR signs at primary access points; . Plan and construct trails, interpretive signs, observation platforms, boardwalks, etc.; and . Planning for 2nd year.
2	Reserve Manager (1) Clerical worker (1) Education Coordinator (1) Research Coordinator (1) Conservation officer (1) Volunteer Coordinator (.5)	. Develop a well-defined and coordinated outreach program; . More extensive coordination of research and education programs; . Expand monitoring and baseline studies; . Begin construction of education/visitor center; . Initiate volunteer program; . Plan and build interpretive exhibits; . Develop brochures, guides, and other educational materials; and . Planning for 3rd year.

continued <u>PROGRAM YEAR</u>	<u>STAFFING NEEDS*</u>	<u>MAJOR PROGRAM DEVELOPMENT ACTIVITIES</u>
3	(Fully Staffed) Reserve Manager (1) Clerical worker (1) Education Coordinator (1) Research Coordinator (1) Conservation Officer (1) Volunteer Coordinator (1) Maintenance (1)	. Complete construction of education/visitor center; . Continue monitoring and baseline studies; . Build ancillary facilities as needed for education program; . Continue to augment research and education programs; . Staff participation in research and education; . Management Plan should be fully implemented; and . Planning for 4th year.
4	Fully Staffed	. Open education/visitor center; . Plan, develop and install indoor education exhibits; . Continue monitoring and baseline studies; . Continue to augment research and education programs; and . Planning for 5th year.
5	Fully Staffed	. Continue to manage the ACE Basin NERR, refining and modifying operations as new experience is gained; and . Convene a Blue Ribbon Committee to review progress and achievements and to make recommendations.

4. 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 FEIS/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 development grants.

A portion of the state-owned Bear Island WMA is intended to be developed as headquarters for the ACE Basin NERR operation. While overall direction for reserve program administration will come from MRD in Charleston, Bear Island is administered by WFWF. Therefore, overall reserve administration will require effective coordination between MRD and WFWF. The facility will serve to centralize reserve activities with those of the overall ACE Basin project involving all participants, i.e., SCWMRD, USFWS, TNC, DU, and private landowners.

a. Education/Visitor Center

There are several reasons why an education/visitor center is a necessary component of the management concept. The major reasons are:

- . The center will provide a focal point for ACE Basin activities. Located in the heart of the ACE Basin, the center will attract visitors and expose them to all facets of the area, including sites and activities not accessible elsewhere; it will also allow controlled access;
- . Educational and interpretive programs at the center will foster compatible visitor use of the Basin and enhance meaningful educational experiences, thereby promoting public awareness and understanding of ecological values associated with natural estuarine areas;

- . The center will facilitate programing between resource professionals and a variety of public interests, environmental and conservation groups. It will rally local support and attract volunteers to participate in hands-on projects of local interests;
- . With proper planning and design, the center will be an asset to the community; and
- . Commitment to the long-term protection and management of the ACE Basin.

b. Siting of the Education/Visitor Center

The NERRS Program Regulations stipulate that final selection of a site for facilities such as the center will appear in the management plan. During preparation of this plan, several locations were identified as alternatives for the center other than the Bear Island site. However, no serious discussions were ever held because Bear Island is the "perfect" site for such a facility. It is already under public ownership in the SCWMRD Wildlife Management Area (WMA) system; you can drive to it; it is large enough to accommodate development as needed for present and future expansion; it offers an on-site presence for resource protection and management; it is in proximity to a variety of habitat types, including the core area; and it is easily accessible from U.S. Highway 17.

Prior to construction or renovation of a visitor center, an environmental assessment or categorical exclusion checklist will be prepared and submitted to NOAA before any federal funds may be expended. All architectural and engineering plans, including specifications, must be approved by NOAA for any proposed construction. This includes facility development, boat ramps, nature trails, etc.

Various organized groups interested in natural resource conservation annually visit Bear Island WMA for self-guided tours and presentations by SCWMRD personnel. Such groups include local elementary and high school science classes, scouts, botany and wildlife management students from various universities, waterfowl biologists, wetland ecologists and natural history groups as well as members of other private conservation organizations and governmental agencies. Individuals interested in bird watching, general wildlife observation and amateur and professional photographers frequently visit Bear Island WMA.

c. Space Requirements

The center will accommodate various program areas. The following represents a preliminary listing of requirements:

- . Staff and Administration
 - Reserve manager's Office
 - Bear Island WMA Office
 - Education Coordinator's Office
 - Volunteer Coordinator's Office
 - Reception Area
 - Conference Room
- . Education and Interpretation
 - Exhibit areas
 - Classroom/Hands-on Discovery Room
 - Auditorium providing seating area
 - Outdoor classroom/amphitheater
 - Wildlife observation deck
 - Demonstration area
 - Trailhead
 - Storage for national and site specific education materials
- . Research
 - Work space for visiting scientists/research interns
 - Basic laboratory facilities including wet and dry labs
 - Storage
- . Common Building Areas
 - Visitor parking
 - Staff parking
- . Other
 - Restrooms
 - Kitchen
 - Dormitory

d. Development and Construction

Development of the education/visitor center will entail the following general steps:

- . Appointment of a task force by SCWMRD to oversee the design, planning and funding for the center;
- . Preparation of a site plan illustrating the layout of buildings, parking lot, road access, and trail network;
- . Preparation of a brief building concept plan for the center that includes detailed objectives for each function, general layout and architectural design

guidelines;

- . Detailed site surveys and preparation of detailed landscape design and construction drawings including measures for minimizing construction impacts; and
- . Agency and local review of the above through a workshop process.

Listed below are further considerations for development of the center. These are adapted from Manly (1977):

- . The design should be functional and efficient. Some caution should be exercised so the interpretive building will not turn out to be an impractical architectural oddity;
- . Entrances, exits, and interior spaces should be correlated with an overall traffic flow or circulation plan. Whenever possible, unsupervised groups or individuals should move through the building over the grounds in one-way pattern;
- . The design should permit simultaneous use of the building by several groups;
- . Low-profile buildings generally are less obtrusive visually than buildings with a high profile;
- . The design of the buildings should be such that the center itself will be a model of energy efficiency and resource conservation, incorporating such features as solar heating where practicable.
- . All public parts of the building should be accessible to the handicapped;
- . The color and texture of architectural exterior finishing materials should be compatible with the natural surroundings. Natural materials such as weathered, rough sawn wood will be used. No teak, mahogany, rosewood or other rain forest woods will be used;
- . Interior finishes may be the same as exterior finishes. Other contemporary materials can be used where budget and design needs dictate;
- . All required landscaping around the center should reflect the composition and layout of indigenous floral communities. Buildings should be situated so as to minimize impact to existing trees and native plants; and

- . Structures surrounding the center such as signs, lighting, wastebins, all contribute to the total visual impact of the building. Design must be given careful attention to ensure that these have minimal impact on the natural appearance of the site.

e. Trails and Observation Platforms

Self-guided interpretive trails will be constructed around the education/visitor center. Some of these will allow access for the physically handicapped. At several locations, wildlife observation platforms and/or blinds will be installed.

The main functions of the trail network will be as follows:

- . To control pedestrian access within the complex to minimize impact of visitor use on sensitive areas; and
- . To contribute to the education/interpretation plan as outlined.

Interpretive services associated with the pedestrian trails are discussed under the education/interpretation plan.

5. Research and Monitoring Plan

a. General Context For Management

Development of the research function of the ACE Basin NERR is a high priority. The reserve, because of its relatively low level of development, has retained many of the attributes associated with estuaries at the turn of the century. This provides a benchmark against which to compare other coastal areas where significant human disturbances are occurring. Such comparisons are necessary in developing an understanding of the impacts, both obvious and subtle, on coastal resources. It is particularly important to make research results available in a useful form to those responsible for resource management and coastal zone planning at individual, local, state and federal levels.

The large expanse of the reserve, its biological diversity and high water quality standards provide an outstanding environment for these types of research. The core area is well protected and will serve as an undisturbed baseline monitoring area while the buffer zone is large and diverse enough to serve as an experimental research and demonstration area. For example, Bear Island WMA will be a "staging" area for demonstrating the sustainability of managed ecosystems through water level manipulations in coastal impoundments and the study of harmonious land uses, short-term studies for specific management needs, etc. The research plan has the following goals and objectives:

(1) Goals

- . Establish and manage key areas of the reserve for long-term use as natural field laboratories;
- . Coordinate ACE Basin research projects to streamline scientific efforts, maximize efficient use of funds, and avoid unnecessary duplication of efforts.
- . Enhance scientific understanding of estuarine ecosystem processes and functions;
- . Gather and make available information needed by reserve managers and coastal decision makers for improved understanding and management of estuarine ecosystems;
- . Collect important baseline data to use in monitoring differences over time and for making comparisons with other areas;
- . Identify priority resources, gather baseline information on them and establish them as indicators of change;
- . Monitor the impacts of human stresses on the estuarine environment and the effectiveness of water pollution control strategies;
- . Establish critical habitat requirements of living aquatic resources; and
- . Evaluate land use management strategies.

(2) Objectives

- . Collecting and building a database for use in long-term and interdisciplinary studies;
- . Becoming a repository for data collected on-site and at other National Estuarine Research Reserves;
- . Promoting the reserve components in the research community as long-term field laboratories to be used by State, local and private organizations;
- . Utilizing volunteers to achieve research and monitoring goals;
- . Encouraging staff participation in conferences and workshops;

- . Developing facilities and equipment as necessary to aid in research and monitoring; and
- . Seeking agreements with research organizations to facilitate and augment research and monitoring projects.

b. National Research Priorities

In 1964, the first major symposium on estuaries was held at Jekyll Island, Georgia to exchange ideas on estuarine research, to summarize the existing state of knowledge and to refine the direction of current research. The book ESTUARIES was a product of that conference and has since set the standard for estuarine research quality. Since that first meeting, many more symposia have been held.

In 1984, a representative cross section of the nation's top estuarine scientists again gathered to review the existing state of knowledge on the Nation's estuaries (Copeland et al. 1984). Based on proceedings of this conference, NOAA (1988) has compiled lists of national research needs and priorities for better understanding the following: water management, sediment management, nutrients and other chemical inputs, coupling of primary and secondary productivity, and fishery habitat requirements. Proposed funding decisions for NERRS research projects will be based on the relationship between proposed research and these national priorities.

(1) Water Management

Water management is one of the most important problems facing the nation. In highly developed areas the consumptive uses of water for commercial, industrial, agricultural, recreational and municipal activities are increasing and thus, strongly competing with the availability of water to estuaries. Adjacent land use practices also affect the quality, quantity and timing of freshwater inflow into estuaries. Consequently, estuarine productivity is altered and this raises a number of research questions. The following research topics are identified as priority areas in the NERRS Research Plan developed by NOAA (1988):

- . Determining the volumes of inflows needed to maintain viable estuaries and the reliability of freshwater inflow estimates;
- . Establishing the functional relationship between nutrient inflows to the estuary and primary and secondary productivity;
- . Determining the quantitative relationship between freshwater inflow and fisheries production in specific estuaries and regional groups of estuaries;
- . Delineating the factors that control the response and recovery of estuarine

biological systems to large changes in water input;

- . Establishing the role of coastal upwelling in determining estuarine productivity; and
- . Preparing nutrient budgets on estuarine systems to clearly elucidate the roles freshwater inflows, marshes, benthic systems, coastal waters, precipitation, and other sources, and to delineate the importance of each source in providing nutrients and recycling them.

(2) Sediment Management

Sediment Management studies are needed to fill information gaps pertaining to the sedimentation process and to develop criteria for alternative management schemes. Priority research topics include:

- . Detailed studies of sediment dynamics to include the effects of sedimentation on flushing and sedimentation rates, accumulation rates and changes in sediment composition between points of entry and accumulation, the joint impacts of reduced freshwater inflow and sediment delivery, the impacts of sediment delivery rates, and shallow water sedimentation processes;
- . The testing and development of biological models that predict the impacts of sedimentation;
- . Characterization of the processes that control absorption and desorption of contaminants and other dissolved substances;
- . Assessing the impacts of sedimentation on benthos and mobile fauna;
- . Determining the relationship of sediment to habitat types;
- . Identifying the optimal balance between the long-term negative impacts of estuarine filling and the short-term positive stimulation of estuarine productivity; and
- . Examining the recovery rates of ecosystems after large-scale sedimentation events.

(3) Nutrients and other Chemical Inputs

Nutrients and other chemical inputs are associated with 75 percent of the nation's population living within 50 miles of our coasts; consequently, estuaries are

experiencing increased nutrient loads. Little is known about the response of estuaries to nutrient and chemical additions. As a result, management strategies are presently based on provisional data in many cases. Priority research should focus on:

- . Testing the responses of estuarine ecosystems to combinations of nutrient inputs and recycling by developing ecosystem-level experiments involving microcosms, mesocosms, and field manipulations;
- . Examining the fate of synthetic chemicals in estuaries through the chemical analysis of sediments; the performance of tissue-chemical, gross pathological and histological analyses; evaluation of community structures; conducting controlled laboratory and in situ field studies to identify chemicals responsible for field-observed and other toxic effects and determine their relationships; and developing research protocols to understand the long-term effects of exotic materials on estuarine ecosystems.

(4) Coupling of Primary and Secondary Productivity

Coupling of primary and secondary productivity includes almost all food web interactions in the estuary and how they are quantitatively and qualitatively connected. A clear understanding of the relationship between the various producer levels is lacking. Priority research topics should examine the following:

- . The comparative trophic importance of organic matter derived from vascular plant versus plankton;
- . The degree to which coastal fishery organisms utilize detritus as an energy source; and
- . The impact of removing large tracts of detritus-producing salt marshes and seagrass beds.

These must be accomplished through:

- . The use of multiple isotopes and other techniques to indirectly identify sources of organic carbon for primary consumers in estuaries;
- . Studies to determine the chemical composition and nutritional status of detritus complexes of different age and particle size;
- . Laboratory feeding experiments to detail the utilization of vascular plant detritus by consumers;
- . Growth and ecological efficiency studies in large tanks or small ponds to

investigate consumer diets; also, in situ experiments to examine quality and quantity of diets;

- . Controlled field experiments in ponds to determine the feasibility of detritus aquaculture;
- . Carefully designed "before and after" investigations on the local impact of marsh or seagrass removal on community structure and composition; and
- . Field investigations and laboratory experiments to investigate the potential and realized importance of hypothetical reduced-sulfur food webs.

(5) Estuarine Fishery Habitat Requirements

In order to determine why some estuaries are more productive than others, scientists need to focus on habitat selection, species migration, species residence time, food quality and quantity, and the effects of environmental variations on survival, growth and movement of estuarine species. Priority research topics include:

- . Delineation of the characteristics of a good nursery;
- . Fishery yield per acre of salt marsh and species-specific relationships;
- . Relationships between fish catch and river discharge, wetland/water ratios, and primary production;
- . The roles of various sources of primary production and their relative abundance (importance?) among estuaries;
- . The effects of differing primary production sources on fish production;
- . The relative contribution of different habitats to total stock;
- . Flow requirements for critical life stages;
- . Hydrodynamic influences on distribution, abundance, and survival of fishery species;
- . Contaminant impacts on estuarine yields; and
- . Food as a limiting factor to estuarine fish and crustacean populations.

(6) Other Research Topics

In addition to the above research priorities, NOAA recognizes the need for site specific baseline data and lists the following research areas as being appropriate for national funding:

- . Baseline studies to characterize the reserve's resources, environment and ecology;
- . Environmental monitoring of selected parameters to provide a data base for detecting changes, predicting impacts, and identifying correlations with other observed phenomena; and
- . Special research designed to answer specific management concerns.

The rationale for these research priorities is described in NOAA's NERRS Research Plan (1987). Each year NOAA issues a NERRS Research Opportunity Announcement in which it elaborates on the latest interpretation of these priorities. Proposal funding decisions are based on the relationship between the proposed research and these national priorities as well as other factors.

(7) Initial Baseline Studies

Some baseline data for water quality parameters has already been collected at or near the ACE Basin NERR by the SCWMRD and DHEC (Mathews and Shealy 1978, Mathews and Shealy 1982, Shealy 1971, Shealy 1974, DHEC 1990). Water quality parameters include salinity, turbidity, temperature, dissolved oxygen, pH, fecal coliform, and others. Information is also available on emergent wetlands and impoundments (Morgan 1974, Tiner 1977), plant communities (Prevost 1987, Stalter 1972), fishes (Shealy et al. 1974), and other specialized areas. Baseline surveys will be conducted to fill gaps and to provide a more thorough characterization of the site. Other ecological parameters which might be explored include soil characteristics, nutrient concentrations, weather, organic fluxes, primary production and species composition of plant and animal communities.

Baseline surveys will be used to: 1) yield data necessary to define or confirm estuarine management issues of concern; 2) serve as a reference for detection of environmental/ecological change in the estuary; and 3) aid in planning and conducting special studies related to the estuarine ecosystem.

(8) Environmental Monitoring

Environmental monitoring will entail the systematic periodic collection of selected data using many of the same parameters and, ideally, the same sampling techniques and locations as the initial baseline surveys. This data may be collected by staff or volunteers, by other government agencies, or by outside researchers as part of their research projects. Impacts of new technology, products, and management strategies

may be observed. A policy for quick response to collect data in the event of unusual conditions such as hurricanes, floods etc. will be established where feasible. U.S. Environmental Protection Agency approved methods for sampling and sample handling will be adhered to in all water chemistry monitoring.

Environmental monitoring will be designed to: 1) detect trends in estuarine resources or ecosystems; 2) provide information to aid in the management of the ACE Basin NERR and in coastal zone management in general; and 3) provide a data base for special studies.

(9) Special Studies

Special studies may include experimental research relating to natural resources, cultural resources, or socio-economic topics. Special studies will be approved and may be supported based on the research priorities of the NERRS Research Plan, the NERR Monitoring Program, the ACE Basin Program, and site-specific management needs. Special studies may identify and examine relationships between human stresses and ecological effects. Studies may include temporary manipulative experiments appropriate to better management of estuarine systems. Major habitat manipulation is not permitted in the core area but may be performed in the reserve buffer zone with adequate controls and a demonstrated need. Those manipulative activities not identified in this DMP must receive prior approval of the state and NOAA.

c. ACE Basin NERR Research Priorities

Research that relates directly to the management of reserve resources will be actively encouraged and receive highest priority. An initial task assigned to the research coordinator will be to develop a program using inputs from: 1) questionnaires mailed to scientists and resource managers throughout the region soliciting recommendations for specific research; 2) a conference convened to review estuarine processes in several areas relative to management efforts in the ACE Basin; and 3) a scientific and technical committee review of detailed research needs and recommendations.

Groups that have a high interest in conducting research and educational programs in the ACE Basin, including the types of studies that they are most eager to initiate or continue, are as follows:

Clemson University

Development of aquaculture, particularly in the Edisto buffer area; and

- . Waterfowl and wetlands research.

University of South Carolina (USC)

- . Interdisciplinary studies of estuarine productivity and fluxes; and
- . Archaeological surveys to locate, identify and catalogue resources of historical or cultural importance.

USC at Beaufort and Coastal Zone Education Center

- . Participation in a variety of research and educational activities.

S.C. Wildlife & Marine Resources Department (SCWMRD)

- . Development of aquaculture technology and dissemination of information;
- . Fishery populations assessments and habitat studies;
- . Marsh ecology investigations;
- . Water quality, including pollution studies;
- . Fishery restoration activities;
- . Estimates of recreational and commercial use of living marine resources;
- . Diseases of important recreational and commercial fishery species;
- . Effects of habitat alteration, e.g., renourishment of beaches, dredging, impounding, marina siting, etc.;
- . Use by endangered and threatened species, e.g. eagles, woodstorks, sea turtles and shortnose sturgeon;
- . Impoundment studies (management effects on water quality, species composition and community structure);
- . Habitat manipulation and resource management studies; and
- . Impacts of fish harvesting gear on the physical environment and on non-target species.

S.C. Department of Parks, Recreation and Tourism

- . Education and eco-tourism related activities; and
- . Cultural, natural and historic preservation and interpretation.

College of Charleston

- . Broad range of ecological studies.

South Carolina State College

- . Ecological and water quality studies in conjunction with SCWMRD.

U.S. Forest Service, Southeastern Forest Experiment Station

- . Studies of silviculture impacts on wetlands.

NMFS, SE Fisheries Center, Charleston

- . Microbiological contaminants and chemicals in organisms and sediments and rates of change.

The Citadel

- . Shorebird and wading bird ecological studies; and
- . Ecological studies of estuarine macrophytes.

U.S. Soil Conservation Service and S.C. Land Resources Conservation Commission

- . Wetlands mapping and interpretation; and
- . Soil classification and identification of hydric soils.

U.S. Fish and Wildlife Service, Fish Hatchery, Orangeburg Bears Bluff Lab

- . Fish restoration and stock enhancement.

S.C. Department of Health and Environmental Control

- . Water quality analyses and classification;

- . Certification of shellfish growing areas; and
- . Effects of point and non-point discharges on water quality.

S.C. Water Resources Commission

- . Various water resources policies on overall water quality and quantity;
- . Conduct policy and environmental research through the use of geographic information systems;
- . Floodplain zoning; and
- . Recreational fish and wildlife opportunities.

DU's Atlantic Flyway Regional Office

- . Wetland ecology studies; and
- . Interaction of waterfowl with managed and unmanaged estuarine habitats.

S.C. Coastal Council

- . Application of research findings in coastal decision making; and
- . Demonstrating the vital role of natural areas to the local economic and environmental well-being of the coastal zone.

National Shellfish Indicator Study

- . Proposed use of the ACE Basin estuary as a pristine site for developing new shellfish safety standards.

S.C. Sea Grant Consortium

- . Basic research on estuarine processes; and
- . Development of educational programs.

Taking advantage of this interest, ACE Basin research priorities will be carefully developed and evaluated as part of the management planning process. Input will be sought from area scientists, academicians, government officials and concerned citizens.

The reserve will encourage and support projects which correspond with regional research priorities. Such projects do not necessarily have to be within the NERR boundaries but should be within the ACE Basin framework. In order to receive reserve approval, research must be conducted at approved sites and must fulfill one or more of the following ACE Basin NERR research priorities (or updates thereof):

(1) **Initial Short-Term Priorities** - Research to provide management information on sediment/water column nutrient flux; evaluation of BMP effectiveness; analysis of living resource data sets; stock assessments; evaluation and analysis of monitoring capabilities; and sublethal responses to toxins.

(2) **Longer-Term Priorities** - Fundamental research on circulation and mixing processes; water quality, habitat, and ecosystem-level models; interaction between various trophic levels; genetic makeup of living resources (particularly exploitable stocks); significance of groundwater flow; and impacts of specific land uses on aquatic, wetland, and riparian habitats.

(3) **Research Support Priorities** - Support related to preparedness to conduct research, including advanced analytical chemical equipment remote sensing; and automated data analysis technologies.

(4) **Generic, Longer-Term Needs** - Research related to improved understanding of structure and function of coastal habitats (emergent saline marshes, tidal freshwater habitats, non-vegetated wetlands, benthic habitats, oyster reefs); impacts of modification of coastal and contiguous habitats; water column processes (related to plankton communities, inorganic nutrient cycling, replenishment, and storage, micro-circulation, and interactions among mainstream and adjacent water bodies); toxins; circulation (in relation to eddies, fronts, plumes, wind anoxia, and transport of planktonic larvae); genetic variability and structure of ACE Basin stocks; watershed processes (including transport, fate and processing of dissolved and particulate material; effects of land use activities; role and extent of water transport and transformation above the saltwater intrusion line; and role of wetland and riparian zones in controlling or modifying discharge); ground water contribution (including spatial and temporal input and outflows; chemical characteristics, extent and magnitude of pesticide, nutrient, and other pollutant contamination; impacts on sediment-water column pollution interactions; and methods to reduce ground water pollution); socio-legal economic implications of alternative restoration and preservation strategies; impacts of population growth development; public health and the ACE Basin ecosystem; and structure, function, and role of non-tidal wetlands.

Research priorities will be further developed by the research coordinator working with a technical advisory committee. These priorities will be developed and modified based on system-wide and site-specific management needs and information gained from initial baseline surveys and environmental monitoring. They will reflect NERRS

national research priorities and ACE Basin priorities.

Special studies to answer specific management questions and improve coastal resource management will be conducted. Other research topics that address coastal management issues identified as having a local, region or national significance may also be considered. Example of special studies topics appropriate for the ACE Basin include:

- . Quantifying the effects of sea level rise on wetlands formation and productivity;
- . Temporal and spatial variability in the use of marsh/tidal creek ecosystems as nursery areas for species of commercial and recreational importance;
- . Studies comparing tributary systems protected within the reserve to those in other more developed areas;
- . Identifying criteria and standards for mitigation by using the reserve as a control for offsite mitigation projects;
- . Quantifying the effectiveness of forested and agricultural buffer strips and other BMPs, including the value to water quality, flood control, sediment stabilization and wildlife;
- . Succession of plant communities within the Basin;
- . Shellfish production and diseases and enhancement of growing areas;
- . Effects of fire on island ecology;
- . Coastal geology - erosion problems, geological-mapping, benchmarks for monitoring sea level rise events;
- . Surveys of Flora and Fauna to determine population densities, distribution, dynamics, conditions and habitat requirements;
- . Visitor use surveys to determine the effects of increased public use of the area;
- . Boating traffic assessments;
- . Ecosystem modelling - a predictive, interactive model of the ACE Basin is needed to assist resource managers in assessing the implications of proposed and potential activities in the basin.

The above is not intended to be a complete list of research topics but only to serve as an example of the types of special studies that will be conducted. The list will expand in time with experience and knowledge of the area.

d. **NOAA Funded Monitoring Program**

In 1989, NOAA initiated a phased monitoring program to assist states in developing a better understanding of the estuarine resources being managed under the NERRS program. The monitoring program includes the following phases:

- (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 in Phase I 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 costs; and
- (4) Phase IV, Implementation, which involves, first, pilot projects and, upon successful evaluation, full-scale monitoring of selected parameters.

The phased monitoring programs have been incorporated into the five-year plan under the administration plan. This program will be integrated with other monitoring programs in the region, including fisheries survey and harvests, shellfish sanitation, game and nongame wildlife, rare and endangered species, etc. The phased monitoring program will be developed by NOAA guidelines. Scoping meetings and workshops will be convened as needed to assist in development of this program.

e. **Research Policies and Procedures**

(1) **General Policies**

Research opportunities at the ACE Basin NERR are available to any qualified scientist, academician, or student affiliated with any university, college or school; non-profit research institution (e.g., research laboratory, independent museum, professional society); private profit organization; or state, local, or federal government

agency. Unaffiliated individuals who have the capability and facilities needed to perform research may also qualify for research funds.

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 ACE Basin NERR.

Activities permitted in the core area are limited to research activities which do not manipulate habitats. 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, NOAA and private property owners.

To assist new researchers at the reserve, information packets will be available from the research coordinator. 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 ACE Basin NERR research and monitoring plan.

Research opportunities will be available to all applicants without regards to manner of funding. Financial support may be available for research if the results are directly applicable to improved coastal zone management. Support may come from NOAA, EPA, SCWMD, SCC, Sea Grant, and other sources of funding, including private endowments. Researchers seeking funds from NOAA must follow NOAA's research and monitoring time table.

All research proposals are evaluated by the reserve manager, the research coordinator and selected reviewers for consistency with ACE Basin NERR goals and to ensure that the proposed research will not interfere with other research at the reserve. Projects are 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.

(2) Procedures for NOAA Funded Research

Proposals which target NOAA funding will also be evaluated by NOAA using established guidelines. In order to qualify for NOAA funding, ACE Basin NERR 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 NERRS. The Advisory Committee should be involved in the review of NOAA-funded proposals.

The ACE Basin NERR research coordinator is responsible for coordinating all research and monitoring activities for the reserve. To facilitate this, NOAA will maintain close contact with the research coordinator and will keep him or her informed of the progress of NOAA-funded researchers. NOAA has agreed to send two courtesy copies of quarterly progress reports, the final report and any other research information which they receive to the ACE Basin NERR in a timely manner. One copy will be kept at the MRD central repository and the reserve manager will keep the second copy. The research coordinator will maintain regular communication with the researchers themselves. He or 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 NERR 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 researchers will be requested to provide a presentation on their research findings at appropriate symposia, conferences, meetings, etc.

(3) Procedures for Research Funded By State or Other Sources

All proposals which do not target NOAA funding will also be evaluated by the appropriate reserve staff and selected reviewers. Specific procedures will be developed by the research coordinator.

An Advisory Committee will help determine appropriate research topics and policies. Committee members will lend expertise to specific projects and advise research programs on such matters as quality assurance. Research proposals that focus

primarily on site-specific topics and do not rely on NOAA funding do not need to be approved by NOAA as long as they are consistent with identified ACE Basin research needs, but a courtesy copy of these proposals will also be sent to NOAA. Coordinated and streamlined procedures for the review and approval of research proposals and permits will be established.

Researchers will provide the research coordinator with quarterly progress reports, a final report, and an abstract and one copy of any publications resulting from any state-funded research at the reserve. The final report will include; an abstract; a literature review; methods; analyses; results; and a conclusion. It will include a summary of the gathered data and a list of the analyses completed. The raw data should also be included with the report as data appendices. In addition to a final report, the researcher will keep the research coordinator updated on the progress of the project by means of quarterly written progress reports.

Copies of these documents will also be sent to the appropriate staff members. Records, data, reports, publications, and other relevant materials will be kept at the MRD central repository. Research information will also be forwarded to NOAA, which will act as a central clearinghouse and the center of the information network on the NERRS.

After completion of the final report, a presentation will be developed by the researcher to provide information on the project findings. This presentation will be given at an appropriate time and site negotiated by the research coordinator and the researcher. These presentations will help to achieve the goal of the reserve to provide information necessary for improved understanding and management of estuarine systems to coastal decision makers and the public.

(4) Research Support

As manager of the ACE Basin NERR, MRD can provide on a cost reimbursable basis much of the support required for ongoing research. This includes the MRD physical plant, laboratories, analytical and sampling equipment, vessels and specific equipment acquired for the reserve. Additional computer hardware and software, field equipment and other forms of research support will be acquired as the need arises and funds are available. Resources of the MRD library will also be available. The library currently receives 395 serial titles through subscription, has 7,405 volumes of bound periodicals and a collection of 25,140 reprint items. The total number of volumes in the cataloged collection is now 17,997.

(5) Data Management

Systematic computer storage and retrieval of raw data and bibliographic materials have become indispensable to modern research. The magnitude of the data

management challenge presented by this program should be evident from the range of research and analysis activities described previously. Fortunately, MRD has an excellent data management capability. "Data" include numerical, bibliographic, graphic and narrative materials.

Data management activities for the ACE Basin NERR, depending on level of funding, may include:

- . assistance to researchers in organizing raw data sets for efficient archival handling, especially computer storage, retrieval and processing;
- . compilation of bibliographic materials maintained locally;
- . programming consultation and service;
- . assistance in gaining access to and contributing to remote data bases; and
- . preparation of useful data summaries and special bibliographic search products.

It is anticipated that many of the databases will use geographic information processing (GIP) for analysis and display. GIP is an emerging technology which, when coupled with proper data collection techniques and organizational structure, can provide researchers and resource managers the most powerful analytical tools available for explaining the complex spatial relationships between aquatic, human, and terrestrial environments. The great majority of spatial data required to support management efforts will be made available through the NOAA/SCWRC Natural Decision Support System program. This data base construction is scheduled for completion in 1992.

Data management activities in the proposed ACE Basin NERR will be coordinated through MRD's GIP program and other similar state and federal programs. This will ensure consistency between data base development within the reserve and the coastal zone of South Carolina.

(6) Recruitment for ACE Basin NERR Research Programs

Recruitment of researchers is important to building the ACE Basin NERR data base and to establishing the reserve as a long-term natural field laboratory. Recruitment of researchers with an established interest and capability will be a function of the research coordinator. Recruitment strategies include:

- . Coordination through scientific/technical advisory committees;
- . Participation of appropriate staff in research symposia, conferences and

workshops;

- . Intern programs for graduate students or upper class college students;
- . Providing support facilities for research in the ACE Basin NERR.
- . Annual announcements of research opportunities and NOAA research funds through NOAA's Sanctuaries and Reserves Division; and
- . Other research and monitoring funding.

(7) Coordination of Research Efforts

Another research benefit offered by the reserve is the potential for coordination of research efforts. The reserve does not add another research program to a long list of institutional research projects in the ACE Basin. Instead, the reserve offers permanent places where various research institutions coordinate their projects and compare results to complement one another's work in the Basin. Data will be compiled, assembled, analyzed and made available in the appropriate form, for use by other researchers, coastal managers and the public. For example, an appropriate form for researchers is a journal article in the peer-reviewed literature. Appropriate forms for decision makers and the public may include educational slide presentations, and "glossies" along the lines of those prepared by SCWMRD. Coordination of research in the reserve creates a model for all ACE Basin research efforts, reduces unnecessary duplication, and effectively decreases the cost of publicly supported research.

(a) Coordination of ACE Basin Research

The research coordinator coordinates the research within the reserve with assistance from the advisory committee and NOAA. Meetings will be arranged and computer networks will be established. The MRD will receive copies of reserve research results and will serve as a central clearinghouse. The Bear Island education/visitor center may also be a repository for site-specific information and research results.

(b) Coordination with the NERRS

The Ace Basin NERR will work closely with NOAA staff to develop and assess National Research Priorities. NOAA is also involved with the reserve through research funding and proposal evaluation as already discussed. The reserve manager will communicate with other estuarine reserve managers in other states and will work with NOAA and other reserve managers to establish a national information exchange network.

Data from the ACE Basin contributes to the national network long-term study to monitor the status and trends of estuarine ecosystems. Data from the NERRS 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.

With assistance from NOAA, an electronic mail system (OMNET) will be established at the ACE Basin NERR headquarters. The system will help link the reserve to other NERRs, National Marine Sanctuaries, NOAA, the South Carolina Sea Grant Program, and other programs in the marine and estuarine science community.

(8) Information Dissemination

Information gathered in research and monitoring and the management implications of this information will be made available to decision makers and the public in understandable form.

Both NOAA and the ACE Basin NERR will encourage the dissemination of research results. Methods include:

- . Journal articles in the peer-reviewed literature;
- . Presentations at professional societies; and
- . 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.

In addition to NOAA information dissemination routes, the ACE Basin NERR will utilize several State and regional avenues of information exchange including;

- . Summary of research at the reserve;
- . Workshops, conferences and meetings at the reserve;
- . ACE Basin NERR brochure, distributed with the annual call for proposals and at appropriate conferences and other events;
- . Press releases to local media;
- . Articles in journals of local organizations;
- . Direct mailings to State and Local decision makers;

- . Regular contact with representatives of other state and federal agencies, local government agencies and planning boards; and
- . Contributions to the Technical Report Series, South Carolina Marine Resources Center.

(9) Review and Evaluation

ACE Basin NERR will submit an annual report on research activities to NOAA as required by NERRS Regulations Section 921.34. The report will include a description of overall program success, accomplishments, and work plans for coming years. The first report will cover the 12-month period following receipt of acquisition/development funds, and will be submitted within three months after the end of that period. In addition, ACE Basin NERR will be prepared to arrange for the periodic NOAA evaluation visits and public meetings described in Section 921.34 of the NERRS regulations.

6. Education/Interpretation Plan

a. General Context For Management

Education/interpretation will serve as the integrator for all functions of the ACE Basin 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 ACE Basin NERR and bring about positive attitudes and values in the user community.

The program will focus on the values of the ACE Basin estuary and its 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 ACE Basin. 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

- . Enhance public awareness and understanding of estuarine ecosystems, human effects on them, and the interrelationships of these ecosystems with the environment as a whole;
- . Provide information and education opportunities to coastal managers and other decision makers, enabling them to make sound, informed decisions;

- . Increase awareness of the value of the ACE Basin for seafood, recreation, wildlife, and aesthetics;
- . Promote greater understanding among citizens about the ACE Basin, its uniqueness, and policies and programs designed to help it;
- . Foster individual responsibility and stewardship of estuarine resources and increase awareness of actions citizens can take to protect these important resources;
- . Promote public appreciation of the Basin, its tributaries, and estuaries in general;

(2) Objectives

- . Provide facilities, materials, and staff as necessary to aid in education and interpretation;
- . Challenge people to observe nature, pose questions and seek answers, while positively influencing their attitudes about the environment;
- . Educate the public about the importance of estuaries in the natural environment, through exposure and participation in activities that will develop a sense of ecological awareness, appreciation, and responsibility;
- . Provide exhibits and displays which focus on the functions and importance of estuaries, with emphasis on a multisensory, interactive approach;
- . Conduct educational activities on-site and provide outreach programs for schools, camps, and other organizations;
- . Participate in regional, State and local programs such as National Estuaries Day, and Coastweeks events; and
- . Utilize volunteers and community resources to implement educational objectives.

b. Education Policies

- . On-site programs will be provided in conjunction with CEC's and MRD's existing educational program. The education coordinator, a CEC employee, will coordinate this effort to ensure that such activities do not interfere with established research and management projects on the reserve.

- . Programs will be provided in association with elementary and secondary school systems, civic and environmental organizations, colleges and universities and other educational groups and institutions to make the public aware of the ACE Basin NERR, its facilities and its role at the national, state, regional and local levels.
- . Programs will be developed cooperatively with local user groups, organizations, fishermen, etc., to ensure community relevance and supplying mutual needs. Opportunities for active involvement of local people will be given consideration.
- . On-site orientation will be provided to help visitors understand and appreciate resource protection rules and safety regulations in the reserve. This will be developed as a "preventive" enforcement program.
- . Programs will provide the public with accurate and relevant information about the reserve, its ecological, economic, cultural and historical values and the issues related to its protection and management.
- . Dissemination of scientific information for research in the reserve will be encouraged through written and visual materials and presentation.
- . Compatible types of recreation will be enhanced through development of educational/interpretive resources.

c. Themes and Messages

Interpretive messages are specific topics or ideas illustrating more general themes for education. The most important messages are answers to questions before, during and after a visit to the reserve. The basic categories of information to be conveyed to visitors are:

(1) Orientation

What is the NERRS (National) and its relationship to the ACE Basin NERR?

How do I get there?

What can I expect to see?

Where are the major access points?

(2) Living Resources in the Reserve

Vegetation - How do salt marsh communities differ from brackish and fresh water marshes?

What species of fishes, birds and mammals are associated with the different habitats?

What species are threatened or endangered?

(3) Estuarine Processes in the Reserve

What is the watershed of the ACE Basin?

Sedimentation rates?

Salinities, tidal regimes, etc.?

(4) People in the Reserve

What archaeological artifacts have been found, their historical perspective and importance?

Rice culture?

Civil war sites?

Agriculture, commercial fishing, etc.?

(5) Management of the Reserve

Why do we have the ACE Basin NERR and the national program?

How many and where are the other Reserves? Why are the others designated?

How is the land protected?

(6) How development affects an estuarine system

Comparisons of primary and secondary productivity?

Benthic communities?

Predators?

Nesting activities?

The above categories of information will form the basic content for printed materials and exhibits at the reserve.

d. On-Site Interpretive Media

(1) Interpretive Exhibits and Signs

The development of on-site outdoor signs and wayside exhibits is an important element of this plan because it clearly establishes an identity for the reserve. Signs for the ACE Basin NERR will include the following:

(2) Reserve Name and Directional Signs

It is recommended that a simple sign layout be designed whereby joint agency signs can be produced and sited at major access points, including the exit off of U.S. Highway 17, the Bear Island entrance and various locations in the Ashepoo, Combahee and Edisto rivers as well as on the core area islands.

(3) Wayside exhibits

Different reserve resources can be interpreted through wayside exhibits located at strategic points within the reserve. The exhibits will depict major habitat areas, inhabitants common to each and seasonal changes. The education coordinator will work with volunteers and professionals to produce a "hands-on classroom" (see Education/Visitor Center Services).

(4) Trail Signs

Trail signs with numbers keyed to a self-guiding brochure will be installed at appropriate intervals along nature trails in the proposed reserve.

(5) Printed Materials

Printed materials will include brochures, posters, newsletters, and special educational publications. These materials will address reserve identity and the need for compatible visitor use. The full reserve name and a reserve logo will appear on all printed materials.

- (a) Brochures - a general purpose reserve brochure, with a site map, an introduction to the reserve concept, and a description of project elements, will be developed. The possibility of developing a joint brochure with the other project participants (SCWMRD, USFWS, DU,

TNC) will be investigated. Informational brochures will also be developed on various ecological concepts, identity of flora and fauna and natural processes taking place in the reserve. Additional brochures will be developed as needed and as funds become available.

- (b) Newsletter - a low-cost newsletter will be published to provide an update on reserve activities, upcoming events, schedules, etc.
- (c) Reserve Poster - this could be developed through a local contest in the schools.
- (d) School Information Packages - this could include a combination of printed materials and suggestions for school field trips and experiments, very similar to SCWMRD's "Project Wild" program.

Additional curriculum materials for training programs and local media use will be developed as funding becomes available.

- (e) Press Releases - feature articles and periodic releases on special events in the reserve will be circulated to local news media.

(6) Slide Shows

A valuable tool for on-site and off-site education. A special slide presentation with audio will be developed for the reserve. This program will be made available to interested groups throughout the region.

(7) Films

A film on the reserve will be produced by CEC, SCWMRD as funding allows. Also, the reserve will obtain environmentally-oriented films as educational supplements.

(8) Personal Contact

Reserve staff and volunteers will participate in nature walks, on-site tours, lectures, presentations, etc.

(9) Teacher Workshops

Workshops will be provided to orient group users to the reserve and to develop curricula.

(10) Volunteer Program

Volunteers will be an integral part of the reserve program and will expand the staff without great expenditure of funds. A volunteer training program will be developed whereby volunteers can carry their knowledge and enthusiasm to a portion of the general public which is out-of-reach to the scientist and environmentalist.

e. Off-site Programs and Media

(1) Traveling Exhibits

Mobile exhibits and displays of educational/interpretive value will be designed since the proposed reserve's education/visitor center is located in such an isolated area. The display will be made available at schools, the S.C. Marine Science Museum, organization and community functions, shopping malls, and other off-site locations.

(2) Outreach

A special outreach program will be valuable in reaching those who are unable to travel to the reserve. Staff, scientists, and trained volunteer speakers will be available to make audio-visual lecture presentations on the reserve and its activities. Targets for presentations are schools, civic groups, and conferences.

f. Education/Visitor Center Services

One of the main functions of the visitor center recommended in the "Facilities Development Plan" will be to offer a variety of interpretive and educational services to the general public. This will require careful consideration of the needs and expectations of visitors, as well as the type of educational experience intended prior to the full-scale design of the visitor center. Carefully formulated educational objectives will help direct the design of exhibits, tours, and events. In turn, if the full scope of interpretive programs is planned at the outset, it should be possible to anticipate and incorporate specific spatial and other physical requirements into the architectural design of the building.

The following are preliminary guidelines for interpretive services at the center:

- . The center should convey the full scope of resources associated with the reserve including biological, physical, and human resources, and the value of estuarine management;
- . Exhibits and events should emphasize the estuary as an integrated system and should not be limited to interpretation of separate parts of the system only;

- . The theme of multiple compatible uses of the estuary and watershed should be carried through to the design and selection of exhibits. There should be an attempt to convey the spirit of cooperation (i.e., among users and agencies) and shared resources. Incompatible uses should also be addressed;
- . Exhibits and tours should be "timely." Interpretive material should be updated periodically, providing an opportunity for visitors to learn about current events, issues, and research activities associated with the reserve;
- . Change and "system response" could serve as strong themes in the exhibit design. Exhibits should communicate the changeable dynamic nature of the estuary. Changes could be interpreted in an historical, seasonal, or annual perspective;
- . Exhibits and events that are interactive and provide opportunities for visitor participation such as guessing games, investigations and searches, building scenarios, and handling equipment and objects should be incorporated. There is also a need to encourage interaction among visitors;
- . Strong linkages should be established between center exhibits and current research at the reserve. The participation of research groups particularly through the internship program should be encouraged;
- . Topics, design and level of detail of both exhibits and events should answer the needs of a variety of visitors of different interests, ages, and skills;
- . Related to the above, a variety of potential visitor experiences should be incorporated into the exhibits, reflecting a spectrum from short and simple to longer and more in-depth visit scenarios; and
- . A variety of opportunities should be provided for local organizations and schools to participate in special events at the center including seminars, workshops, and the development of temporary rotating exhibits.

In accordance with these guidelines, the following specific interpretive and educational services are to be provided at the visitor center:

- . Permanent interpretive exhibits - these could include (1) a large wall map of the reserve for orientation; (2) a salt marsh energy flow/food web model; (3) a fresh- water marsh exhibit; (4) an endangered species exhibit; (5) waterfowl management exhibit; (6) various reserve research exhibits; (7) upland game management exhibit; and (8) an historical mapping/photograph exhibit.

- Regular tours and school programs - staff and trained volunteers will give regular tours out of the reserve visitor center.

- Special events - "Theme Days" and special outdoor activities

- Public information services - these will include such things as a small reference library of pertinent scientific journals, field guides, etc. Brochures, user guides, and other materials will be provided at the visitor center.

g. Coordination of Education Efforts

(1) Coordination with Existing Programs

The reserve manager and education coordinator will coordinate with education programs existing in the public and private school systems, SCPRT, Coastal Zone Education Center, S.C. Aquarium, etc. The reserve will work with these groups and organizations in a supporting role. The ACE Basin NERR will augment not duplicate the overall education effort in coastal S.C. For example, the reserve might work with county school systems in expanding student environmental field trips and teacher training at the reserve. Also, courses and field trips for adults will be encouraged.

(2) Coordination with the NERRS

Newsletters, special events, and other news at the ACE Basin NERR will be distributed to other NERR staff throughout the U.S. Information will be provided on a regular basis to NOAA for inclusion into the NERRS Status Reports. The reserve manager will communicate directly and frequently with NOAA and attend NERR manager meetings and the annual NERRA conference.

(3) 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, DU, Sea Grant, the USFWS, TNC, County Chamber of Commerce, S.C. Marine Education Association, etc.

7. Public Access Plan

a. Policy

Public access to the ACE Basin NERR will be generally increased through organized programs and field activities at Bear Island WMA. Regulated access to the core area will be maintained on a site-specific basis to protect the area's integrity for research

and education. However, the major portion of the reserve is accessible only by boat and will be open to the public for uses that are compatible with NERR goals and objectives.

b. Current and Proposed Access

(1) Bear Island WMA

Road access to Bear Island WMA is provided by S.C. Highway 26 off of U.S. Highway 17. The education/visitors center will be open to the general public during normal working hours (8:00 A.M. - 5:00 P.M.) and at other times as arranged through the reserve and Bear Island WMA staff. Hunting and fishing activities on WMA properties will continue to be set by WFWF, SCWMRD and will not be altered due to reserve activities. Improved public access to certain special areas on Bear Island WMA will be accomplished through hiking trails, boardwalks, etc.

(2) Core Area

Access to the reserve core area is by boat only. The nearest and most convenient public boat ramp is on Bennetts Point at the southeastern end of S.C. Highway 26. Another public boat ramp is located up river where Highway 26 crosses the Ashepoo River.

Public access to the core area will not be restricted except on certain uplands and perhaps wetlands where sensitive research is carried out. In such cases, public use may be closely monitored. However, most of the core area is tidal marsh and open waters currently open to the public. No major changes that would restrict this access are anticipated.

(3) Buffer Zone

Public access to the reserve buffer zone is also self-limiting due to geography. Major access routes are off of U.S. Highway 17 and include S.C. Highways 174, 38, 161, 162 and 43, going from north to south. There are about twelve (12) public boat ramps in Charleston, Colleton and Beaufort Counties which provide convenient access to the buffer zone. However, most of these ramps are located miles away from major traffic flows and some off unpaved roads.

There will not be any further restrictions on public access in the buffer zone beyond existing regulations. Traditional public use will be encouraged to the extent it is consistent with reserve goals and objectives.

8. Objectives and Policies for Other Activities

a. Hunting, Fishing and Shellfishing

The ACE Basin has traditionally been used for hunting migratory game birds (including waterfowl), white-tailed deer, wild turkey, mourning dove, bobwhite quail and other game species. Recreational fishing in the rivers, creeks and impoundments and commercial fishing and shellfishing in the proposed reserve waters are also recognized traditional uses. Each of these activities is currently subject to state regulation through required licenses, permits, boundaries, seasons, bag limits, catch limits, and other laws. Designation of the NERRS will not change the existing laws and regulations concerning these or any other traditional uses of the ACE Basin. The proposed boundaries for the reserve will not have any relationship to established commercial fishing boundaries and will not be used in the future to change or relocate established fishing grounds.

B. Other Alternatives Considered

1. No Action/Status Quo

Under this option the ACE Basin estuary would not be designated as part of the NERRS and there would be no change in current management direction or level of management intensity. Early in the preliminary planning stages, this option was rejected because the proposed site is recognized nationally as one of the largest undeveloped estuaries on the east coast. Recently, an unprecedented effort (involving SCWMRD, USFWS, TNC, DU and private landowners) has been launched to preserve a 350,000 acre area containing bottomland hardwoods, cypress/tupelo swamps, former ricefield impoundments and salt, brackish and freshwater wetlands. The proposed ACE Basin NERR is a primary component of the ACE Basin Project and will serve as a mechanism to protect the lower estuary from future adverse development.

Continuing development pressures on the South Carolina coastal zone demands a better understanding of coastal resources, interrelationships within ecosystems, and the area's capacity to withstand human disturbances. The research and education functions built into the reserve program will make a valuable contribution to understanding and protecting sensitive coastal resources and improve coastal zone planning and decision-making. The "No Action" alternative runs counter to state, federal and local goals for protecting, studying and managing the ACE Basin.

2. Alternate Sites

Several other sites (i.e., Port Royal Sound, Calibogue Sound and Santee Delta) were reviewed in the initial stages, but rejected in favor of the proposed site. Overall, the proposed ACE Basin site was the best representation of the South Atlantic

province in the Carolinian Biogeographic Region as defined in the typology scheme of the national program. It contains a diverse assemblage of outer coastal plains natural communities, including the full array of communities typically associated with barrier islands, marsh islands and major estuarine rivers. Especially well represented in the proposed site are saltmarsh, brackish and freshwater marsh and maritime forest communities. An abundance of managed, brackish and freshwater impoundments, the total absence of industrial pollution, and the isolated, undeveloped nature of the ACE Basin were major considerations in the selection process.

3. Alternative Boundaries

Alternative boundaries for the proposed ACE Basin NERR were considered during the early planning stages of site selection. Major consideration has been given to the reserve consisting of only those five (5) islands which are currently protected in the core area. Within this concept, the buffer zone would include only the surrounding marshes, bottoms and waters (Figure 10). This is a reasonable alternative in so far as protecting key land and water areas representative of the lower estuary. However, the overall integrity of the ACE Basin may be dependent on the inclusion of Otter, Pine and South Hutchinson islands and on a much larger buffer zone to accommodate a shift of the core in case of future changes.

The preferred buffer boundary provides an area for manipulative research and management (impoundments) which is not allowed in the core. It also includes an area best suited for development of facilities required for research and education (Bear Island WMA). Since federally funded research must be conducted within reserve boundaries, the preferred buffer zone would allow a much broader area for applied research. This will ultimately provide for a wider range of research and educational activities throughout the ACE Basin area.

4. Alternative Management Plan Options

Various alternative management plan options have been reviewed and rejected prior to proposing the preferred alternative. Those given major consideration are as follows:

a. Establishing Management of the Reserve Within an Agency Other Than SCWMRD

The S.C. Coastal Council rejected this alternative early in the preliminary planning stages. The Council is the state's lead agency for coastal zone management and serves as the official administrative contact point with NOAA. SCWMRD is the logical choice for managing the reserve because of its long experience in land and facility management, wildlife and fisheries research and management, estuarine research, and

ASHEPOO-COMBAHEE-EDISTO (ACE) BASIN NATIONAL ESTUARINE RESEARCH RESERVE

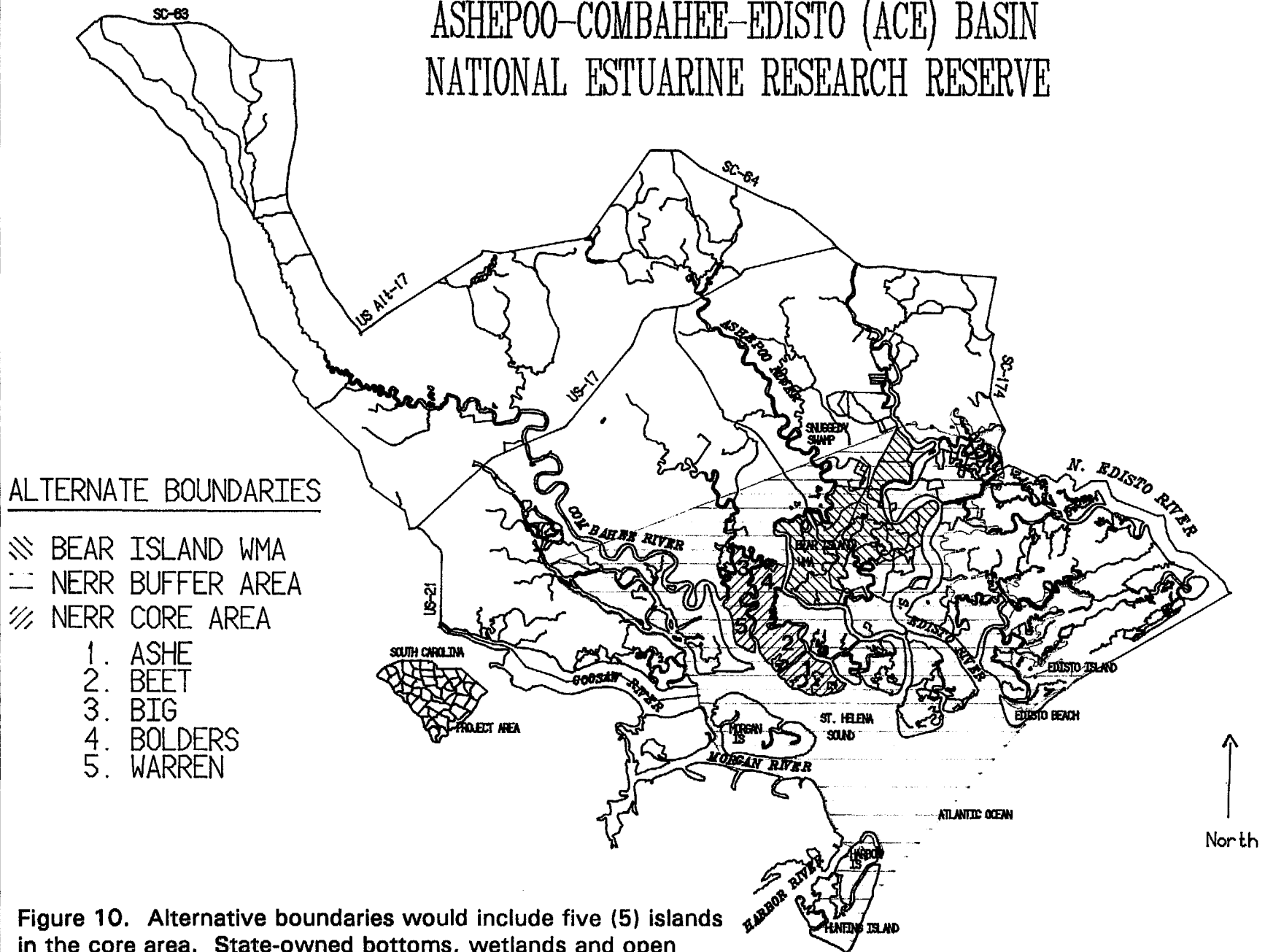


Figure 10. Alternative boundaries would include five (5) islands in the core area. State-owned bottoms, wetlands and open waters around the islands would comprise the buffer zone.

conservation education. SCWMRD also manages Bear Island WMA, the site recommended for the proposed education/visitor center.

b. **Location of Reserve Headquarters and Education/ Visitor Center Somewhere Other Than Bear Island WMA**

Other sites, such as the SCDPRT lands on Edisto Beach and Hunting Island and privately owned lands in the reserve's buffer zone, were considered and rejected. SCWMRD owns and operates Bear Island which is easily accessible by road and located in the heart of the ACE Basin. It is large enough for development of the proposed education/visitor center and can accommodate ancillary facilities development, i.e., hiking trails, observation platforms, visitor parking, etc. Also, Bear Island can serve as a demonstration or "staging" area for experimental research and habitat manipulation studies outside the core area.

No other area has been identified with resources comparable to the Bear Island site relative to road access, water access, open space and general environmental setting in relationship to the proposed reserve.

III. AFFECTED ENVIRONMENT

A. The Regional Setting

1. Physiographic Features

The land surrounding the ACE Basin NERR includes portions of Charleston, Colleton and Beaufort counties. The gradient of the mainland topography consists of subtle undulations in the landscape, characteristic of the ridge and bay topography of beach ridge plains. Elevations in this region range from sea level to approximately 125 ft. well inland.

The region is drained by three river systems: the Ashepoo, Combahee and South Edisto - thus, the name ACE Basin is derived. All three rivers have significant freshwater discharges, with the Combahee-Salkehatchie forming the southwestern boundary, the Ashepoo bisecting the Basin area and the Edisto forming part of its northern boundary. Because of the low topography, many broad, low gradient interior drains are present as either extensions of the tidal streams and rivers or flooded bays and swales. All surface water in the ACE Basin eventually drains into the lower estuary.

The drainage area of the Edisto River is approximately 3,000 square miles. Headwaters of the Edisto's two major tributaries, the North Fork and the South Fork, are 200 river miles from the coast at an elevation of 650 feet. Average discharge of the Edisto River as measured near Givhans is 2,596 cubic feet per second. About

114 cubic feet per second a day, above the gaging station near Givhans, is diverted for Charleston's water supply. Records of streamflow in the Edisto River date back to 1931 (South Carolina Water Resources Commission 1972).

Stream flow data for the Salkahatchie River, the major tributary of the Combahee River, are recorded near Miley. The headwaters of the Salkehatchie River are 112 river miles from the coast at an elevation of 360 feet. The average discharge of the Salkehatchie River near Miley is 320 cubic feet per second.

The Coosawhatchie River has its headwaters 54 river miles from the coast at an elevation of 190 feet. Stream flow data for the Coosawhatchie River are recorded near Hampton. The average discharge as measured at this site is 177 cubic feet per second.

The Ashepoo River has its headwaters approximately 60 river miles from the coast at elevations near 80 feet. There are no stream flow records for this river.

The combined average freshwater flow from the Combahee and Edisto Rivers is approximately 3,090 cubic feet per second. St. Helena Sound, which the tri-river system empties into, is a drowned river valley/bar-built estuary that is vertically homogenous with lateral variations in salinity. The inlet connecting the open ocean with the estuary has a main ebb channel aligned perpendicular to the coast (class D of Oertel 1977). The ebb-tidal delta of St. Helena is in a state of dynamic equilibrium, changing its geometry in response to fluctuations in littoral sand supply (direction and amount), wave climate, tidal prism, and freshwater discharge (Mathews et al. 1980). The depth of St. Helena Sound is variable, but relatively deep (15-30 feet) except on large banks and flats such as Egg Bank, Pelican Bank, Combahee Bank and Marsh Spit. The mean range of the semi-diurnal tides in St. Helena Sound varies from approximately 7.2 feet at the mouth to about 6.1 feet in the upper reaches. Salinities range from sea strength (32-35 parts per thousand) at the mouth of the sound to fresh water in the upper reaches of the estuary. Diverse estuarine wetlands provide an extensive complex of wildlife and fisheries habitat types in the Basin. The region contains approximately 91,000 acres of tidal marshes. Of this, 65,600 acres are salt marshes, 13,600 acres are brackish marshes and 12,100 acres are freshwater marshes (Aichele 1984, Tiner 1977). Interspersed within the three tidal marsh zones are approximately 26,000 acres of managed wetlands or marsh impoundments. St. Helena Sound comprises approximately 23,870 acres of open coastal marine and estuarine waters.

Islands in the Ace Basin region consist of: 1) sea islands, erosion remnants of much older islands with an oceanward fringe of marsh and/or beach dune ridges constructed since the middle Holocene ($\leq 5,000$ yr. ago); 2) sand barrier islands with extensive dune ridges; and 3) marsh islands with widely spaced dune ridges surrounded by marsh. The barrier and marsh islands are Holocene in age, while the sea islands are

Pleistocene. All three types which face the ocean have experienced erosion and deposition, while serving as protective barriers for the mainland. Table 6 summarizes physiographic data for select islands in the ACE Basin region.

2. Geology

For millions of years this area was probably a part of the ancient continent of Appalachia whose eastern shore may have lain along the outer edge of the present Continental Shelf. It appears that during the Triassic (185 million years ago) the land was shattered by faults, and at the end of the Lower Cretaceous (125 million years ago) a continental warping formed the Appalachian Mountains and tilted down the land lying east, south and southwest of that area. With this downward tilting of land, the sea level rose in the present area of our Coastal Plain and possibly reached as far as the present Fall Line.

A study of the geologic history of South Carolina's Coastal Plain reveals numerous advances and retreats of the sea during which sediments were deposited and planed off over and over again. The entire Coastal Plain area consists of sedimentary deposits, ranging in age from Upper Cretaceous (65 million years ago) to Recent (2 million years ago), laid on top of ancient rocks such as granites, schists and other crystalline rocks. The numerous changes in sea level were partly due to tilting of the land and partly to variation of world climate. During a series of "ice ages" when world climate was much colder than at present, the polar ice caps tied up much of the ocean's water, thus causing a drop in sea level. When the climate gradually became warmer, much of the ice melted and returned to the ocean, causing substantial rises in sea level and inundating tremendous land area (Cooke 1936).

Most of South Carolina's Coastal Plain deposits are unconsolidated and are soft or soluble. Therefore, they are more easily eroded than the hard crystalline rocks of the Piedmont region. As streams tumble off the more resistant rocks at the edge of the Piedmont into the softer sediments of the Coastal Plain, a series of rapids or falls is formed, thus the term, "Fall Line."

The Coastal Plain is divided into five geographic divisions as follows:

- 1) the marine coastal terraces or "low country,"
- 2) the Aiken Plateau,
- 3) the High Hills of Santee,
- 4) the Richland red hills, and
- 5) the Congaree sand hills.

Table 6. Physiographic data and development status for select barrier, marsh and sea islands in the ACE Basin Region.

County Island	Length (Miles)(a)	Width (Miles)(b)	Miles of Ocean Shoreline	Max. Eleva. ft. above MSL	Tidal Range	Physiograph- ic Type (c)	Geological Age (d)	Erosional Status (e)	Adjacent Major Inlets	Vegetative Cover (f)	Acres of High Land	Acres of Marsh	Impound- ments present acreage	Acres of Developed High Land	Acres of Undeveloped High Land	Ownership	Access (g,h)	Future Development Status
Beaufort																		
St. Helena	13.0	2.0	0	20	6.2- 7.3	S	P	S	St. Helena Sound Beaufort R.	CP	21,053	13,125	*	*	*	private	bridge	unknown
Hunting	4.1	1.1	4.0	20	6.2- 7.3	B	H	E	Johnson Creek Fripp Inlet	MF	1,420	270	0	100	1,320	state	bridge	none
Colleton																		
Edisto Beach	4.4	1.5	4.0	30	5.9- 6.9	B	H	E	Jeremy Inlet S. Edisto R.	MF	920	464	0	870	50	private & state	bridge	yes
Pine	1.7	1.0	1.6	10	6.1- 7.2	H	H	S	S. Edisto R. Fish Creek	MSS MF	40	900	0	0	40	private	boat	none
Otter	2.0	1.2	1.8	10	6.2- 7.3	H	H	S	Fish Creek, Jefford Creek & St. Helena Sound	MF	250	2,000	0	0	250	private	boat	none

The coastal zone, as defined in South Carolina's Coastal Zone Management Act of 1977, roughly comprises the same area as the marine coastal terraces. The marine coastal terraces occupy more than two-thirds of the present Coastal Plain. For thousands of years the area of the terraces was a level plain. With the recurrent rising and falling of sea level, deposits were laid down; and during temporary stands of the sea, sand bars were built across mouths of bays. As the sea withdrew, the bars remained to mark the abandoned shoreline. The area between two successive shore lines is treated as a separate terrace, and seven of these terraces have been identified and named in South Carolina's Coastal Plain. They are, from the oldest to the most recent, the Pamlico, Talbot, Penholoway, Wicomico, Sunderland, Coharie and Brandywine.

The present shoreline, which forms the seaward boundary of the most recent terrace, has a total length of 1,241 miles, including 281 miles of mainland and 960 miles around islands. From Cape Fear, North Carolina, to South Carolina's Winyah Bay, the coast forms a great arc and is distinguished by miles of fine sand beaches broken by several inlets including Little River Inlet, Murrells Inlet and North Inlet. From Winyah Bay to the Savannah River, the coast line trends to the southwest and is

broken by numerous barrier islands, sea islands, bays, inlets and rivers. Mathews et. al. (1980) presents a detailed review of stratigraphy and structural geology of the Coastal Plain. This review includes geophysics, seismicity, historic sea level changes and economic mineral deposits for the region.

3. Soils

Within the ACE Basin region, the soils found are Pleistocene and Holocene in age. Soils of the mainland and the sea islands, as well as some of the barrier islands, were laid down during the Pleistocene period at least 25,000 to 35,000 years ago (Hoyt 1968). Other barrier island soils (such as those on Edisto, Hunting, Otter and Pine Islands) are of more recent origin, having been laid down during the recent or Holocene period within the last 4,000 to 5,000 years. Marshland soils are also of Holocene origin (Hoyt 1968).

4. Groundwater

Groundwater may well be the most important natural economic resource of the ACE Basin region. Abundant quantities of high quality water are available from various aquifers (Mathews et al. 1980). Information regarding withdrawals, water quality, number of wells, etc. is largely restricted to the deeper aquifers although the shallow or surface aquifers are used extensively.

Limestones of upper and middle Eocene age (Santee Formation and the Ocala Group) comprise the Floridian aquifer of southeastern South Carolina. Throughout

much of the region the original head was so great that wells were free flowing at the surface. However, extensive use of this aquifer has resulted in a continuous decline in head, with marked cones of depression near major well fields at Savannah, Brunswick and St. Marys, Georgia.

Saline water encroachment upon the potable water - producing zones of the Floridian aquifer has been observed just south of the ACE Basin in the Port Royal Sound area. Back et al. (1970) concluded that present day ocean water is entering this aquifer under Port Royal Sound and is moving towards the cone of depression at Savannah.

Aquifers other than the Floridian aquifer are also exploited in the ACE Basin region. Cretaceous age sands (in ascending order, the Middendorf Formation, the Black Creek Formation and the Peedee Formation) serve as the primary artesian aquifers in coastal S.C. (Siple 1975, Spigner et al. 1977, Hayes 1977). The water quality is variable with certain aquifers suitable for municipal drinking and others only for agriculture.

5. Climate

The climate of the ACE Basin region is classified as maritime subtropical in which winter is relatively short and mild and the summer is long, hot and humid. Major features which control the climate in the region are:

- . Warm ocean currents (Gulf Stream)
- . Seasonal pressure centers such as the Azores High
- . Tropical cyclones
- . Prevailing winds generated by the sea breeze effect

The region's summer season begins in May and lasts through the end of October. During the summer months, sea breeze effect is the predominant climate control. On a daily basis, the land heats up quicker than the adjacent ocean waters creating warm air at the land surface. By afternoon this warm air rises and is replaced by moist, cooler air from over the ocean. This circulation creates an onshore "sea breeze". In most instances, these breezes can extend inland only a few miles. During the nighttime hours, this process reverses since the ocean waters retain the heat gained during the day, and the breezes blow out to sea. Further inland, summer temperatures are several degrees higher than those along the immediate coastline since the sea breeze effect diminishes with landward distance.

The sea breeze effect also influences the daily development of showers and thunderstorms. Showers will develop offshore during the day as warm, moist air from the land rises and moves over the cooler ocean water. At night, isolated showers will develop over land. Rainfall, on the average, is highest during the summer months throughout the region. Occasionally, severe thunderstorms will develop ahead of cold

fronts which pass through the region. These severe storms sometimes generate tornadoes or water spouts and can be accompanied by high winds and hail.

Across the ACE Basin, the annual total number of thunderstorm days is 59. Over the period from 1950-1989, 6 tornadoes have touched down in the region. Annual total rainfall varies from 50.2 inches at Beaufort, S.C. to 46.9 inches along the coast. The month with the heaviest rainfall is July (7.1 inches) and the month with the lowest rainfall is November (2.1 inches). Rainfall induced from tropical weather systems normally account for 25 percent of the total rainfall received during the period from August through October. Precipitation extremes range from a maximum of 22.69 in July of 1964 to a minimum of 0.44 inches in November of 1956.

Temperatures vary from an average minimum in January of 38.2 degrees F to an average maximum in July of 89.9 degrees F. Average temperatures along the immediate coast are 1 to 3 degrees F cooler in summer and 1 to 3 degrees F warmer in winter compared with inland locations in the ACE Basin. Inland temperature extremes range from a high of 105 (7/20/1986) degrees F in the summer to a low of 0 degrees F (1/21/85) in the winter.

The ACE Basin occasionally experiences tropical storms and hurricanes during the hurricane season which lasts from May through November. Tropical cyclones form predominantly in the Atlantic Ocean west of the Antilles Islands, while the remainder form offshore, in the Caribbean, or in the Gulf of Mexico. Hurricanes which hit the lower South Carolina coast occurred in 1885 (unnamed), 1803 (unnamed), 1911 (unnamed), 1940 (unnamed), 1954 Hazel, 1959 (Gracie), 1979 (David), 1985 (Bob), and 1989 (Hugo). These storms resulted in the loss of many lives and millions of dollars in property damage to South Carolina's lower coastlines. In recent memory, Hurricane David had the greatest impact on the ACE Basin.

In addition to the damage caused by hurricanes, the most significant climatic impacts on the environment in the ACE Basin are the result of drought (1954, 1977, 1986, 1988, 1990); flooding (1989, 1990); and cold temperatures (1977, 1983, 1985). Long periods of drought and extensive flooding cause wide fluctuations in the fresh water flow into estuarine systems, while cold air outbreaks can lower water temperatures to less than 45 degrees. Each of these extreme climatic events has a significant impact on fisheries and sensitive vegetation throughout the basin.

6. Water Quality

Water quality standards and classifications in the ACE Basin NERR are highly rated by the South Carolina DHEC (1990). Two primary classes apply to these waters:

- a. **Outstanding Recreational or Ecological Resource Waters (ORW)**: waters which are of exceptional recreational or ecological importance or of unusual value.

Such waters may include, but not be limited to: waters in national or state parks or wildlife refuges; waters supporting threatened or endangered species; waters under the National Wild and Scenic Rivers Act or S.C. Scenic Rivers Act; waters known to be significant nursery areas for commercially important species or known to contain certain significant commercial or public shellfish resources; or waters used for or having significant value for scientific research and study.

b. **Shellfish Harvesting (SFH)**: waters approved for the taking of bivalve mollusks, specifically clams, mussels, or oysters for direct marketing or human consumption. Table 7 summarizes the various bodies of water in the ACE Basin area by DHEC classification. Key water sampling stations are located throughout the Basin for monitoring water quality.

B. Socio-Economic Features

1. Early Historical Development

At the time of first contact with European explorers, Indians of the coast were in the last Mississippian Period. Indians who inhabited this area, belonged to the Iroquoian, the Muskogean and the Eastern Siouan tribes (Milling 1969, Rogers 1970). Other tribes included the Timucuans, Guales, Yamassees, Cauboyes and Yuchis of South Carolina (Millings 1969, Hudson 1976). Probably no more than 50,000 Indians, living in villages of 50 to 200 individuals, inhabited the coastal plain during the initial period of contact with Europeans. Generally, these Indians shared certain common traits. All had developed a fairly diversified agriculture; they built increasingly substantial dwellings and lived in villages. Although varying widely with specific tribes, their culture was based primarily upon the cultivation of food crops with very important, but secondary, emphasis on hunting (Milling 1969).

Although recorded prehistoric occupation spanned more than 100 centuries, coastal Indians developed a subsistence technology that did not appreciably alter their environment. Hunting, agriculture, and limited manufacturing practices have left little or no readily perceptible evidence of prehistoric occupation on the landscape. Pottery, weapon fragments (e.g., arrowheads), and shellmiddens and rings are the most obvious evidence of the Indian's presence in the ACE Basin.

The first Europeans to land in South Carolina were presumably the Spanish (Wallace 1951, Rogers 1970). The late seventeenth and early eighteenth centuries were characterized by continuous struggles between the Spanish and English for the contested territory along the South Atlantic coast. Even during nominal peace, there were numerous intrigues with the Indian tribes to encourage turmoil.

Spain, realizing that the ever-expanding English settlements along the South Atlantic coast posed a threat to her sovereignty in the area, launched several military

Table 7. Status of DHEC (1990) Water Classifications for the ACE Basin.

<u>Waterbody</u>	<u>Counties</u>	<u>Class</u>	<u>Waterbody Description</u> <u>(Site-Specific)</u>
Ashepoo River	Colleton	SFH	Salt Water Intrusion to Atlantic Ocean
Combahee-Salkehatchie	Colleton Beaufort	SFH	Salt Water Intrusion to St. Helena Sound
Coosaw River	Beaufort	SFH	Entire River to St. Helena Sound
Dawho River	Charleston	SFH	Entire River from S. Edisto to N. Edisto
Edisto River	Charleston	ORW	From U.S. 17 to confluence with the Dawho and S. Edisto
Fishing Creek	Charleston	ORW	Entire creek tributary to Dawho River
ICW	Charleston	SFH	From S. Edisto to Dawho River
Mosquito Creek	Colleton	SFH	From Bull Cut to S. Edisto
New Chehaw River	Colleton	SFH	Entire stream tributary to St. Helena Sound
Old Chehaw River	Colleton	SFH	Entire stream to Combahee River
Sampson Island	Colleton	ORW	Entire Creek to S. Edisto River

area, launched several military operations against the interlopers. A major attack was directed at Charleston in 1704 and another at Saint Simons in 1743. Both attacks failed, ultimately leaving the British in firm control of the area north of Florida.

2. Beginning of Agriculture

The early settlers planted mostly subsistence crops, although agricultural experiments with commercial crops were conducted almost from the beginning. Indian trade, especially in deerskins, supplied the major export in the early years. As the Indian trade along the coast dwindled, the emphasis changed first to naval stores obtained from the forests, and then more to indigo and rice. Even as late as the 1720's, the production of pine pitch and tar was more profitable than growing rice (Rogers 1970). By 1718, rice cultivation was extensive in the ACE Basin up to the Santee area.

After the mid-eighteenth century, rice and its attendant culture dominated along the major tidewater rivers of S.C. and Georgia. In the Santee/Winyah area, the insular effects of the waterways allowed a distinct society to develop, at the center of which, until the twentieth century, was the rice plantation (Rogers 1970). The generally confining topography of all South Carolina rice plantations encouraged this type of social development.

After the American Revolution, indigo declined in importance. Cotton, the great staple crop of the South, did not become important until the early 1800's. For most of the eighteenth century, rice was the major agricultural enterprise in the Sea Island Coastal Region.

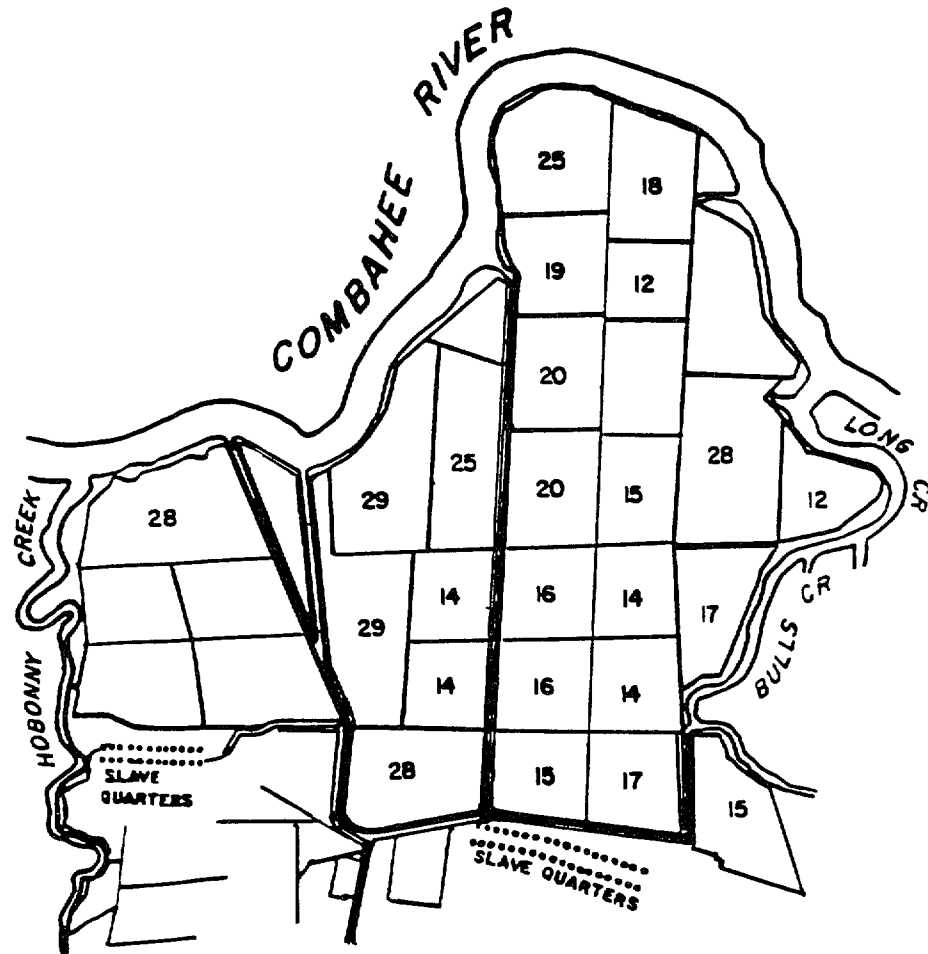
During the early period of rice cultivation, fields were located away from the coast. One of the more readily apparent features of the ACE Basin Region today is the extensive system of rice field dikes, canals, and reservoirs still visible adjacent to the coastal rivers (Figure 11). Gradually, cultivation was brought closer to the tidal estuaries. By the end of the eighteenth century, tidal action was used to flood rice fields (Wallace 1951). Rice was successfully grown from the St. Marys River in southern Georgia to the Cape Fear River in North Carolina, with the greatest production centering around the Georgetown/Santee area in South Carolina (Gray 1941).

Although the Civil War and its aftermath did not immediately destroy the South Atlantic rice culture, it did speed its final decline. Capital, as well as labor, was scarce and the industry was never able to fully recover.

3. Archaeological and Historic Landmarks

Intensive archaeological reconnaissance has been undertaken on relatively few

Figure 11. A view of a fully developed tidewater rice plantation of the early nineteenth century (Doar 1936).



locations in the ACE Basin. Additional unknown sites probably exist on many of the islands and privately owned plantations. Most site records contained in the files of the State archaeologists have been placed there by interested laymen and are not the products of any scholarly research. Generally, site records contain only brief descriptions or, frequently, no description at all.

Much more is known about historic and archaeological sites on land than those located underwater, but additional sites are continually being discovered. Indian occupation began about 10,000 B.C. and produced many sites. The European development of the region also produced innumerable historic sites. Wars have added additional important sites. Table 8 presents some of the more significant sites known in the ACE Basin region. This is not a complete listing but only an example of what is found in the area. A systematic survey of all known and unrecorded sites in the ACE Basin will be undertaken as funding becomes available.

4. Economics

The heart of the proposed ACE Basin NERR lies almost entirely within Colleton County, one of the eight counties comprising South Carolina's coastal zone. The Colleton County seat at Walterboro is the most closely tied urban area to the proposed reserve. According to statistics published by the S.C. Division of Research and Statistical Services (1990), the population of the county is around 36,800 or approximately 35 persons per square mile. This represents only about 23% of the total population for the Lowcountry (Beaufort, Jasper and Colleton Counties) and 4% for the entire coastal zone of S.C.

In 1988, this area was estimated to have a civilian labor force of 17,590 with a 5.2% unemployment rate. Agriculture, timber production and fishing constitute the bulk of the economic base for the lower ACE Basin.

a. Agriculture

In 1987, there were 481 farms employing 600 persons in Colleton County. This accounted for about 20% of the total land area (673,024 acres). Leading income-producing crops were soybeans, hay, corn and wheat. In terms of cash receipts from crops, livestock and livestock products, Colleton County ranked 29th in the state (45 counties). Agriculture provides about 3% of the total labor and proprietor's income in this area.

b. Forestry

As of 1989, 74% (501,274 acres) of the total Colleton County land area was protected forest area. Ownership of this forest land is primarily divided among the forest industry, private corporations, farmers, private landowners and the state. The

Table 8. Sites of Archaeological and Historic Significance in the ACE Basin.

<u>Names</u>	<u>Period</u>	<u>National Register/National Monument</u>
Green Pond	18th Century	NO
Combahee Ferry	Prehistoric/Historic	NO
Heyward Plantation	Prehistoric/Historic	Unknown
Combahee River	Prehistoric	NO
Colleton Co. Courthouse	19th Century	YES
Walterboro Library	19th Century	YES
Old Colleton Co. Jail	19th Century	YES
Pon Pon Chapel	18th Century	YES
Issac Hayne Hall & Gave	18th Century	YES
Jacksonboro Bridge	Historic	NO
Ashepoo Trestle	Historic	NO
Ashepoo	Unknown	NO
Maybank	Unknown	NO
Gun Boat Island (Federal Vessel)	Civil War	Unknown
Ferwick (Confederate Fort)	Civil War	Unknown
Ashepoo River (Vessel-Federal Confederate)	Civil War	Unknown
Ashepoo River (Fort Chapman)	Civil War	Unknown
Ashepoo River (Confederate Fort-Unnamed)	Civil War	Unknown
Bear Island Road (Confederate Fort-Unnamed)	Civil War	Unknown
Combahee River (Confederate Fort-Unnamed)	Civil War	Unknown
Combahee River (Confederate Fort-Unnamed)	Civil War	Unknown
Otter Island (Confederate & Federal)	Civil War	Unknown
(Note: May possible now be underwater).		
(Fort-Unnamed)		
Otter Island (Federal Signal Tower)	Civil War	Unknown
East end Hwy 17 (Confederate Fort causeway at Combahee entrenchments)	Civil War	Unknown
Fields Pt. (Confederate Fort earthworks or fortification)	Civil War	Unknown
Tar Bluff (Confederate Fort earthworks or fortification)	Civil War	Unknown

Hutchinson Island, Bennetts Point and many other points accessible by water contain both Civil War Camps and picket posts.

types of various timber species can be grouped as longleaf-slash, loblolly-shortleaf, oak-pine, oak-hickory, and oak-gum-cypress. The variety of soil conditions within the ACE Basin results in timber producing sites of varying quality. Forest acreage by timber stand includes sawtimber, pole timber (includes pulpwood), sapling-seedling, and non-merchantable stock.

Commercial forestry is an important industry within the ACE Basin. There are a number of foresters with the SCFC working in the area as well as consulting and other foresters with private concerns. These foresters assist woodland owners in the Basin in overall woodland management, timber harvesting, tree planting, watershed management, fire protection, wildlife management, insect and tree disease control and other miscellaneous matters related to forest resources.

In the area of fire protection, the SCFC has a number of employees, including rangers, wardens, district rangers, etc., who spend a great deal of their time in forest fire prevention within the Basin. The fire prevention program consists of education material for school children as well as planned contacts through individuals, groups, civic clubs and news media.

In 1989, the county had 251 wild fires, burning 1335 acres of forest land. This represents less than 1/2 of one percent of the woodland in the ACE Basin.

c. Fisheries

The marsh/estuarine system of the ACE Basin is extremely valuable as habitat and as spawning and nursery grounds for species of commercial and recreational importance.

Commercial fisheries are primarily for Penaeid shrimp, blue crabs, oysters, clams and various species of finfish. The combined commercial fisheries harvest for this system is approximately 1.1 million lbs. annually or about seven percent of the state's total volume of fish and shellfish production. This catch has an annual dockside value of approximately \$1.6 million or about six percent of the statewide value going to the commercial fishermen (Table 9).

The shrimp fishery is conducted primarily in the lower estuary and adjacent ocean waters. Blue crab pot fishing is confined to the inner estuarine area of the sound and tidal rivers, streams and tributaries. The major portion of shellfish growing areas in this river basin are intertidal and are either under permit for commercial harvesting or designated as State and public grounds. A recent discovery of subtidal clam beds in the Ashepoo River has added significant value to the commercial shellfish production in this area. At present, there is no evidence of over-exploitation of any marine or estuarine resources in this system.

Table 9. Average Annual Landings and Ex-Vessel Value for Products Landed in the ACE Basin.

	Catches from within the ACE Basin		Offshore Landings within the ACE Basin	
	<u>Volume</u>	<u>Value</u>	<u>Volume</u>	<u>Value</u>
Shrimp	180,434	\$176,042	276,225	\$807,779
Crab	337,915	\$158,532	77	\$35
Clams & Oyster	45,039	\$186,473	0	\$ 0
Inshore Fish	204,835	\$156,106	3,762	\$2,540
Offshore Fish	0	\$0	33,214	\$32,060
Total	768,222	\$677,152	313,277	\$842,412
		<u>Volume</u>		<u>Value</u>
Total All Areas		16,640,217		\$25,563,096
Percent of State Landings:		6.5%		5.9%
Docks	9			
Vessels	32			
Fishermen	104			

Saltwater sport fishing, although a popular recreational activity in the area, is not as intensive as in many other marine areas along the S.C. coast. Major sport fishing activities take place in the sound, tidal rivers, and ocean waters adjacent to Edisto Island. For the most part, this consists of small boat fishing for inshore species such as sea trout, drums, flounder and cobia, or near shore trolling for mackerels, jacks and bluefish. Surf and bridge fishing is also popular in the area, as are recreational shrimping, crabbing, and shellfishing.

SCWMRD recreational fisheries management programs currently in effect in this area by the SCWMRD include: artificial fishing reef construction; public shellfish areas; assistance in facilities development, such as boat launching ramps; and the administration and enforcement of State regulations pertaining to recreational fisheries.

d. Other Marine Uses

The Ace Basin is also utilized for recreational boating, swimming and other water sports. Seventeen public boat launching ramps are located in the area east of Walterboro in Colleton County. As is the case with recreational fishing, however, such use of the area is comparatively light.

Other than small pleasure craft, navigational usage of the ACE Basin estuary is not intensive. Pleasure craft, commercial barge traffic and fishing vessels are the primary users of the waterways in this area.

The ACE Basin has been the location of a number of scientific research investigations over the years. Continuous, ongoing research and monitoring programs in this area are being conducted primarily by the SCWMRD and SCDHEC. Current research activities by the SCWMRD are primarily related to fisheries management, including shellfish studies, shrimp monitoring, estuarine trawl surveys, and an inventory of coastal wetlands in the area. The SCDHEC is primarily engaged in continuous monitoring of water quality and shellfish growing areas.

5. Traditional Land Use - Wildlife Management and Hunting

Wildlife management is an important land use practice in the overall ACE Basin region and represents the principal land use activity occurring on upland areas within the proposed reserve. Accounts of hunting during the early to mid 1800's document the rich abundance of game animals associated with extensive tidewater rice plantations and other lands within the region (Elliott 1859). Within the reserve buffer zone, intensive wildlife management currently is practiced on some eight major privately-managed properties as well as the state-owned Bear Island WMA.

Historic emphasis relating to hunting together with the evolution of more sophisticated wildlife management techniques largely have been responsible for maintaining the natural character of privately-managed properties. Interest in bobwhite quail management beginning in the 1950's had a positive impact on white-tailed deer populations by providing increased habitat diversity through prescribed burning, timber management and establishment of numerous food plots. Significant cooperation efforts between SCWMRD and private landowners have resulted in innovative programs to effectively manage deer populations and encourage sound stewardship of the deer resource. During the period of mid 1970's through the 1980's wild turkeys have been restocked in appropriate habitats and huntable populations now occur on numerous properties. Mourning doves are an abundant game bird on agricultural lands planted annually in corn, soybeans and various small grains. As previously described in the discussion of estuarine impoundments, considerable emphasis is placed on managing some 3,300 acres of impoundments to provide waterfowl habitat. In order to promote overall wildlife resource stewardship on private lands, SCWMRD provides a comprehensive technical guidance program for both wetland and upland game species.

The 12,000 acre Bear Island WMA has been developed to provide management potential for a diversity of wildlife species and consists of a complex of habitats including: managed impoundments 5,400 acres; tidal marshes 5,000 acres, forest lands 1,200 acres and agricultural lands 400 acres. The area provides public hunting opportunities for a variety of game animals including waterfowl, mourning dove, white-tailed deer and small game species. In addition to game species, Bear Island provides important habitat for non-game and endangered species. Other than hunting, wildlife related recreational activities (i.e. birdwatching, photography, and nature study) compatible with habitat management and public hunting programs, also are encouraged.

In addition to public hunting opportunities provided on Bear Island WMA, the surrounding creeks, rivers, marshes and open waters of St. Helena Sound provide significant public hunting opportunities for waterfowl and rails. Although estuarine impoundments are the principal habitats used by waterfowl, hunters are afforded opportunities to hunt ducks in public waters when birds fly over tidal wetlands during their normal daily movements. Regularly flooded salt marshes located in both the core and buffer areas of the proposed reserve provide extensive habitat for clapper rails and offer excellent rail hunting opportunities especially during periods of spring tides.

6. Local Activities Affecting the Site

There are two activities that may affect the ACE Basin site from an environmental standpoint. These are dredging activities associated with maintenance of the AIWW and nonpoint source pollution (NPS) runoff.

a. **Dredging Activities**

Maintenance dredging of the AIWW has a significant effect on the site not only from the mechanical removal of sediments from the bottom, but also from the creation of disposal areas in adjacent marshes. There are four disposal sites located on Ashe Island in the reserve which are currently being used by the Corps of Engineers. Permanent easements for future use are also held along the AIWW within the site. This activity is reviewed through the public review process required by federal regulation.

b. **NPS Runoff**

Nonpoint source pollution is defined by the Association of State and Interstate Water Pollution Control Administrators as those discharges that are not covered by a site-specific discharge permit. Categories of NPS pollution include agriculture, silviculture, construction, urban runoff, mining, land disposal of solid and hazardous wastes and hydrologic modifications. In an area like the ACE Basin, the most likely potential sources of NPS pollution are agriculture, and to a lesser degree silviculture and hydrologic modifications in the form of impoundments managed for waterfowl and mariculture activities.

Agriculture accounts for about 20% of the total land area in Colleton County, and farmers have requested that a high priority be given to establishing a baseline of information on contaminant levels within the system. Runoff from agriculture activities typically contains high levels of suspended sediments, nutrients, pesticides, animal wastes, and other oxygen-demanding substances. Runoff from silviculture activities and impoundments also contains sediments and oxygen-demanding substances and may contain nutrients and pesticides as well. All of these contaminants can degrade water quality, interfere with the biological activities of aquatic organisms, and create long-term ecological imbalances.

The degree to which NPS runoff has affected the ACE Basin is unknown at this time. Apparently, it has not been a serious threat to water quality standards based on the present DHEC classifications. However, NPS runoff is an area that needs study in the early stages of characterization.

c. **Biological Features**

Detailed narrative treatment is provided for the major ecosystem components in Appendix G. Functional relationships are discussed for 23 ecological systems, subsystems and general community types represented in the ACE Basin NERR. Species lists are provided for plants, birds, mammals, reptiles and amphibians, and fishes in Appendix H.

IV. ENVIRONMENTAL CONSEQUENCES

A. General Impacts

The overall impact of establishing the ACE Basin NERR would be environmentally beneficial. Social and economic benefits would override any adverse impacts.

Designation of the reserve would entail minimal development or physical alteration of present environmental conditions beyond what is proposed for Bear Island in the facilities development plan. Reserve status will give the lower ACE Basin estuary protection beyond what it currently has in the state's coastal management program. The land acquisition strategy, including purchases, donations and easements, will further discourage adverse development in the lower estuary.

Traditional uses of the area will not be changed. Hunting, fishing and shellfishing will continue to be administered by SCWMRD and access to the area for recreation and education will be enhanced.

B. Specific Impacts

1. Natural Environment

Physical impacts on the natural environment through designation of the ACE Basin NERR would be negligible. Effects of the education and research programs outlined in the management plan would be beneficial in the long-term through a better understanding of estuaries and their management. Also, the research and monitoring program will incorporate studies to determine the optimum amount of use (in terms of varying use patterns and mixes) the area can support.

2. Human Environment

a. Scientific and Educational

Research and educational activities outlined in the management plan will help to solve coastal zone management issues through a better understanding of estuarine processes. Thus, the proposed ACE Basin NERR is an outstanding investment because of its societal returns in terms of practical application.

As our society becomes more aware of and concerned with the need for protecting our environment, we are seeing an ever increasing emphasis on the subject in our schools and universities. To properly carry out our educational responsibilities, these institutions will need quality representative outdoor environmental laboratories for student field trips and research activities.

b. Public Access

Development of the proposed education/visitor center will serve as a focal point for public access to the reserve. Access points will be enhanced and areas, not otherwise open to the public in the past, will be available for research, education and general public use. For researchers, access to estuarine areas will be available along with support of the ACE Basin NERR.

c. State and Federal

Acquisition, management and development activities within the ACE Basin NERR will have a short-term fiscal impact on the federal government and a long-term financial impact on the state of South Carolina. The state must make a commitment for the long-term operation of the reserve. Alternate funding sources to supplement the state's share will be investigated.

Any state/federal expenditures will be offset by two un-quantifiable benefits:

- (1) The creation of an irreplaceable natural laboratory where long-term and short-term studies will be conducted and applied in coastal decision-making.
- (2) The reserve will be part of a national program which will foster cooperation from scientists, institutions, educators and local, state and federal government.

C. Unavoidable Adverse Environmental or Socio-Economic Impacts

1. Tax Revenue Loss

Acquisition of property in the reserve may result in an initial loss of tax revenue to Colleton, Beaufort and Charleston counties. According to the 1989 tax records, taxes assessed on the eight islands proposed for acquisition in the reserve core area were \$10,566.40. This will be easily offset by gains in the local economy due to tangible and intangible benefits. Positive values are associated with providing facilities for education and training. Direct economic benefits will be derived locally from visiting scientists, educators, organized groups and casual visitors. More wide spread benefits are derived from applied research which addresses major coastal zone management issues. There are also serendipity values of basic research in natural environments such as the ACE Basin NERR (Krutilla 1975).

Designation of the research reserve could also enhance property values of adjoining lands. As the amenities of the estuary and coastal wetlands are preserved, adjacent properties may become more valuable and desirable. Also, there are

substantial community benefits associated with conservation easements, which are vital components of the overall ACE Basin Project. Easements that restrict development and protect fish and wildlife habitat are likely to increase the market value of adjacent lands. This principle, known as the "betterment theory" has been recognized in the context of federal tax appraisals (Stockford, 1990).

2. Traffic Impacts

Designation of the ACE Basin NERR will introduce more people into the reserve. This will result in more vehicles on U.S. 17 and South Carolina Highway 26, more pedestrians on reserve grounds and a probable increase in boat and waterway traffic.

Although education and research activities are encouraged, NERR sites are "tourist" type facilities. The number of visitors will be monitored to ensure no damage occurs to the resources being protected.

Development of the education/visitor center at Bear Island WMA would initially entail only the reserve staff and researchers. This would involve approximately ten (10) vehicle trips per day during year one increasing to less than twenty (20) during year five. As the program develops and becomes better known, these figures will increase. Special events and other planned activities at the reserve center will produce "pulses" of traffic entering and exiting the facility.

D. Relationship Between the Proposed Action on the Environment and the Maintenance and Enhancement of Long-Term Productivity

The stated purpose of the ACE BASIN NERR is to protect the area in perpetuity so as to guarantee long-term stability of the natural resources for research and education. Traditional uses of these resources will continue under present regulations. However, there will be no short-term or exploitative uses of these resources at the expense of long-term productivity or continued public use. By implication, all short-term uses that would reduce or eliminate long-term productivity will be prevented with the proposed action and intended management.

The proposed action of resource protection is consistent with maintaining natural productivity of estuaries and ecosystem processes with little or no work or subsidy by man. Designation of the ACE Basin NERR will serve to maintain, and possibly enhance the ecosystem's long-term productivity.

E. Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitments of resources have been identified in the assessment or are expected to result from the proposed action. No other adverse, unavoidable environmental impacts are known. No significant construction is

anticipated, except for possible education facilities such as an interpretative center, trails, signs, and small upland parking areas at controlled access points. Other than sport and commercial fishing, shellfishing, and game harvesting, no extraction of renewable or nonrenewable resources will occur. Endangered, threatened, and sensitive species and their vital habitats would be protected, as would any known or discovered archeological or historical sites on lands owned by participants in the program.

Minor maintenance and energy expenditures would be incurred, as would the expenditure of public funds. These may be regarded as a commitment of economic resources and also as an investment in recreational, educational and environmental amenities for the welfare of present and future generations.

F. Possible Conflicts Between the Proposed Action and the Objectives of Federal, State, Regional and Local Land-Use Plans, Policies and Controls For the Areas Concerned

No conflicts have been noted in the assessment used to develop the ACE Basin NERR designation. By incorporating existing local, State, and Federal regulatory, land-use, and resource management programs, it is intended that the reserve operation will carefully fit into its natural and institutional environment.

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VI. LIST OF AGENCIES, ORGANIZATIONS AND PERSONS RECEIVING COPIES OF THE FEIS/DMP.

Federal Agencies

Advisory Council of Historic Preservation
Army Corps of Engineers, South Atlantic Division
Department of Agriculture
Department of Commerce, National Marine Fisheries Service
Department of Defense
Department of Energy
Department of Health and Human Services
Department of the Interior, U.S. Fish and Wildlife Service
Department of Justice
Department of Labor
Department of Transportation, U.S. Coast Guard and Federal Highway Administration
Environmental Protection Agency, permits Branch, Region IV
Federal Energy Regulatory Commission
General Services Administration

Nuclear Regulatory Commission

Congressional

Senator Ernest F. Hollings
 Senator Strom Thurmond
 Representative Arthur Ravenel

State Distribution

Governor
 Attorney General
 Archaeology Institute
 South Carolina Coastal Council
 South Carolina Department of Archives and History
 South Carolina Department of Health and Environmental Control
 South Carolina Department of Highways and Public Transportation
 South Carolina Department of Parks, Recreation, and Tourism
 South Carolina Forestry Commission
 South Carolina Land Resources Conservation Commission
 South Carolina Public Railways Commission
 South Carolina Public Service Authority
 South Carolina Public Service Commission
 South Carolina State Budget & Control Board
 South Carolina State Development Board
 South Carolina State Ports Authority
 South Carolina Water Resources Commission

Local Distribution

Beaufort County

Beaufort County Development Commission
 Beaufort County Joint Planning Commission
 Beaufort County Administrator

Colleton County

County Supervisor
 Mayor, Edisto Beach
 Mayor, Walterboro
 Walterboro-Colleton Recreation Commission
 Lowcountry Council of Governments
 The Edisto Island Community Association

Environmental Interest Groups

Center for Environmental Education
Environmental Defense Fund
The Nature Conservancy
National Wildlife Federation
Sierra Club
The Preservation Society of Charleston
South Carolina Chamber of Commerce
South Carolina Coastal Conservation League
South Carolina Environmental Coalition
South Carolina Wildlife Federation

Libraries

Beaufort County Library
Charleston County Library
Colleton County Library
South Carolina State Library

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VIII. LIST OF APPENDICES

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APPENDIX A

ANALYSIS OF ACE BASIN SITE

BASED ON NERRS BIOGEOGRAPHIC SCHEME/TYOLOGY

I. Representativeness

- A. Appendix 1 - Biogeographic Classification Scheme
Carolinian - South Atlantic (Santee River to St.
John's River)
- B. Appendix 2 - Typology of National Estuarine Areas
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: Uniola

Group II- Transition Areas

- A. Coastal Marshes
 - a. Tidal
 - 1. Saltmarsh cordgrass
 - 2. Brackish marshes
 - 3. Freshwater marshes
- B. Coastal Swamps
- D. Intertidal Beaches
- E. Intertidal Mud and Sand and Flats

Group III - Submerged Bottoms

- A. Subtidal Hardbottoms
- B. Subtidal Softbottoms

Class II - Physical Characteristics

Group I - Geologic

- A. Basin Type

- 3. Bay
- B. Basin Structure
 - 1. Coastal Plains Estuary
- C. Inlet Type
 - 1. Unrestricted
- D. Bottom Composition
 - 1. Sand
 - 2. Mud
 - 4. Oyster Shell

Group II- Hydrographic

- A. Circulation
 - 1. Stratified
- B. Tides
 - 2. Semidiurnal
- C. Freshwater
 - 1. Surface water
 - b. Groundwater

Group III-Chemical

- A. Salinity
 - 1. Positive Estuary
 - 3. Salinity Zones
 - c. Mixohaline
- B. PH Regime
 - 2. Circumneutral

II. Value for Research

- A. Basic Research Topics
 - 1. Interdisciplinary Studies of Estuarine Productivity
 - 2. Marsh Ecology Investigations
 - 3. Long-term Water Quality Studies
 - 4. Nutrient Cycling
 - 5. Characterization of Community Types
- B. Applied Research and Management Topic
 - 1. Habitat manipulation Studies
 - 2. Habitat Alteration and long-term vs. short-term effects
 - 3. Multiple Use Studies of Impoundments
 - 4. Non-game and Endangered Species Management
 - 5. Traditional Use Studies
 - 6. Shellfish Management and Cultivation Studies

7. Fisheries Use Investigation

III. Value For Education

- A. Instructional area for undergraduate and graduate courses taught at the College of Charleston, U.S.C., The Citadel, Clemson and S.C. State.
- B. Proximity to Intermediate and Senior High Schools in the following counties:
 - 1. Collection
 - 2. Beaufort
 - 3. Charleston
 - 4. Jasper
 - 5. Hampton
 - 6. Dorchester
 - 7. Orangeburg
 - 8. Bamberg
 - 9. Berkeley
- C. Proximity To Urban Centers
 - 1. Walterboro - 32 miles
 - 2. Charleston - 45 miles
 - 3. Beaufort - 46
- D. Proximity to Institutions
 - 1. USC (Walterboro & Beaufort)
 - 2. The College of Charleston
 - 3. The S.C. Marine Resources Research Institute
 - 4. The Citadel
 - 5. S.C. State University

APPENDIX B
Current NERRS Regulations

Registered Federal Report

Monday
July 23, 1990

Part II

Department of Commerce

**National Oceanic and Atmospheric
Administration**

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, Chief, Marine and Estuarine Management Division; Office of Ocean and Coastal Resource Management, NOS/NOAA; 1825 Connecticut Avenue NW.; Suite 714; Washington, DC 20235, (202) 673-5126.

FOR FURTHER INFORMATION CONTACT: Mr. Joseph A. Uravitch, (202) 673-5126.

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 § 921.10. Of this amount, up to \$25,000 may be used to conduct the site selection process as described in § 921.11. 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 1985 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 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 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 Reserve Research System, as stated in § 921.1(a), "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)(5)—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)(5) 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 307(c)(1) of the Coastal Zone Management Act of 1972, as amended. NOAA views this mechanism as an effective means for ensuring that Reserves support and advance the relevant coastal and estuarine management objectives including those of the National Estuary Program. Therefore, § 921.11(c)(5) 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(a)(11)—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 Reserve 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(a)—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 T1.420, 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. 315, 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 315 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 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 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 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 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 Research 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 predesignation 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 mutual 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(s)

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 predesignation 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 predesignation 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 Federal-state relationship during 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 therein 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 per centum 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 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. 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 § 921.81.

§ 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 final 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 reserves 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 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 (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 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 resource 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 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

§ 921.60 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 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 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 ericaceous species, and thickets of Myrica, Prunus, and Rosa
2. **Southeast Areas:** Floral dominants include Myrica, Baccharis, and Ilex.
3. **Western Areas:** Adenostoma, Arcotophylos, 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. Umola; and
4. Mid-Atlantic/Gulf. Spartina patens.

D. Coastal Tundra: This ecosystem, which is found along the Arctic and Boreal coasts of North America, is characterized by low temperatures, a short growing season, and some permafrost, producing a low, treeless mat community made up of mosses, lichens,

heath, shrubs, grasses, sedges, rushes, and herbaceous and dwarf woody plants.

Common species include arctic/alpine plants such as Empetrum nigrum and Betula nana, the lichens Cetraria and Cladonia, and herbaceous plants such as Potentilla tridentata and Rubus chamaemorus. Common species on the coastal beach ridges of the high arctic desert include Dryas intergrifolia and Saxifrage oppositifolia. This area can be divided into two main subdivisions:

1. **Low Tundra:** characterized by a thick, spongy mat of living and undecayed vegetation, often with water and dotted with ponds when not frozen; and

2. **High Tundra:** a bare area except for a scanty growth of lichens and grasses, with underlying ice wedges forming raised polygonal areas.

E. Coastal Cliffs: This ecosystem is an important nesting site for many sea and shore birds. It consists of communities of 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 Macoma).

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 echinoid worm Urechis, the mud snail Nassarius, and the sea cucumber Thyone.

F. Intertidal Algal Beds: These are hard substrates along the marine edge that are dominated by macroscopic algae, usually thalloid, but also filamentous or unicellular in growth form. This also includes the rocky coast tidepools that fall within the intertidal zone. Dominant fauna of these areas are barnacles, mussels, periwinkles, anemones, and chitons. Three regions are apparent:

1. **Northern Latitude Rocky Shores:** It is in this region that the community structure is best developed. The dominant algal species include Chondrus at the low tide level, Fucus and Ascophyllum at the mid-tidal level, and Laminaria and other kelp-like algae just beyond the intertidal, although they can be exposed at extremely low tides or found in very deep tidepools.

2. **Southern Latitudes:** The communities in this region are reduced in comparison to those of the northern latitudes and possesses algae consisting mostly of single-celled or filamentous green, blue-green, and red algae, and small thalloid brown algae.

3. **Tropical and Subtropical Latitudes:** The intertidal in this region is very reduced and contains numerous calcareous algae such as Porolithon and Lithothamnion, as well as green algae with calcareous particles such as Halimeda, and numerous other green, red, and brown algae.

Group III—Submerged Bottoms

A. Subtidal Hardbottoms: This system is characterized by a consolidated layer of solid rock or large pieces of rock (neither of biotic origin) and is found in association with geomorphological features such as submarine canyons and fjords and is usually covered with assemblages of sponges, sea fans, bivalves, hard corals, tunicates, and other attached organisms. A significant feature of estuaries in many parts of the world is the oyster reef, a type of subtidal hardbottom. Composed of assemblages of organisms (usually bivalves), it is usually found near an estuary's mouth in a zone of moderate wave action, salt content, and turbidity. If light levels are sufficient, a covering of microscopic and attached macroscopic algae, such as kelp, may also be found.

B. Subtidal Softbottoms: Major characteristics of this ecosystem are an unconsolidated layer of fine particles of silt, sand, clay, and gravel, high hydrogen sulfide levels, and anaerobic conditions often existing below the surface. Macrophytes are either sparse or absent, although a layer of benthic microalgae may be present if light levels are sufficient. The faunal community is dominated by a diverse population of deposit feeders including polychaetes, bivalves, and burrowing crustaceans.

C. Subtidal Plants. This system is found in relatively shallow water (less than 8 to 10 meters) below mean low tide. It is an area of extremely high primary production that provides food and refuge for a diversity of faunal groups, especially juvenile and adult fish, and in some regions, manatees and sea turtles. Along the North Atlantic and Pacific coasts, the seagrass *Zostera marina* predominates. In the South Atlantic and Gulf coast areas, *Thalassia* and *Diplanthera* predominate. The grasses in both areas support a number of epiphytic organisms.

Class II—Physical Characteristics

Group I—Geologic

A. Basin Type: Coastal water basins occur in a variety of shapes, sizes, depths, and appearances. The eight basic types discussed below will cover most of the cases:

1. **Exposed Coast:** Solid rock formations or heavy sand deposits characterize exposed ocean shore fronts, which are subject to the full force of ocean storms. The sand beaches are very resilient, although the dunes lying just behind the beaches are fragile and easily damaged. The dunes serve as a sand storage area, making them chief stabilizers of the ocean 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: Aunu'u Island, American Samoa.

8. **Anchialine Systems:** These small coastal exposures of brackish water form in lava depressions or elevated fossil reefs, have only a subsurface connection to the ocean, but show tidal fluctuations. Differing from true estuaries in having no surface continuity with streams or ocean, this system is characterized by a distinct biotic community dominated by benthic algae such as *Rhizoclonium*, the mineral encrusting *Schizothrix*, and the vascular plant *Ruppia maritima*. Characteristic fauna, which exhibit a high degree of endemism, include the mollusks *Theodoxus neglectus* and *T. carnosus*, the small red shrimp *Metabetaeus lohena* 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 channel.

3. *Rock*: Rocks usually occur in areas where the stream runs rapidly over a steep gradient with its coarse materials being derived from the higher elevations where the stream slope is greater. The larger fragments are usually found in shallow areas near the stream mouth.

4. *Oyster shell*: Throughout a major portion of the world, the oyster reef is one of the most significant features of estuaries, usually being found near the mouth of the estuary in a zone of moderate wave action, salt content, and turbidity. It is often a major factor in modifying estuarine current systems and sedimentation, and may occur as an elongated island or peninsula oriented across the main current, or may develop parallel to the direction of the current.

Group II—Hydrographic

A. *Circulation*: Circulation patterns are the result of the combined influences of freshwater flow, tidal action, wind and oceanic forces, and serve many functions: nutrient transport, plankton dispersal, ecosystem flushing, salinity control, water mixing, and more.

1. *Stratified*: This is typical of estuaries with a strong freshwater influx and is commonly found in bays formed from "drowned" river valleys, fjords, and other deep basins. There is a net movement of freshwater outward at the top layer and saltwater at the bottom layer, resulting in a net outward transport of surface organisms and net inward transport of bottom organisms.

2. *Non-stratified*: Estuaries of this type are found where water movement is sluggish and flushing rate is low, although there may be sufficient circulation to provide the basis for a high carrying capacity. This is common to shallow embayments and bays lacking a good supply of freshwater from land drainage.

3. *Lagoonal*: An estuary of this type is characterized by low rates of water movement resulting from a lack of significant

freshwater influx and a lack of strong tidal exchange because of the typically narrow inlet connecting the lagoon to the sea. Circulation, whose major driving force is wind, is the major limiting factor in biological productivity within lagoons.

B. *Tides*: This is the most important ecological factor in an estuary, as it affects water exchange and its vertical range determines the extent of tidal flats which may be exposed and submerged with each tidal cycle. Tidal action against the volume of river water discharged into an estuary results in a complex system whose properties vary according to estuary structure as well as the magnitude of river flow and tidal range. Tides are usually described in terms of their cycle and their relative heights. In the United States, tide height is reckoned on the basis of average low tide, which is referred to as datum. The tides, although complex, falls into three main categories:

1. *Diurnal*: This refers to a daily change in water level that can be observed along the shoreline. There is one high tide and one low tide per day.

2. *Semidiurnal*: This refers to a twice daily rise and fall in water that can be observed along the shoreline.

3. *Wind/Storm Tides*: This refers to fluctuations in water elevation to wind and storm events, where influence of lunar tides is less.

C. *Freshwater*: According to nearly all the definitions advanced, it is inherent that all estuaries need freshwater, which is drained from the land and measurably dilutes seawater to create a brackish condition. Freshwater enters an estuary as runoff from the land either from a surface and/or subsurface source.

1. *Surface water*: This is water flowing over the ground in the form of streams. Local variation in runoff is dependent upon the nature of the soil (porosity and solubility), degree of surface slope, vegetational type and development, local climatic conditions, and volume and intensity of precipitation.

2. *Subsurface water*: This refers to the precipitation that has been absorbed by the soil and stored below the surface. The distribution of subsurface water depends on local climate, topography, and the porosity and permeability of the underlying soils and rocks. There are two main subtypes of surface water:

a. *Vadose water*: This is water in the soil above the water table. Its volume with

respect to the soil, is subject to considerable fluctuation.

b. *Groundwater*: This is water contained in the rocks below the water table, is usually of more uniform volume than vadose water, and generally follows the topographic relief of the land, being high below hills and sloping into valleys.

Group III—Chemical

A. *Salinity*: This reflects a complex mixture of salts, the most abundant being sodium chloride, and is a very critical factor in the distribution and maintenance of many estuarine organisms. Based on salinity, there are two basic estuarine types and eight different salinity zones (expressed in parts per thousand—ppt).

1. *Positive estuary*: This is an estuary in which the freshwater influx is sufficient to maintain mixing, resulting in a pattern of increasing salinity toward the estuary mouth. It is characterized by low oxygen concentration in the deeper waters and considerable organic content in bottom sediments.

2. *Negative estuary*: This is found in particularly arid regions, where estuary evaporation may exceed freshwater inflow, resulting in increased salinity in the upper part of the basin, especially if the estuary mouth is restricted so that tidal flow is inhibited. These are typically very salty (hyperhaline), moderately oxygenated at depth, and possess bottom sediments that are poor in organic content.

3. *Salinity zones (expressed in ppt)*:

- a. Hyperhaline—greater than 40 ppt.
- b. Euhaline—40 ppt to 30 ppt.
- c. Mixohaline: 30 ppt to 0.5 ppt.
- (1) Mixoeuhaline—greater than 30 ppt but less than the adjacent euhaline sea.
- (2) Polyhaline—30 ppt to 18 ppt.
- (3) Mesohaline—18 ppt to 5 ppt.
- (4) Oligohaline—5 ppt to 0.5 ppt.
- d. Limnetic: Less than 0.5 ppt.

B. *pH Regime*: This is indicative of the mineral richness of estuarine waters and fall into three main categories:

1. Acid: Waters with a pH of less than 5.5.
2. Circumneutral: A condition where the pH ranges from 5.5 to 7.4.
3. Alkaline: Waters with a pH greater than 7.4.

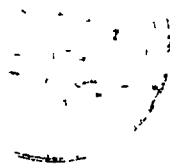
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APPENDIX C

ACE Basin Site Selection

APPENDIX C.1

Governor Campbell's Letter for Site Nomination



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

A handwritten signature in black ink, appearing to read "Carroll A. Campbell, Jr.", written over the word "sincerely".

Carroll A. Campbell, Jr.
Governor

CACjr/tad

Attachment

APPENCIX C.2

Approval of Nomination by U.S. Department of Commerce



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 thorough 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

cc: ES - GC - AS - N - N/ORM - N/ORM2
Steve Snyder, South Carolina Coastal Council
N/ORM2:CGraham:673-5122:sp:3/6/90



THE ADMINISTRATOR

APPENDIX D

Draft Proposed Memoranda of Understanding and Agreements

**DRAFT PROPOSED
MEMORANDUM OF UNDERSTANDING**

**BETWEEN
THE STATE OF SOUTH CAROLINA
AND
THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
CONCERNING THE
ESTABLISHMENT AND ADMINISTRATION
OF THE
ASHEPOO-COMBAHEE-EDISTO (ACE) BASIN NATIONAL ESTUARINE
RESEARCH RESERVE**

This Memorandum of Understanding ("MOU") is made this day of _____, 1990 by and between the State of South Carolina to the benefit of the South Carolina Wildlife and Marine Resources Department ("SCWMRD"), having an address at the Marine Resources Division, 217 Fort Johnson Road, P. O. Box 12559, Charleston, South Carolina, 29412 and the National Oceanic and Atmospheric Administration, Department of Commerce ("NOAA"), having an address at Office of Ocean and Coastal Resource Management, National Ocean Service/NOAA, 1825 Connecticut Avenue, N.W., Suite 714, Washington, D. C. 20235 and concerns the establishment and administration of the Ashepoo-Combahee-Edisto ("ACE") Basin National Estuarine Research Reserve in South Carolina ("the Reserve").

WHEREAS, the SCWMRD has determined that the waters and related coast habitats of the ACE Basin provide representative opportunities to study natural and human processes occurring within an estuarine ecosystem; and

WHEREAS, it is the finding of the SCWMRD that the resources of the ACE Basin and the values they represent to the citizens of South Carolina and the United States will benefit from the management of this site as a National Estuarine Research Reserve; and

WHEREAS, NOAA has concurred with that finding and pursuant to its authority under Section 315 of the Coastal Zone Management Act of 1972 ("CZMA"), as amended, P. L. 92-593, 16 U.S.C. 1461, and in accordance with implementing regulations at 15 CFR 921.30, may designate the ACE Basin site as a reserve in the National Estuarine Research Reserve System; and

WHEREAS, the SCWMRD, as the State agency designated in the management plan for the Reserve (the "Plan") and by the State of South Carolina as being responsible for managing the Reserve, acknowledges the need and requirement for continuing State-Federal cooperation in the long-term management of the ACE Basin site in a manner consistent with the purposes sought through their designation.

NOW, THEREFORE, in consideration of the mutual covenants contained herein it is agreed by and between the SCWMRD and NOAA, effective on the date of designation of the ACE Basin site as the Reserve, as follows:

ARTICLE I: State-Federal Roles in Reserve Management

- A. The SCWMRD, as the principal contact for the State of South Carolina in all matters concerning the Reserve, will serve to ensure that the Reserve is managed in a manner consistent with the goals of the National Estuarine Research Reserve System ("NERRS") and the management objectives of the Plan. Its responsibilities for Plan implementation will include the following:**
- 1. Effect and maintain a process for coordinating and facilitating the roles and responsibilities of all State and county 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 administration of facilities, programs, and tasks related to Reserve management;**
 - c. Activities and programs conducted pursuant to the State's Federally-approved coastal management program authorized under the CZMA, as amended; and**
 - d. Research and education agenda developed and implemented in accordance with corresponding elements of the Plan;**
 - 2. As the Governor's designee under 15 CFR 921.50 and the recipient State entity in matters concerning all financial assistance awards authorized under Section 315 of the CZMA, the SCWMRD will apply for, budget, and allocate such funds received for acquisition and development, operation and management, and research, monitoring and education;**
 - 3. Serve as principal negotiator on issues involving proposed boundary changes and/or amendments to the Plan;**
 - 4. Submit annual reports to NOAA on the Reserve describing, in accordance with 15 CFR 921.34, program performance in implementing the Plan and a detailed work program for the following year of Reserve operations, including budget projections and research efforts;**
 - 5. Respond to NOAA's requests for information and to evaluation findings made pursuant to Section 312 of the CZMA; and**
 - 6. In the event that it should become necessary, based on findings of program**

deficiency, serve as the point-of-contact for the State of South Carolina in actions involving the possible withdrawal of Reserve designation, as provided at 15 CFR 921.35.

B. Within NOAA, the Sanctuaries and Reserves Division ("SRD"), the 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 NERRS and the Plan. In carrying out its responsibilities, the SRD will:

1. Subject to appropriation, provide financial assistance to the SCWMRD, consistent with 15 CFR 921 for acquisition, development, management and operation of the Reserve;
2. Subject to appropriation, provide financial assistance to the SCWMRD and other eligible entities on a competitive basis for research and monitoring and education programs at the Reserve;
3. Serve as the point-of-contact for NOAA in discussion regarding applications for and any financial assistance received by the SCWMRD 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 SCWMRD's performance in 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 management program; and
5. Regarding, SRD-funded research conducted within the Reserve, maintain communication with the SCWMRD and, in a timely manner, supply the SCWMRD with copies of all progress reports, final reports, and data sets received by SRD.
6. Establish an information exchange network cataloging all available research data and educational material developed on each site included within NERRS.

ARTICLE II. Real Property Acquired for the Purpose of the Reserve

The SCWMRD agrees that deeds for any real property acquired for the Reserve by the SCWMRD with federal funds under Section 315 of the CZMA will contain the language set forth in 15 CFR 921.21(e.)

ARTICLE III. Program Evaluation

During the period that federal financial assistance is available for Reserve operations and management, OCRM will schedule, pursuant to 15 CFR 921.34, periodic evaluations of the SCWMRD's performance in meeting the conditions of such awards and progress in implementing the Plan and the provisions of this MOU. Where findings of deficiency occur, NOAA may initiate action in accordance with the procedures established at 15 CFR 921.35.

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

Timothy R. E. Keeney
Director
Office of Oceans and Coastal
Resource Management
National Oceanic and Atmospheric
Administration
U. S. Dept. of Commerce

James A. Timmerman, Jr.
Executive Director
South Carolina Wildlife and
Marine Resources Department

Date

Date

Joseph A. Uravitch
Chief
Marine and Estuarine Management
Division
Administration
U. S. Department of Commerce

H. Wayne Beam
Executive Director
South Carolina Coastal Council

APPENDIX D.2

Draft Proposed MOU Between DUF and SCWMRD

DRAFT

MEMORANDUM OF UNDERSTANDING

This is a Memorandum of Understanding ("MOU") made this _____ day of _____, 1991 by and between the South Carolina Wildlife and Marine Resources Department ("SCWMRD"), acting through the South Carolina Coastal Council ("SCCC") and having an address at P.O. Box 12559, Charleston, South Carolina 29412 and the Ducks Unlimited Foundation ("DUF"), a subsidiary of Ducks Unlimited, Incorporated, headquartered in Long Grove, Illinois and having an address at P.O. Box 3067, Chapel Hill, North Carolina 27515-3067.

RECITALS

WHEREAS, DUF owns and administers the property known as Bolders Island, located in Colleton County, South Carolina; and

WHEREAS, Bolders Island has been recognized as a natural area of mutual interest to all parties; and

WHEREAS, DUF is willing to have Bolders Island included in the core area of the ACE Basin National Estuarine Research Reserve (the "Reserve") for the purposes and in the manner set forth below and in the Management Plan for the ACE Basin NERR; and

WHEREAS, the SCWMRD, the DUF, SCCC and the National Oceanic and Atmospheric Administration (NOAA) recognize that inclusion of Bolders Island into the ACE Basin NERR is an acknowledgement that the island is a natural field laboratory to be used, in consonance with current uses, to study and gather data on natural and human processes occurring within the ACE Basin and further to provide a basis for increased public awareness and understanding of the complex nature of estuarine systems, their values and benefits to man and nature, and the problems that confront them, all of which are reflective of the goals of the National Estuarine Research Reserve System, ie., preservation, research, education and interpretation; and

WHEREAS, Bolders Island will be cooperatively managed and operated by SCWMRD and DUF in accordance to the ACE Basin NERR Management Plan; and

WHEREAS, SCWMRD and DUF agree that long-range plans for Bolders Island are compatible with the National Estuarine Research Reserve program and all parties can benefit from its inclusion into the system and desire to enter into this MOU to govern the incorporation of Bolders Island into the Reserve;

NOW, THEREFORE, for and in consideration of mutual covenants contained herein, SCWMRD and the DUF do hereby agree as follows:

ARTICLE I: RESERVE BOUNDARY

Bolders Island contains six hundred and nine (609) acres of upland and one thousand and forty (1,040) acres of marsh for a total area of one thousand six hundred forty nine (1,649) acres. All of this island will be included in the Reserve. It is a long and narrow tract which lies generally in a north-south direction, bounded on the west by New Chehaw River, on the southeast by Rock Creek, on the east by Ashepoo River, and on the north by marsh and unnamed waterways. The only access to Bolders Island is by boat. However, access is relatively easy by way of either the Ashepoo or New Chehaw Rivers. There are no improvements on Bolders Island. The boundaries are designated on the map which is appended to this MOU.

It is understood and agreed that the Reserve shall be identified at its boundaries and main access points on the Ashepoo and New Chehaw Rivers by the placement of signs which will be in keeping with the natural appearance of Bolders Island and the Reserve. The design will be agreed to by the DUF project director or other DUF representatives, SCWMRD, SCCC and approved by NOAA.

ARTICLE II: MANAGEMENT PLAN

There shall be a management plan ("Management Plan") for the Reserve which shall describe a framework for conducting research and educational programs. Resource protection and enforcement policies will be described in the Management Plan. The Management Plan shall be developed by SCWMRD in cooperation with the SCCC and NOAA. It will be reviewed and adopted by the DUF and the ACE Basin NERR Advisory Committee. The Management Plan will not take effect for Bolders Island without the approval of the DUF, SCWMRD, SCCC and NOAA. The Management Plan shall be reviewed and revised, if appropriate, on an "as needed" basis. Any changes must follow the same review procedures as stated above.

ARTICLE III: Title and Use of the Bolders Island Property

Title to Bolders Island will remain with the DUF. Bolders Island will be protected in perpetuity as a part of the Reserve core area, and will be used as described in the Management Plan, i.e. research, monitoring, education and interpretation with the ultimate goal of improved management of estuarine systems in South Carolina and throughout the United States.

Multiple uses of Bolders Island will be encouraged to the extent that such uses are compatible with the goals of the Reserve and NERRS. Uses and/or levels of use which result in significant, long-term damage to the natural processes or resources will be prohibited.

Incorporation of Bolders Island into the ACE Basin NERR will not obstruct existing hunting leases and/or agreements. However, it will be incumbent upon the DUF to administer said leases and hold those responsible for keeping the area in accordance with

established NERR policies.

Execution of this MOU between SCWMRD and the DUF will allow authorized personnel of the ACE Basin NERR program freedom of access to Bolders Island in carrying out the research and education mission. Permittees shall carry and display an official permit issued by SCWMRD. This agreement shall not limit the DUF authority to carry out its activities and programs on the island except as agreed to in this MOU.

The parties agree to coordinate fully their programs and activities conducted on Bolders Island.

ARTICLE IV: PROHIBITED AND RESTRICTED ACTIVITIES

The following activities will be prohibited within the boundaries of Bolders island:

- A. Industrial or commercial activities, except for commercial fishing in State waters as regulated by the SCWMRD.
- B. Display of signs shall be restricted to those identifying the Reserve and to those needed for educational, interpretive, research, or monitoring programs.
- C. Dumping of soil, trash, ashes, garbage, waste, abandoned vehicles, appliances, machinery, or other materials on the Reserve. DUF will not be responsible for unauthorized dumping.
- D. Excavation, dredging, mining and removal of loam, gravel, soil, rock, sand, coal, and other materials, except as related to the collection of geological data.
- E. Diking, draining, filling or alternation of wetlands.
- F. No building, facility or other structure, shall be constructed on the Reserve after the date of this MOU without express written approval from SCWMRD and NOAA, except (1) temporary structures designed, constructed and utilized in connection with the scientific, naturalistic, and educational uses of the Reserve may be constructed with SCWMRD approval and (2) permanant boardwalks, observation decks, etc. may be constructed with SCWMRD approval. All construction must comply with applicable county, state and federal regulations.
- G. Bolders Island shall not be partitioned or subdivided.
- H. The operation of motor vehicles, trail bikes, or all-terrain vehicles, except those used for authorized research or hunting activities, shall be prohibited

ARTICLE V: OPERATION AND MANAGEMENT

SCWMRD will serve as the on-site manager for research on Bolders Island and will be responsible for seeing that research on the property is conducted in a manner consistent with the goals of the ACE Basin NERR, the objectives of the Management Plan, and the wishes of DUF and SCWMRD.

SCWMRD will have the primary responsibility for funding, operating and maintaining Bolders Island as a component of the Reserve core area.

SCWMRD has an existing facility and well-known technical staff at Bear Island Wildlife Management Area located just across the Ashepoo River from Bolders Island. Plans are to expand this facility in conjunction with the ACE Basin NERR. SCWMRD will allow DUF shared use of these facilities and technical staff in carrying out the terms of this MOU.

ARTICLE VI: TERMINATION OF THE MOU

This MOU shall be in effect for the life of the ACE Basin NERR program from the date of its approval.

If SCWMRD ceases to operate the Reserve at Bolders Island as a designated Reserve, or Reserve designation is withdrawn or otherwise terminated, this MOU and the SCWMRD's interest shall be terminated and the DUF shall again have the full and exclusive control of the property.

For purposes of this Article, the parties agree that a decision to terminate this Agreement shall be made jointly by the parties, with one year's advance notice given.

IN WITNESS WHEREOF, the parties hereto have caused this Memorandum of Understanding to be executed this _____ day of _____, 1991.

WITNESS

COY JOHNSTON, ACE Basin
Project Director, Ducks
Unlimited Foundation

WITNESS

James A. Timmerman, Jr.
Executive Director, S.C
Wildlife & Marine Resources
Department

APPENDIX D.3

Letter of Intent to Transfer Title From NFWF to SCWMRD



NATIONAL FISH AND WILDLIFE FOUNDATION

ROOM 2556

18TH AND C STREETS, N W

WASHINGTON, D.C. 20240

(202) 208-3040 FAX (202) 208-4051

May 31, 1990

Linda Lundquist
Land Programs Coordinator
South Carolina Nature Conservancy
P.O. Box 5475
Columbia, South Carolina 29250

Dear Linda:

Further to our telephone conversation, here is the clarification of the Big and Warren Islands issue. The National Fish and Wildlife Foundation received both islands from The Nature Conservancy as a non-Federal match, valued at \$951,000, for a grant of \$150,000 in Federal funds.

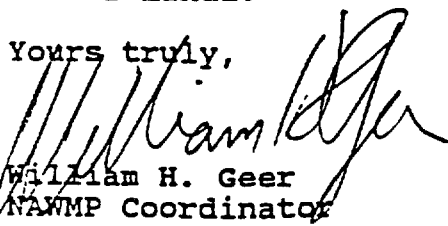
It has always been our intent to transfer the islands to the South Carolina Department of Wildlife and Marine Resources for inclusion into a National Estuarine Research Reserve as a functional part of the A.C.E. River Basin Project. Title transfer to the State will take place on completion of a toxic-waste survey by the State.

Enclosed also is the original transfer of title from TNC to the Foundation. As we discussed, would you please assist us by recording the title transfer in the name of the National Fish and Wildlife Foundation. If possible, could you please pay the recording cost and call Lewis Nash (202-208-3040) for an immediate and full reimbursement. If that is not possible, give Lew a call to arrange for our check to be issued in advance.

Our headquarter's address is on our letterhead, and we are an IRS-certified 501 (c)(3), not-for-profit organization.

Thanks Linda.

Yours truly,


William H. Geer
NAWMP Coordinator

Enclosures
BGLundq.ltr

APPENDIX D.4

Major Land Owners in the ACE Basin NERR Region

(Note)

The acreage shown in the following table is based on figures obtained from the County tax rolls and do not necessarily agree with registered survey acreage depicted in land appraisals. Also, this is a list of major landowners in the entire ACE Basin (350,000 acres), much of which is outside proposed NERR boundaries. A base map showing each tract is on file at SCWMRD.

ACE RIVER BASIN

OWNERSHIP INFORMATION INDEX

<u>TRACT#</u>	<u>TRACT NAME</u>	<u>COUNTY</u>	<u>OWNER</u>	<u>ACREAGE</u>	<u>ACE CONTACT</u>	<u>ACTION COMMENTS</u>
1	Otter Island	Colleton	Clifton Stevens	1,889	TNC	NOAA
2a	Pine Island	Colleton	Chelonia Institute	99	TNC	NOAA
2b	Pine Island	Colleton	Chelonia Institute	2,676	TNC	NOAA
3	Pine Island	Colleton	Letitia Frank	102		NOAA
4	Pine Island	Colleton	Unlisted	53.3		NOAA
5	Pine Island	Colleton	Letitia Frank	138		NOAA
6	Pine Island	Colleton	J. L. Moore	15.5		NOAA
7	Pine Island	Colleton	Frank E. James	27		NOAA
Pine Island total acreage:				3,112.8		
8	Hutchinson	Colleton	Forfeited Land Commission	2,687	D.U.	NOAA
9	Hutchinson	Colleton	Hutchinson Island Association	3,050	D.U.	NOAA:Conservation Easement
10	Hanahan	Colleton	Buist Lucas Hanahan	237		NOAA
11	Ashe Island	Colleton	S.C. Nature Conservancy	1,722	TNC	NOAA:Purchased
12	Beet Island	Colleton	S.C. Nature Conservancy	1,824	TNC	Purchased, NOAA
13	South Fenwick	Colleton	Dewey Wise	305	TNC	Conservation Easement
14a	Fenwick Island	Colleton	Gaylord Donnelly	4,094	TNC & D.U.	
14b	Ashepoo Plantation	Colleton	Gaylord Donnelly	8,920	D.U.	Conservation Easement
15a	Mussleboro Island	Colleton	Gaylord Donnelly	953	TNC & D.U.	Easement

15b	Dodge	Colleton	Donald D. Dodge	3,420	Charles, D.U.	Easement/Purchase
16	Bear Island	Colleton	S.C.W.M.R.D.	7,681	SCUMRD	Secure
	The Cut	Colleton	D.U. Foundation	966	D.U.	Secure
	Sampson Island	Colleton	S.C.W.M.R.D.	2,713	TMC	Secure
	Springfield	Colleton	S.C.W.M.R.D.	695	D.U.	Secure
Total Acres for Bear Island G.M.A.				12,055		
17	Cheehaw Combahee	Colleton	Sumner Pinegree	11,874	TMC & D.U.	Easement
18	Airy Hall Plantation	Colleton	Buck Linehouse	1,561	D.U. & TMC	Easement
19a	Ti - Ti (Snuggedy Swamp)	Colleton	Ruth Cummings	875	TMC	Easement/Purchase
19b	Ti - Ti (Snuggedy Swamp)	Colleton	Ruth Cummings	2,613	TMC	Easement/Purchase
20	Bear Island Club	Colleton	Bear Island Hunt Club	500	D.U.	Easement
21	Boulder Island	Colleton	D.U. Foundation	1,640	D.U. & SCUMRD	Secure
22	Block Island	Colleton	Block Island Hunt Club	300	D.U.	Easement/Purchase
23a	Fee Farm	Colleton	Morris Lightsey	6,305	D.U.	Easement - Re: Westvaco
23b	Munster	Colleton	Morris Lightsey	6,887	D.U.	Easement - RE: Westvaco
24a	Snuggedy	Colleton	Louise Lightsey	7,735	TMC	Easement/Purchase
24b	Snuggedy	Colleton	Louise Lightsey	2,732	TMC	Easement/Purchase

24c	Folly Creek	Colleton	Louise Lightsey	1,856	TNC	Easement/Purchase
24d	Tupelo	Colleton	Louise Lightsey	1,148	TNC	Easement/Purchase
24e	Laurel Springs Plantation	Colleton	Morris & Louise Lightsey	4,436	TNC & D.U.	Easement
25	Combahee Marsh	Colleton	State of S.C.	406	SCMHRD	
26	Paul and Dalton Plantation	Colleton	Theodore Maybank	1,915	Charles	Easement
27	Long Brow	Colleton	Santee Portland Cement	731	D.U.	Easement
28a	Mary's Island Plantation	Colleton	N. Smith Richardson Est.	8,059	TNC	Easement
28b	Mary's Island Plantation	Colleton	N. Smith Richardson Est.	808	TNC	Easement
29	Poco Sabo Plantation	Colleton	William Allen Spaulding	1,615	TNC	Easement
30	Lavington Plantation	Colleton	Ben Haygood	794	TNC & D.U.	Easement
31	Lavington Plantation	Colleton	David Maybank	2,324	TNC & D.U.	Easement
32	Lavington Plantation	Colleton	John Maybank	3,276	TNC & D.U.	Easement
33	Hope Plantation	Colleton	Ted Turner	5,232	TNC	Easement - Secure
34a	Westvaco	Colleton	Westvaco	12,241	D.U.	Easement
34b	Westvaco	Colleton	Westvaco	1,752	D.U.	Easement
34c	Westvaco	Colleton	Westvaco	995	D.U.	Easement

34d	Westvaco	Colleton	Westvaco	4,308	D.U.	Easement
				Total Westvaco acres: 19,296		
35a	Georgia Pacific	Colleton	Georgia Pacific	3,363	TNC	Easement
35b	Georgia Pacific	Colleton	Georgia Pacific	992	TNC	Easement
35c	Georgia Pacific	Colleton	Georgia Pacific	7,920	TNC	Easement
				Total Georgia Pacific areas: 12,275		
36	Cherokee Plantation	Colleton	Randy Updike	3,727	D.U.	Easement
37	Herndon	Colleton	Herndon Stockyard	213		
38	The Bluff Plantation	Colleton	Bluff Farms	3,063	Charles, D.U.	Easement
39a	Combahee Plantation	Colleton	Alexander Moore	527	TNC	Easement
39b	Combahee Plantation	Colleton	Alexander Moore	675	TNC	Easement
40	Marvin	Colleton	Robert Marvin	627	TNC	Easement
41	Marvin	Colleton	H. W. Marvin	389	D.U.	Easement
42	Myrtle Grove Plantation	Colleton	Gewitt Tucker	2,264	D.U.	Easement
43	Combahee Duck Club	Colleton	Combahee Fields Partnership	1,819	D.U.	Easement
44	Calf Pen	Colleton	Dr. L. L. Erwin	588		Easement
45	White Hall Plantation	Colleton	Trois Bois Ltd.	964		Easement

63	Old Dominion Plantation	Charleston
64	Little Edisto Island	Charleston
65	Edisto Shrimp Co.	Charleston
66	Jehossee Island	Charleston
67	Grove Plantation	Charleston
68	Willtown Bluff Plantation	Charleston
69	Willtown	Charleston
70	Hutton Plantation	Charleston
71	Prospect Hill Plantation	Charleston
72	McCleod Property	Charleston
73	Knox Property	Charleston
74	Hermitage Plantation	Charleston
75	Fishburne Property	Charleston
76	Oak Lawn Plantation	Charleston
77	Auld Brass Plantation	Beaufort
78	Duck Pond Plantation	Beaufort
79	Old Combahee Plantation	Beaufort

46	White House Plantation	Colleton	Albert Simmonds	448	Charles	Easement
47	Bonnie Doone	Colleton	Harold Robinson	940	D.U.	Easement
48	Dawn Plantation	Colleton	Nora Kolczynski	1,789		Easement
49	Bootle	Colleton	Freddie Bootle	498		Easement
50	Padgett	Colleton	Elizabeth Pagett	438	D.U.	Easement
51	Gunboat Island	Colleton	Fripp and Harrelson	26.4		Easement
52	Upper Hope	Colleton	Northrop Knox	365	D.U., Charleston	Easement
53	Oakhurst/Prospect Hill Island	Colleton	Dr. James Martin	304	Charles	Easement
54	Edisto Island Marsh	Charleston				
55	Raccoon Island	Charleston				
56	Raccoon Island	Charleston				
57	Bailey Island	Charleston				
58	Bailey Island	Charleston				
59	Scanawah Island	Charleston				
60	Scanawah Island	Charleston				
61	Burbage Property	Charleston				
62	Orvin Property	Charleston				

80	Twitchenhaw Plantation	Beaufort
81	Hobony Plantation	Beaufort
82	Bonny Hall Club	Beaufort
83	Bonny Hall Plantation	Beaufort
84	Parkers	Beaufort
85	Newport Plantation	Beaufort
86	Nemours Plantation	Beaufort
87	Coosaw Plantation	Beaufort
88	Keans Neck Plantation	Beaufort
89	Chisolm Plantation	Beaufort
90	North Williamson Island	Beaufort
91	South Williamson Island	Beaufort

APPENDIX E

Management of ACE Basin NERR Through South Carolina's Coastal Management Program

APPENDIX E.1

**Documentation that ACE Basin NERR is Consistent with
S.C.'s Coastal Management Program**



May 22, 1991

**SOUTH
CAROLINA
COASTAL
COUNCIL**

Ms. Cheryl A. Graham
Marine and Estuarine Management Division
Office of Ocean and Coastal Resource Management
U.S. Department of Commerce, NOAA
1825 Connecticut Avenue, NW
Washington, DC 20235

Ashley Corporate Center
4130 Faber Place
Suite 300
Charleston, S C 29405
(803) 744-5838
FAX 744-5847

John C. Hayes, III
Chairman

H. Wayne Beam, Ph D
Executive Director

Re: Ashepoo-Combahee-Edisto
(ACE) National Estuarine
Research Reserve in South
Carolina

Dear Ms. Graham:

The staff of the S.C. Coastal Council certifies that the Environmental Impact Statement and draft management plan for the Ashepoo-Combahee-Edisto (ACE) National Estuarine Research Reserve in South Carolina is consistent with the South Carolina Coastal Zone Management Program.

The Coastal Council, with the aid of a site selection committee, recommended to the Governor in July of 1989 that the ACE Basin site be nominated as a component of the National Estuarine Research Reserve System. Since that time the Council has worked closely with NOAA and the South Carolina Wildlife and Marine Resources Department to achieve that goal. We look forward to seeing a final designation in the near future.

Sincerely,

H. Stephen Snyder
Director of Planning
and Certification

HSS:0076C

cc: Dr. H. Wayne Beam
Mr. Christopher L. Brooks
Dr. James A. Timmerman, Jr.
Mr. Mike McKenzie
Mr. Mike Nussman



APPENDIX E.2
SCCC Permit Policy

On February 28, 1978, the following were proposed to the 1978 General Assembly for promulgation as Final Rules and Regulations for permitting in critical areas of the coastal zone. During the 90-day period of review in the General Assembly, no action was taken on the Proposed Rules and Regulations, and as a result, these Rules and Regulations became final. On June 7, 1978, they were published as Final Rules and Regulations in the State Register, Vol. 2, No. 15, June 7, 1978.

The Council's principal office of business is the Office of Coastal Planning; 4 Carriage Lane, Suite 205; Charleston, South Carolina 29407. Permit applications are available at this office, and all correspondence with the Council concerning the permit process shall be through this office, unless otherwise directed. The Council encourages those wishing to receive general information on permits and alterations in critical areas to contact this office.

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The saline marshes are highly productive components of the marine food web of coastal waters and estuaries. Decaying plant materials, called detritus, serve as the basis of the food web and are the major biological contribution of the saline marshes. Many commercially and recreationally important fish and shellfish species depend on the marshlands and estuaries for all or part of their life cycle. In addition, many birds and other forms of wildlife utilize wetlands as habitat as well as a source of food. Tidelands and coastal waters also have become increasingly important in recent years for the purposes of aquaculture.

Among the more important functions of the salt and brackish marshes is their role in protecting adjacent highlands from erosion and storm damage. Marsh vegetation absorbs and dissipates wave energy and establishes a root system which stabilizes the soils. Its effectiveness as a buffer depends on the surface area available which, combined with the composition of the underlying substrate, allows tidelands to act as "sponges" in absorbing and releasing waters during storms or times of heavy riverine discharge.

Marshes also perform a valuable waste treatment function since the dense vegetation acts as a filter, trapping sediments and pollutants which enter as run-off from upland areas. The trapping of sediments helps maintain water clarity, a factor important to clam, oyster, and phytoplankton productivity. The marshes also assimilate pollutants and recycle nutrients through various biochemical processes.

Coastal waters and the adjacent marshes are also significant as aesthetic, recreational and educational resources. Much of the expenditure for recreation and tourism in the South Carolina coastal zone is for purposes of enjoying outdoor activities and the aesthetic pleasures of undisturbed tideland areas. These natural areas lend themselves to meaningful and important academic pursuits such as bird-watching and wildlife population and nutrient recycling studies.

These same unique natural resource areas face increasing land development pressure and negative impacts from man's activities in and around them. The marshes constitute a fragile ecosystem; consequently, indiscriminate dredging and filling, degradation of water quality or unsound building practices can have long-term detrimental effects. All development need not be prohibited; rather, the range of favorable and unfavorable results needs to be realized, and analogies made to determine priorities, evaluate alternatives, anticipate impacts, and suggest the best methods and designs to carry out wise development of these resources.

B. The Value of Beaches and Dunes. The Atlantic Ocean shoreline of South Carolina, including its barrier islands, is an extremely dynamic system composed of the sands of the beaches and dunes. The beach is the gently sloping shore washed by waves, extending from below the low tide line to the point above high tide, at which non-littoral vegetation is established. Above this beach area is the dune system, the ridges of wind-blown sand which are normally vegetated. These comprise a very dynamic system, constantly shifting—eroding and accreting—with the effects of waves and wind. These fragile resources are incorporated in the 1977 South Carolina Coastal Management Act as "critical areas".

Each year millions of South Carolina citizens and visitors enjoy the natural setting of the State's shoreline. Aesthetically, the beaches are a unique experience; and recreationally, these areas are increasingly needed for boating, swimming, sunning, and fishing, as leisure time and mobility continue to increase.

Beaches and dunes are nesting grounds for sea turtles and numerous bird species, several of which are endangered. The beaches and adjacent coastal waters are also habitat for many marine species.

Probably the most vitally important aspect of the beach and dune system is its contribution to storage of sand and shoreline stability. It serves as a barrier which

by the South Carolina Coastal Council, 4 Carriage Lane, Suite 205, Charleston, South Carolina 29407 until (insert date, 10 days after date of this newspaper notice).

b) Other activities: In the case of applications for other than minor development permits, the applicant shall publish notice at least once in both a newspaper of general statewide circulation (The State, News and Courier, or The Greenville News) and a newspaper of local circulation in the county of the proposed activity. The newspaper notices should be published within 15 days of the date of Public Notice (see R.30-2(C)). No permit shall be issued by the Council until at least 15 days following the date of the last-published newspaper publication. The following form shall be used for newspaper publication:

PUBLIC NOTICE

SOUTH CAROLINA COASTAL COUNCIL

(Name of applicant) will apply (has applied) to the South Carolina Coastal Council for a permit to (description of work) for (public/private) use, at/in (location and name of waterway). Comments will be received by the South Carolina Coastal Council, 4 Carriage Lane, Suite 205, Charleston, South Carolina 29407 until (insert date, 15 days after date of this newspaper notice).

(8) When considered appropriate by the Council or its staff, additional information may be required, such as impoundment management plans, and maintenance dredging schedules.

C. Notification: The Council is directed in Section 14 (C) of the Act and shall within thirty days of receiving either a Joint Public Notice or South Carolina Coastal Council permit application, notify, in writing, interested agencies, all adjoining landowners, local government units in which the land is located and other interested persons. This notice shall indicate the nature and extent of the applicant's proposal.

D. Permit processing: Permit processing shall commence immediately upon receipt of either a Joint Public Notice or a South Carolina Coastal Council permit application and shall proceed concurrently but separately from any Federal authorization.

E. Comments on application: Section 14(C) of the Act allows all interested federal and state agencies, all adjoining landowners, local government units and other interested persons to have thirty days after the receipt of Public Notice of permit application from the Council to file written comments pertaining to the application. Only those comments received within the thirty day period must be considered in the Council's decision on a permit application. Any persons wishing to receive notice of the initial decision on a permit application shall notify the Council within this comment period. Exception: Comments on permit applications for minor development activities, as defined in Section 3(N) of the Act, must be received within fifteen days after receipt of Public Notice of permit application.

F. Public information: The complete file on each permit application, including all comments received, will be available for inspection by any member of the general public during regular business hours at the principal Council offices.

G. Minor development activities: In determining whether a particular project is a minor development, as defined in Section 3(N) of the Act, a private pier shall be defined as a non-commercial, strictly private recreational facility that is not used for, or in support of, any industry or commercial operation. Any charge to members of the public or any person for use of the facility is prohibited for a structure qualifying as a minor development.

Minor dock or pier developments shall have the same specifications as furnished under the general permitting provisions with the Army Corps of Engineers. Erosion control structures means, in the case of minor developments, those structures commonly known as bulkheads which follow the existing shoreline, not fronting on the Atlantic Ocean and the construction of which involves no direct effects on wetlands.

H. State comment: Issuance or denial of the permit by the Coastal Council shall be the State comment on the corresponding federal permit application.

I. Water quality certificate: If a water quality certificate, as required under §401 of P.L. 92-500, is not required by a Federal permitting agency, the Coastal Council

applicable, may continue such use without obtaining a permit. Any person may request the Council to review any project or activity to determine if he is exempt under this section from the provisions of this act. The Council shall make such determinations within forty-five days from the receipt of any such request.

30-5 Exceptions.

A. List of exceptions: Section 13(D) of the Act lists several exceptions which do not require a permit. These are as follows:

(1) The accomplishment of emergency orders of any duly appointed official of a county, municipality or of the State, acting to protect the public health and safety, upon notification to the Council (see R.30-5(B)).

(2) Hunting, erecting duckblinds, fishing, shellfishing and trapping when and where otherwise permitted by law; the conservation, repletion and research activities of State agencies and educational institutions; or boating or other recreation provided that such activities cause no material harm to the flora, fauna, physical, or aesthetic resources of the area.

(3) The discharge of treated effluent as permitted by law; provided, however, that the Council shall have the authority to review and comment on all proposed permits that would affect critical areas.

(4) Dredge and fill performed by the United States Corps of Engineers for the maintenance of harbor channels and the collection and disposal of the materials so dredged, provided, however, that the Council shall have authority to review and certify all such proposed dredge and fill activities.

(5) Construction of walkways over sand dunes in accordance with Section 12 of the Act (see R.30-13(B)).

(6) Emergency repairs to any existing bank, dike or structure which has

been erected in accordance with federal and State laws, including fishing piers which are provided for by general law or acts passed by the General Assembly of South Carolina; provided, however, that notice shall be given to the Council within seventy-two hours from the onset of needed repairs (see R.30-5(B)).

(7) Maintenance and repair of drainage and sewer facilities constructed in accordance with federal or State laws, and normal maintenance and repair of any utility or railroad.

(8) Normal maintenance or repair to any pier or walkway, provided that such maintenance or repair shall not involve dredge or fill.

(9) Construction or maintenance of a major utility facility where the utility has obtained a certificate for such facility under "The Utility Facility Siting and Environmental Protection Act," Sections 58-1301 through 58-1332 of the 1962 Code (Sections 58-33-10 through 58-33-430 of the 1976 Code). Provided, however, that the South Carolina Public Service Commission shall make the Council a party to certification proceedings for utility facilities within the coastal zone.

B. Notification to Council, emergency orders:

(1) As in A(1) above, notification to the Council of emergency orders that normally would require a Council permit shall consist of telephoning, telegraphing, or radioing at the earliest possible time to the Council:

(a) the nature of the emergency;

(b) the substance of the emergency order;

(c) the time the order will be issued, or if circumstances preclude prior notice, when the order was issued;

(d) the location of the activity ordered;

(e) the estimate of when such order shall be withdrawn.

(2) If the Council is not notified within seventy-two hours of the issuance of the emergency action taken, the official issuing such order or ordering such emergency action shall be in violation of the Act and these rules and regulations. Within

H. Record of Appeal: A Record of Appeal shall be kept and filed in the Council's office. Oral proceedings or any part thereof shall be transcribed upon request of any party. The Council may, in its discretion, require persons requesting a transcript to pay reasonable printing costs.

I. Decision on Appeal: A decision on the Appeal may be made by the Council immediately after the presentation of oral arguments but, in any case, no later than 35-days after the presentation. Each party shall be notified in writing of the decision.

30-7 Judicial Appeal: Section 18 of the Act allows judicial review of Council action. Before seeking judicial relief from a Council permit application decision, a person must seek relief through the Council appeal process in 30-6 above.

30-8 Enforcement.

A. Permit revocation and modification: One of the needs in administering a permit system to manage coastal resources is the enforcement of the provisions of the system and the identification of unpermitted and unauthorized activities. The Council has initiated a routine aerial surveillance program for the coastal counties which identifies and reports illegal dredging, filling or other alterations in the critical areas.

As the state agency responsible for managing the critical areas, the Council is adamant in its enforcement of terms of an approved permit. Section 15(E) of the Act empowers the Council to revoke a permit for noncompliance with or violation of its terms after written notice of intention to do so has been given the holder, and the holder, in return, has been given an opportunity to present an explanation to the Council. Financial hardship on the part of a holder shall not be a defense to the revocation of a permit. The Council may also revoke a permit if it finds that the holder or his agent submitted false information to the Council.

B. Cease and desist directive: When any person is found altering a critical area without a permit and such activity is not exempted by Section 13(D) of the Act, has not been authorized by a permit, is in violation of the terms of a Council permit or is violating provisions of the Coastal Management Act in any manner, the Council, or its duly appointed agent, may issue a cease and desist directive. This directive shall inform the person that he is in violation of the Act and that such person should cease unauthorized activity. The Council may then request the person to remove or restore the area to its original condition. If the person responsible for the unauthorized activity refuses to comply with the Council directive, the Council may then file suit in the appropriate circuit court as outlined in Section 16 of the Act.

C. Arrest warrants: When a person is found altering a critical area without a permit and such activity is not exempted by Section 13(D) of the Act, has not been authorized by a permit, is in violation of the terms of a Council permit or is violating provisions of the Coastal Management Act in any manner, the Council may cause to be issued a warrant for the arrest of the violator.

D. Penalties: As stated in Section 17 of the Act, any person found guilty of violation of the Act shall be punished by imprisonment of not more than six months, or by a fine of not more than five thousand dollars, or both, for the first offense; and by imprisonment of not more than one year, or by a fine of not more than ten thousand dollars, or both, for each subsequent offense.

E. Judicial Enforcement: Section 16 of the Act provides the Council, the Attorney General or any person adversely affected, a remedy to restrain violations of the Act.

30-9 Other Provisions.

A. Savings Clause: If any provisions of the Act or of these Rules and Regulations are adjudged invalid or unconstitutional, the remainder of the Act and these Rules

APPENDIX E.3

Legal Authority Citations for Coastal Activities Subject Management By State Agencies

Legal Authority Citations (1976 S. C. Code of Laws) for

Activities Subject to Management by State Agency

South Carolina Aeronautics Commission

Airports - Section 55-5-120

South Carolina Institute of Archeology and Anthropology

Residential developments - Sections 1-11-70,80,90

Ports - Section 1-11-70

Roads and Highways - Section 1-11-90

Airports - Section 1-11-70

Railways - Section 1-11-80

Parking facilities - Section 1-11-70

Mining - Sections 10-9-170, 180

Manufacturing - Section 1-11-70

Aquaculture - Section 1-11-70

Commercial - Section 1-11-70

Marinas - Section 1-11-70

Boat Ramps - Section 1-11-70

Tourist attractions - Section 1-11-70

Artificial reefs - Section 1-11-70

Docks and Piers - Section 1-11-70

Dredging - Section 1-11-70

Dredge material disposal - Section 1-11-70

Sewage treatment - Section 48-3-140, Section 48-5-30

Solid waste disposal - Section 1-11-70

Energy - Section 1-11-80

South Carolina Coastal Council

Residential developments - Sections 48-39-80 (B)(11), 130, R30-11 **R30-12

Ports - Sections 48-39-110, 130

Roads and highways - Sections 48-39-80 (B)(11), 130, R30-11, R30-12

Airports - Sections 48-39-80 (B)(11), 130, R30-11, R30-12

Railways - Sections 48-39-80 (B)(11), 130, R30-11, R30-12

Parking facilities - Sections 48-39-80(B)(11),130, R30-11 R30-12

Agriculture - Sections 48-39-80 (B)(11), 130, R30-11

Forestry - Sections 48-39-80(B)(11), 130; R30-11

Mining - Sections 48-39-80 (B)(11), 130, R30-11,R30-12

Manufacturing - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Aquaculture - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Fish and seafood processing - Sections 48-39-80(B)(11),130,R30-11, R30-12

Commercial Activities - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Parks - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Marinas - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Boat ramps - Sections 48-39-80 (B)(11), 130,R30-11, R30-12

Tourist Attractions - Sections 48-39-80(B)(11),130, R30-11, R30-12

Artificial reefs - Sections 48-39-80 (B)(11), 130,R30-11,R30-12

Wildlife and Fisheries management - Sections 48-39-80(B)(11), 130,R30-11,R30-12

Docks and Piers - Sections 48-39-80(B)(11), 130,R30-11, R30-12

Dredging - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Dredge Material Disposal - Sections 48-39-80(B)(11), 130,R30-11,R30-12

Underwater salvage - Sections 48-39-80 (B)(11),130, R30-11, R30-12

Sewage treatment - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Public/Quasi-Public Buildings - Sections 48-39-80 (B)(11),130, R30-11, R30-12

Dams and reservoirs - Sections 48-39-80 (B)(11), 130; R30-11,R30-12

South Carolina Coastal Council ... continued

Water supply - Sections 48-39-80(B)(11), 130; R30-11; R30-12

Bulkheads, seawalls, revetments - Sections 48-39-80(B)(11) 130; R30-11, R30-13

Jetties and Groins - Sections 48-39-80(B)(11), 130, R30-11, R30-13

Breakwaters - Sections 48-39-80(B)(11), 130, R30-11; R30-13

Renourishment - Sections 48-39-80(B)(11), 130; R30-11; R30-13

Energy activities - Sections 48-39-80 (B)(11), 130; R30-11; R30-12, R30-13

*(South Carolina Coastal Council Regulations citations are to the Final Rules and Regulations for Permitting in Critical Areas of the Coastal Zone", May 29, 1978).

South Carolina Department of Health and Environmental Control

Residential developments - Section 44-1-100; Section 44-1-140 (11); Section 44-55-610 through 700; Sections 44-55-820, 830; R61-9; R61-40; R61-56; R61-57

Parking facilities - Section 48-1-40; Section 48-1-90 (a); R61-9

Manufacturing - Section 48-1-40; Section 48-1-140; R61-62; R61-62.1; R61-62.6; R61-66

Aquaculture - Section 44-1-140(5); R61-47

Fish and Seafood processing - Section 44-1-140(5); R61-47

Commercial - Sections 44-1-140(2), (11); Section 48-1-40; Section 48-1-140; R61-25; R61-41; R61-62

Tourist attractions - Section 44-1-140; Section 48-1-140(7); R61-9; R61-62

Sewage treatment - Section 44-1-140; Section 44-55-1410; Sections 48-1-90(a), 100, 110; Sections 48-3-60, 140; Sections 48-5-20; R61-9; R61-56; R61-57

Solid waste disposal - Section 44-1-140(11); R61-59; R61-60; R61-61; R61-70

Public/Quasi-Public Buildings - Section 44-1-140(11); Sections 48-1-100, 110; R61-9; R61-62

Water supply - Section 44-55-40

South Carolina Development Board

Roads and Highways - Section 13-3-20(3); Section 13-3-100 (4) (d)

Airports - Section 13-3-20(3); Section 13-3-100(4) (d)

Railways - Section 13-3-20(3); Sections 13-3-100(4) (c), (d), (e)

Legal Authority Citations (1976 S. C. Code of Laws) for

Activities Subject to Management by State Agency

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Roads and Highways - Section 1-11-90

Airports - Section 1-11-70

Railways - Section 1-11-80

Parking facilities - Section 1-11-70

Mining - Sections 10-9-170, 180

Manufacturing - Section 1-11-70

Aquaculture - Section 1-11-70

Commercial - Section 1-11-70

Marinas - Section 1-11-70

Boat Ramps - Section 1-11-70

Tourist attractions - Section 1-11-70

Artificial reefs - Section 1-11-70

Docks and Piers - Section 1-11-70

Dredging - Section 1-11-70

Dredge material disposal - Section 1-11-70

Sewage treatment - Section 48-3-140, Section 48-5-30

Solid waste disposal - Section 1-11-70

Energy - Section 1-11-80

South Carolina Coastal Council

Residential developments - Sections 48-39-80 (B)(11), 130, R30-11, R30-12

Ports - Sections 48-39-110, 130

Roads and highways - Sections 48-39-80 (B)(11), 130; R30-11, R30-12

Airports - Sections 48-39-80 (B)(11), 130, R30-11, R30-12

Railways - Sections 48-39-80 (B)(11), 130; R30-11, R30-12

Parking facilities - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Agriculture - Sections 48-39-80 (B)(11), 130, R30-11

Forestry - Sections 48-39-80(B)(11), 130; R30-11

Mining - Sections 48-39-80 (B)(11), 130, R30-11, R30-12

Manufacturing - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Aquaculture - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Fish and seafood processing - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Commercial Activities - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Parks - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Marinas - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Boat ramps - Sections 48-39-80 (B)(11), 130, R30-11; R30-12

Tourist Attractions - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Artificial reefs - Sections 48-39-80 (B)(11), 130, R30-11, R30-12

Wildlife and Fisheries management - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Docks and Piers - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Dredging - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Dredge Material Disposal - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Underwater salvage - Sections 48-39-80 (B)(11), 130, R30-11, R30-12

Sewage treatment - Sections 48-39-80(B)(11), 130, R30-11, R30-12

Public/Quasi-Public Buildings - Sections 48-39-80 (B)(11), 130, R30-11, R30-12

Dams and reservoirs - Sections 48-39-80 (B)(11), 130; R30-11, R30-12

South Carolina Coastal Council ... continued

Water supply - Sections 48-39-80(B)(11), 130, R30-11; R30-12

Bulkheads, seawalls, revetments - Sections 48-39-80(B)(11) 130; R30-11, R30-13

Jetties and Groins - Sections 48-39-80(B)(11), 130; R30-11; R30-13

Breakwaters - Sections 48-39-80(B)(11), 130, R30-11; R30-13

Renourishment - Sections 48-39-80(B)(11), 130, R30-11; R30-13

Energy activities - Sections 48-39-80 (B)(11), 130, R30-11; R30-12; R30-13

*(South Carolina Coastal Council Regulations citations are to the Final Rules and Regulations for Permitting in Critical Areas of the Coastal Zone", May 29, 1978).

South Carolina Department of Health and Environmental Control

Residential developments - Section 44-1-100; Section 44-1-140 (11); Section 44-55-610 through 700; Sections 44-55-820, 830; R61-9; R61-40; R61-56; R61-57

Parking facilities - Section 48-1-40; Section 48-1-90 (a); R61-9

Manufacturing - Section 48-1-40; Section 48-1-140; R61-62; R61-62.1; R61-62.6; R61-66

Aquaculture - Section 44-1-140(5); R61-47

Fish and Seafood processing - Section 44-1-140(5); R61-47

Commercial - Sections 44-1-140(2), (11); Section 48-1-40; Section 48-1-140; R61-25; R61-41; R61-62

Tourist attractions - Section 44-1-140; Section 48-1-140(7); R61-9; R61-62

Sewage treatment - Section 44-1-140; Section 44-55-1410; Sections 48-1-90(a), 100, 110; Sections 48-3-60, 140; Sections 48-5-20; R61-9; R61-56; R61-57

Solid waste disposal - Section 44-1-140(11); R61-59; R61-60; R61-61; R61-70

Public/Quasi-Public Buildings - Section 44-1-140(11); Sections 48-1-100, 110; R61-9; R61-62

Water supply - Section 44-55-40

South Carolina Development Board

Roads and Highways - Section 13-3-20(3); Section 13-3-100 (4) (d)

Airports - Section 13-3-20(3); Section 13-3-100(4) (d)

Railways - Section 13-3-20(3); Sections 13-3-100(4) (c), (d), (e)

Parks - Section 13-3-100(4) (h)

Dredging - Sections 13-3-40,50; Sections 13-3-320,330

Energy - Sections 13-3-100 (4) (c), (d)

South Carolina Forestry Commission

Forestry - Sections 48-23-80,90,120,200

South Carolina Department of Highways and Public Transportation

Roads and Highways - Sections 57-3-10, 610, Section 57-5-1330

Bulkheads, seawalls, revetments - Section 57-3-40

Jetties and groins - Section 57-3-40

Breakwaters - Section 57-3-40

Renourishment - Section 57-3-40

South Carolina Land Resources Conservation Commission

Agriculture - Section 48-9-1270(9); Sections 48-9-1510, 1570

Mining - Section 48-19-40

Dams and Reservoirs - Sections 49-11-200, 210, 240

South Carolina Department of Parks, Recreation and Tourism

Parks - Sections 51-1-60(b), (f); Sections 51-3-10,80

Tourist Attractions - Section 51-1-60(c)

Public/Quasi-Public Buildings - Section 51-1-60(b)

Patriot's Point Development Authority

The authority's jurisdiction covers Hog Island in Charleston Harbor. See

Sections 51-13-710 through 850

South Carolina Public Railways Commission

Railways - Section 58-19-30

South Carolina Public Service Authority

Dams and Reservoirs - Section 58-31-30(5)

Energy - Sections 58-31-30(7),(8)

South Carolina Public Service Commission

Energy - Section 58-27-1230; Section 58-11-110

South Carolina State Housing Authority

Residential developments - Section 31-3-140

South Carolina State Ports Authority

Ports - Sections 54-3-110, 130, 140

Docks and Piers - Section 54-3-620

Bulkheads, Seawalls, Revetments - Section 54-3-610

Breakwaters - Section 54-3-130(9)

South Carolina Water Resources Commission

Wildlife and fisheries management - Sections 51-5-60, 100

Water supply - Sections 49-5-40,50,60,70

South Carolina Wildlife and Marine Resources Department

Aquaculture - Sections 50-5-20,50; Sections 50-15-50; Section 50-17-710

Boat ramps - Section 57-5-870

Artificial reefs - Section 50-3-90

Wildlife and fisheries management - Section 50-3-100, Section 50-11-2610;

Section 51-5-140

APPENDIX F
NERR Research Permit



FEDERAL OPPORTUNITY AGENCY

*South Carolina
Wildlife & Marine
Resources Department*

James A. Timmerman, Jr., Ph.D.
Executive Director
Paul A. Sandifer, Ph.D.
Director of
Marine Resources Division

REVISED NOVEMBER 1988

Under authorization of Section 50-17-50, S. C. Code of Laws as amended, you are hereby granted permission to collect specimens of marine life in the coastal waters of this State for scientific purposes.

This permit is subject to the following conditions:

- a) No specimens of fish, shellfish, crustaceans, or other marine life collected may be used for personal consumption, sold or used for commercial purposes.
- b) All scientific permit holders are required to notify the Law Enforcement Office at Fort Johnson (Phone 803-795-6350, Extension 5018/5019) or this office (803-795-6350, Extension 5061/5010), at least twenty-four (24) hours in advance of their collecting schedule and to provide certain information including (Date(s) of sampling; location(s) where collecting will take place; boat description; type of gear to be utilized; and purpose of sampling.
- c) Any collecting done by otter trawl or trawl net will be confined to the legal trawling areas specified under Section 50-17-610 and 50-17-615, only during the open season, unless otherwise specifically approved in writing by the Division of Marine Resources.
- d) This permit or a legible copy thereof must be in possession of the person to whom issued or a staff member of the institution to which it is issued, at all times during scientific collecting operations.
- e) This permit is subject to the rules and regulations of the S. C. Department of Health and Environmental Control and any other governmental agency having jurisdiction in the coastal area.

Any person violating the provisions of Section 50-17-50 is subject to the penalties prescribed therein. This permit may be revised, suspended, or revoked upon notification in the event of violation of the conditions set forth herein, or at any time that the Marine Resources Division deems it advisable in the best interest of conservation.

Sincerely,

Charles M. Bearden, Director
Office of Fisheries Management

CMB/pgc

No. 345

Issued by authorization of Section-50-17-50, S.C. Code of Laws as amended. This permit is for the collection of specimens from marine waters for scientific purposes only.

Failure to comply with the attached conditions will result in the revocation of this permit.

No. 345

S.C. WILDLIFE AND MARINE
RESOURCES DEPARTMENT
SCIENTIFIC PERMIT

Name _____

Address _____

City & State _____

Organization _____

Expiration Date _____

DIVISION OF MARINE RESOURCES
CHARLESTON, S.C.

By _____

Date _____

NON-TRANSFERRABLE

APPENDIX G

Analysis of ACE Basin Site

Based on NERR Biogeographic Scheme/Typology

(Ecological Characterization)

**NOTE: Literature Cited In this Section Is Included In
VII. References, page 108**

ECOLOGICAL ANALYSIS OF ACE BASIN NERR SITE

An analysis of the site based on the NERRS classification scheme illustrates a complex of subsystems and habitat types. The region contains a diverse assemblage of representative outer coastal plain communities including the full array of communities typically associated with barrier islands, marsh islands and major estuarine rivers. Especially well represented are salt and brackish marshes and maritime forest communities. An abundance of managed estuarine impoundments, the total absence of industrial pollution and the isolated, undeveloped character of the area add considerably to the ecological significance of the region (Murdock 1981). These exceptional habitat characteristics and associated wetland functions have resulted in national designation of the ACE Basin region as a priority conservation area (U. S. Fish and Wildl. Serv. 1990).

1. Representative Ecosystems

The ACE Basin NERR is characterized by tremendous spatial heterogeneity. From northeast to southwest, the area is divided by the Edisto, Ashepoo and Combahee rivers and associated tributaries flowing through extensive wetland acreage into St. Helena Sound. Wetland diversity is high and includes palustrine, estuarine (oligohaline to polyhaline types) and marine ecosystems. Over 30 percent of the natural communities as described by Nelson (1986) for South Carolina are encompassed within the reserve. A total of 23 ecological systems and subsystems/general community types are represented (Table 1). It is emphasized that these habitats are interacting components of a tremendously larger system (ACE Basin regional ecosystem - ca 350,000 acres) that is an extremely dynamic, open system through which organisms and materials constantly move (Figure 1). Therefore, the reserve is not easily delineated by artificial boundaries.

a. Coastal Marine

The coastal marine ecosystem is well represented and occurs where lands and water have unobstructed access to the open ocean. As such, it consists of two components; the intertidal and the subtidal. The intertidal subsystem includes tidal ocean beaches of Edisto Beach, Harbor, Hunting, Otter and Pine Islands as well as other islands with bars contiguous to coastal waters. The intertidal zone is a high energy, highly turbid environment with a continually shifting substrate of sand. These factors coupled with regular and frequent exposure to the air provide a harsh environment. Intertidal beach communities such as Otter Island may include relic forests where erosion of the beach and dune systems has encroached upon maritime forest communities. The subtidal subsystem consists of coastal waters extending

Table 1. Representative ecosystems of the proposed ACE Basin MERR.

ECOSYSTEM	SUBSYSTEM/COMMUNITY TYPE	EXAMPLE
Coastal Marine	Subtidal	Offshore-waters to St. Helena Sound COLREGS
	Intertidal	Colregs line Otter Island - beaches and bars
Maritime	Bird Key and Bank Dune	Pelican and Egg Banks Otter and Edisto Isls. - dune fields
	Transitional Shrub	Otter and Pine Isl. - shrub thickets
	Maritime Forest	Otter and Pine Isl. - woodlands
Estuarine	Subtidal	St. Helena Sound Estuary - submerged substrate to continuously - unconsolidated mud and sands
	Intertidal - Flats	St Helena Sound Estuary Flats - salt and brackish marshes
	Intertidal - Emergent wetlands	St. Helena Sound Estuary
	Intertidal - Impoundments	Bear Island WMA and private plantations - divided marshes
Palustrine	Bay Forest	Snuggedy Swamp - southern portions
	Bottom land Hardwood	Private plantations
	Scrub-shrub/emergent wetlands	Bear Island WMA and private plantations
	Emergent/Aquatic Bed wetlands	
Upland	Old Field	Core area islands
	Pine Forest	and/or buffer lands
	Pine-mixed hardwood	zone including Bear
	Hardwood	Island WMA and private lands

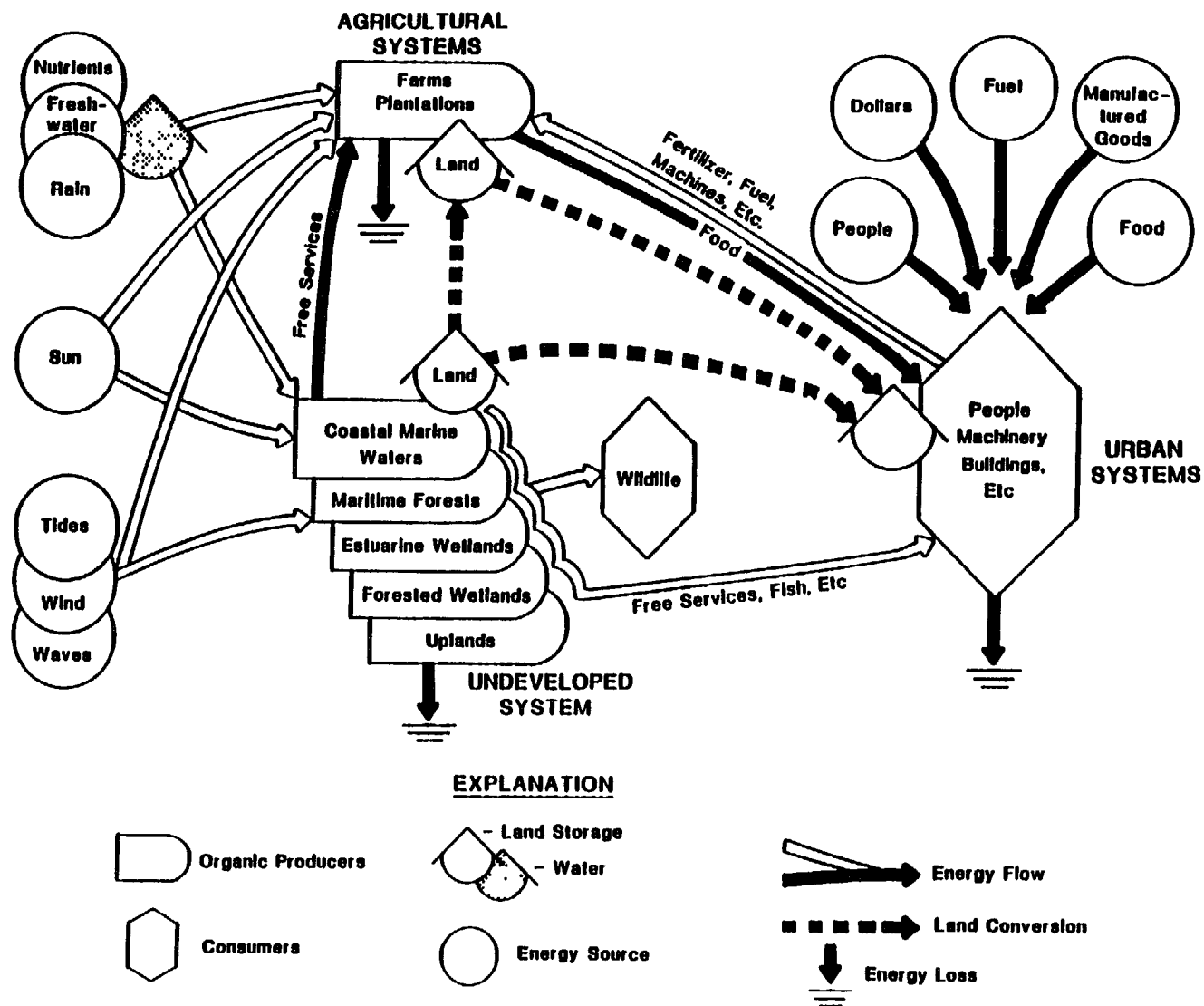


Figure 1 The Ace Basin is a complex mixture of subsystems that interconnect by energy pathways to form a regional ecosystem

seaward of extreme low spring tide level and with salinities consistently exceeding 30 o/oo. Unconsolidated coastal bottom communities are composed of loose sand and associated sediments or mud with shells and shell fragments (Sandifer et al, 1980, Nelson 1986).

b. Maritime

The maritime ecosystem is principally represented by Edisto Beach, Hunting, Harbor, Pine and Otter islands. It includes all upland and isolated wetland areas located on those islands and others bordered on one side by tidal marshes, rivers and/or creeks and on another side by an active ocean-formed beach. Four subsystems are recognized: Bird key and bank, dune, transition shrub and maritime forest. The bird key and bank subsystem is a special ecological unit physically separated from the others by water (Sandifer et al, 1980).

The bird key and bank subsystem consists of small isolated islands typically found in tidal inlets and broad bays. These islands are characterized by erratic, annual fluctuations in size, shape and vegetative cover as the sand shifts in response to storms and other physical forces (Sandifer et al, 1980). Within the reserve, this subsystem is best represented by Egg Bank in St. Helena Sound. This sand island exhibits low topographic profile and is frequently overwashed by storms and astronomically influenced high tides.

The dune subsystem consists of a variety of types ranging from low, relatively narrow dune fields found on Otter and Pine Islands to higher, more well-developed dunes found on the southwest portion of Edisto Beach. Dune or maritime grassland communities exhibit a variety of floristic zones relative to species tolerance of salt spray, saltwater immersion and wind blown sand. Due to their ability to tolerate salt spray and other harsh environmental conditions, the robust perennials, grasses, sea oats and sea beach panic grass dominate the front slope and crest of foredunes.

Fleshy herbs including sea rocket, beach elder, Russian thistle, beach pennywort and sea purslane occur in the foredune zone and assist in the early stages of dune development. Back slopes of foredunes, backdunes and interdune areas are dominated by a variety of grasses, sedges, herbs and shrubs including: saltmeadow cordgrass, salt marsh fimbriatylis, camphor weed, prickly pear, frog fruit, sand grass, finger grass, beach hogwort, beach sandspur, seaside goldenrod, yucca, groundsel tree and wax myrtle. (Johnson et al, 1974, Hillestad et al, 1975, Sandifer et al, 1980, Nelson 1986).

Interdune ponds occur between beach dunes and maritime forest ridges and for the purposes of this document are considered to be a component of the dune subsystem. These isolated wetlands are seasonally flooded by rainfall or periodically inundated by exceptionally high and/or lunar tides. Numerous interdune ponds are

G-5

characterized by freshwater emergents including cattail, false nettle, giant plume grass, fall panic grass, flat sedges and dotted smartweed. Depending on frequency and depth of inundation, ponds flooded by tidal action are more brackish and are vegetated to varying degrees by tropical cattail, saltmarsh bulrush, salt grass, smooth cordgrass, black needlerush, sea purslane and giant foxtail millet. Fresh and brackish interdune ponds are well represented on Otter Island.

The transitional shrub subsystem or maritime shrub thicket is a dense but generally narrow ecotonal band between dune and maritime forest communities. This subsystem with its characteristic sheared canopy functions to further protect less salt-spray tolerant maritime forest vegetation (Sandifer et al, 1980). Maritime shrub thickets occurring within the proposed reserve site generally are dominated by wax myrtle. Other relatively salt-tolerant species represented are yaupon, cabbage palmetto, southern red cedar, red bay, green brier and pepper vine.

The maritime forest ecosystem is represented by the zone of forest vegetation between transitional shrub communities on the seaward side and salt shrub thicket communities on the marsh side of islands. Within the proposed site, principal canopy species include live oak, loblolly pine, and slash pine. Midstory and understory species include cabbage palmetto, southern magnolia, southern red cedar, red bay, wax myrtle, yaupon, beauty-berry and coral bean. Virginia creeper, rattan vine, green brier, poison ivy, braken fern, nut rush and prickly pear also occur as understory components. In addition to the above general community description, several distinct forest community types based on various degrees of dominance by palmetto, oaks, other hardwoods and pines have been recognized for the maritime forest ecosystem (Sandifer et al, 1980). Such distinct types are exemplified by four maritime forest communities identified by Gaddy (1982) for Hunting Island located within the reserve buffer zone.

c. Estuarine

The estuarine ecosystem extends upstream in the tri-river system and landward to where ocean-derived salts measure less than 0.5 o/oo during the period of average annual flow. The seaward limit is an imaginary line across the mouth of St. Helena Sound.

The ACE Basin estuarine ecosystem is a deepwater habitat with adjacent tidal wetlands that are semi-enclosed by land but having access to the open ocean. This system is diluted by freshwater flows of the tri-river drainage basin and from upland runoff. The estuary is influenced more by terrestrial processes than is the contiguous coastal marine ecosystem. As defined by Cowardin et al (1979), the ACE Basin estuary contains a complete array of salinity zones as follows: Oligohaline (0.5 o/oo - 5 o/oo), mesohaline (5 o/oo - 18 o/oo), Polyhaline (18 o/oo - 30 o/oo), and Euhaline (30 o/oo - 40 o/oo) (Figure 2).

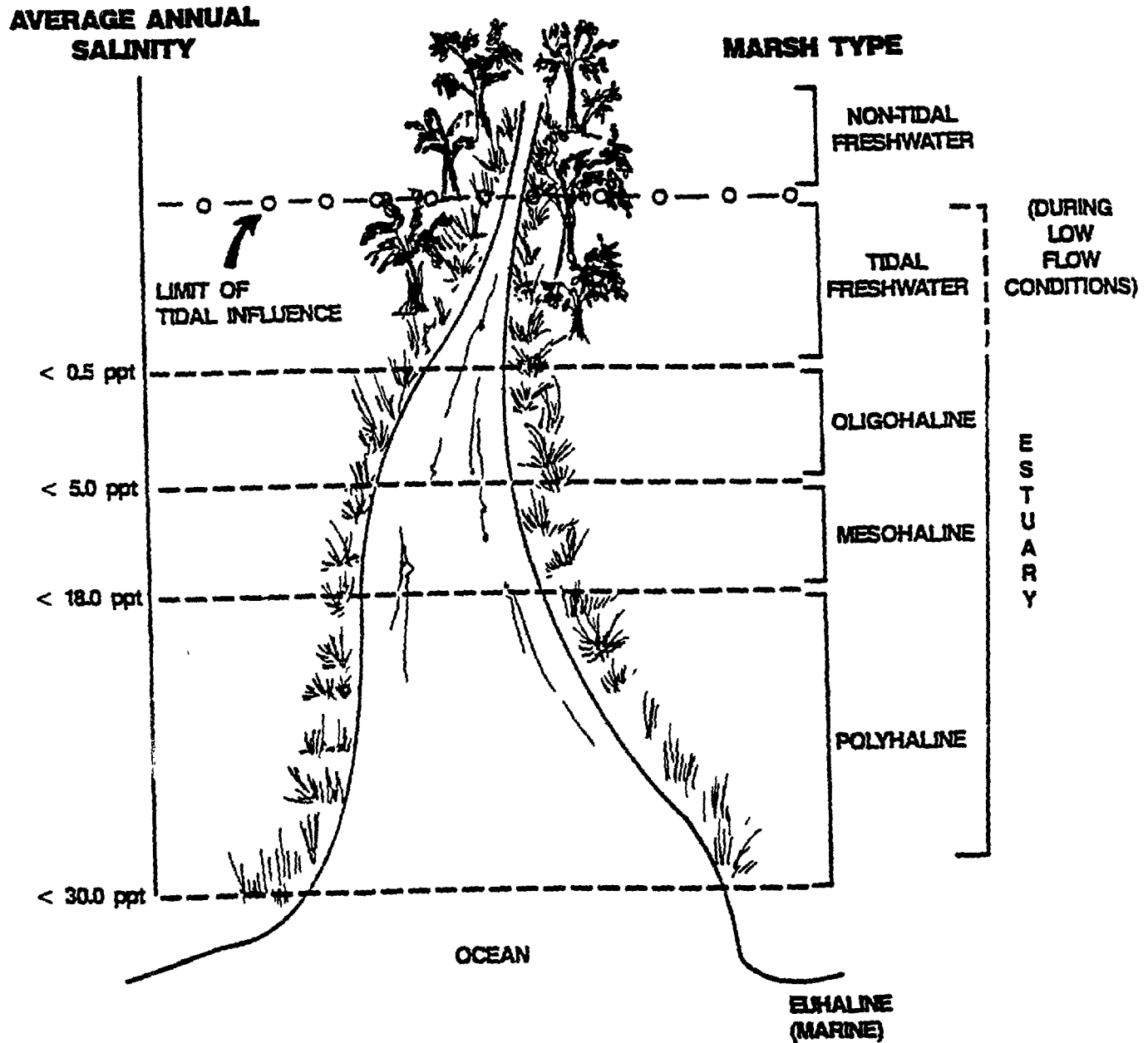


Figure 2. The relationship between marsh type and average annual salinity (values are approximately only). Terminology is based on Cowardin et al. (1979).

In accordance with Cowardin et al (1979), the Basin's estuarine ecosystem is divided into two subsystems, the subtidal and the intertidal. St. Helena Sound and the waters of the Ashepoo, Combahee and Edisto Rivers, where salinities are greater than 0.5 o/oo, comprise the subtidal sub-system. The intertidal subsystem includes those areas where the substrate is exposed and flooded by tides (e.g., marshes, bars, flats, oyster rocks, etc.) and includes the associated splash zone. The following habitat types are included in the reserve: subtidal bottom and intertidal flats and bars, 59,400 acres, tidal marshes, 60,100 acres and estuarine impoundments, 8,300 acres (SCWMRD, unpubl. data).

The estuarine subtidal subsystem provides a rich and varied environment for phytoplankton populations but macrophyte production generally is limited. Due to environmental factors, estuarine phytoplankton populations tend to be larger and more productive than populations in adjacent systems. However, general absence of solid, permanent substrates, as well as turbidity, and the scouring action of tides severely limit the growth of macroscopic algae. The continuously immersed parts of seawalls, pilings, oyster reefs and subtidal substrates such as shell, man-discarded objects and invertebrates provide sites for algae attachment (Sandifer et al. 1980).

Estuarine intertidal flats, level land forms composed of unconsolidated sediments, occur in areas sheltered from strong currents and wave action. Flats may be irregularly shaped or elongated and continuous with the shore, whereas bars generally are elongate, parallel to the shoreline and separated from the shore by water. Water regimes are restricted to irregularly exposed, regularly flooded and irregularly flooded flats, (Cowardin et al. 1979). Although flats are rich in mud algae, no vascular plants are typically found. On occasion, macroscopic algae such as sea lettuce may locally dominate flats (Sandifer et al 1980, Tiner 1984). Flats and associated oyster reefs are well represented throughout the reserve.

Marshes dominate the ACE Basin intertidal zone. Although estuarine intertidal wetlands are a complex nutrient rich ecosystem, vascular plant diversity is relatively low due to limiting factors such as salinity, drainage, temperature and tidal influence (Penfound 1952, Adams 1963, Johnson et al. 1974, Baden et al. 1975, Sandifer et al. 1980). Emergent wetlands within the intertidal subsystem may be classified as two distinct units, salt and brackish marshes.

Salt marsh salinities range from 10 o/oo to as high as 35 o/oo or even greater under certain environmental conditions. Saltmarshes are composed of two zones defined by elevation. The regularly flooded zone ("low marsh") is flooded at least once but usually twice daily while the irregularly flooded zone high marsh is flooded only during storm and/or astronomically high lunar tides.

Plant communities associated with regularly and irregularly flooded salt marshes are distinctly different in species composition. Extensive monotypic stands of smooth

cordgrass dominate the low marsh. Along creek banks, this species typically attains heights of over 6 feet while in the interior of the low marsh, plant height may vary from 3 to 6 feet. In contrast to the vegetatively homogenous low marsh, species diversity of the high marsh is quite varied. A number of halophytic grasses, rushes and forbs occur in abundance: glasswort, sea blite, salt wort, sea lavender, salt marsh aster, salt grass, sea ox-eye, black needlerush, salt meadow cordgrass, coastal dropseed, salt-marsh fimbriatilis, marsh elder and short form (< 1.5 feet high) smooth cordgrass (Tiner 1979). Salt marshes dominate the entire marsh zone for the reserve core area, all of the buffer zone in the Combahee system and the buffer zone associated with the Ashepoo and South Edisto Rivers to the approximate lower boundary of Bear Island WMA. High salt marshes including "salt flats or pannes" are particularly well represented along the upland perimeters of Otter and Pine Islands.

Within the reserve buffer zone, brackish marsh salinities range from 0.5 o/oo to 10 o/oo and occur primarily in the central to upper regions of the South Edisto and Ashepoo Rivers. Throughout most of this region, the marshes are influenced by mesohaline salinities and are dominated by mixed stands of black needlerush and big cordgrass. Other species occurring in this zone include saltmarsh bulrush, saltmarsh aster, marsh elder, groundsel tree, sea oxeye and seaside goldenrod. Oligohaline conditions predominate from the main Jehossee Island marsh peninsula to the abandoned SCR bed on the South Edisto and in the extreme upper portions of Ashepoo River marshes. In this zone, emergent wetlands are characterized by a diverse assemblage of plants typical of transitional brackish and freshwater communities.

Representative species include: big cordgrass, cattails, salt marsh bulrush, common three-square, soft-stem bulrush, sawgrass, pickerel weed, arrow-arum, spider lily, alligator weed, water parsnip, wild rice, and giant cutgrass. A narrow zone of smooth cordgrass often occurs at lowest marsh elevations along river and creek banks (Tiner 1979).

d. Palustrine

Due to geographic and associated ecological features related to boundaries of the reserve, the palustrine system is the least represented in regards to areal occurrence. However, a diversity of palustrine wetland communities are represented in the buffer zone and include bay forest, bottomland hardwood, scrub-shrub/emergent wetlands, and emergent/aquatic bed wetlands.

Bay Forest communities occur in the extreme northern portions adjacent to the abandoned SCR bed and tidal marshes of the South Edisto River. This community consists of the lower reaches of Snuggedy Swamp, a Holocene peat deposit up to 13.5 feet resting on a sequence of silty and clayey saltmarsh deposits (Mathews et al. 1980). These peaty swamps are characterized by poorly drained, deep organic, acid soils that are seasonally or intermittently saturated. Vegetative structure is

characterized by a generally thick canopy and very tangled subcanopy layers made up of viney growth and tall shrubbery including loblolly bay, red bay, sweet bay, wax myrtle, red maple, pond pine, green brier and other broad-leaved evergreen species (Penfound 1952, Cowardin et al. 1979, Sharitz and Gibbons 1982, Nelson 1986).

Bottomland hardwood communities within the reserve are found on poorly-drained lowlands not associated with river channels and are influenced by seasonal and intermittently flooded water regimes. These wetlands generally occur on minimal soils or highly decomposed organic soils (Cowardin et al. 1979). This habitat type occurs on private lands in the reserve buffer zone and is best represented by non-alluvial swamp forest communities. A diverse assemblage of canopy and subcanopy species occur including swamp chestnut oak, water oak, sweetgum, ash, red maple, swamp tupelo, and cabbage palmetto. Understory and herb components include dwarf palmetto, wax myrtle, red bay, smartweeds, lizard's tail, various grasses and sedges (Nelson 1989, C. A. Smith, pers. comm.)

Scrub-shrub/emergent wetlands are represented by small (generally less 0.5 acre) ponds and depressions located on Bear Island WMA and private land within the buffer zone. These communities are composed of varying ratios of sapling trees, shrubs and persistent and non-persistent emergents including: sweetgum, red maple, willows, buttonbush, wax myrtle, water loosestrife, various panic grasses, rushes and sedges. An excellent example of this community type is the maiden cane dominated depression meadow (Nelson 1986, A. Smith, pers. commun.)

Emergent/aquatic bed wetlands are best represented by a limited number of palustrine impoundments (approximately 200 acres) chiefly associated with the Ashepoo River drainage system. These wetlands are influenced by a semipermanently flooded water regime except when dewatered by extended drought or for management purposes. Typical emergents include: common cattail, soft rush, water loosestrife, smartweeds, spikerush, maiden cane, and sedges. Frogbit, pennywort, white waterlily, bladderwort and coontail are the principal floating-leaved and submerged aquatics. Scattered stands of low density trees and shrubs including: red maple, swamp tupelo, buttonbush, willows and wax myrtle also occur as minor community components (SCWMRD unpubl. 1989 data).

e. Uplands

For the purposes of this document uplands are considered to occur in two distinct ecosystems: Maritime - 1) maritime forest communities located in marsh/barrier islands, 2) uplands - all other upland areas within the proposed reserve. Total upland area is approximately 7,752 acres including some 900 acres of maritime forests located principally on Otter, Pine, Ashe and South Hutchinson Islands. Maritime forest communities also occur, to a more limited extent, on other core area islands and at isolated locations throughout the buffer zone. A description of maritime forests

communities has been previously provided under the maritime ecosystem discussion.

The remaining uplands ecosystem (approximately 6,852 acres) is divided into four major subsystems: 1) old field, 2) pine forest, 3) pine-mixed hardwood forest, and 4) mixed hardwood forests. The reserve contains many of the community types characteristically found within the ACE Basin Region (Table 2). Pine communities dominate the uplands. The original upland forests were probably mixed hardwood and pyric climax pine forests. Subsequent logging and clearing for agriculture and forest management resulted in the creation and maintenance of pine dominated upland. Pine-mixed hardwood forests also are common in the project area and range from extremely xeric to mesic sites. Mesic pine-mixed hardwood communities generally have a super canopy of pines (slash, spruce or short leaf) and hardwood xeric pine-mixed hardwood communities, generally found on ridges of coarse sand, are more complex with long leaf pines being the predominant species. The effects of fire and logging in the community determine canopy height, understory composition and height and density of both. The southern mixed hardwood forest is an extremely complex subsystem, with dominance varying among various sites. As many as 20 different community variations have been described for mixed hardwood forests in the region (Sandifer et al. 1980).

2. Fish and Wildlife Resources

a. Endangered and Threatened Species

Habitat diversity, the absence of industrial pollution, and the undeveloped nature of the ACE Basin collectively contribute to the region's importance to endangered and threatened species. Eight species of Federally-listed endangered and/or threatened animals have been documented to occur in the vicinity of the reserve (Table 3). However, only 6 species (Atlantic loggerhead turtle, southern bald eagle, wood stork, shortnose sturgeon and peregrine falcon) are considered to be residents or regularly utilize the area during portions of their annual life cycle (S. H. Murphy and T. M. Murphy, pers. commun.) In accordance with the amended Federal Endangered Species Act of 1978, these species are managed by recovery plans developed by the U.S. Fish and Wildlife Service (birds and terrestrial species) and the National Marine Fisheries Service (marine species except sea turtles). Development of recovery plans for sea turtles is a joint responsibility of these two agencies (Sandifer et al. 1980). Management of endangered species within the reserve will be coordinated by SCWMRD, Nongame and Endangered Species Section.

The beaches of Hunting, Harbor, Otter, Pine and Edisto Islands provide important nesting habitat for the Atlantic loggerhead turtle (Table 4). Otter Island is considered to be the most important nesting site on the southern coast of South Carolina and is ranked among the top nesting beaches in the state. Annual nest site monitoring and surveillance is conducted by various SCWMRD permitted cooperators and volunteer

Table 2. Generalized community structure of the vascular flora of the Upland Ecosystem in the ACE Basin Region.

I. OLDFIELD COMMUNITY

Upland (well drained)
Lowland (poorly drained)

II. PINE FOREST COMMUNITIES

Longleaf
Slash
Loblolly
Mixed Pine

III. PINE-MIXED HARDWOODS COMMUNITY

A. Mesic - loblolly dominate

1. loblolly - mixed hardwoods communities

- a. white oak phase
- b. ravine slope phase
- c. sweet gum-tupelo phase

2. mixed pine-mixed hardwoods communities

- a. shortleaf
- b. loblolly

B. Xeric-longleaf dominate

1. longleaf pine-turkey oak community

- a. turkey, blackjack, and shrubby post oak,
- b. Chapman, live, turkey, shrubby post oak, long-leaf dominate

2. longleaf-shortleaf turkey oak communities

- a. above, plus slash pine, Chapman and laurel oak, mockernut hickory
- b. blackjack and turkey oak shrubby post oak, longleaf association

IV. MIXED HARDWOOD

A. Mesic slope hardwoods

- 1. ravine slope hardwoods
- 2. beech ravine
- 3. mixed mesophytic hardwoods
- 4. bluff and slope forest
- 5. beech-bull bay community

B. Upland mesic hardwoods
(or oak-hickory)

- 1. forest, southern mixed hardwoods
- 2. forest or mesophytic broadleaved forest

C. Hammock community

- 1. lowland broadleaf evergreen forest
- 2. evergreen scrub-lichen forest

D. Scrub forest community

- 1. evergreen scrub forest
- 2. evergreen scrub-lichen forest

E. Dwarfed oak-mixed hardwood community

- 1. turkey oak-longleaf pine association
- 2. turkey oak association
- 3. blackjack oak pine
- 4. mockernut hickory association

F. Live oak-mixed hardwood community

Table 3. Federally listed endangered and threatened animals documented to occur in/or within the vicinity of the proposed ACE Basin NERR.

SPECIES	STATUS	ECOSYSTEM	PREFERRED HABITS	OCCURRENCE
American Alligator	Threatened	Estuarine	Low salinity brackish marshes and impoundments	Abundant
Atlantic loggerhead turtle	Threatened	Marine Estuarine	Offshore waters; St. Helena Sound; nest on beaches	Common in summer
Finback whale	Endangered	Marine	Open ocean	Rare
Peregrine Falcon	Endangered	Maritime	Beaches of barrier islands	Fairly common in winter
Shortnose sturgeon	Endangered	Estuarine	Estuarine Rivers	
Southern Bald eagle	Endangered	Estuarine Palustrine Upland	Estuarine rivers, impoundments and associated uplands	Common in fall and winter
West Indian Manatee	Endangered	Marine	Estuarine rivers	Uncommon
Wood Stork	Endangered	Estuarine Palustrine	Estuarine impoundments and intertidal flats; Forested/scrub-shrub wetlands	Common in spring and summer

Table 4. Atlantic loggerhead turtle nesting activity within the proposed Ace Basin NERR, 1980-87.
(Adapted from SCLMRD, Nongame and Endangered Species Section; unpublished data)

Nesting Beach/Island	Length of Beach (Mi)	<u>Estimated Active Nests/Season</u>	
		1980-82	1985-87
Edisto Island*	11.0	403	367
Pine Island	1.4	25	8
Otter Island	2.6	310	158
Harbor Island	1.2	55	41
Hunting Island	4.2	105	139
Totals	20.4	898	713

*Includes beaches of Eddingsville Beach and Botany Bay Island that are outside the proposed NERR site but within the overall ACE Basin Project area

organizations as follows: Hunting Island - SCDPRT; Otter and Pine Islands-Chelonia Institute (a private sector marine turtle conservation organization); and Edisto Island Edisto Beach Turtle Project (Murphy and Murphy, 1982, S. H. Murphy, pers. commun.).

In addition to the Atlantic loggerhead, other marine turtles potentially occurring as transient individuals within the reserve include the Kemps Ridley and Green Sea Turtle.

The ACE Basin, presently supporting 40 percent of South Carolina's nesting eagles, represents the most important southern bald eagle nesting region in the state. Seven of the 24 nesting territories within the Basin currently are located in the reserve and have contributed significantly to restoration of state-wide eagle populations (Table 5). The presence of suitable nest trees and the distance to rivers and impoundments have been cited as being potentially the most important factors for eagle nest site selection (Murphy and Coker 1978, Cely and Phillips 1981). Within the reserve, the interspersed of impoundments and isolated forested islands supporting large pine trees provide excellent eagle nesting habitat. The isolated nature of the reserve and the high availability of food in rivers (fish) and impoundments (waterfowl and fish) enhance successful eagle nesting. Principal avian food remains found in eagle nests suggest high utilization of common moorhens and occasional use of coots with catfish being the primary fish species identified (Murphy and Coker 1978). The lack of industrial pollutants also contribute to eagle productivity (T. M. Murphy, pers. commun.).

Wetlands in the ACE Basin provide a diversity of habitat types important to the American alligator. Overall, alligator populations within the tri-river system have exhibited increasing trends (Table 6). In an intensive study of alligator nesting ecology in coastal South Carolina, Wilkinson (1983) characterized the ACE Basin as one of the most important nesting regions in the state (Table 7). Marsh impoundments are the preferred habitat type for nesting. Estuarine impoundments provide abundant and diverse food resources, a variety of water depths providing optimum foraging habitat for all age classes of alligators and excellent nesting sites on internal remnant dikes and berms of functional embankments (Chabreck 1960, Bara 1975, Wilkinson 1983). Since freshwater or low salinity wetlands ($\leq 12\%$) are preferred by alligators for nesting, most of this activity occurs within impoundments of the proposed reserve's buffer zone.

In response to extended protective status, South Carolina's alligator populations have increased significantly and the species currently is officially considered as "threatened upon similarity of appearance." The alligator's present status allows for a controlled harvest that SCWMRD initiated in 1988 through exclusive removal of "nuisance" alligators by authorized controlled agents. This program is designed to minimize problematic alligator-human interactions typically associated with expanding

Table 5. Southern bald eagle nesting activity within the proposed ACE Basin NERR, 1973-90.
(SCMNRD, Nongame and Endangered Species Section, unpublished data).

YEAR	NO.NEST	PRODUCTION
1973	1	unknown
1974	1	unknown
1975	1	unknown
1976	1	unknown
1977	1	0
1978	1	0
1979	2	1
1980	2	2
1981	3	5
1982	3	5
1983	3	3
1984	4	5
1985	4	4
1986	4	6
1987	4	6
1988	6	9
1989	7	6
1990	7	6
TOTALS	55	58

Table 6. American alligator observations and relative densities in the Asheepoo, Combahee and Edisto Rivers, 1978 and 1983
(Adaped from Murphy and Coker 1983).

River	1978			1983		
	miles surveyed	observations	observations/mile	miles surveyed	observations	observation/mile
Asheepoo	23.5	32	1.36	23.5	49	2.08
Combahee	17.5	27	1.31	17.5	30	1.70
Edisto	34	51	1.5	27	134	4.96

Table 7. American alligator nesting densities in three marsh types associated with the Ashepoo, Combahee and South Edisto rivers
(adapted from Wilkinson 1983).

River	Impoundments Surveyed			Remanent Impoundments Surveyed			Tidelands Surveyed		
	No.Acres	No.Nests	Acres/Nest	No.acres	No.Nests	Acres/Nest	No.Acres	No.Nests	Acres/Nest
Ashepoo	3,934	24	164	3,837	13	295	82	0	0
Combahee	10,634	57	186	4,178	4	1,045	N/S	-	-
South Edisto	6,574	10	657	3,264	7	466	816	7	117
Totals	21,142	91	232	11,279	24	470	898	7	117

urban communities. Bear Island WMA serves as the headquarters for alligator hide storage and sale for animals removed through this program.

The wood stork is one of the most spectacular wading birds occurring within the reserve and represents the only true stork of regular occurrence in the United States. Wood stork nesting activity was first documented in the ACE Basin in 1981 when 11 pairs nested. Nesting activity has exhibited dramatic annual increases with 536 nests currently documented in three rookery sites. An estimated minimum of 1,289 storks were fledged in 1990 (T. M. Murphy, pers. commun.).

The ecological relationships of productive, shallowly-flooded foraging habitats to wood stork and other colonial wading bird nesting sites is well established (Kushland 1976, Custer and Osborn 1978, Custer et al. 1980, Kushland 1981). Although not located within boundaries of the reserve, the three ACE Basin rookeries are located within proximity and storks are regularly observed feeding in intertidal mud flats and estuarine impoundments throughout the reserve area. Wood storks, employing tactile feeding strategies, forage extensively on small fish and other aquatic animals concentrated in tidal marsh pools and topographic depressions characteristically found in estuarine impoundments when water levels are lowered for waterfowl habitat management. In addition to breeding storks, the reserve provides important foraging habitat for wood storks migrating from more southern breeding grounds in mid to late summer (T. M. Murphy, pers. commun.).

Although the peregrine falcon has experienced a dramatic decline within the Continental United States, the species continues to be regularly reported in South Carolina during migration and in winter (Gauthreaux et al. 1979). During annual migration, several hundred peregrines are believed to pass through the reserve with up to six individuals regularly utilizing the beaches and associated estuarine habitat throughout the winter. Migrating peregrines are believed to feed extensively on migratory shore birds and passerines while wintering. Falcons feed heavily on red-winged blackbirds (T. M. Murphy, pers. commun.).

Little is known concerning the abundance and ecology of the shortnose sturgeon in the ACE Basin except that the species has been documented to occur in the South Edisto River and, although not currently confirmed, historically has likely inhabited the Combahee and Ashepoo Rivers. The marl hole above Givhans Ferry, located outside the project area, on the South Edisto is believed to be an important spawning area for the closely-related Atlantic Sturgeon (Sandifer, et al. 1980). The undamed nature general high water quality of the tri-river system contribute to the Basin's value as important habitat for sturgeon.

During the warmer months, the West Indian manatee moves as far north as North Carolina along the Atlantic Coast and has been documented to occur on an uncommon but regular basis in summer at locations both north and south of the

reserve. A cow and calf have been observed for several hours feeding on smooth cordgrass at the Parris Island Marine Depot immediately south of the project area. The size of the calf suggests that it was probably born in South Carolina waters. Other sightings of manatees feeding on smooth cordgrass have been noted in other estuarine rivers of South Carolina (Sandifer et al. 1980, T. M. Murphy, pers. commun.). Several species of whales, including the Atlantic right, blue, bowhead, finback, humpback, sei and sperm, occasionally occur in marine waters off South Carolina. In 1987, an adult finback whale stranded on the beach of Harbor Island, located in the extreme southeastern portion of the reserve. This stranding represents the first documented occurrence of finback whales in coastal waters of South Carolina. In general, very little is known concerning marine mammal population levels or movements along the southeastern coast of the United States (Sandifer et al. 1980, T. M. Murphy, pers. commun.).

b. Amphibians and Reptiles

Except for marine turtles that were previously discussed in the endangered species section, essentially no site-specific information is available for herpetofauna associated with the maritime ecosystem of the reserve. The reserve core area is expected to support a representative diversity of herpetofauna groups including various species of salamanders, frogs, toads, lizards, snakes, and turtles typically occurring on undeveloped barrier and marsh islands.

The diamondback terrapin is the only reptile truly characteristic of the estuarine subtidal region and perhaps is also the most characteristic reptile of irregularly flooded intertidal estuarine habitats. Terrapins are most abundant in the salt marsh creeks particularly over shell bottoms and near oyster bars (Sandifer et al. 1980). As discussed previously, the American alligator also is an extremely important herpetofauna component of the estuarine ecosystem but prefers low salinity habitats.

Although there is a general paucity of herpetological research in saline habitats of the United States, amphibians and reptiles evidently invade intertidal salt and brackish water areas much more often than has generally been realized (Neill 1958). Within the reserve, ecotonal communities associated with intertidal emergent marshes, impoundments and a variety of terrestrial habitats support a diverse assemblage of herpetofauna (Table 8). Undoubtedly, additional species also occur but at present have not been verified

c. Mammals

Mammals in the project area may be classified as two distinct groups, marine mammals and semi-terrestrial and terrestrial species. Other than the previously discussed endangered species, four species of marine mammals including two

Table 8. Some amphibians and reptiles occurring within the proposed ACE Basin NERR verified by collection and observations.
(South Carolina Wildlife and Marine Resources Department, Non-game and Endangered Species Section, unpubl. data.)

<u>Crocodilians</u>	<u>Snakes</u>
American alligator	Banded water snake
	Black swamp snake
	Brown snake
<u>Frogs and Toads</u>	Copperhead
	Corn snake
Barking treefrog	Eastern coral snake
Bullfrog	Eastern cottonmouth
Eastern narrowmouth toad	Eastern diamondback
Eastern spadefoot toad	Eastern garter snake
Green frog	Eastern hognose snake
Green treefrog	Eastern kingsnake
Little grass frog	Eastern ribbon snake
Ornate chorus frog	Mud snake
Pig frog	Rainbow snake
Pine woods treefrog	Rat snake
Southern chorus frog	Redbelly snake
Southern cricket frog	Redbelly water snake
Southern leopard frog	Ringneck snake
Southern toad	Rough earth snake
Spring peeper	Rough green snake
Squirrel treefrog	Scarlet kingsnake
	Scarlet snake
	Southeastern crown snake
<u>Lizards</u>	Southern black racer
	Southern hognose snake
Broadhead skink	Worm snake
Five-lined skink	
Green anole	
Ground skink	<u>Turtles</u>
Slender glass lizard	Chicken turtle
Southeastern five-lined skink	Eastern box turtle
Southern fence lizard	Mud turtle
<u>Salamanders</u>	Musk turtle
	Snapping turtle
Eastern newt	Spiny softshell turtle
Marbled salamander	Yellowbelly slider
Mole salamander	

dolphins, one whale and one seal have been documented to occur in the vicinity of the reserve (Golley 1966, Sandifer et al. 1980). Although limited information is available concerning the overall composition of terrestrial and semi-terrestrial mammalian communities within the reserve, a minimum of 19 species are believed to occur in the general ACE Basin region (Murdock 1981).

Of the marine mammals, the Atlantic bottle-nose dolphin is the only resident species and is the dominant mammal of the estuarine open water system and nearshore marine habitat. In the estuarine system, the dolphin's feeding niche is essentially the same as in nearshore waters where they prey on a variety of fishes with striped mullet and Atlantic menhaden probably constituting the bulk of its diet (Sandifer et al. 1980). Bottle-nose dolphins are commonly observed in St. Helena Sound and in the estuarine zone throughout the tri-river system. The common dolphin, a pelagic species found in temperate and tropical oceans, is documented in the project area by a stranding on Edisto Island. A female goosebeaked whale measuring 15 feet, 7 inches in length also is noted to occur through a stranding at Edisto Island (Golley 1966). The harbor seal is considered to be an uncommon but regular species occurring along the South Carolina coast both north and south of the reserve (Sandifer et al. 1980, T. M. Murphy, pers. commun.). A young harbor seal has been collected at Hilton Head Island, immediately south of the reserve (Golley 1966, Sanders 1978).

Other than marine mammals, furbearers represent the mammalian group most closely associated with estuarine habitats. The river otter is the only furbearer utilizing both subtidal and intertidal estuarine wetlands. Otters are considered to be common faunal components of the reserve and often are observed in tidal creeks and rivers and traveling or crossing dikes of estuarine impoundments. Principal food items of otters using salt marshes include various species of minnows, striped mullet and blue crabs (Chabreck et al. 1982). In the reserve the mink is the other semi-aquatic, carnivorous mammal chiefly associated with estuarine wetlands. Minks remain mostly in dense cover but feed along shorelines and enter open water only when crossing a body of water is necessary (Chabreck 1988). In comparison with the river otter, the diet of the mink is more varied and likely includes marsh birds and rodents along with fish and crustaceans (Golley 1966; Sandifer et al. 1980). Estuarine wetlands within the reserve core area, particularly the marshes of Otter, South Hutchinson and Ashe Islands, are considered to support some of the highest mink populations along the South Carolina coast. The lack of environmental contaminants in the ACE Basin estuarine system is believed to contribute to the value of these marshes as important mink habitat (O. E. Baker, III, pers. commun.).

The ACE Basin provides important habitat for a number of other furbearer species including the raccoon, bobcat and gray fox. SCWMRD furbearer census data suggest that populations of these three species in the ACE Basin contribute significantly to the statewide, coastal furbearer resource. The raccoon is the most abundant medium

sized, mammalian omnivore inhabiting tidal wetlands and adjacent upland habitats. Within the project area, the raccoon successfully exploits a wide-variety of habitats including: intertidal beaches, dune systems, maritime forests, intertidal flats and marshes, impoundments and various upland community types. The bobcat represents the principal large mammalian predator inhabiting maritime forest as well as other upland habitats and is commonly observed traveling the dikes of estuarine impoundments. Although food habits of bobcats in coastal areas are poorly known, bobcats inhabiting coastal islands have been identified as a principal predator on white-tailed deer fawns (Epstein et al. 1983) and it is likely that marsh rabbits and rice rats constitute important food items (Sandifer et al. 1980).

The gray fox, being more typically associated with palustrine wetlands, is most abundant in inland areas of the ACE Basin but occurs commonly in the reserve buffer zone.

Small mammals also represent important faunal components of estuarine and maritime-influenced habitats and function as both predator and prey species within coastal ecosystems (Golley 1966, Sandifer et al. 1980). Although no known inventories of small mammal populations have been conducted in the reserve, reasonable inferences can be drawn from investigations and general observations made in similar coastal habitats. In an intensive study of mammals of Kiawah Island, located slightly north of the reserve, Schacher and Pelton (1979) documented the following species as occurring in various habitat types: dunes - house mouse, cotton rat, least shrew, rice rat, cotton mouse and wood rat; woodlands - cotton mouse, least shrew, wood rat, and cotton rat; dikes and chenicks - rice rats, least shrew, cotton mouse and cotton rat; pond/marsh edges - cotton rat, least shrew, rice rat and house mouse. In surveys of small mammals associated with rice field dikes along the Ashley River at Magnolia Gardens, Forsythe (unpubl. data) found the rice rat to be the most common species followed by the short-tailed shrew, house mouse, cotton mouse and cotton rat. Sandifer et al. (1980) also recognized the marsh rice rat as being among the most highly aquatic coastal rodents and the principal omnivorous mammal of the saltmarsh community. Dunes and high salt marshes vegetated by salt meadow cordgrass and associated transitional shrub communities have been noted as important habitat for the least shrew and cotton rat (Sanders 1978). The eastern mole has been documented to occur in several estuarine and maritime habitats including: a bare, tidal, sand flat between two "islands"; sand dunes, sandy soil within 50 feet of the tidal marsh and a sandy path through woods on Edisto Island (Golley 1966). Similar small mammal associations are expected to occur in respective habitats within the reserve.

Large to intermediate-sized herbivorous mammals associated with estuarine wetlands and/or adjacent upland habitats include: white-tailed deer, marsh rabbit, eastern cottontail rabbit, gray squirrel, and fox squirrel. The white-tailed deer occurs

in a variety of habitat types within the reserve with its relative abundance ranging from common on cove area islands to extremely abundant on mainland areas within the buffer zone. Although typically associated with mainland forest communities, the white tail, being an excellent swimmer and quite capable of traversing coastal marshes, often is observed crossing estuarine wetlands to reach marsh and barrier islands where it utilizes a diversity of habitats including beaches, dune systems and high salt marsh communities (Johnson et al. 1974, Schacher and Pelton 1979, Sandifer et al. 1980, Chabreck 1988). A recognized taxonomic subspecies of white tail, the Hunting Island white-tailed deer, occurs on Hunting Island, within the reserve buffer zone, and likely inhabits other closely adjoining islands (Taylor 1956). The marsh rabbit represents the herbivorous mammal most closely associated with estuarine marshes. The marsh rabbit, an ecologically dominant mammal of the high marsh zone, is, along with certain small mammals, an important link in food chains of predacious mammals, a variety of raptorial birds and some reptiles (Sandifer et al. 1980). Although cottontail rabbits are found on barrier islands and mainland areas adjacent to estuarine wetlands, they typically are more abundant on inland areas dominated by old field and agricultural habitats (Sanders 1978, Schacher and Pelton 1979). Therefore, cottontails are considered to be less significant components of the reserve's mammalian community. Gray and fox squirrels occur in various forest types within the reserve buffer zone. The gray squirrel is the most abundant of the two species and occurs in pine-mixed hardwood and hardwood communities; whereas, the fox squirrel is most often observed in open pine forests. Other than the raccoon, the opossum represents the most abundant medium-sized, omnivorous, forest mammal associated with the reserve. Although most typically associated with woodlands and palustrine forested wetlands, opossums occur in a variety of habitat types including dune areas (Golley 1966, Schacher and Pelton 1979).

Flying squirrels, together with several species of bats, represent a group of specialized arboreal mammals occurring in the project area. The flying squirrel is primarily a resident of hardwood forests where it utilizes tree cavities as den sites. Although bat populations are little studied in the reserve area, species accounts providing geographic distribution and habitat requirements suggest that at least five species (including the red bat, seminole bat, evening bat, eastern pipistrelle and Brazilian free-tailed bat) likely occur within the reserve. These bats are generally insectivorous and roost in trees or beneath tree bark except for the seminole bat that roosts in clumps of spanish moss (Golley 1966, Sanders 1978, Schacher and Pelton 1979).

D. Birds

As a taxonomic group, birds are perhaps the most studied and highly recognized class of vertebrates found in the ACE Basin NERR. The basin's complex system of diverse wetland types together with associated upland communities provide habitat for over 260 bird species (Murdock 1981). This large avian community includes

permanent residents, spring and winter residents and transients that reflect the biological richness of the region through a broad array of trophic relationships.

Birds of the coastal marine ecosystem are primarily piscivorous or benthic feeders but also include omnivorous species and scavengers (Johnson et al. 1974, Sandifer et al. 1980). Dominant piscivorous and scavenger species include the brown pelican, double crested cormorant and five species of gulls and terns. Three species of waterfowl (lesser scaup, surf scoter and black scoter) inhabiting coastal marine waters in winter are benthivores feeding on mollusks crustaceans and worms. Other than the gulls and terns utilizing adjacent coastal waters, the dominant birds of intertidal beaches are shore birds feeding on macrobenthic organisms. The black skimmer employs a specialized feeding behavior by taking fish while skimming the surface of shallow waters. Most of the principal birds of intertidal beaches are permanent residents except for the knot and the least tern which are winter and spring residents, respectively (Table 9).

Within the maritime ecosystem, the royal tern, laughing gull, brown pelican, tricolored heron and snowy egret are the dominant birds of bird key and bank habitats (Table 10). Although bird keys and banks provide important loafing and perching sites for coastal water birds, perhaps their greatest ecological value is providing nesting sites for breeding marine birds. Egg bank, located within the Beaufort County portion of St. Helena Sound, is a relatively large sand bank that historically has served as an important rookery for brown pelicans, black skimmers and royal terns (Wilkinson 1981). Although pelican nesting habitat on Egg Bank recently has been lost due to severe erosion from coastal storms, Egg Bank continues to function as a productive rookery for black skimmers and royal terns. As bird key and banks are a highly dynamic component of the maritime ecosystem, their annual stability as productive rookery sites is expected to vary in accordance with site-specific erosion and accretion processes.

Other important shore bird rookery sites located within the maritime ecosystem of the ACE Basin NERRS include several least tern colonies associated with beaches on Edisto Island (Table 10). As South Carolina least tern populations currently are classified as threatened on the state level, the SCWMRD closely monitors the Edisto Island least tern colonies.

As the three remaining subsystems of the maritime ecosystem (dune, transitional shrub and maritime forest) are contiguous and grade into one another, considerable overlap of species exist among associated avian communities (Table 10). Due to harsh environmental factors and comparative lower vegetative diversity, species richness is considerably lower in dune (11 dominant species) and transitional shrub (9 dominant species) habitats as compared to the maritime forest (38 dominant species).

Table 9. Dominant birds of the coastal marine ecosystem occurring in the proposed ACE Basin NERR.
(Compiled from Sprunt and Chamberlain 1949, 1970; Audubon Field Notes 1967-1970, Chamberlain 1968, American Birds 1971-1977, Forsythe 1978 in Sandifer et al. 1980).

Marine Subtidal Waters			Intertial Beaches		
Brown Pelican	C	PR	Brown Pelican	C	PR
Double Crested Cormorant	C	PR	Black-bellied plover	C	PR
Herring gull	C	PR	Willet	C	PR
Ring-billed gull	C	PR	Knot	FC	WR
Laughing gull	C	PR	Least sandpiper	C	PR
Royal tern	C	PR	Dunlin	C	PR
Forsters tern	C	PR	Semipalmated sandpiper	C	PR
Lesser scaup	C	WR	Western sandpiper	C	PR
Surf scoter	C	WR	Sanderling	C	PR
Black scoter	C	WR	Herring gull	C	PR
			Ring-billed gull	C	PR
			Laughing gull	C	PR
			Least tern	C	SR
			Royal tern	C	SR
			Black skimmer	C	PR

C - common, seen in good numbers

FC - fairly common, moderate numbers

PR - permanent resident, present year around

WR - winter resident

SR - summer resident

Table 10. Dominant birds of the maritime ecosystem occurring in the proposed ACE Basin WERR (compiled from Sprunt and Chamberlain 1949, 1970, Burleigh 1958, Audubon Field Notes 1967-1970, Chamberlain 1968, American Birds 1971-1977, Shanholtzer 1974, Forsythe 1978 in Sandifer et al. 1980).

Bird Keys and Banks			Dune Subsystem			Transition Shrub System			Maritime Forest Subsystem					
Royal Tern	C	PR	Sparrow hawk	C	PR	Ground dove	C	PR	Red-tailed hawk	C	PR	Northern parula	C	SR
Laughing gull	C	PR	Least tern	C	SR	Eastern kingbird	C	SR	Red-shouldered hawk	C	PR	Yellow-rumped warbler	C	WR
Brown pelican	C	PR	Mourning dove	C	PR	Tree Swallow	C	WR	Mourning dove	C	PR	Pine Warbler	C	PR
Louisiana heron	C	PR	Ground dove	FC	PR	Mocking bird	C	PR	Yellow-billed cuckoo	C	SR	Yellow throat	C	PR
Snowy Egret	C	PR	Night hawk	C	SR	Yellow-rumped warbler	C	WR	Great horned owl	FC	PR	American redstart	C	T
			Tree Swallow	C	WR	Yellow throat	C	PR	Chuck-will's widow	C	SR	Red winged blackbird	C	PR
			Fish crow	C	PR	Yellow-breasted chat	C	SR	Chimney swift	C	SR	Boat-tailed grackle	C	PR
			Yellow-rumped warbler	C	WR	Red-winged blackbird	C	PR	Ruby-throated hummingbird	C	PR	Common grackle	C	PR
			Red-winged blackbird	C	PR	Painted bunting	C	SR	Common flicker	C	PR	Cardinal	C	PR
			Boat-tailed grackle	C	PR				Pileated woodpecker	FC	PR	Painted bunting	C	SR
			Savannah sparrow	C	WR				Red-bellied woodpecker	C	PR	Rufous-sided towhee	C	PR
									Downy wood pecker	C	PR	White-throated sparrow	C	WR
									Great crested flycatcher	C	SR	Song sparrow	C	WR
									Eastern phoebe	C	WR	Swamp sparrow		
									Tree swallow	C	WR			
									Common crow	C	PR			
									Fish crow	C	PR			
									Carolina chickadee	C	PR			
									Carolina wren	C	PR			
									Catbird	C	PR			
									Robin	C	PR			
									Blue-gray gnatcatcher	C	PR			
									Ruby-crowned kinglet	C	WR			
									White-eyed vireo	C	PR			

C - Common, seen in good numbers
FC - Fairly common, moderate numbers
PR - Permanent resident, present year around
WR - Winter resident
SR - Summer resident
T - Transient resident

Birds characteristically inhabiting the dunes are principally grainivores (doves, blackbirds, sparrow) and insectivores (swallows, warblers, night hawks). The fruits of shrubs and vines such as wax myrtle, red cedar yaupon, greenbrier and Virginia creeper are important foods for many birds of the transitional shrub zone including the tree swallow, mocking bird, yellow-rumped warbler and yellow-breasted chat. The maritime forest offers a variety of vertical zones or niches for birds.

The live oak forests draped with festoons of Spanish moss are particularly important in providing nesting and feeding habitat for large numbers of songbirds and woodpeckers. Although dominated by insectivorous species, trophic levels range from the diminutive, nectar feeding ruby-throated hummingbird to large avian predators such as the red-tailed hawk and great horned owl. Overall seasonal variation in the number of bird species using the maritime ecosystem is dominated by permanent residents, however, spring and winter residents also are well represented (Johnson et al 1974, Sandifer et al. 1980).

Birds of the estuarine subtidal system are principally scavengers, piscivores, benthivores and occasional insectivores. Dominant scavengers include the herring gull, ring-billed gull and laughing gull. The laughing and ring billed gulls also occasionally employ insectivorous feeding strategies. The brown pelican, double crested cormorant, red breasted merganser, royal tern and forster's tern are the dominant piscivores. The gulls, terns, brown pelican and cormorant are considered to be the most characteristic birds of the open water estuarine system and are observed throughout the year resting and feeding in open waters of St. Helena Sound and the associated tri-river drainage basin (Sandifer et al. 1980). The red-breasted merganser is a common winter resident most often associated with the extensive saltmarsh river and creek system. During winter, large concentrations of sea and diving ducks principally lesser scaup and black scoter often are observed in St. Helena Sound resting and feeding on benthic organisms (Table 11).

Estuarine emergent marshes provide a unique habitat for birds, and significant ecological relationships exist between large numbers of birds and the marsh vegetation. The vegetation itself serves as a base for feeding, reproduction and roosting activities for birds. Emergent marsh vegetation is used as roosting and resting sites for red-winged black birds, swallows and wrens. Shorebirds use wracks of dead smooth cordgrass as resting sites. Most plant-based roosting occurs in the medium to tall smooth cordgrass zone, where the grass presumably is better able to support the bird weight. Emergent marshes serve as important nesting areas for the long-billed marsh wren and red-winged blackbird. The clapper rail is one of the most dominant and perhaps the most characteristic bird of estuarine emergent marshes. It is a permanent resident that feeds, roosts, nests and raises its young within the regularly flooded salt marsh. Examples of the eight trophic levels occupied by estuarine emergent bird species are as follows: raptors - northern harrier;

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C - Common, seen in good numbers
PR - Permanent resident, present year around
WR - Winter resident
SR - Summer resident

piscivores - great blue heron; scavengers - fish crow; insectivores - long-billed marsh wren; aquatic herbivores - lesser scaup; macrobenthivores - white ibis; microbenthivores - spotted sandpiper; and omnivores - boat-tailed grackle (Johnson et al. 1974, Shanholtzer 1974, Sandifer et al. 1980). Most of the dominant birds of the emergent marshes are common residents throughout the year. However, the Least tern is a common summer resident and the tree swallow, sharp-tailed sparrow and lesser scaup are common during winter (Table 11).

At least 12 colonial wading bird rookeries occur in close proximity to estuarine emergent wetlands within the ACE Basin NERR (Table 12). Most of these sites are directly associated with isolated freshwater or low-salinity wetlands that function to provide energetically efficient foraging habitats. Although extensive foraging habitat is typically available in the nearby salt marshes, these isolated wetlands provide the required high concentration of readily available small fish essential in meeting the nutritional requirements of both adult and young colonial wading birds. Accordingly, individual nesting colony productivity may vary annually in response to available water conditions as influenced by local rainfall (T. M. Murphy, person commun.).

Intertidal flats represent a highly dynamic and productive habitat for estuarine-dependent birds. Flats support a diverse biotic community, which in turn support a large and diverse avian population. Of the 23 dominant species all but the least tern are permanent residents (Table 11). Most of the characteristic species using intertidal flats are either wading birds or true shore birds. Five species of egrets and herons make extensive use of intertidal flats when feeding on penaeid shrimp, fiddler crabs and small fish. The rich meiofaunal and macrofaunal benthic communities provide important food sources for large numbers of resident and migrating shorebirds. A variety of gulls and terns that feed primarily in adjacent habitats use flats as resting sites. Although generally not considered aquatic, the boat-tailed grackle forages on invertebrates and small fishes associated with intertidal flats (Sandifer et al. 1980).

Estuarine impoundments are among the most dramatic and active ecological units for birds. Some 69 species of wetland dependent birds are associated with impoundments in the ACE Basin NERR (Table 13). Additionally, the impoundment dike systems provide an extensive complex of terrestrial habitats that function as productive ecotonal communities for birds. Over 140 species of birds, many of which are passerine or generally considered as non-wetland dependent, have been found using the dikes of estuarine impoundments (Bettinger and Hamilton 1985).

Waterbirds associated with estuarine impoundments may ecologically be classified into 7 groups: waterfowl, wading birds, aerial divers, surface divers, shorebirds, rails and raptors (Epstein 1989). Most impoundments in the ACE Basin NERR are specifically managed to provide wintering habitat for waterfowl and are characterized by a dominance of plants providing food and cover for migratory ducks; waterfowl are probably the dominant group numerically.

Table 12. Documented Colonial wading bird nesting activity in the proposed ACE Basin NERR, 1978-1990
(S.C. Wildlife and Marine Resources Department, Unpubl. data).

Species	Yearly number of nests													
	1978	1979	1980	1981	1982	1983	1984	1985	1986	*1987	1988	1989	1990	TOTAL
Great blue heron	30	22	0	55	12	52	41	25	34	28	29	60	72	460
Great egret	0	0	0	0	0	0	47	63	5	14	63	25	112	329
Snowy egret	0	0	0	0	0	0	23	20	0	20	8	370	110	551
Arhinga	0	0	0	0	0	0	6	0	0	0	0	0	0	6
Little Blue heron	0	0	0	0	0	0	0	0	0	0	0	24	0	24
Green-backed heron	0	0	0	0	0	0	2	0	0	0	0	43	0	45
Tricolored heron	0	0	0	0	0	0	0	0	0	0	0	42	25	67
Black-crowned night-heron	0	0	0	0	0	0	0	0	0	0	16	6	0	22

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*Initial year of comprehensive annual colonial wading bird surveys.

Table 13. Birds of estuarine intertidal impoundments in the ACE Basin (Sprunt and Chamberlain 1949, 1970, Burleigh 1958, Audubon Field Notes 1967-1970, Chamberlain 1968, American Birds 1971, Sharholtzer 1974, Forsythe 1978 in Sandifer et al. 1980; SCWRD unpubl. records).

Black-bellied plover	C	PR	Great egret	C	PR	Common moorhen	C	PR
Semipalmated plover	C	PR	Snowy egret	C	PR	American Coot	C	WR
Spotted sandpiper	C	PR	White ibis	C	PR	Mallard	C	WR
Semipalmated sandpiper	C	PR	Glossy ibis	FC	PR	Black duck	C	WR
Least sandpiper	C	PR	Wood stork	FC	PR	Mottled duck	C	PR
Dunlin	C	PR	Herring gull	C	PR	Pintail	C	WR
Lesser yellowlegs	FC	WR	Ring-billed gull	C	PR	Gadwall	C	WR
Greater yellowlegs	C	PR	Laughing gull	C	PR	American wigeon	C	WR
Dowitcher	C	PR	Belted kingfisher	FC	PR	Shoveler	C	WR
Black-necked stilt	FC	SR	Forsters tern	C	PR	Blue-winged teal	C	WR
Willet	C	PR	Gull-billed tern	FC	SR	Wood duck	FC	PR
American avocet	U	WR	Brown pelican	C	PR	Green-winged teal	C	WR
Great blue heron	C	PR	Black skimmer	FC	PR	Canvasback	U	WR
Tricolored heron	C	PR	Double-crested cormorant	C	PR	Redhead	FC	WR
Little blue heron	C	PR	Anhinga	C	PR	Bufflehead	FC	WR
Green-backed heron	FC	PR	Pied-billed grebe	C	PR	Ruddy duck	C	WR
Black-crowned night heron	C	PR	Horned grebe	U	WR	Hooded merganser	C	WR
Black-crowned night heron	C	PR	Bald eagle	FC	WR	Red breasted merganser	U	WR
Yellow-crowned night heron	FC	PR	Osprey	FC	PR	Canada goose	U	WR
Least bittern	FC	SR	Virginia rail	FC	WR	Snow goose	U	WR
American bittern	FC	WR	King rail	FC	WR	Tundra Swan	U	WR
			Black rail	U	?			
			Sora	FC	WR			

C - Common, seen in good numbers
 FC - Fairly common, moderate number
 PR - Permanent resident, present year around
 WR - Winter resident
 SR - Summer resident
 T - Transient resident

Dabbling ducks represent the principal group of waterfowl using the impoundments and are generally characterized as seed eating herbivores (i.e. mallard, northern pintail, green-winged teal) and grazing herbivores (i.e. American widgeon, gadwall). Wading birds are perhaps the second most abundant group and forage intensively in shallow water areas associated with high marsh zones within impoundment complexes. Impoundments also receive intensive use by wading birds, particularly great egrets, snowy egrets and white ibis when the availability of prey organisms (small fish and invertebrates) is enhanced during the drawdown phase of management. Estuarine impoundments are considered to be important foraging habitats for numerous nesting colonies of wading birds both within the reserve site and in the overall ACE Basin region (T. M. Murphy, person. commun.). A wide variety of aerial divers (gulls, terns, brown pelicans, black skimmers, belted kingfishers) and surface divers (pied-billed grebe, anhinga, double-crested cormorant) rest on the water's surface and feed on fish in the impoundments. When mud flats are exposed during spring drawdown, shore birds particularly sandpipers, plovers, dunlins and dowitchers forage intensively on benthic invertebrates. A distinctive shorebird, the black-necked stilt appears to be increasing in abundance and has been observed to successfully nest on impoundment berms in stranded emergent debris. The American coot, common winter resident, and the common moorhen, that breeds in abundance as well as winters in estuarine impoundments, feed extensively on submerged aquatics and represent the dominant species of the rail group. The black rail, generally considered to be rare and poorly understood, has been sighted in association with impoundment habitat on Bear Island WMA (D. Forsyth, person. commun.). Other than the bald eagle previously discussed, the osprey which commonly forages the impoundments, is the only other raptor directly associated with estuarine impoundments.

Upland habitat within the reserve is classified as including three general community types (old field, pine forest and pine-mixed hardwood forest) each having characteristic densities of birds. Old field habitats characterized by high interspersions of vegetative types, support rich concentrations of bird life including raptors (red tailed hawk) insectivores (cardinal, wren) omnivores (eastern bobwhite), and granivores (savannah sparrow). Characterized by relatively low habitat diversity, the upland pine forest supports only 13 species of dominant birds compared to the old field and pine-mixed hardwood communities that support 25 and 33 dominant species, respectively.

The pine-mixed hardwood forest community, involving significant vegetation structure with diverse understory and subcanopy characteristics, represents an important bird habitat. Avifauna trophic relationships of pine-mixed hardwood habitats are complex and involve seven consuming groups represented as follows: raptors (screech owl), insectivores (pileated woodpecker), omnivores (robin), scavengers (black vulture), vegetarian (cedar waxwing), granivores (mourning dove), and nectivores (ruby-throated hummingbird) (Sandifer et al. 1980). Overall seasonal

balance among dominant birds in upland habitats involves a preponderance of permanent residents, however, spring and winter residents also are well represented (Table 14).

e. Fishes

(1) Marine and Estuarine

The ACE Basin NERR provides a diversity of habitat types for a variety of fishes. The majority of fishes found in the area are of two general categories: 1) resident species which spend their entire lives in nearshore or estuarine environments (e.g., killifishes, silversides, and bay anchovy), and 2) seasonal migrants which utilize the area during only a part of their life cycle (e.g., mullets, menhaden, and many sciaenids). The first group of fishes is restricted to nearshore and estuarine waters, while the latter (which is the predominant group in terms of numbers of species and individuals) generally spawns offshore, moving into the estuary as larvae or postlarvae.

The reserve provides valuable habitat, nursery areas rich in food and refuge from predators. Vast numbers of young-of-the-year, motile species are found in the estuarine zone, moving seaward in response to physiological and environmental changes, especially during the summer and fall. Like penaeid shrimp, such fishes are "migrating subsystems" (Odum et al. 1974) linking the marine and estuarine environments. The major types of habitat supporting marine and estuarine fishes within the reserve are: subtidal marine waters; intertidal marine surf zone; subtidal estuarine waters (tidal rivers, channels, creeks); intertidal estuarine bottoms including flats, marshes, and oyster reefs; and salt or brackish water impoundments. Most common marine fish species are not confined to one habitat type and may occur in several habitats on a seasonal basis or at different stages in their life cycles (Bearden 1990).

Those species which have adapted to the rigors of highly variable salinities, temperatures, and habitat types are generally the most successful in the ACE Basin. Some euryhaline species, such as several sciaenids, menhaden, mullet, and others are found up-river in fresh water at times, especially as juveniles. Although no all-inclusive list of fish species occurring in the reserve marine waters is given here, Table 15 presents the characteristic habitats of some of the more common species.

Fishes of subtidal estuarine habitats (sounds, tidal rivers, and large creeks) have been investigated more intensively than those of any other environment within the ACE Basin. Bears Bluff Labs conducted trawl sampling in the ACE Basin area at regularly monthly stations from 1953-1964 (Bears Bluff Labs, 1964). Shealy (1974, 1975) and Shealy et. al. (1974, 1975) reported on bottom trawl investigations in estuaries of South Carolina. Key sampling locations were in the ACE Basin region.

Table 14: Dominant birds of the upland ecosystem occurring in the proposed ACE Basin NERR (Sprunt and Chamberlain 1949, 1970, Burleigh 1958, Audubon Field Notes 1967-1970, Chamberlain 1968, American Birds 1971-1977, Sharholtzer 1974, Forsythe 1978 in Sandifer et al. 1980).

Old Field Communities			Pine Forest Communities			Pine-Marsh Hardwood Forest Communities					
Red-tailed hawk	C	PR	Eastern bobwhite	C	PR	Black vulture	C	PR	Blue-gray gnatcatcher	C	PR
American kestrel	C	PR	Screech owl	C	PR	Mourning dove	C	PR	Ruby-crowned kinglet	C	WR
Eastern bobwhite	C	PR	Red-bellied woodpecker	C	PR	Screech owl	C	PR	White-eyed vireo	C	PR
Eastern kingbird	C	SR	Eastern wood pewee	C	SR	Chuck-wills widow	C	SR	Red-eyed vireo	C	SR
Tree swallow	C	WR	Southern crested flycatcher	C	SR	Ruby-throated hummingbird	C	SR	Northern warbler	C	SR
Barn swallow	C	PR	Common crow	C	PR	Common Flicker	C	PR	Yellow-rumped warbler	C	WR
Common crow	C	PR	Carolina chickadee	C	PR	Pileated woodpecker	FC	PR	Yellow-throated warbler	C	PR
House wren	C	WR	Brown-headed nuthatch	C	PR	Red-bellied woodpecker	C	PR	Hooded warbler	C	T
Carolina wren	C	PR	Eastern bluebird	C	PR	Downy woodpecker	C	PR	American redstart	C	PR
Mockingbird	C	PR	Yellow-throated warbler	C	PR	Great crested flycatcher	C	SR	Cardinal	C	PR
Loggerhead shrike	C	PR	Pine warbler	C	PR	Blue jay	C	PR	Rufous-sided towhee	C	PR
Yellow-rumped warbler	C	WR	Summer tanager	C	SR	Common crow	C	PR	Dark-eyed junco	C	WR
Prairie warbler	C	PR	Bachman's sparrow	FC	PR	Carolina chickadee	C	PR	White-throated sparrow	C	WR
Yellowthroat	C	PR				Tufted titmouse	C	PR	Song sparrow	C	WR
Yellow-breasted chat	C	SR				House wren	C	WR			
Eastern meadowlark	C	PR				Carolina wren	C	PR			
Red-winged blackbird	C	PR				Catbird	C	PR			
Cardinal	C	PR				Robin	C	WR			
Painted bunting	C	SR				Hermit thrush	C	WR			
Rufous-sided towhee	C	PR									
Savannah Sparrow	C	WR									
Dark-eyed junco	C	WR									
Chipping sparrow	C	PR									
White-throated sparrow	C	WR									
Song sparrow	C	WR									

C - Common, seen in good numbers
 FC - Fairly common, moderate numbers
 PR - Permanent resident, present year around
 WR - Winter resident
 SR - Summer resident
 T - Transient resident

Table 15. Characteristic habitats of some of the more important marine and estuarine fishes occurring in the ACE Basin Reserve. -Rare, *Uncommon, **Common, ***Abundant

SPECIES	HABITAT TYPE				
	SUBTIDAL MARINE	SURF ZONE	SUBTIDAL ESTUARINE	INTERTIDAL ESTUARINE	IMPOUNDMENTS
<u>Carcharhinus</u> spp.	***	**	**	*	-
<u>Sphyrna</u> spp.	**	*	**	*	-
Spiny dogfish	***	*	**	-	-
Clearnose skate	**	-	*	-	-
Atlantic stingray	*	*	**	**	-
Atlantic sturgeon	*	-	**	*	-
Longnose gar	*	-	**	**	***
Ladyfish	*	*	**	**	-
American eel	**	-	**	*	**
Atlantic menhaden	***	*	***	**	***
<u>Dorosoma</u> spp.	*	-	***	**	*
Atlantic thread herring	***	*	***	**	*
<u>Alosa</u> spp.	**	*	**	*	*
Carp	-	-	*	**	-
Bay anchovy	**	***	***	***	**
Mummichog	-	*	**	***	***
Striped killifish	*	***	*	**	*
Sailfin molly	-	-	*	**	***
Sheepshead minnow	-	*	*	***	**
Mosquitofish	-	-	*	*	-
White catfish	-	-	***	*	***
Sea catfish	***	*	***	***	-
Oyster toadfish	**	*	**	*	-
<u>Urophycis</u> spp.	***	*	***	-	-
<u>Menidia</u> spp.	*	***	*	***	**
<u>Morone</u> spp.	-	-	**	**	*
Bluefish	**	*	**	**	-
Spanish mackerel	***	*	*	*	-
Atlantic bumper	**	*	**	*	*
<u>Trachinotus</u> spp.	**	***	*	*	*
<u>Caranx</u> spp.	**	**	**	*	*
<u>Eucinostomus</u> spp.	*	*	*	**	**
Pigfish	**	-	**	*	*

Table 15. Concluded

Pinfish	**	-	**	**	*
Silver perch	**	*	**	*	**
Sheepshead	**	*	***	***	**
Weakfish	*	*	**	***	**
Banded drum	***	-	***	*	**
Spot	**	*	**	*	-
Southern kingfish	***	*	***	**	***
Gulf kingfish	**	**	*	-	-
Atlantic croaker	***	*	***	*	*
Black drum	*	**	**	**	**
Star drum	***	*	***	*	-
Red drum	**	**	**	**	**
<u>Mugil</u> spp.	**	***	***	***	***
Southern strargazer	*	*	**	*	-
<u>Hypsoblennius</u> spp.	*	-	**	*	-
<u>Gobionellus</u> spp.	*	-	**	**	*
<u>Gobiosoma</u> spp.	*	-	**	**	*
Atlantic cutlassfish	***	-	**	-	-
<u>Peprilus</u> spp.	**	*	**	-	-
<u>Prionotus</u> spp.	***	*	**	*	-
Windowpane	**	-	**	-	-
<u>Citharichthys</u> spp.	***	*	***	*	*
Fringed flounder	***	*	***	*	*
<u>Paralichthys</u> spp.	**	*	***	***	**
Hogchoker	***	*	***	*	*
Blackcheek tonguefish	***	*	***	*	*
Planehead filefish	***	*	***	-	-
Northern puffer	**	*	**	*	-
Striped burrfish	**	*	**	**	*

Table 16. Trophic levels of some of the more important marine and estuarine fishes occurring within the ACE Basin Region.

<u>SPECIES</u>	<u>ORGANIC DETRITUE</u>	<u>VASCULAR PLANTS</u>	<u>ALGAE</u>	<u>PHYTOPLANKTON</u>	<u>ZOOPLANKTON</u>	<u>BENTHIC INVERTEBRATES</u>	<u>INSECTS</u>	<u>FISH</u>
I. <u>Herbivores</u> (predominately)								
Striped mullet	x	-	x	x	-	x	-	-
Atlantic menhaden	x	-	x	x	x	-	-	-
Sheepshead minnow	x	x	x	-	-	-	x	-
Sailfin molly	x	-	x	-	x	-	x	-
II. <u>Omnivores</u>								
Atlantic sturgeon	-	x	x	-	-	x	x	x
Carp	-	x	x	-	-	x	x	x
<u>Dorosoma</u> app.	x	-	-	-	x	x	-	-
White catfish	x	x	-	-	x	x	x	x
III. <u>Primary Carnivores</u>								
Bay anchovy	-	-	-	-	x	-	-	-
Atlantic silverside	-	-	-	-	x	-	-	-
Mosquitofish	-	-	-	-	-	-	x	-
IV. <u>Mid Carnivores</u>								
Atlantic stingray	-	-	-	-	-	x	-	x
American eel	-	-	-	-	-	x	x	x
Sea catfish	-	-	-	-	-	x	-	x
Oyster toadfish	-	-	-	-	-	x	-	x
<u>Urophycis</u> spp	x	-	-	-	x	x	-	x
Mummichog	x	-	x	-	x	x	x	x
Striped killifish	-	-	-	-	x	x	-	x
Atlantic bumper	-	-	-	-	x	-	-	x
<u>Trachinotus</u> spp	-	-	-	-	x	x	-	x
<u>Peprilus</u> spp.	-	-	-	-	x	x	-	x
Pinfish	-	-	-	-	x	x	-	x
Silver perch	-	-	-	-	x	x	-	x
Banded drum	-	-	-	-	x	x	-	x
Southern kingfish	-	-	-	-	x	x	-	x
Spot	-	-	-	-	x	x	-	x

Table 16. Concluded

<u>SPECIES</u>	<u>ORGANIC DETRITUE</u>	<u>VASCULAR PLANTS</u>	<u>ALGAE</u>	<u>PHYTOPLANKTON</u>	<u>ZOOPLANKTON</u>	<u>BENTHIC INVERTEBRATES</u>	<u>INSECTS</u>	<u>FISH</u>
Atlantic croaker	-	-	-	-	X	X	-	X
Star Drum	-	-	-	-	X	X	-	X
<u>Gobionellus</u> spp.	-	-	-	-	X	X	-	X
<u>Hypsoblennius</u> spp.	-	-	-	-	X	X	-	X
<u>Prionotus</u> spp.	-	-	-	-	X	X	-	X
Bay whiff	-	-	-	-	X	X	-	X
Fringed flounder	-	-	-	-	X	X	-	-
Hogchoker	-	-	-	-	-	X	-	-
Blackcheek tonguefish	-	-	-	-	-	X	-	-

V. Top Carnivores

<u>Carcharhinus</u> spp.	-	-	-	-	-	X	-	X
Longnose gar	-	-	-	-	-	X	-	X
Atlantic needlefish	-	-	-	-	-	X	-	X
Striped bass	-	-	-	-	-	X	-	X
White perch	-	-	-	-	-	X	-	X
Ladyfish	-	-	-	-	-	X	-	X
Bluefish	-	-	-	-	-	X	-	X
Spanish mackerel	-	-	-	-	-	X	-	X
<u>Cynoscion</u> spp.	-	-	-	-	-	X	-	X
Red drum	-	-	-	-	-	X	-	X
<u>Paralichthys</u> spp.	-	-	-	-	-	X	-	X

a. Larval and juvenile stages may function as mid carnivores.

Some of these same sampling stations are currently being used by SCWMRD (David Whitaker, per. comm.).

Table 16 presents a summary of trophic levels of the more important species occurring in the ACE Basin. Of the more common fish species found within the estuary, the predominant herbivores are mullets and menhaden. The predominant primary carnivores within this habitat is the bay anchovy, which feeds largely on copepods and other zooplankters (Odum 1970a). Most of the common young-of-the-year fishes found within the estuarine habitat (including star drum, Atlantic croaker, spot, silver perch, juvenile weakfish, flounders, hogchokers, blackcheek tonguefish, white catfish and spotted hake) are opportunistic mid carnivores, feeding on a wide variety of planktonic and benthic organisms (Table 16). Top carnivores in estuarine waters include various species of sharks such as carcharinids and hammerheads (Bearden 1965, Hicks 1972), as well as longnose gar, Atlantic needlefish, striped bass, white perch, bluefish, ladyfish, Spanish mackerel, weakfish, seatrout, red drum, and flounders. The young of many of these species may function as mid carnivores or even primary carnivores as postlarvae and early juveniles. These species feed largely on smaller fishes including the herbivores, primary carnivores, and mid carnivores mentioned above, as well as on penaeid shrimp, grass shrimp (*Palaemonetes* spp.), crabs, squid, mollusks, and other motile and sessile invertebrates (Tabb 1966, Mahood 1974).

(2) Freshwater

Freshwater fish studies conducted in the lower ACE Basin have dealt primarily with anadromous species (Wade 1971, Curtis 1970, White 1969, 1970). However, limited census work (Curtis 1970, Allen 1990) and fish surveys (Anderson 1964, Bayless 1968) have been conducted in the upper riverine areas.

The tri-river system is important to six species of anadromous fishes (American shad, hickory shad, blueback herring, striped bass, Atlantic sturgeon and shortnose sturgeon) and one catadromous species (American eel). Anadromous species annually use the upper reaches of the riverine system as spawning grounds and nursery grounds for developing larvae and juveniles. The American eel spends most of its adult life in this and adjoining freshwater ecosystems.

APPENDIX H
SPECIES LISTS

PLANTS

Alders
Alligator-weed
Amaranth
American beech
American climbing fern
American elm
American holly
American hornbeam
American three-square bulrush
Annual salt marsh aster
Arrow-arum
Arrowhead
Arrowheads
Arrowwood
Asiatic dayflower
Asiatic panic grass
Asiatic panicum
Aster
Aster
Aster
Aster
Aster
Aster
Aster
Asters
Autumn coral-root

Baggy-knees
Bald cypress
Bald rush
Baldwin's nutrush
Bamboo
Bamboo brier
Banana water-lily
Barbara's buttons
Barley
Bay starvine
Beach elder
Beach grass
Beach hogwort
Beach pea
Beach pennywort
Beak rush
Beak rush
Beak rush
Beak rush
Beak rush
Beak rush
Beak rushes
Bearded grass-pink
Beard grass
Beard grass
Beard grass
Bedstraw
Beech
Beggar lice
Beggar lice
Beggar ticks
Beggar ticks
Beggar ticks
Beggar weeds
Bermuda grass
Big duckweed
Big floating heart

Alnus spp.
Alternanthera philoxeroides
Amaranthus spp.
Fagus grandifolia
Lygodium palmatum
Ulmus americana
Ilex opaca
Carpinus caroliniana
Scirpus americanus
Aster subulatus
Peltandra virginica
Sagittaria graminea var. weatherbiana
Sagittaria spp.
Viburnum dentatum
Aneilema keisak
Panicum bisulcatum
Panicum bisulcatum
Aster laevis var. concinus
Aster laevis var. laevis
Aster praealtus
Aster puniceus
Aster simplex
Aster squarrosus
Aster tenuifolius
Aster spp.
Corallorhiza odontorhiza

Sacciolepis striata
Taxodium distichum
Psilocarya scirpoides
Scleria baldwinii
Smilax laurifolia
Smilax auriculata
Nymphaea mexicana
Marshallia graminifolia
Hordeum spp.
Schisandra glabra
Iva imbricata
Panicum amarulum
Croton punctatus
Strophostyles helvola
Hydrocotyle bonariensis
Rhynchospora Careyana
Rhynchospora corniculata
Rhynchospora decurrens
Rhynchospora glomerata
Rhynchospora macrostachya
Rhynchospora megalocarpa
Rhynchospora plumosa
Rhynchospora spp.
Calopogon barbatus
Andropogon Elliottii
Gymnopogon brevifolius
Andropogon sp.
Galium circaezans
Fagus grandifolia
Desmodium spp.
Desmodium marilandicum
Desmodium spp.
Bidens spp.
Bidens pilosa
Desmodium spp.
Cynodon dactylon
Spirodela polyrrhiza
Nymphoides aquatica

Big primrose willow
 Big-rooted manroot
 Bird's eye
 Biscuit-flower
 Bitter gallberry
 Blackberries
 Black cherry
 Black gum
 Black jack oak
 Black needlerush
 Black oak
 Black-root
 Black rush
 Black-stemmed spleenwort
 Black titi
 Black willow
 Bladderwort
 Bladderwort
 Bladderwort
 Bladderwort
 Bladderwort
 Bladderwort
 Bladderworts
 Blazing star
 Blazing stars
 Blue beach
 Blueberries
 Blueberry
 Blueberry
 Blue cat-tail
 Blue-eyed grass
 Blue flag
 Bluegrass
 Bluejack oak
 Blue star
 Bluestem
 Bluestem
 Bog buttons
 Bottlebrush three awn grass
 Box elder
 Boykin's lobelia
 Bracken fern
 Brazilian elodea
 Bristle-fruited spermolepsia
 Broadleaf waterplantain
 Broom sedge
 Broom-straw
 Broom-straw
 Broom-straw
 Brown-top millet
 Buckwheat tree
 Bugleweed
 Bugleweed
 Bull bay
 Bullgrass
 Bullgrass
 Bullgrass
 Bulrush
 Bulrush
 Bulrush
 Bulrush
 Bulrush
 Bulrushes
 Burmannia
 Bushy broom sedge
 Bushy pondweed
 Bushy pondweed
 Bushy pondweeds
 Buttercup-leaved pennywort
 Butterfly-bush
 Butterfly pea

Ludwigia peploides var. glabrescens
Ipomoea macrorhiza
Veronica persica
Sarracenia flava
Ilex glabra
Rubus spp.
Prunus serotina
Nyssa sylvatica
Quercus marilandica
Juncus roemerianus
Quercus velutina
Pterocaulon pycnostachyum
Juncus roemerianus
Asplenium resiliens
Cliftonia monophylla
Salix nigra
Utricularia inflata
Utricularia inflata var. minor
Utricularia olivacea
Utricularia purpurea
Utricularia subulata
Utricularia vulgaris
Utricularia spp.
Liatris tenuifolia
Liatris spp.
Carpinus caroliniana
Vaccinium spp.
Vaccinium caesariense
Vaccinium myrsinites
Typha glauca
Sisyrinchium mucronatum
Iris virginica
Poa compressa
Quercus incana
Amsonia ciliata
Andropogon elliottii
Andropogon gerardii
Lachnocaulon bevrichianum
Aristida spiciformis
Acer negundo
Lobelia boykinii
Pteridium aquilinum
Egeria densa
Spermolepsia echinata
Alisma plantago-aquatica
Andropogon virginicus
Andropogon sp.
Andropogon elliottii
Andropogon ternarius
Panicum ramosum
Cliftonia monophylla
Lycopus americanus
Lycopus sessilifolius
Magnolia grandiflora
Paspalum boscianum
Paspalum dissectum
Paspalum distichum
Scirpus americanus
Scirpus cyperinus
Scirpus etuberculatus
Scirpus robustus
Scirpus validus
Scirpus spp.
Burmannia biflora
Andropogon virginicus
Najas guadalupensis
Najas minor
Najas spp.
Hydrocotyle ranunculoides
Buddleja sp.
Centrosema virginianum

Butterfly pea
 Butter-print
 Butterweed
 Butterwort
 Butterworts
 Button bush
 Buttonweed

 Cabbage palmetto
 Cactus
 Calliopsis
 Camphorweed
 Camphorweed
 Camphorweed
 Canada bluegrass
 Cancer root
 Cancer root
 Cane
 Cape-weed
 Cardinal flower
 Carolina cherry laurel
 Carolina dog-hobble
 Carolina grass-of-parnassus
 Carolina spleenwort fern
 Carolina trillium
 Carpet grass
 Castor-bean
 Castor oil plant
 Catbrier
 Catbriers
 Cat-tail
 Cat-tail
 Cat-tails
 Celery
 Centipede grass
 Chaff-seed
 Chapman oak
 Chapman's sedge
 Cherrybark oak
 Cherry laurel
 China-berry
 Chinaman's shield
 Chinquapin
 Chinquapin oak
 Chocolate-weed
 Chufa
 Cinnamon fern
 Cinquefoil
 Clearweed
 Climbing fetterbush
 Climbing hempweed
 Close-flowered triple awn grass
 Clovers
 Clubmosses
 Coastal love grass
 Coast bacopa
 Coast pigweed
 Coffee-weed
 Colic root
 Colic root
 Colic root
 Common bladderwort
 Common cat-tail
 Common lespedezas
 Common reed
 Common sundew
 Common three-square
 Coontail
 Coontail
 Coontails
 Coral honeysuckle

Clitoria mariana
Abutilon theophrastii
Senecio sp.
Pinguicula lutea
Pinguicula spp.
Cephalanthus occidentalis
Spermacoce glabra

Sabal palmetto
Opuntia compressa
Coreopsis tinctoria
Heterotheca graminifolia
Heterotheca subaxillaris
Pluchea purpurascens
Poa compressa
Conopholis americana
Orobanche uniflora
Arundinaria gigantea
Lippia nodiflora
Lobelia cardinalis
Prunus caroliniana
Leucothoe populifolia
Parnassia caroliniana
Asplenium heteroresiliens
Trillium pusillum var. pusillum
Reimarochloa oligostachya
Ricinus communis
Ricinus communis
Smilax bona-nox
Smilax spp.
Typha domingensis
Typha glauca
Typha spp.
Apium graveolens
Eremochloa ophuroides
Schwalbea americana
Quercus chapmanii
Carex chapmanii
Quercus falcata var. pagodaefolia
Prunus caroliniana
Melia azedarach
Centella asiatica
Castanea pumila
Quercus muehlenbergii
Melochia corymbifolia
Cyperus esculentus var. sativus
Osmunda cinnamomea
Potentilla norvegica
Pilea pumila
Pieris phillyreifolia
Mikania scandens
Aristida condensata
Trifolium spp.
Lycopodium spp.
Eragrostis refracta
Bacopa monnieri
Amaranthus pumilus
Sesbania exaltata
Aletris aurea
Aletris farinosa
Aletris lutea
Utricularia vulgaris
Typha latifolia
Lespedeza sp.
Phragmites communis
Drosera rotundifolia
Scirpus americanus
Ceratophyllum demersum
Ceratophyllum echinatum
Ceratophyllum spp.
Lonicera sempervirens

Cordgrass
 Cordgrass
 Cordgrass
 Cordgrasses
 Coreopsis
 Coreopsis
 Corn
 Cotton rose
 Cottonweed
 Cottonwood
 Cowpea
 Crab grasses
 Cranberries
 Crane-fly orchid
 Creeping cucumber
 Creeping fig
 Creeping rush
 Creeping spikerush
 Creeping spurge
 Creeping water plantain
 Crinkled amaranth
 Cross vine
 Croton
 Crownbeard
 Crow-poison
 Cudweed
 Cudweeds
 Curtiss' dropseed
 Cutgrass
 Cutgrass
 Cutgrass
 Cutgrass
 Cypresses

Dahoon
 Dahoon
 Daisy fleabane
 Damask rose
 Dangleberry
 Dasheen
 Dayflower
 Dayflower
 Deciduous holly
 Delta duck potato
 Dewberries
 Diodia
 Dock
 Dodder
 Dodder
 Dodder
 Dog fennel
 Dog fennel
 Dog-tongue
 Dogwood
 Dotted smartweed
 Downy rattlesnake plantain
 Dropseed
 Dropseed
 Dropseed
 Drummond's prickly pear
 Duck potato
 Duckweed
 Duckweed
 Duckweed
 Duckweeds
 Duckweeds
 Dwarf blueberry
 Dwarf huckleberry
 Dwarf laurel
 Dwarf palmetto
 Dwarf pawpaw

Spartina alterniflora
Spartina cynosuroides
Spartina patens
Spartina spp.
Coreopsis spp.
Coreopsis falcata
Zea mays
Filago germanica
Froelichia floridana
Populus deltoides
Vigna unguiculata
Digitaria spp.
Vaccinium spp.
Tipularia discolor
Melothria pendula
Ficus pumilus
Juncus repens
Eleocharis sp.
Euphorbia serpens
Echinodorus cordifolius
Amaranthus crispus
Anisostichus capreolata
Croton punctatus
Verbesina occidentalis
Zigadenus densus
Gnaphalium purpureum
Gnaphalium spp.
Sporobolus curtissii
Leersia hexandra
Leersia lenticularis
Leersia oryzoides
Leersia virginica
Taxodium spp.

Ilex cassine
Ilex cassine var. myrtifolia
Erigeron strigosus
Rosa damascena
Gaylussacia frondosa
Colocasia esculentum
Commelina erecta
Commelina virginica
Ilex decidua
Sagittaria graminea
Rubus spp.
Diodia teres
Rumex bucephalophorus
Cuscuta sp.
Cuscuta cephalanthii
Cuscuta indecora
Eupatorium capillifolium
Eupatorium capillifolium var. leptophyllum
Eriogonum tomentosum
Cornus racemosa
Polygonum punctatum
Goodyera pubescens
Sporobolus teretifolius
Sporobolus virginicus
Oxypolis rigidior
Opuntia drummondii
Sagittaria latifolia
Lemna minor
Lemna perpusilla
Lemna valdiviana
Lemna spp.
Spirodela spp.
Vaccinium myrsinites
Gaylussacia dumosa
Kalmia hirsuta
Sabal minor
Asimina parviflora

Dwarf spikerush
Dwarf trillium
Dwarf witch alder

Eastern cottonwood
Eastern lilaeopsis
Eastern red cedar
Eastern wolffiella
Eel grass
Elderberry
Elderberry
Elephant's foot
Elliot's blueberry
English plantain
Eryngo
Euphorbia
Evening primrose
Evening primroses
Everlasting
Everlastings

Fall panic grass
False asphodel
False asphodel
False buckthorn
False indigo
False nettle
False willow
Fanwort
Feathery bamboo
Fern
Fescue
Fescue
Fescue
Fetter-bush
Fetter-bush
Fig
Finger grass
Finger grass
Fishweed
Flag
Fleabane
Floating heart
Floating hearts
Floppy water milfoil
Florida adder's mouth
Florida bladderwort
Florida dropseed
Florida privet
Flowering dogwood
Fly-catcher
Fly-poison
Flytrap pitcher-plant
Foxtail clubmoss
Foxtail grass
Foxtail grass
Foxtail grass
French mulberry
Fringed loosestrife
Fringe-leaved paspalum
Frog's bit
Frost aster

Gaillardia
Gamma grass
Gentians
Georgia fever bark
Georgia plume
Georgia's bulrush
Gerardia
Giant cordgrass
Giant cutgrass

Eleocharis parvula
Trillium pusillum var. pusillum
Fothergilla gardenii

Populus deltoides
Lilaeopsis chinensis
Juniperus virginiana
Wolffiella floridana
Zostera marina
Sambucus canadensis
Sambucus simpsonii
Elephantopus tomentosus
Vaccinium elliotii
Plantago lanceolata
Eryngium integrifolium
Euphorbia polygonifolia
Oenothera humifusa
Oenothera spp.
Gnaphalium obtusifolium
Gnaphalium spp.

Panicum dichotomiflorum
Tofieldia glabra
Tofieldia racemosa
Bumelia lanuginosa
Amorpha fruticosa
Boehmeria cylindrica
Baccharis angustifolia
Cabomba caroliniana
Bambusa vulgaris
Polypodium aureum
Festuca myuros
Festuca octoflora
Festuca rubra
Leucothoe racemosa
Lyonia lucida
Ficus carica
Chloris petraea
Digitaria horizontalis
Potamogeton illinoiensis
Iris tridentata
Erigeron vernus
Nymphoides aquatica
Nymphoides spp.
Myriophyllum laxum
Malaxis spicata
Utricularia floridana
Sporobolus floridanus
Forestiera perulosa
Cornus florida
Sarracenia flava
Amianthium muscaetoxicum
Sarracenia purpurea
Lycopodium alopecuroides
Setaria geniculata
Setaria macrosperma
Setaria magna
Callicarpa americana
Lysimachia lanceolata
Paspalum setaceum
Limnium spongia
Aster pilosus

Gaillardia drummondii
Tripsacum dactyloides
Gentiana spp.
Pickneya pubens
Elliotia racemosa
Scirpus erismannae
Agalinis maritima
Spartina cynosuroides
Zizaniopsis miliacea

Giant foxtail grass
 Giant plume grass
 Giant reed
 Giant-seeded beak rush
 Giant spiral-orchid
 Gladiolus
 Glasswort
 Glasswort
 Glasswort
 Glassworts
 Goat's rue
 Godfrey's sandwort
 Golden aster
 Golden aster
 Golden canna lily
 Golden club
 Goldenrod
 Goldenrod
 Goldenrod
 Goldenrods
 Gooseberries
 Gopher apple
 Grain sorghum
 Grapefruit
 Grass-leaved ladies' tresses
 Grass-pinks
 Green ash
 Greenbrier
 Greenbrier
 Greenbrier
 Greenbrier
 Greenbriers
 Green fringed orchid
 Green fringeless orchid
 Ground cherry
 Ground cherry
 Ground cherry
 Groundnut
 Gum

Hackberry
 Hair grass
 Hairy wild-indigo
 Halberd-leaved marsh mallow
 Hartwrightia
 Haws
 Hawthorn
 Hedge hyssop
 Hercules' club
 Hercules' club
 Heterotheca
 Hickory
 Highbush blueberry
 Hightide bushes
 Hollies
 Hooded pitcher-plant
 Hop hornbeam
 Horned bladderwort
 Horned-pondweed
 Hornwort
 Hornwort
 Hornworts
 Horse balm
 Horse sugar
 Horsetweed
 Huckleberries
 Huckleberries

Incised groovebur
 Indian fig

Setaria magna
Erianthus giganteus
Arundo donax
Rhynchospora megalocarpa
Spiranthes longilabris
Gladiolus hortulana
Salicornia bigelovii
Salicornia europaea
Salicornia virginica
Salicornia spp.
Tephrosia virginiana
Arenaria godfreyi
Heterotheca floridana
Heterotheca graminifolia
Canna flaccida
Orontium aquaticum
Solidago chapmanii
Solidago gymnospermoides
Solidago sempervirens
Solidago spp.
Vaccinium spp.
Chrysobalanus oblongifolius
Sorghum vulgare
Citrus paradisi
Spiranthes praecox
Calopogon spp.
Fraxinus pennsylvanica
Smilax auriculata
Smilax bona-nox
Smilax rotundifolia
Smilax smallii
Smilax spp.
Habenaria lacera
Habenaria lacera
Physalis pubescens var. grisea
Physalis virginiana
Physalis viscosa var. maritima
Apios americana
Nyssa sylvatica var. biflora

Celtis laevigata
Aira caryophyllea
Baptisia arachnifera
Hibiscus militaris
Hartwrightia floridana
Viburnum spp.
Crataegus sp.
Gratiola pilosa
Aralia spinosa
Zanthoxylum clava-herculis
Heterotheca subaxillaris
Carya spp.
Vaccinium corymbosum
Baccharis spp.
Ilex spp.
Sarracenia minor
Ostrya virginiana
Utricularia cornuta
Zannichellia palustris
Ceratophyllum demersum
Ceratophyllum echinatum
Ceratophyllum spp.
Collinsonia canadensis
Symplocos tinctoria
Erigeron canadensis
Gaylussacia spp.
Vaccinium spp.

Agrimonia incisa
Opuntia ficus-indica

Indian grass
Indian grass
Iris
Ironweed
Ironweed
Ironweed
Ironweed
Ironwood
Italian rye grass

Japanese clover
Jerusalem artichoke
Jewel-weed
Johnson grass
Jointed spikerush
Jove's fruit
June grass

Knawel
Knotweed
Knotweed
Knotweeds

Lacegrass
Lace-lip spiral orchid
Ladies eardrops
Lambkill
Lamb's quarters
Large-rooted morning glory
Large-seed smartweed
Laurel greenbrier
Laurel oak
Leafy pondweed
Least adder's tongue
Leather-flower
Leather-leaf
Lemon bacopa
Lespedeza
Leucothoe
Leucothoe
Lippia
Little bluestem
Little burhead
Little floating heart
Live oak
Lizard's tail
Lobelia
Loblolly bay
Loblolly pine
Longleaf pine
Long-styled smartweed
Loosestrife
Loose water milfoil
Lotus
Lotus
Love grass
Love grass
Love grass
Low millewort
Low showy aster
Lupine

Macartney rose
Maidencane
Male-berry
Mangrove
Marsh cress
Marsh cress
Marsh daisy
Marsh elder
Marsh eryngo

Sorghastrum nutans
Sorghastrum secundum
Iris tridentata
Vernonia sp.
Vernonia altissima
Vernonia blodgettii
Vernonia harperi
Carpinus caroliniana
Lolium multiflorum

Lespedeza striata
Helianthus tuberosus
Impatiens capensis
Sorghum halepense
Eleocharis aquisetoides
Lindera melissaefolium
Koeleria phleoides

Scleranthus annuus
Polygonum lapathifolium
Polygonum persicaria
Polygonum spp.

Eragrostis capillaris
Spiranthes laciniata
Brunnichia cirrhosa
Kalmia angustifolia var. carolina
Chenopodium album
Ipomoea macrorhiza
Polygonum pennsylvanicum
Smilax laurifolia
Quercus laurifolia
Potamogeton foliosus
Ophioglossum nudicaule
Clematis crispa
Cassandra calyculata
Bacopa caroliniana
Lespedeza bicolor
Leucothoe axillaris
Leucothoe populifolia
Lippia nodiflora
Andropogon scoparius
Echinodorus parvulus
Nymphoides cordata
Quercus virginiana
Saururus cernuus
Lobelia elongata
Gordonia lasianthus
Pinus taeda
Pinus palustris
Polygonum longistylum
Lythrum lineare
Myriophyllum laxum
Nelumbo lutea
Nelumbo pentapetala
Eragrostis capillaris
Eragrostis pilosa
Eragrostis refracta
Polygala nana
Aster spectabilis
Lupinus perennis

Rosa bracteata
Panicum hemitomon
Lyonia ligustrina
Rhizophora mangle
Rorippa islandica
Rorippa sessiliflora
Boltonia asteroides
Iva frutescens
Eryngium aquaticum

Marsh fleabane
Marsh fleabane
Marsh fleabanes
Marsh-gentian
Marsh hemp
Marsh pennywort
Marsh-pink
Marsh purslane
Meadow beauties
Meadow beauty
Meadow beauty
Melonette
Memorial rose
Milk pea
Milk-vine
Milkwort
Millet
Millets
Milo
Miterwort
Mock-bishopweed
Mock-bishopweed
Mockernut hickory
Mosquito fern
Moundlily yucca
Muhlenberg's amphi­carpum
Muhly grass
Muhly grass
Mulberries
Muscadine grape
Muscle tree
Muskgrasses
Myrtle holly
Myrtle oak
Myrtles

Narrow-leaved cat-tail
Narrow-leaved pondweed
Narrow-leaved rushfoil
Needle palm
Netted chain fern
Nightshade
Nitella
Nodding smartweed
Nut grass
Nut rush
Nut rush
Nut rush
Nutmeg hickory

Oatgrass
Oats
Odorless wax myrtle
Ogeechee plum
Olive
Olney's three-square buirush
Orach
Orchids
Overcup oak

Panic grass
Panic grass
Panic grass
Panic grasses
Parrot-feather
Parrot pitcher-plant
Partridge berry
Partridge pea
Paspalum
Passion-flower
Pawpaw
Pawpaw
Pawpaw
Peanut

Pluchea purpurascens
Pluchea rosea
Pluchea spp.
Sabatia stellaris
Amaranthus cannabinus
Hydrocotyle umbellata
Sabatia foliosa
Ludwigia natans
Rhexia spp.
Rhexia alifanus
Rhexia cubensis
Melothria crassifolia
Rosa wichuraniana
Galactia elliptica
Cynanchum palustre
Polygala grandiflora
Pennisetum glaucum
Echinochloa spp.
Sorghum vulgare
Cynoctonum sessilifolium
Ptilimnium capillaceum
Ptilimnium costatum
Carya tomentosa
Azolla caroliniana
Yucca gloriosa
Amphicarpum muhlenbergianum
Muhlenbergia capillaris
Muhlenbergia expansa
Morus spp.
Vitis rotundifolia
Carpinus caroliniana
Chara spp.
Ilex cassine var. myrtifolia
Quercus myrtifolia
Myrica spp.

Typha angustifolia
Potamogeton berchtoldii
Crotonopsis linearis
Rhaphidophyllum hystrix
Woodwardia areolata
Solanum aculeatissimum
Nitella sp.
Polygonum lapathifolium
Cyperus esculentus
Scleria baldwinii
Scleria ciliata
Scleria triglomerata
Carya myristicaeformis

Arrhenatherum elatius
Avena sativa
Myrica inodora
Nyssa ogeche
Olea europaea
Scirpus olneyi
Atriplex patula
Habenaria spp.
Quercus lyrata

Panicum amarum
Panicum leucothrix
Panicum virgatum
Panicum spp.
Myriophyllum brasiliense
Sarracenia psittacina
Mitchella repens
Cassia fasciculata
Paspalum sp.
Passiflora lutea
Asimina incana
Asimina pygmaea
Asimina triloba
Arachis hypogaea

Peat mosses
 Pecan
 Pennywort
 Pennyworts
 Pepper-vine
 Perennial glasswort
 Periwinkle
 Persimmon
 Petunia
 Pickerelweed
 Pigeon grape
 Pigmy-pipes
 Pignut hickory
 Pigweed
 Pigweed
 Pigweeds
 Pineland agrimony
 Pineweed
 Pin-weeds
 Pipewort
 Pipewort
 Pitcher-plants
 Plume grass
 Plume grasses
 Poison ivy
 Poke weed
 Polygala
 Polygala
 Polygala
 Polygalas
 Polypremum
 Pond cypress
 Pond pine
 Pond spice
 Pondweed
 Pondweed
 Pondweed
 Pondweed
 Pondweed
 Pondweeds
 Poor-joe
 Poor-mans pepper
 Popcorn tree
 Poplar-leaved fetterbush
 Poplars
 Possum haw
 Possum haw
 Post oak
 Potato bean
 Prickly mallow
 Prickly pear
 Princess-feather
 Privet
 Proliferating spikerush
 Pumpkin ash
 Purple bladderwort
 Purple silkyscale
 Purple top
 Pussy-toes

Queen's delight

Rabbit tobacco
 Ragweed
 Ragweeds
 Railroad vine
 Rain lily
 Rambler rose
 Raspberries
 Rattanvine
 Rattlebox

Sphagnum spp.
Carya illinoensis
Hydrocotyle ranunculoides
Hydrocotyle spp.
Ampelopsis arborea
Salicornia virginica
Vinca major
Diospyros virginiana
Petunia axillaris
Pontederia cordata
Vitis cinerea var. floridana
Monotropis odorata
Carya glabra
Amaranthus lividus
Amaranthus pumilus
Amaranthus spp.
Agrimonia incisa
Hypericum gentianoides
Lechea spp.
Eriocaulon compressum
Eriocaulon decangulare
Sarracenia spp.
Erianthus giganteus
Erianthus spp.
Rhus radicans
Phytolacca rigida
Polygala cymosa
Polygala lutea
Polygala sanguinea
Polygala spp.
Polypremum procumbens
Taxodium ascendens
Pinus serotina
Litsea aestivalis
Potamogeton berchtoldii
Potamogeton foliosus
Potamogeton illinoensis
Potamogeton nodosus
Potamogeton pectinatus
Potamogeton spp.
Diodia teres
Lepidium virginicum
Sapium sebiferum
Leucothoe populifolia
Populus spp.
Ilex decidua
Viburnum nudum
Quercus stellata
Apios americana
Sida spinosa
Opuntia drummondii
Polygonum orientale
Ligustrum japonicum
Eleocharis baldwinii
Fraxinus tomentosa
Utricularia purpurea
Anthraenantia rufa
Tridens flavus var. flavus
Antennaria spp.

Stillingia sylvatica

Gnaphalium obtusifolium
Ambrosia artemisiifolia
Ambrosia spp.
Ipomoea pes-caprae
Zephyranthes simpsonii
Rosa multiflora
Rubus spp.
Berchemia scandens
Crotalaria intermedia

Rattlebox
 Rattlebox
 Rattlesnake fern
 Ravenel's button snakeroot
 Ravenna-grass
 Rayless goldenrod
 Red ash
 Red basil
 Red bay
 Red buckeye
 Redbud
 Red cedar
 Red chokeberry
 Reddish anthaenanthia
 Red fescue
 Red-hot poker
 Red maple
 Red oak
 Redroot
 Redrooted nutgrass
 Redtop
 Red-veined dock
 Reed
 Reindeer lichen
 Resurrection fern
 Rice cutgrass
 Rice cutgrass
 Riverbank sandreed
 River birch
 Rosebud orchid
 Rose dicerandra
 Rose mallow
 Rose pogonia
 Roundleaf bacopa
 Royal fern
 Running oak
 Rush
 Rush
 Rush
 Rush
 Rush
 Rushes
 Russian thistle
 Rusty lyonia
 Rusty lyonia
 Rye
 Rye grass

Sabatia
 Sabatia
 Sabatia
 Sacciolepis
 Sageretia
 Sago pondweed
 Salt grass
 Salt marsh aster
 Salt-marsh bulrush
 Salt marsh fimbriatylis
 Salt marsh millet
 Saltmeadow cordgrass
 Saltwort
 Salvinia
 Sand grass
 Sand pine
 Sand spurrey
 Sandspur
 Sandspur
 Sarvis holly
 Sassafras
 Saw grass
 Saw grass
 Saw palmetto

Crotalaria lanceolata
Crotalaria retusa
Botrychium virginianum
Eryngium aquaticum var. ravenelii
Erianthus ravennae
Chondrophora nudata
Fraxinus pennsylvanica
Satureja calamintha
Persea borbonia
Aesculus pavia
Cercis canadensis
Juniperus virginiana
Sorbus arbutifolia var. arbutifolia
Anthraenanthia rufa
Festuca rubra
Polygala lutea
Acer rubrum
Quercus rubra
Lachnanthes caroliniana
Cyperus erythrorhizos
Agrostis stolonifera
Rumex sanguineus
Phragmites communis
Cladonia spp.
Polypodium polypodioides
Leersia hexandra
Leersia oryzoides
Calamovilfa brevipilis var. brevipilis
Betula nigra
Cleistis divaricata
Dicerandra adoratissima
Hibiscus moscheutos
Pogonia ophioglossoides
Bacopa rotundifolia
Osmunda regalis
Quercus pumila
Juncus biflorus
Juncus nodatus
Juncus secundus
Juncus subcaudatus
Juncus spp.
Salsola kali
Lyonia ferruginea
Rhynchospora megalocarpa
Secale cereale
Lolium sp.

Sabatia brachiata
Sabatia dodecandra
Sabatia stellaris
Sacciolepis striata
Sageretia minutiflora
Potamogeton pectinatus
Distichlis spicata
Aster tenuifolius
Scirpus robustus
Fimbristylis spadicea
Echinochloa walteri
Spartina patens
Batis maritima
Salvinia rotundifolia
Triplasis purpurea
Pinus clausa
Spergularia marina
Cenchrus longispinus
Cenchrus tribuloides
Ilex amelanchier
Sassafras albidum
Cladium jamaicense
Mariscus jamaicense
Serenoa repens

Scarlet oak
 Scarlet spiderling
 Scrub oaks
 Seabeach orach
 Seabeach panic grass
 Sea-blite
 Sea elder
 Sea lavender
 Sea lavender
 Sea lavenders
 Sea myrtle
 Sea myrtles
 Sea oats
 Sea ox-eye
 Sea pink
 Sea pink
 Sea purslane
 Sea purslane
 Sea purslanes
 Sea rocket
 Seashore mallow
 Seashore paspalum
 Seaside goldenrod
 Seban
 Sebastian bush
 Sedge
 Sedge
 Sedge
 Sedge
 Sedge
 Sedge
 Sedge
 Sedge
 Sedge
 Sedges
 Sedges
 Seed box
 Sensitive fern
 Sericea
 Sesbania
 Shepherd's purse
 Short leaf pine
 Showy aster
 Shrubby post oak
 Shrub oaks
 Shumard oak
 Silver maple
 Single-flowered baldwina
 Single-flowered cancer root
 Sixweeks fescue
 Skullcap
 Slash pine
 Sleepy catchfly
 Slender spikerush
 Slippery elm
 Small-flowered buckthorn
 Small pondweed
 Smartweed
 Smartweeds
 Smooth aster
 Smooth cordgrass
 Smooth winterberry
 Sneeze-weed
 Snow-on-the-mountain
 Soapberry
 Soft-haired cornflower
 Soft rush
 Soft-stem bulrush
 Sour grass
 Sour orange
 Sourwood
 Southern adder's tongue

Quercus coccinea
Boerhaavia diffusa
Quercus spp.
Atriplex arenaria
Panicum amarum
Suaeda linearis
Iva imbricata
Limonium carolinianum
Limonium nashii
Limonium spp.
Baccharis halimifolia
Baccharis spp.
Uniola paniculata
Borrichia frutescens
Sabatia dodecandra
Sabatia foliosa
Sesuvium maritimum
Sesuvium portulacastrum
Sesuvium spp.
Cakile harperi
Kosteleskya virginica
Paspalum vaginatum
Solidago sempervirens
Sesbania macrocarpa
Sebastiania ligustrina
Carex decomposita
Carex joorii
Carex shortiana
Cyperus brevifolius
Cyperus odoratus
Cyperus polystachos
Cyperus rivularis
Cyperus rotundus
Cyperus strigosus
Carex spp.
Cyperus spp.
Ludwigia pilosa
Onoclea sensibilis
Lespedeza cuneata
Sesbania exaltata
Capsella rubella
Pinus echinata
Aster spectabilis
Quercus margaretta
Quercus spp.
Quercus shumardii
Acer saccharinum
Baldwina uniflora
Orobancha uniflora
Festuca myuros
Scutellaria sp.
Pinus elliotii
Silene antirrhina
Eleocharis acicularis
Ulmus rubra
Sageretia minutiflora
Potamogeton berchtoldii
Polygonum hirsutum
Polygonum spp.
Aster laevis var. laevis
Spartina alterniflora
Ilex laevigata
Helenium vernale
Euphorbia marginata
Sapindus marginatus
Rudbeckia mollis
Juncus effusus
Scirpus validus
Rumex acetosella
Citrus aurantium
Oxydendrum arboreum
Ophioglossum vulgatum var. pycnostichum

Southern bog buttons
 Southern bulrush
 Southern cat-tail
 Southern elderberry
 Southern lady fern
 Southern lepuropetalon
 Southern magnolia
 Southern naiad
 Southern red cedar
 Southern red oak
 Southern rein orchid
 Southern smartweed
 Southern smartweed
 Southern spicebush
 Southern sugar maple
 Southern wild rice
 Soybean
 Spanish bayonet
 Spanish moss
 Sparkleberries
 Sparkleberry
 Spatter-dock
 Sphagnum mosses
 Spider-lily
 Spike-grass
 Spike-grass
 Spike-grass
 Spikemoss
 Spikerush
 Spikerush
 Spikerush
 Spikerush
 Spikerush
 Spleenwort
 Sprangletop
 Sprangletop
 Spreading pogonia
 Spring coral-root
 Spring-flowered goldenrod
 Spruce pine
 Square-stem spikerush
 Squaw-huckleberry
 Squaw-root
 Stagger bush
 Stagger bush
 Star grass
 Star grass
 Star-rush
 Starved aster
 Sticky tofieldia
 Stillingia
 Stinging needle
 St. John's-wort
 St. John's-wort
 St. John's-wort
 St. John's-wort
 St. John's-wort
 St. John's-wort
 St. John's-wort
 St. John's-worts
 Storax
 Storax
 Strawberry bush
 Sugarberry
 Sumac
 Summer-farewell
 Summer grape
 Summer grape
 Sun-bonnets
 Sundews
 Sunflower
 Sunflower
 Sun-petaled meadow beauty
 Swamp chestnut oak

Lachnocaulon beyrichianum
Scirpus californicus
Typha domingensis
Sambucus simpsonii
Athyrium asplenoides
Lepuropetalon spathulatum
Magnolia grandiflora
Najas guadalupensis
Juniperus silicicola
Quercus falcata
Babenaria flava
Polygonum densiflorum
Polygonum portoricense
Lindera melissaefolium
Acer saccharum floridanum
Zizaniopsis miliacea
Glycine max
Yucca aloifolia
Tillandsia usneoides
Vaccinium spp.
Vaccinium arboreum
Nuphar advena
Sphagnum spp.
Hymenocallis crassifolia
Uniola latifolia
Uniola laxa
Uniola sessiliflora
Selaginella arenicola
Eleocharis sp.
Eleocharis acicularis
Eleocharis albida
Eleocharis elongata
Eleocharis robbinsii
Asplenium heteroresiliens
Leptochloa sp.
Leptochloa uninervia
Cleistes divaricata
Corallorhiza wisteriana
Solidago verna
Pinus glabra
Eleocharis quadrangulata
Vaccinium stamineum
Conopholis americana
Lyonia ferruginea
Lyonia mariana
Aletris lutea
Hypoxis sessilis
Dichromena colorata
Aster lateriflorus
Tofieldia racemosa
Stillingia sylvatica
Cnidioscolus stimulosus
Hypericum apocynifolium
Hypericum fasciculatum
Hypericum pseudomaculatum
Hypericum tubulosum
Hypericum virginicum
Hypericum walteri
Hypericum spp.
Styrax americana
Styrax grandifolia
Euonymus americanus
Celtis laevigata
Rhus spp.
Petalostemum pinnatum
Vitis aestivalis
Vitis aestivalis var. aestivalis
Chaptalia tomentosa
Drosera spp.
Helianthus angustifolius
Helianthus tuberosus
Rhexia aristosa
Quercus michauxii

Swamp cottonwood
 Swamp dock
 Swamp dogwood
 Swamp holly
 Swamp lily
 Swamp milkweed
 Swamp privet
 Swamp rose
 Swamp smartweed
 Swamp smartweed
 Swamp thistle
 Swamp tupelo
 Swamp willow
 Swaying bulrush
 Sweet bay
 Sweetflag
 Sweet gallberry
 Sweet grass
 Sweet gum
 Sweet leaf
 Sweet pepperbush
 Sweet pignut hickory
 Sweet pitcher-plant
 Switchgrass
 Sycamore

Tag alder
 Tall oatgrass
 Tansey-mustard
 Tarflower
 Tearthumb
 Tearthumb
 Thistle
 Thoroughwort
 Thoroughworts
 Three awn grass
 Three awn grass
 Three awn grass
 Three awn grass
 Three awn grasses
 Three-birds orchid
 Three-seeded mercury
 Three-way sedge
 Thyme-leave speedwell
 Tick trefoil
 Titi
 Toad-flax
 Toad rush
 Toothache grass
 Toothache grass
 Toothache grasses
 Tough buckthorn
 Trailing lantana
 Trianglestem spikerush
 Trillium
 Tropical carpet grass
 Trumpet-plant
 Trumpet vine
 Tulip tree
 Turkey foot
 Turkey oak
 Turtle grass
 Twig-rush

Umbrella tree
 Umbrella tree

Vanilla-plant
 Variable-leaved pondweed
 Velvet-leaf

Populus heterophylla
Rumex verticillatus
Cornus stricta
Ilex decidua
Crinum americanum
Asclepias incarnata sp. pulchra
Forestiera acuminata
Rosa palustris
Polygonum hydropiperoides
Polygonum setaceum
Carduus carolinianus
Nyssa sylvatica var. biflora
Salix caroliniana
Scirpus subterminalis
Magnolia virginiana
Acorus calamus
Ilex coriacea
Muhlenbergia filipes
Liquidambar styraciflua
Symplocos tinctoria
Clethra alnifolia
Carya ovalis
Sarracenia rubra
Panicum virgatum
Platanus occidentalis

Alnus serrulata
Arrhenatherum elatius
Descurainia pinnata
Befaria racemosa
Polygonum arifolium
Polygonum sagittatum
Carduus carolinianus
Eupatorium album
Eupatorium spp.
Aristida gyrans
Aristida purpurascens
Aristida spiciformis
Aristida stricta
Aristida spp.
Triphore trianthophora
Acalypha virginica
Dulichium arundinaceum
Veronica serpyllifolia
Desmodium sp.
Cyrilla racemiflora
Linaria canadensis
Juncus bufonius
Campulopus aromaticus
Ctenium aromaticum
Ctenium spp.
Bumelia tenax
Lantana montevidensis
Eleocharis robbinsii
Trillium pusillum
Axonopus compressus
Sarracenia flava
Campsis radicans
Liriodendron tulipifera
Andropogon gerardii
Quercus laevis
Thalassia testudinum
Cladium mariscoides

Magnolia macrophylla
Melia azedarach

Trilisa odoratissima
Potamogeton diversifolius
Abutilon theophrastii

Venus' fly trap
Venus' looking-glass
Venus' looking-glasses
Vervain
Violet
Violet
Violet
Virginia chain fern
Virginia creeper
Virginia willow

Walter's sedge
Wampee
Watches
Water ash
Water elm
Water grass
Water hemlock
Water hemp
Water hickory
Water-hoarhound
Water hyacinth
Water hyssop
Water hyssop
Water-lily
Water-lily
Water-lily
Water locust
Water loosestrife
Water-meal
Water milfoil
Water milfoil
Water milfoil
Water milfoils
Water nymph
Water oak
Water parsnip
Water pimpernel
Water-primrose
Water-primroses
Water purslane
Water-shield
Water spider orchid
Water spikerush
Water tupelo
Water-weed
Water-weed
Water-weeds
Wax myrtle
Wedge grass
Weeping willow
Wheat
White arrow-arum
White ash
White-bracted sedge
White colic root
White-fringed orchid

White mulberry
White oak
White water-lily
White wicky
Widgeon grass
Wild azalea
Wild grapes
Wild licorice
Wild millet
Wild olive
Wild plum
Wild rice

Dionaea muscipula
Specularia perfoliata
Specularia spp.
Verbena officinalis
Viola cucullata
Viola papilionacea
Viola triloba
Woodwardia virginica
Parthenocissus quinquefolia
Itea virginica

Carex walteriana
Eichhornia crassipes
Sarrenia flava
Fraxinus caroliniana
Planera aquatica
Hydrochloa carolinensis
Cicuta maculata
Amaranthus cannabinus
Carya aquatica
Lycopus virginicus
Eichhornia crassipes
Bacopa monnieri
Bacopa rotundifolia
Nymphaea bombicina
Nymphaea mexicana
Nymphaea odorata
Gleditsia aquatica
Decodon verticillatus
Wolffia columbiana
Myriophyllum heterophyllum
Myriophyllum laxum
Myriophyllum pinnatum
Myriophyllum spp.
Najas gualanensis
Quercus nigra
Sium suave
Samolus parviflorus
Ludwigia peploides
Ludwigia spp.
Ludwigia natans
Brasenia schreberi
Habenaria repens
Eleocharis elongata
Nyssa aquatica
Elodea canadensis
Egeria densa
Elodea spp.
Myrica cerifera
Sphenopholis intermedia
Salix babylonica
Triticum aestivum
Peltandra sagittaeifolia
Fraxinus americana
Dichromena latifolia
Aletris obovata
Habenaria blephariglottis var.
integrilabia
Morus alba
Quercus alba
Nymphaea odorata
Kalmia cuneata
Ruppia maritima
Rhododendron canescens
Vitis spp.
Galium circaezans
Echinochloa crusgalli
Osmanthus americana
Prunus americana
Zizania aquatica

Wild rye
Wild rye grass
Wild rye grass
Willow
Willow oak
Willows
Winged elm
Wire grasses
Wire-leaved dropseed
Witch alder
Witch grass
Witch grass
Witch-hazel
Wood awn-grass
Wood fern
Wood grass
Wood reed
Woolgrass bulrush
Wreath aster

Yaupon holly
Yellow asphodel
Yellow chestnut oak
Yellow cress
Yellow cress
Yellow-eyed grass
Yellow-eyed grass
Yellow-eyed grass
Yellow-eyed grasses
Yellow fringeless orchid
Yellow nelumbo
Yellow pitcher-plant
Yellow pond-lily
Yellow poplar
Yellow star grass

Zenobia

Elymus villosus
Elymus villosus
Elymus virginicus
Salix caroliniana
Quercus phellos
Salix spp.
Ulmus alata
Aristida spp.
Sporobolus teretifolia
Fothergilla gardenii
Leptoloma cognatum
Panicum capillare
Hamamelis virginiana
Brachyelytrum erectum
Dryopteris dentata
Sorghastrum nutans
Cinna arundinacea
Scirpus cyperinus
Aster vimineus

Ilex vomitoria
Narthacium americanum
Quercus muehlenbergii
Rorippa islandica
Rorippa sessiliflora
Xyris caroliniana
Xyris elliotii
Xyris smalliana
Xyris spp.
Habenaria integra
Nelumbo lutea
Sarracenia flava
Nuphar luteum
Liriodendron tulipifera
Hypoxis sessilis

Zenobia pulverulenta

BIRDS

Acadian flycatcher
American avocet
American bittern
American coot
American goldeneye
American goldfinch
American kestrel
American oystercatcher
American redstart
American wigeon
American woodcock
Anhinga
Arctic peregrine falcon
Audubon's shearwater

Bachman's sparrow
Bachman's warbler
Bald eagle
Baldpate
Bank swallow
Barn owl
Barn swallow
Barred owl
Barrow's goldeneye
Belted kingfisher
Bewick's wren
Black-and-white warbler
Black-bellied plover
Black-bellied whistling duck
Black-billed cuckoo
Black-crowned night heron
Black duck
Black-headed gull
Black-necked stilt
Blackpoll warbler
Black rail
Black scoter
Black scoter
Black skimmer
Black tern
Black-throated blue warbler
Black-throated green warbler
Black vulture
Blue goose
Blue-gray gnatcatcher
Blue grosbeak
Blue grosbeak
Blue-headed vireo
Blue jay
Blue-winged teal
Blue-winged warbler
Boat-tailed grackle
Bobolink
Bobwhite
Bonaparte's gull
Broad-winged hawk
Brown creeper
Brown-headed cowbird
Brown-headed nuthatch
Brown pelican
Brown thrasher
Bufflehead

Cabot's tern
Canada goose
Canvasback
Cape May warbler

Empidonax virescens
Recurvirostra americana
Botaurus lentiginosus
Fulica americana
Bucephala clangula americana
Carduelis tristis
Falco sparverius
Haematopus palliatus palliatus
Setophaga ruticilla ruticilla
Anas americana
Philohela minor
Anhinga anhinga
Falco peregrinus tundrius
Puffinus lherminieri

Aimophila aestivalis
Vermivora bachmanii
Haliaeetus leucocephalus
Anas americana
Riparia riparia
Tyto alba
Hirundo rustica erythrogaster
Strix varia
Bucephala islandica
Megasceryle alcyon
Thryomanes bewickii bewickii
Mniotilta varia
Pluvialis squatarola
Dendrocygna autumnalis
Coccyzus erythrophthalmus
Nycticorax nycticorax
Anas rubripes
Larus ridibundus
Himantopus mexicanus mexicanus
Dendroica striata
Laterallus jamaicensis
Melanitta nigra
Melanitta nigra americana
Rynchops nigra
Chlidonias niger
Dendroica caerulescens
Dendroica virens waynei
Coragyps atratus
Chen caerulescens
Polioptila caerulea
Guiraca caerulea
Guiraca caerulea caerulea
Vireo solitarius solitarius
Cyanocitta cristata cristata
Anas discors
Vermivora pinus
Quiscalus major
Dolichonyx oryzivorus
Colinus virginianus
Larus philadelphia
Buteo platypterus
Certhia familiaris
Molothrus ater
Sitta pusilla pusilla
Pelecanus occidentalis
Toxostoma rufum rufum
Bucephala albeola

Sterna sandvicensis acufilavidus
Branta canadensis
Aythya valisineria
Dendroica tigrina

Cardinal
Carolina chickadee
Carolina parakeet
Carolina wren
Caspian tern
Catbird
Cattle egret
Cedar waxwing
Chimney swift
Chipping sparrow
Chuck-will's-widow
Cinnamon teal
Clapper rail
Cliff swallow
Common crow
Common eider
Common flicker
Common gallinule
Common goldeneye
Common grackle
Common loon
Common merganser
Common snipe
Common tern
Cooper's hawk

Dark-eyed junco
Doubled-crested cormorant
Dowitchers
Downy woodpecker
Dunlin
Dusky seaside sparrow

Eastern bluebird
Eastern bobwhite
Eastern brown pelican
Eastern kingbird
Eastern meadowlark
Eastern phoebe
Eastern wood pewee
Eskimo curlew
European wigeon

Field sparrow
Fish crow
Florida red-shouldered hawk
Forster's tern
Fox sparrow
Fulvous whistling duck

Gadwall
Gannet
Glossy ibis
Golden-crowned kinglet
Golden eagle
Golden-winged warbler
Grasshopper sparrow
Gray-cheeked thrush
Great black-backed gull
Great blue heron
Great crested flycatcher
Great egret
Greater scaup
Greater shearwater
Greater yellowlegs
Great horned owl
Green heron
Green-winged teal
Ground dove
Gull-billed tern

Richmondia cardinalis cardinalis
Parus carolinensis
Conuropsis carolinensis carolinensis
Thryothorus ludovicianus
Sterna caspia
Dumetella carolinensis
Bubulcus ibis ibis
Bombycilla cedrorum
Chaetura pelagica
Spizella passerina passerina
Caprimulgus carolinensis
Anas cyanoptera
Rallus longirostris
Petrochelidon pyrrhonota
Corvus brachyrhynchos
Somateria mollissima
Colaptes auratus
Gallinula chloropus
Bucephala clangula
Quiscalus quiscula
Gavia immer
Mergus merganser
Capella gallinago
Sterna hirundo
Accipiter cooperii

Junco hyemalis
Phalacrocorax auritus
Limnodromus spp.
Picoides pubescens
Calidris alpina
Ammodramus maritima nigrescens

Sialia sialis
Colinus virginianus virginianus
Pelecanus occidentalis carolinensis
Tyrannus tyrannus
Sturnella magna
Sayornis phoebe
Contopus virens
Numenius borealis
Anas penelope

Spizella pusilla
Corvus ossifragus
Buteo lineatus alleni
Sterna forsteri
Passerella iliaca
Dendrocygna bicolor

Anas strepera
Morus bassanus
Plegadis falcinellus falcinellus
Regulus satrapa
Aquila chrysaetos
Vermivora chrysoptera
Ammodramus savannarum
Catharus minimus
Larus marinus
Ardea herodias
Myiarchus crinitus
Casmerodius albus
Aythya marila
Puffinus gravis
Tringa melanoleucus
Bubo virginianus virginianus
Butorides striatus
Anas crecca
Columbigallina passerina
Gelochelidon nilotica

Hairy woodpecker
Harlequin duck
Henslow's sparrow
Hermit thrush
Herring gull
Hooded merganser
Hooded warbler
Horned grebe
House wren
Hudsonian curlew

Iceland gull
Indigo bunting
Ipswich sparrow
Ivory-billed woodpecker

Kentucky warbler
Kestrel
Killdeer
King eider
King rail
Kirtland's warbler
Knot

Laughing gull
Least bittern
Least sandpiper
Least tern
Le Conte's sparrow
Lesser scaup
Lesser yellowlegs
Limpkin
Little blue heron
Loggerhead shrike
Long-billed curlew
Long-billed curlew
Long-billed marsh wren
Long-billed marsh wren
Louisiana heron
Louisiana waterthrush

Macgillivray's seaside sparrow
Magnolia warbler
Mallard
Marbled godwit
Marsh hawk
Marsh hen
Masked duck
Merlin
Mexican duck
Mississippi kite
Mockingbird
Mockingbird
Mottled duck
Mourning dove
Muscovy duck

Nighthawk
Northern oriole
Northern parula
Northern phalarope
Northern shoveler
Northern waterthrush

Oldsquaw
Orange crowned warbler
Orchard oriole
Osprey
Osprey
Ovenbird

Picoides villosus
Histrionicus histrionicus
Passerherbulus henslowii
Catharus guttatus
Larus argentatus
Lophodytes cucullatus
Wilsonia citrina
Podiceps auritus
Troglodytes aedon
Numenius phaeopus hudsonicus

Larus glaucoides
Passerina cyanea
Passerculus sandwichensis princeps
Campephilus principalis principalis

Oporornis formosus
Falco tinnunculus
Charadrius vociferus
Somateria spectabilis
Rallus elegans
Dendroica kirtlandii
Calidris canutus rufa

Larus atricilla
Ixobrychus exilis
Calidris minutilla
Sterna albifrons
Passerherbulus caudacutus
Aythya affinis
Tringa flavipes
Aramus gularis
Florida caerulea caerulea
Lanius ludovicianus
Numenius americanus
Numenius americanus americanus
Cistothorus palustris
Cistothorus palustris griseus
Hydranassa tricolor
Seiurus motacilla

Ammodramus maritima macgillivrayi
Dendroica magnolia
Anas platyrhynchos
Limosa fedoa
Circus cyaneus
Rallus longirostris
Oxyura dominica
Falco columbarius
Anas diazi
Ictinia mississippiensis
Mimus polyglottos
Mimus polyglottos polyglottos
Anas fulvigula
Zenaidura macroura
Cairina moschata

Chordeiles minor minor
Icterus galbula
Parula americana
Lobipes lobatus
Anas clypeata
Seiurus noveboracensis

Clangula hyemalis
Vermivora celata
Icterus spurius
Pandion haliaetus
Pandion haliaetus carolinensis
Seiurus aurocapillus

Painted bunting
Palm warbler
Peregrine falcon
Pied-billed grebe
Pigeon hawk
Pileated woodpecker
Pine siskin
Pine warbler
Pine warbler
Pine warbler
Pintail
Piping plover
Prairie warbler
Prothonotary warbler
Purple finch
Purple gallinule
Purple martin

Quail

Red-bellied woodpecker
Red-breasted merganser
Red-breasted nuthatch
Red-cockaded woodpecker
Red-cockaded woodpecker
Red-eyed vireo
Redhead
Red-headed woodpecker
Red-shouldered hawk
Red-tailed hawk
Red-throated loon
Red-winged blackbird
Ring-billed gull
Ring-necked duck
Robin
Rough-winged swallow
Royal tern
Ruby-crowned kinglet
Ruby-throated hummingbird
Ruddy duck
Ruddy turnstone
Ruffed grouse
Rufous-sided towhee
Rusty blackbird

Sanderling
Sandwich tern
Savannah sparrow
Screech owl
Seaside sparrow
Semipalmated plover
Semipalmated sandpiper
Sharp-shinned hawk
Sharp-tailed sparrow
Short-billed dowitcher
Short-billed marsh wren
Short-eared owl
Shoveler
Snipe
Snow goose
Snowy egret
Solitary sandpiper
Solitary vireo
Song sparrow
Sora
Southern bald eagle
Southern crested flycatcher
Southern crow
Southern downy woodpecker
Southern screech owl
Spotted sandpiper
Starling
Summer tanager

Passerina ciris ciris
Dendroica palmarum
Falco peregrinus anatum
Podilymbus podiceps
Falco columbarius columbarius
Dryocopus pileatus pileatus
Carduelis pinus
Dendroica pinus
Dendroica pinus pinus
Anas acuta
Charadrius melodus
Dendroica discolor discolor
Protonotaria citrea
Carpodacus purpureus
Porphyryula martinica
Progne subis subis

Colinus virginianus

Melanerpes carolinus carolinus
Mergus serrator
Sitta canadensis
Picoides borealis
Picoides borealis borealis
Vireo olivaceus
Aythya americana
Melanerpes erythrocephalus erythrocephalus
Buteo lineatus lineatus
Buteo jamaicensis borealis
Gavia stellata
Agelaius phoeniceus
Larus delawarensis
Aythya collaris
Turdus migratorius migratorius
Stelgidopteryx ruficollis serripennis
Sterna maxima
Regulus calendula
Archilochus colubris
Oxyura jamaicensis
Arenaria interpres
Bonasa umbellus
Pipilo erythrophthalmus
Euphagus carolinus

Crocethia alba
Sterna sandvicensis
Passerculus sandwichensis
Otus asio
Ammospiza maritima
Charadrius semipalmatus
Calidris pusillus
Accipiter striatus velox
Ammospiza caudacuta
Limnodromus griseus
Cistothorus platensis
Asio flammeus
Anas clypeata
Capella gallinago
Chen caerulescens
Egretta thula thula
Tringa solitaria
Vireo solitarius
Melospiza melodia atlantica
Porzana carolina
Haliaeetus leucocephalus leucocephalus
Myiarchus crinitus crinitus
Corvus brachyrhynchos paulus
Picoides pubescens pubescens
Otus asio asio
Actitis macularia
Sturnus vulgaris
Piranga rubra rubra

Surf scoter
Swainson's thrush
Swainson's warbler
Swallow-tailed kite
Swamp sparrow
Swamp sparrow

Tennessee warbler
Tree swallow
Tufted titmouse
Turkey
Turkey vulture

Veery
Vesper sparrow
Virginia rail

Wayne's clapper rail
Western sandpiper
Whimbrel
Whip-poor-will
Whistling swan
White-breasted nuthatch
White-eyed vireo
White-fronted goose
White ibis
White-throated sparrow
White-winged scoter
Willet
Wilson's petrel
Wilson's plover
Wilson's snipe
Winter wren
Woodcock
Wood duck
Wood ibis
Wood stork
Wood thrush
Worm-eating warbler

Yellow-bellied sapsucker
Yellow-billed cuckoo
Yellow-breasted chat
Yellow-crowned night heron
Yellow rail
Yellow-rumped warbler
Yellow-shafted flicker
Yellowthroat
Yellow-throated vireo
Yellow-throated warbler
Yellow warbler

Melanitta perspicillata
Catharus ustulatus
Limothlypis swainsonii
Elanoides forficatus
Melospiza georgiana
Melospiza georgiana georgiana

Vermivora peregrina
Iridoprocne bicolor
Parus bicolor
Meleagris gallopavo
Cathartes aura aura

Catharus fuscescens
Poocetes gramineus
Rallus limicola

Rallus longirostris waynei
Calidris mauri
Numenius phaeopus
Caprimulgus vociferus
Olor columbianus
Sitta carolinensis
Vireo griseus
Anser albifrons
Eudocimus albus
Zonotrichia albicollis
Melanitta deglandi
Catoptrophorus semipalmatus
Oceanites oceanicus
Charadrius wilsonia
Capella gallinago delicata
Troglodytes troglodytes
Philohela minor
Aix sponsa
Mycteria americana
Mycteria americana
Hylocichla mustelina
Helminthos vermivorus

Sphyrapicus varius varius
Coccyzus americanus americanus
Icteria virens
Nyctanassa violacea
Coturnicops noveboracensis
Dendroica coronata
Colaptes auratus auratus
Geothlypis trichas
Vireo flavifrons
Dendroica dominica dominica
Dendroica petechia

MAMMALS

Antillean beaked whale
Atlantic beaked whale
Atlantic bottle-nosed dolphin
Atlantic right whale

Beaver
Big brown bat
Black bear
Blue whale
Bobcat
Bottle-nosed dolphin
Bowhead whale
Brazilian free-tailed bat
Bridled dolphin
Bryde's whale

California sea lion
Colonial pocket gopher
Common dolphin
Common porpoise
Cotton mouse

Cotton rat
Cow
Cumberland Island pocket gopher

Dolphin
Domestic hog
Dwarf sperm whale

Eastern cottontail
Eastern cougar
Eastern mole
Eastern pipistrelle
Eastern wood rat
European fallow deer
European wild hog
Evening bat

False killer whale
Feral hog
Finback whale
Florida manatee
Florida panther
Flying squirrel
Fox squirrel

Goat
Goose-beaked whale
Grampus
Gray fox
Gray squirrel
Gray wolf

Harbor porpoise
Harbor seal
Harvest mouse
Hoary bat
Horse
House mouse
Humpback whale

Killer whale

Least shrew
Little brown myotis

Mesoplodon europaeus
Mesoplodon densirostris
Tursiops truncatus
Eubalaena glacialis

Castor canadensis
Eptesicus fuscus fuscus
Ursus americanus
Sibbaldus musculus
Lynx rufus
Tursiops truncatus
Balaena mysticetus
Tadarida brasiliensis cynocephala
Stenella frontalis
Balaenoptera edeni

Zalophus californianus
Geomys colonus
Delphinus delphis
Phocoena phocoena
Peromyscus gossypinus/Peromyscus gossypinus
anastasae

Sigmodon hispidus
Bos taurus
Geomys cumberlandius

Coryphaena hippurus
Sus scrofa domesticus
Kogia simus

Sylvilagus floridanus
Felis concolor cougar
Scalopus aquaticus/Scalopus aquaticus howelli
Pipistrellus subflavus subflavus
Neotoma floridana/Neotoma floridana floridana
Dama dama
Sus scrofa cristatus
Nycticeius humeralis humeralis

Pseudorca crassidens
Sus scrofa
Balaenoptera physalus
Trichechus manatus latirostris
Felis concolor coryi
Glaucomys volans saturatus
Sciurus Niger/Sciurus niger rufiventer

Capra hircus
Ziphius cavirostris
Grampus griseus
Urocyon cinereoargenteus
Sciurus carolinensis
Canis lupus

Phocoena phocoena
Phoca vitulina concolor
Reithrodontomys humilis
Lasiurus cinereus cinereus
Equus caballus
Mus musculus
Megaptera novaeangliae

Orcinus orca

Cryptotis parva
Myotis lucifugus lucifugus

Long-beaked dolphin
Long-beaked porpoise
Long-tailed weasel

Man
Marsh rabbit
Marsh rice rat
Meadow vole
Mink
Minke whale
Muskrat

Nine-banded armadillo

Northern yellow bat
Norway rat
Nutria

Old-field mouse
Opossum

Pine mouse
Pygmy sperm whale

Raccoon
Rafinesque's big-eared bat
Red bat
Red deer
Red fox
River otter
Roof rat
Rough-toothed dolphin
Rough-tooth porpoise

Sei whale
Seminole bat
Sheep
Sherman's pocket gopher
Short-finned blackfish
Short-finned pilot whale
Short-tailed shrew
Silver-haired bat
Southeastern myotis
Southeastern pocket gopher
Southeastern shrew

Southern flying squirrel
Sperm whale
Spotted dolphin
Spotted porpoise
Star-nosed mole
Striped dolphin
Striped skunk
Swamp rabbit

True's beaked whale

Virginia opossum

West Indian manatee
White-tailed deer
White-tailed deer
White-tailed deer
White-tailed deer
White-tailed deer

Stenella longirostris
Stenella longirostris
Mustela frenata olivacea

Homo sapiens
Sylvilagus palustris
Oryzomys palustris
Microtus pennsylvanicus pennsylvanicus
Mustela vison
Balaenoptera acutorostrata
Ondatra zibethicus

Dasypus novemcinctus/Dasypus novemcinctus
mexicanus

Lasiurus intermedius floridanus
Rattus norvegicus
Myocastor coypus

Peromyscus polionotus
Didelphis marsupialis

Pitymys pinetorum
Kogia breviceps

Procyon lotor
Plecotus rafinesquii macrotis
Lasiurus borealis borealis
Cervus elaphus
Vulpes fulva
Lutra canadensis
Rattus rattus
Steno bredanensis
Steno bredanensis

Balaenoptera borealis
Lasiurus seminolus
Ovis aries
Geomys fontanelius
Globicephala macrorhyncha
Globicephala macrorhyncha
Blarina brevicauda
Lasionycteris noctivagans
Myotis austroriparius
Geomys pinetis
Sorex longirostris/Sorex longirostris
longirostris

Glaucomys volans saturatus
Physeter catodon
Stenella plagiodon
Stenella plagiodon
Condylura cristata/Condylura cristata parva
Stenella coerulescens
Mephitis mephitis
Sylvilagus aquaticus

Mesoplodon mirus

Didelphis virginiana

Trichechus manatus latirostris
Odocoileus virginianus
Odocoileus virginianus hiltonensis
Odocoileus virginianus nigribarbis
Odocoileus virginianus taurinsulae
Odocoileus virginianus virginianus

REPTILES AND AMPHIBIANS

American alligator
American crocodile
Atlantic green turtle
Atlantic hawksbill turtle
Atlantic leatherback turtle
Atlantic loggerhead turtle
Atlantic ridley turtle
Atlantic salt marsh snake

Banded water snake
Barking treefrog
Black swamp snake
Box turtle
Brimley's chorus frog
Broad-banded water snake
Broadhead skink
Broad-striped dwarf siren
Broken-striped newt
Bronze frog
Brown snake
Brown water snake
Bullfrog

Canebrake rattlesnake
Carolina crawfish frog
Carolina diamondback terrapin
Carolina pigmy rattlesnake
Carolina salt marsh snake
Carolina swamp snake
Carpenter frog
Central newt
Chicken turtle
Common garter snake
Common snapping turtle
Cope's gray treefrog
Copperhead
Corn snake
Corn snake
Cottonmouth
Crawfish frog

Dwarf salamander
Dwarf waterdog

Earth snakes
Eastern bird-voiced treefrog
Eastern box turtle
Eastern chicken turtle
Eastern coachwhip
Eastern coral snake
Eastern cottonmouth
Eastern diamondback rattlesnake
Eastern earth snake
Eastern garter snake
Eastern glass lizard
Eastern hognose snake
Eastern indigo snake
Eastern kingsnake
Eastern lesser siren
Eastern mud snake
Eastern mud turtle
Eastern narrowmouth toad
Eastern ribbon snake
Eastern river cooter
Eastern slender glass lizard
Eastern spadefoot toad
Eastern spadefoot toad
Eastern tiger salamander
Eastern worm snake

Alligator mississippiensis
Crocodylus acutus
Chelonia mydas mydas
Eretmochelys imbricata imbricata
Dermochelys coriacea coriacea
Caretta caretta caretta
Lepidochelys kemoi
Nerodia fasciata taeniata

Nerodia fasciata fasciata
Hyla gratiosa
Seminatrix pygaea
Terrapene carolina ssp.
Pseudacris brimleyi
Nerodia fasciata confluens
Eumeces laticeps
Pseudobranchius striatus striatus
Notophthalmus viridescens dorsalis
Rana clamitans clamitans
Storeria dekayi
Nerodia taxispilota
Rana catesbeiana

Crotalus horridus atricaudatus
Rana areolata capito
Malaclemys terrapin centrata
Sistrurus miliaris miliaris
Nerodia sipedon williamensei
Seminatrix pygaea paludis
Rana virgatipes
Notophthalmus viridescens louisianensis
Deirochelys reticularia ssp.
Thamnophis sirtalis ssp.
Cheylra serpentina serpentina
Hyla chrysoscelis
Agkistrodon contortrix ssp.
Elaphe guttata ssp.
Elaphe guttata guttata
Agkistrodon piscivorus ssp.
Rana areolata ssp.

Eurycea quadridigitata
Necturus punctatus

Virginia spp.
Hyla avivoca ogechiensis
Terrapene carolina carolina
Deirochelys reticularia reticularia
Masticophis flagellum flagellum
Micrurus fulvius fulvius
Agkistrodon piscivorus piscivorus
Crotalus adamanteus
Virginia valeriae valeriae
Thamnophis sirtalis sirtalis
Ophisaurus ventralis
Heterodon platyrhinos
Drymarchon corais couperi
Lampropeltis getulus getulus
Siren intermedia intermedia
Farancia abacura abacura
Kinosternon subrubrum subrubrum
Gastrophryne carolinensis
Thamnophis sauritus sauritus
Chrysemys concinna concinna
Ophisaurus attenuatus longicaudus
Scaphiopus holbrooki
Scaphiopus holbrooki holbrooki
Ambystoma tigrinum tigrinum
Carpophis amoenus amoenus

Five-lined skink
 Flatwoods salamander
 Florida cooter
 Florida cottonmouth
 Florida crawfish frog
 Florida cricket frog
 Florida green water snake
 Florida pine snake
 Florida softshell

Garter snakes
 Glossy crayfish snake
 Gopher tortoise
 Gray treefrog
 Greater siren
 Green anole
 Green sea turtle
 Green treefrog
 Green turtle
 Green water snake
 Ground skink
 Gulf Coast spiny softshell
 Gulf salt marsh snake

Hawksbill turtle

Indigo snake
 Island glass lizard

Kemp's ridley turtle

Leatherback turtle
 Lesser siren
 Little grass frog
 Loggerhead turtle
 Longtail salamander

Mabee's salamander
 Many-lined salamander
 Marbled salamander
 Mole kingsnake
 Mole salamander
 Mole skink
 Mud salamander
 Mud salamander
 Mud snake
 Mud turtle

Newts
 North Florida swamp snake
 Northern cricket frog
 Northern diamondback terrapin
 Northern leopard frog
 Northern mole skink
 Northern redbelly snake
 Northern scarlet snake
 Northern spring peeper

Oak toad
 Ornate chorus frog

Peninsula ribbon snake
 Pickerel frog
 Pig frog
 Pine snake
 Pine woods snake
 Pine woods treefrog
 Pigmy rattlesnake

Rainbow snake
 Rainbow snake
 Ranid frogs
 Rat snake

Eumeces fasciatus
Ambystoma cingulatum
Chrysemys floridana floridana
Agkistrodon piscivorus conanti
Rana areolata aesopus
Acris gryllus dorsalis
Nerodia cyclopion floridana
Pituophis melanoleucus mugitus
Trionyx ferox

Thamnophis spp.
Rigina rigida rigida
Gopherus polyphemus
Hyla versicolor
Siren lacertina
Anolis carolinensis
Chelonia mydas
Hyla cinerea
Chelonia mydas
Nerodia cyclopion ssp.
Scincella lateralis
Trionyx spiniferus asperus
Nerodia fasciata clarki

Eretmochelys imbricata

Drymarchon corais
Ophisaurus compressus

Lepidochelys kemp

Dermochelys coriacea
Siren intermedia
Limnaeodius ocularis
Caretta caretta
Eurycea longicauda longicauda

Ambystoma mabeei
Stereochilus marginatus
Ambystoma opacum
Lampropeltis calligaster rhombomaculata
Ambystoma talpoideum
Eumeces egregius
Pseudotriton montanus ssp.
Pseudotriton montanus
Farancia abacura ssp.
Kinosternon subrubrum ssp.

Notophthalmus spp.
Seminatrix pygaea pygaea
Acris crepitans crepitans
Malaclemys terrapin terrapin
Rana pipiens
Eumeces egregius similis
Storeria occipitomaculata occipitomaculata
Cemophora coccinea copei
Hyla crucifer crucifer

Bufo quercicus
Pseudacris ornata

Thamnophis sauritus sackeni
Rana palustris
Rana grylio
Pituophis melanoleucus ssp.
Rhadinaea flavilata
Hyla femoralis
Sistrurus miliarius ssp.

Farancia erythrogramma ssp.
Farancia erythrogramma erythrogramma
Rana spp.
Elaphe obsoleta ssp.

Redbelly snake
Redbelly water snake
Red salamander
Red-spotted newt
Ribbon snake
Ringneck snake
River cooter
River frog
Rough earth snake
Rough green snake

Scarlet kingsnake
Six-lined racerunner
Slender glass lizard
Slimy salamander
Smooth earth snake
Southeastern crowned snake
Southeastern five-lined skink
Southern black racer
Southern chorus frog
Southern chorus frog
Southern copperhead
Southern cricket frog
Southern cricket frog
Southern dusky salamander
Southern fence lizard
Southern hognose snake
Southern leopard frog
Southern red salamander
Southern ringneck snake
Southern toad
Southern two-lined salamander
Spiny softshell
Spotted salamander
Spotted turtle
Spring peeper
Squirrel treefrog
Stinkpot
Striped crayfish snake
Striped mud turtle
Striped newt

Texas horned lizards
Three-lined salamander
Tiger salamander
Treefrogs
Two-lined salamander
Two-toed amphiuma

Upland chorus frog

Worm snake

Yellowbelly slider
Yellow rat snake

Storeria occipitomaculata
Nerodia erythrogaster erythrogaster
Pseudotriton ruber
Notophthalmus viridescens viridescens
Thamnophis sauritus ssp.
Diadophis punctatus
Chrysemys concinna ssp.
Rana heckscheri
Virginia striatula
Opheodrya aestivus

Lampropeltis triangulum elapsoides
Cnemidophorus sexlineatus sexlineatus
Ophisaurus attenuatus
Plethodon glutinosus glutinosus
Virginia valeriae
Tantilla coronata
Eumeces inexpectatus
Coluber constrictor priapus
Pseudacris nigrita
Pseudacris nigrita nigrita
Agkistrodon contortrix contortrix
Acris gryllus
Acris gryllus gryllus
Desmognathus auriculatus
Sceloporus undulatus undulatus
Heterodon simus
Rana sphenocephala
Pseudotriton ruber vioscai
Diadophis punctatus punctatus
Bufo terrestris
Eurycea bislineata cirrigera
Trionyx spiniferus ssp.
Ambystoma maculatum
Clemmys guttata
Hyla crucifer
Hyla squirella
Sternotherus odoratus
Regina alleni
Kinosternon bauri palmarum
Notophthalmus perstriatus

Phrynosoma cornutum
Eurycea longicauda guttolineata
Ambystoma tigrinum
Hyla spp.
Eurycea bislineata
Amphiuma means

Pseudacris triseriata feriarum

Carphophis amoenus ssp.

Chrysemys scripta scripta
Elaphe obsoleta quadrivittata

FISHES

Alewife
 Almaco jack
 American eel
 American shad
 Angelfishes
 Atlantic bonito
 Atlantic bumper
 Atlantic croaker
 Atlantic cutlassfish
 Atlantic guitarfish
 Atlantic mackerel
 Atlantic menhaden
 Atlantic midshipman
 Atlantic moonfish
 Atlantic needlefish
 Atlantic sharpnose shark
 Atlantic silverside
 Atlantic spadefish
 Atlantic stingray
 Atlantic sturgeon
 Atlantic thread herring

Balao
 Banded darter
 Banded drum
 Banded pygmy sunfish
 Banded sunfish
 Banded topminnow
 Bandtail puffer
 Barracudas
 Bay anchovy
 Bay whiff
 Bighead searobin
 Blackbanded darter
 Blackbanded sunfish
 Black bullhead
 Blackcheek tonguefish
 Black crappie
 Black drum
 Blackfin snapper
 Blackline tilefish
 Black jumprock
 Black madtom
 Black sea bass
 Blacktip shark
 Blackwing searobin
 Blennies
 Blueback herring
 Blue catfish
 Bluefin killifish
 Bluefish
 Bluegill
 Bluehead chub
 Blue marlin
 Bluespotted sunfish
 Bluntnose stingray
 Bonnethead
 Bowfin
 Broad flounder
 Brook silverside
 Brown bullhead
 Burrfishes
 Butterfish
 Butterfishes

Carolina hake
 Carp
 Chain pickerel

Alosa pseudoharengus
Seriola rivoliana
Anguilla rostrata
Alosa sapidissima
Holacanthus spp.
Sarda sarda
Chloroscombrus chrysurus
Micropogonias undulatus
Trichiurus lepturus
Rhinobatos lentiginosus
Scomber scombrus
Brevoortia tyrannus
Porichthys porosissimus
Vomer setapinnis
Strongylura marina
Rhizoprionodon terraenovae
Menidia menidia
Chaetodipterus faber
Dasyatis sabina
Acipenser oxyrhynchus
Opisthonema oglinum

Hemiramphus balao
Etheostoma zonale
Larimus fasciatus
Elassoma zonatum
Enneacanthus obesus
Fundulus cingulatus
Sphoeroides spengleri
Sphyrna spp.
Anchoa mitchilli
Citharichthys spilopterus
Prionotus tribulus
Percina nigrofasciata
Enneacanthus chaetodon
Ictalurus melas
Symphurus plagiosa
Pomoxis nigromaculatus
Pogonias cromis
Lutjanus buccanella
Caulolatilus cyanops
Moxostoma cervinum
Noturus funebris
Centropristis striata
Carcharhinus limbatus
Prionotus salmonicolor
Chasmodes spp.
Alosa aestivalis
Ictalurus furcatus
Lucania goodei
Pomatomus saltatrix
Lepomis macrochirus
Nocomis leptoccephalus
Makaira nigricans
Enneacanthus gloriosus
Dasyatis sayi
Sphyrna tiburo
Amia calva
Paralichthys squamulentus
Labidesthes sicculus
Ictalurus nebulosus
Chilomycterus spp.
Peprilus triacanthus
Peprilus spp.

Urophycis eairli
Cyprinus carpio
Esox niger

Chain pipefish
 Channel catfish
 Christmas darter
 Clearnose skate
 Clown goby
 Coastal shiner
 Cobia
 Combtooth blennies
 Conger eel
 Cownose ray
 Crappies
 Creek chubsucker
 Crested blenny
 Crevalle jack
 Cypress minnow

 Darter goby
 Darters
 Darters
 Dollar sunfish
 Dolphins
 Dusky anchovy
 Dusky pipefish
 Dusky shark
 Dusky shiner

 Eastern mudminnow
 Everglades pygmy sunfish

 Fathead minnow
 Fat sleeper
 Feather blenny
 Finetooth shark
 Flat bullhead
 Flathead catfish
 Flier
 Florida blenny
 Florida gar
 Florida pompano
 Flounders
 Freshwater drum
 Freshwater goby
 Fringed flounder

 Gafftopsail catfish
 Gag grouper
 Gars
 Gizzard shad
 Glassy darter
 Gobies
 Gobies
 Golden shiner
 Golden topminnow
 Goldfish
 Gold tilefish
 Gray snapper
 Great barracuda
 Greater amberjack
 Green goby
 Greenhead shiner
 Green sunfish
 Groupers
 Guaguanche
 Gulf flounder
 Gulf kingfish

 Hakes
 Halfbeak
 Hammerhead sharks
 Harvestfish
 Herrings
 Hickory shad
 Highfin carpsucker
 Highfin goby

Syngnathus louisianae
Ictalurus punctatus
Etheostoma hopkinsi
Raja eglanteria
Microgobius gulosus
Notropis petersoni
Rachycentron canadum
Hyposoblennius spp.
Conger oceanicus
Rhinoptera bonasus
Pomoxis spp.
Erimyzon oblongus
Hypleurochilus geminatus
Caranx hippos
Hybognathus hayi

Gobionellus boleosoma
Etheostoma spp.
Percina spp.
Lepomis marginatus
Coryphaena spp.
Anchoa lyolepis
Syngnathus floridae
Carcharhinus obscurus
Notropis cummingsae

Umbra pygmaea
Elassoma evergladei

Pimephales promelas
Dormitator maculatus
Hypsoblennius hentzi
Aprionodon isodon
Ictalurus platycephalus
Pyrodicteis olivaris
Centrarchus macropterus
Chasmodes saburrae
Lepisosteus platyrhincus
Trachinotus carolinus
Paralichthys spp.
Aplodinotus grunniens
Gobionellus shufeldti
Etropus crossotus

Bagre marinus
Mycteroperca microlepis
Lepisosteus spp.
Dorosoma cepedianum
Etheostoma vitreum
Gobionellus spp.
Gobiosoma spp.
Notemigonus crysoleucas
Fundulus chrysotus
Carassius auratus
Lopholatilus chamaeleonticeps
Lutjanus griseus
Sphyrna barracuda
Seriola dumerili
Microgobius thalassinus
Notropis chlorocephalus
Lepomis cyanellus
Mycteroperca spp.
Sphyrna guachancho
Paralichthys albigutta
Menticirrhus littoralis

Urophycis spp.
Hyporhamphus unifasciatus
Sphyrna spp.
Peprilus alepidotus
Alosa spp.
Alosa mediocris
Carpiodes velifer
Gobionellus oceanicus

Highfin shiner
Hogchoker
Horse-eye jack

Inshore lizardfish
Irish pompano
Ironcolor shiner

Jacks

Killifishes
Kingfishes
King mackerel
King whittings

Ladyfish
Lake chubsucker
Lancer stargazer
Largemouth bass
Least killifish
Leatherjacket
Lefteye flounders
Lefteye flounders
Lemon shark
Leopard searobin
Lined seahorse
Lined topminnow
Logperch
Longear sunfish
Longnose gar
Lookdown
Lyre goby

Madtoms
Margined madtom
Marked goby
Marsh killifish
Menhaden
Mojarra
Mosquitofish
Mud sunfish
Mullet
Mummichog

Naked goby
Naked sole
Niangua darter
Northern kingfish
Northern pipefish
Northern puffer
Northern searobin

Oceanic whitetip shark
Ocellated flounder
Ocmulgee shiner
Ochopee shiner
Okefenokee pygmy sunfish
Orange filefish
Oyster toadfish

Palespotted eel
Palometa
Permit
Piedmont darter
Pigfish
Pikes
Pinfish
Pirate perch
Planehead filefish
Pompano
Porgies
Porgies
Puffers

Notropis altipinnis
Trinectes maculatus
Caranx latus

Synodus foetens
Diapterus olisthostomus
Notropis chalybaeus

Caranx spp.

Fundulus spp.
Menticirrhus spp.
Scomberomorus cavalla
Menticirrhus spp.

Elops saurus
Erimyzon sucetta
Kathetostoma albigutta
Micropterus salmoides
Heterandria formosa
Oligoplites saurus
Citharichthys spp.
Paralichthys spp.
Negaprion brevirostris
Prionotus scitulus
Hippocampus erectus
Fundulus lineolatus
Percina caprodes
Lepomis megalotis
Lepisosteus osseus
Selene vomer
Evorthodus lyricus

Noturus spp.
Noturus insignis
Gobionellus stigmaticus
Fundulus confluentus
Brevoortia spp.
Eucinostomus spp.
Gambusia affinis
Acantharchus pomotis
Mugil spp.
Fundulus heteroclitus

Gobiosoma boscii
Gymnachirus melas
Etheostoma nianguse
Menticirrhus saxatilis
Syngnathus fuscus
Sphoeroides maculatus
Prionotus carolinus

Carcharhinus longimanus
Ancylorhynchus quadricellatus
Notropis callisema
Notropis leedsii
Elassoma okefenokee
Aluterus schoepfi
Opsanus tau

Ophichthus ocellatus
Trachinotus goodei
Trachinotus falcatus
Percina crassa
Orthopristis chrysoptera
Esox spp.
Lagodon rhomboides
Aphredoderus sayanus
Monacanthus hispidus
Trachinotus spp.
Calamus spp.
Stenotomus spp.
Sphoeroides spp.

Pugnose minnow
Pumpkinseed
Pygmy filefish
Pygmy killifish
Pygmy sunfishes

Rainwater killifish
Redbreast sunfish
Red drum
Red porgy
Red snapper
Redear sunfish
Redfin pickerel
Requiem sharks
River carpsucker
Rock sea bass
Rosefin shiner
Rosyface chub
Rough silverside

Sailfin molly
Sailfin shiner
Sailfish
Sandbar shark
Sand perch
Savannah darter
Sawcheek darter
Scaled sardine
Scalloped hammerhead
Scamp grouper
Seaboard goby
Sea catfish
Searobins
Seatrout
Sharksucker
Sharptail goby
Sheepshead
Sheepshead minnow
Shield darter
Shiners
Shorthead redhorse
Shortnose sturgeon
Shrimp eel
Silk snapper
Silver jenny
Silver perch
Silver redhorse
Silver seatrout
Silversides
Silvery minnow
Skilletfish
Smallmouth bass
Smooth butterfly ray
Smooth dogfish
Smooth hammerhead
Smooth puffer
Snail bullhead
Snappers
Snook
Snowy grouper
Southern flounder
Southern hake
Southern kingfish
Southern stargazer
Southern stingray
Spadefishes
Spanish mackerel
Spanish sardine
Speckled hind
Speckled madtom
Speckled worm eel
Spinycheek sleeper
Spiny dogfish

Notropis emiliae
Lepomis gibbosus
Monacanthus setifer
Leptolucania ommata
Elassoma spp.

Lucania parva
Lepomis auritus
Sciaenops ocellata
Pagrus sedecim
Lutjanus campechanus
Lepomis microlophus
Esox americanus americanus
Carcharhinus spp.
Carpionodes carpio
Centropomus philadelphicus
Notropis ardens
Hybopsis rubrifrons
Membras martinica

Poecilia latipinna
Notropis hypselopterus
Istiophorus platypterus
Carcharhinus milberti
Diplectrum formosum
Etheostoma fricksium
Etheostoma serriferum
Harengula pensacola
Sphyrna lewini
Mycteroperca phenax
Gobiosoma ginsburgi
Arius felis
Prionotus spp.
Cynoscion spp.
Echeneis naucrates
Gobionellus hastatus
Archosargus probatocephalus
Cyprinodon variegatus
Percina peltata
Notropis spp.
Moxostoma macrolepidotum
Acipenser brevirostrum
Ophichthus gomesi
Lutjanus vivanus
Eucinostomus gula
Bairdiella chrysura
Moxostoma anisurum
Cynoscion nothus
Menidia spp.
Hybognathus nuchalis
Gobiesox strumosus
Micropterus dolomieu
Gymnura micrura
Mustelus canis
Sphyrna zygaena
Lagocephalus laevis
Ictalurus brunneus
Lutjanus spp.
Centropomus undecimalis
Epinephelus niveatus
Paralichthys lethostigma
Urophycis floridanus
Menticirrhus americanus
Astroscopus y-graecum
Dasysatis americana
Chaetodipterus spp.
Scomberomorus maculatus
Sardinella anchovia
Epinephelus drummondhayi
Noturus leptacanthus
Myrophis punctatus
Eleotris pisonis
Squalus acanthias

Spot
 Spotfin killifish
 Spotfin mojarra
 Spottail shiner
 Spotted eagle ray
 Spotted hake
 Spotted seatrout
 Spotted sucker
 Spotted sunfish
 Spotted whiff
 Star drum
 Starhead topminnow
 Stingrays
 Striped anchovy
 Striped bass
 Striped blenny
 Striped burrfish
 Striped cusk-eel
 Striped killifish
 Striped mullet
 Striped searobin
 Suckermouth redhorse
 Summer flounder
 Sunfishes
 Swallowtail shiner
 Swamp darter
 Swampfish

Tadpole madtom
 Taillight shiner
 Tarpon
 Temperate basses
 Tessellated darter
 Threadfin shad
 Thread herrings
 Tidewater silverside
 Tilefish
 Tomtate
 Tripletail

Vermilion snapper

Wahoo
 Walleye
 Warmouth
 Warsaw grouper
 Weakfish
 Whiffs
 Whiffs
 White bass
 White catfish
 White crappie
 Whitefin shiner
 White hake
 White marlin
 White mullet
 White perch
 Windowpane

Yellow bullhead
 Yellowedge grouper
 Yellowfin menhaden
 Yellowfin shiner
 Yellow perch

Leiostomus xanthurus
Fundulus luciae
Eucinostomus argenteus
Notropis hudsonius
Aetobatus narinari
Urophycis regius
Cynoscion nebulosus
Minytrema melanops
Lepomis punctatus
Citharichthys macrops
Stellifer lanceolatus
Fundulus notti
Dasyatis spp.
Anchoa hepsetus
Morone saxatilis
Chasmodes bosquianus
Chilomycterus schoepfi
Rissola marginata
Fundulus majalis
Mugil cephalus
Prionotus evolans
Moxostoma pappillosum
Paralichthys dentatus
Enneacanthus spp.
Notropis procne
Etheostoma fusiforme
Chologaster cornuta

Noturus gyrinus
Notropis maculatus
Megalops atlantica
Morone spp.
Etheostoma olmstedi
Dorosoma petenense
Opisthonema spp.
Menidia beryllina
Lopholatilus chamaeleonticeps
Haemulon aurolineatum
Lobotes surinamensis

Rhomboplites aurorubens

Acanthocybium solanderi
Stizostedion vitreum vitreum
Lepomis gulosus
Epinephelus nigritus
Cynoscion regalis
Citharichthys spp.
Etropus spp.
Morone chrysops
Ictalurus catus
Pomoxis annularis
Notropis niveus
Urophycis tenuis
Tetrapturus albidus
Mugil curema
Morone americana
Scophthalmus aquosus

Ictalurus natalis
Epinephelus flavolimbatus
Brevoortia smithi
Notropis lutipinnis
Perca flavescens

APPENDIX I

Groups Endorsing the ACE Basom NERR

ORGANIZATIONS ENDORSING THE ACE BASIN PROJECT

Atlantic Coast Conservation Association of S. C.
Beaufort County Council
Beaufort County Open Land Trust
Carolina Bird Club
Coastal Zone Education Center
Colleton County Council
* Ducks Unlimited, Inc.
* Ducks Unlimited Foundation
Edisto Beach Property Owners Association
Edisto Beach Sport Fishing Association
Edisto Island Community Association
Edisto River Canoe & Kayak Trail Committee
Garden Club of S. C., Inc.
Georgia Conservancy
Greater Charleston Garden Club Council
Hilton Head Island Fishing Club
Jasper County Forestry and Wildlife Management Association
Kiawah Island Natural History Club
Lowcountry Paddlers
Lowcountry Open Land Trust
Lowcountry Saltwater Sports Fisherman's Club
Merck Family Fund
National Audubon Society
National Wild Turkey Federation
National Wildlife Federation
Palmetto Shell Club
Quail Unlimited (National)
Quality Deer Management Association (S.C. Chapter)
S. C. Aquarium (Charleston)
* S. C. Wildlife & Marine Resources Department
S. C. State Development Board
S. C. Chapter of the Sierra Club
S. C. Plantation Managers Association
S. C. Coastal Conservation League
S. C. Outdoor Press Association
S. C. Waterfowl Association
S. C. Shrimpers Association
S. C. Wildlife Federation
S. C. Wildlife Heritage
Sport Fishing Institute
The National Fish & Wildlife Foundation
* The Nature Conservancy
* The S. C. Nature Conservancy
The Trust for Public Land
* U. S. Fish & Wildlife Service
Warm Water Streams Committee of the American Fisheries Society
Wildlife Action, Inc.
The Wildlife Society (S. C. Chapter)
City of Walterboro
Walterboro-Colleton Chamber of Commerce

APPENDIX J

WRITTEN AND ORAL COMMENTS

received on the

ACE Basin National Estuarine Research Reserve DEIS/DMP



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
9450 Koger Boulevard
St. Petersburg, Florida 33702

April 3, 1991

Response to the U.S. Department of Commerce
National Oceanic and Atmospheric Administration

Ms. Susan E. Durden, Regional Manager
Sanctuaries and Reserves Division
Office of Ocean and Coastal Resource Management
National Ocean Service/NOAA
1825 Connecticut Avenue NW., Suite 714
Washington, D.C. 20235

Dear Ms. Durden:

Please reference your February 20, 1991, letter requesting comments on the Ashepoo-Combahee-Edisto (ACE) Basin National Estuarine Research Reserve in South Carolina, Draft Environmental Impact Statement (DEIS), and Draft Management Plan (DMP).

The DEIS and DMP adequately address National Marine Fisheries Service's (NMFS) trust resources. However, we recommend that the NMFS be added to the Advisory Committee list found on page 39 of the document. This recommendation is based on our extensive involvement in both estuarine research and estuarine habitat management activities in the southeast.

1.1

1.1 The National Marine Fisheries Service has been added to the Advisory Committee on pages 42-43, as requested.

Thank you for the opportunity to provide these comments.

Sincerely,

Andreas Mager, Jr.
Assistant Regional Director
Habitat Conservation Division

cc:
CS/EC - Cottingham





United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240



Response to the U.S. Department of the Interior
Office of Environmental Affairs

In Reply Refer To:
ER 91/230

APR 15 1991

Ms. Susan E. Durden, Regional Manager
Sanctuaries and Reserves Division
Office of Ocean and Coastal Resource Management
National Ocean Service/NOAA
1825 Connecticut Avenue, N.W., Suite 714
Washington, D.C. 20235

Dear Ms. Durden:

The Department of the Interior has reviewed the Draft
Environmental Impact Statement and Management Plan for the
Ashepoo-Combahee-Edisto (ACE) Basin National Estuarine Research
Reserve in South Carolina. We have no comments to offer. 2.1

Thank you for the opportunity to review the document.

Sincerely,

Jonathan P. Deason
Director
Office of Environmental Affairs

2.1 Comment noted; no response necessary.

NATIONAL SCIENCE FOUNDATION

WASHINGTON, D.C. 20550



OFFICE OF THE
ASSISTANT DIRECTOR
FOR GEOSCIENCES

MAR 18 1991

Response to the National Science Foundation

Ms. Susan E. Durden
Regional Manager
Sanctuaries and Reserve Division
Office of Ocean and Coastal Resource Management
National Ocean Service/NOAA
1825 Connecticut Avenue, NW
Suite 174
Washington, DC 20235

Dear Ms. Durden:

Thank you for providing us the opportunity to review the Draft
Environmental Impact Statement and Draft Management Plan for the
"Ashepoo-Combahee-Edisto (ACE) Basin National Estuarine Research
Reserve in South Carolina." 3.1

We have no comments to offer at this time.

Sincerely,

A handwritten signature in cursive script that reads "Julian Shedlovsky".

Julian Shedlovsky
Staff Associate for Budget
and Environmental Policy

3.1 Comment noted; no response necessary.



WRITTEN COMMENTS AND RESPONSES
State and Local Organizations



South Carolina Water Resources Commission

1201 Main Street, Suite 1100 ☐ Columbia, S.C. 29201 ☐ Telephone (803) 737-0800

Response to the South Carolina Water Resources Commission
Executive Director's Office

Alfred H. Vang
Executive Director

April 9, 1991

Ms. Susan E. Durden, Regional Manager
Sanctuaries and Reserves Division
Office of Ocean and Coastal Resource Management
National Ocean Service/NOAA
1825 Connecticut Avenue, N.W.
Suite 714
Washington, D.C. 20235

Dear Ms. Durden:

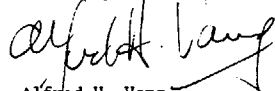
This letter is in reference to the Draft Environmental Impact Statement and Draft Management Plan for the ACE Basin National Estuarine Research Reserve in South Carolina. We would respectfully ask that you include the South Carolina Water Resources Commission as one of the organizations endorsing the ACE Basin Project. My staff will forward additional comments to you on the DEIS and Draft Management Plan.

4.1

4.1 Comment noted; The South Carolina Water Resources Commission has been added to the list of organizations endorsing the ACE Basin Project in Appendix I.

If you have any questions concerning this request, please do not hesitate to contact me. Thank you for your assistance in this matter.

Sincerely,


Alfred H. Vang
Executive Director

AHV/kañ

cc: Mr. David Cottingham, Director
Ecology & Environmental Conservation Office



South Carolina Water Resources Commission

1201 Main Street, Suite 1100 Columbia, S.C. 29201 Telephone (803) 737-0800

Response to the South Carolina Water Resources Commission

Alfred H. Vang
Executive Director

April 8, 1991

Ms. Susan E. Durden, Regional Manager
Sanctuaries and Reserves Division
Office of Ocean and Coastal Resource Management
National Ocean Service/NOAA
1825 Connecticut Avenue NW
Suite 714
Washington, DC 20235

RE: Draft Environmental Impact Statement/Management Plan for ACE Basin
National Estuarine Research Reserve

Dear Ms. Durden:

This letter responds to your request for comments on this draft environmental impact statement relevant to the interests of this agency. We are very pleased to support the inclusion of this area in the National Estuarine Research Reserve and endorse the concepts of this document. Our geographic information section is providing very significant support for the project and the section director, Anne Marie Hale, has submitted some comments on the EIS directly to Michael McKenzie in a letter dated March 27, 1991.

Additionally, we would like to submit the following comments:

Groundwater.

On page 87, the second paragraph under the ground-water section states that "Limestones of upper and middle Eocene age (Santee Formation and the Ocala Group) comprise the Principal Artesian Aquifer of southeastern South Carolina". Historically, this aquifer has been referred to as the Tertiary Limestone Aquifer, Principal Artesian Aquifer, and simply the Santee. The currently accepted nomenclature is the Floridan aquifer. The Santee Limestone has been given formation status and is included in the Orangeburg Group of middle Eocene age. The Ocala is not a group but a formation within the Cooper Group of upper Eocene age. These two formations collectively comprise the Floridan aquifer.

The last paragraph refers to sandstones within the Cretaceous Tuscaloosa and Black Creek Formations. Early investigators used the term Tuscaloosa because of the similarity of the sediments to sands that occurred near Tuscaloosa, Alabama. These sediments have since been determined to be of a younger age and are not in fact part of the Tuscaloosa Formation. The correct terminology for Cretaceous age sands in

5.1

5.1 Corrections have been made to pages 87-88.

Ms. Susan E. Durden
April 8, 1991
Page 2

Response to the South Carolina Water Resources Commission
(Page 2)

South Carolina, in ascending order, is the Middendorf Formation, Black Creek Formation and the Pee Dee Formation.

These comments were provided by Robert Logan of our Groundwater Division.

Climate. We suggest this section on p. 87 be replaced with the following:

"The climate of the ACE Basin region is classified as maritime subtropical in which winter is relatively short and mild and the summer is long, hot and humid. Major features which control the climate in the region are:

- Warm ocean currents (Gulf Stream)
- Seasonal pressure centers such as the Azores High.
- Tropical cyclones
- Prevailing winds generated by the sea breeze effect.

The region's summer season begins in May and lasts through the end of October. During the summer months, sea breeze effect is the predominant climate control. On a daily basis, the land heats up quicker than the adjacent ocean waters creating warm air at the land surface. By afternoon this warm air rises and is replaced by moist, cooler air from over the ocean. This circulation creates an onshore "sea breeze". In most instances, these breezes can extend inland only a few miles. During the nighttime hours, this process reverses since the ocean waters retain the heat gained during the day, and the breezes blow out to sea. Further inland, summer temperatures are several degrees higher than those along the immediate coastline since the sea breeze effect diminishes with landward distance.

The sea breeze effect also influences the daily development of showers and thunderstorms. Showers will develop offshore during the day as warm, moist air from the land rises and moves over the cooler ocean water. At night, isolated showers will develop over land. Rainfall, on the average, is highest during the summer months throughout the region. Occasionally, severe thunderstorms will develop ahead of cold fronts which pass through the region. These severe storms sometimes generate tornadoes or water spouts and can be accompanied by high winds and hail.

Across the ACE Basin, the annual total number of thunderstorm days is 59. Over the period from 1950-1989, 6 tornadoes have touched down in the region. Annual total rainfall varies from 50.2 inches at Beaufort, S.C. to 46.9 inches along the coast. The month with the heaviest rainfall is July (7.1 inches) and the month with the lowest rainfall is November (2.1 inches). Rainfall induced from tropical weather systems normally accounts for 25 percent of the total rainfall received during the period from August through October. Precipitation extremes range from a maximum of 22.69 in July of 1964 to a minimum of 0.44 inches in November of 1956.

5.2 The Climate section, on pages 88-89, has been revised with the recommended text.

Ms. Susan E. Durden
April 8, 1991
Page 3

Response to the South Carolina Water Resources Commission
(Page 3)

Temperatures vary from an average minimum in January of 38.2 degrees to an average maximum in July of 89.9 degrees. Average temperatures along the immediate coast are 1 to 3 degrees cooler in summer and 1 to 3 degrees warmer in winter compared with inland locations in the ACE Basin. Inland temperature extremes range from a high of 105 (7/20/1986) degrees in the summer to a low of 0 degrees (1/21/85) in the winter.

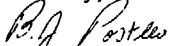
The ACE Basin occasionally experiences tropical storms and hurricanes during the hurricane season which lasts from May through November. Tropical cyclones form predominantly in the Atlantic Ocean west of the Antilles Islands, while the remainder form offshore, in the Caribbean, or in the Gulf of Mexico. Hurricanes which hit the lower South Carolina coast occurred in 1885 (unnamed), 1803 (unnamed), 1911 (unnamed), 1940 (unnamed), 1954 Hazel, 1959 (Gracie), 1979 (David), 1985 (Bob), and 1989 (Hugo). These storms resulted in the loss of many lives and millions of dollars in property damage to South Carolina's lower coastline. In recent memory, Hurricane David had the greatest impact on the Ace Basin.

In addition to the damage caused by hurricanes, the most significant climatic impacts on the environment in the ACE Basin are the result of drought (1954, 1977, 1986, 1988, 1990); flooding (1989, 1990); and cold temperatures (1977, 1983, 1985). Long periods of drought and extensive flooding cause wide fluctuations in the fresh water flow into estuarine systems, while cold air outbreaks can lower water temperatures to less than 45 degrees. Each of these extreme climatic events has a significant impact on fisheries and sensitive vegetation throughout the basin."

These comments were provided by David J. Smith, State Climatologist.

Thank you for the opportunity to comment on this EIS.

Sincerely,


Barbara J. Postles
Environmental Planner

BJP:cw

cc: Danny Johnson
Anne Hale
Robert Logan
D.J. Smith



Fred P. Brinkman, Executive Director

Division of Engineering & Planning
William R. Jennings, Director
(803) 734-0173
FAX: 803 734 1409

April 3, 1991

Ms. Susan Durden, Regional Manager
Sanctuaries and Reserves Division
Office of Ocean & Coastal Resource Management
1825 Connecticut Avenue, N.W.
Washington, D.C. 20235

Dear Ms. Durden:

Thank you for the opportunity to comment on the Ashepoo-Combahee-Edisto (ACE) Basin National Estuarine Research Reserve (NERR) Draft Environmental Impact Statement and Draft Management Plan.

The South Carolina Department of Parks, Recreation and Tourism supports the establishment of the ACE Basic NERR in order to ensure the management of this unique estuarine ecosystem for the purposes of research, education, interpretation, passive recreation, and protection. This was evidenced by the unanimous vote taken at the May 10, 1990 SCPRT Commission meeting to endorse the plan to protect the ACE Basin. SCPRT believes that the "preferred alternative," as described in the Management Plan, would best fulfill the objectives of the National Estuarine Research Reserve. The inclusion of Edisto Beach State Park and Hunting Island State Park in the Buffer Zone is consistent and compatible with the current uses and preservation practices of these two parks. We also welcome the opportunity to participate on the ACE Basin NERR Advisory Committee as outlined in the Management Plan. 6.1

As a more specific comment, I would like to request that SCPRT be added to the list of groups that have a high interest in conducting "research and educational programs" in the ACE Basin (page 59). With Edisto Beach and Hunting Island State Parks in the reserve, we feel that this would greatly enhance our efforts in 1) expanding educational programs and eco-tourism related activities and 2) cultural, natural, and historic preservation and interpretation. 6.2

Thank you again for the opportunity to comment on this very important effort.

Sincerely,

Fred P. Brinkman
Executive Director

cc: Dr. James A. Timmerman

Response to the South Carolina Department of Parks, Recreation and Tourism (SCPRT)

6.1 Comment noted; no response necessary.

6.2 Comment noted; The SCPRT has been added to the list of groups interested in conducting research and educational programs in the ACE Basin National Estuarine Research Reserve on pages 57-60.



Executive Director
BETTY SPENCE

The South Carolina Wildlife Federation

Mailing Address:
PO Box 61159
Columbia, SC 29260-1159

Street Address:
5219 Trenholm Road
Columbia, SC 29206

Phone (803) 782-8626

Response to the South Carolina Wildlife Federation

April 1, 1991

South Carolina Department of Wildlife and Marine Resources
PO Box 12559
Charleston, SC 29412

Dear Sirs:

I have reviewed the Ashepoo-Combahee-Edisto (ACE) Basin National Estuarine Research Reserve Draft Environmental Impact Statement and Draft management Plan dated February, 1991 on behalf of the South Carolina Wildlife Federation.

The Federation commends the South Carolina Wildlife and Marine Resources Department and the National Oceanic and Atmospheric Administration on this document. We support the concepts of the plan and recognize the importance of the Estuarine Research Reserve Program in expanding our knowledge of natural areas and in protecting existing uses while conserving significant natural resources.

The plan will demand careful coordination of programs within various divisions of the Wildlife Department. We encourage utilization of existing programs and facilities to the extent it is feasible in order to prevent duplication both in capital and manpower expenditures.

The meshing of different ownerships and the variety of resource activities and usage are strengths in the plan. The agencies and organizations involved have demonstrated cooperation and a creative approach to accomplishing a conservation objective.

Kindest regards,

Betty Spence
Betty Spence
Executive Director

EHS/erm

7.1

7.1 Comment noted; NOAA and the South Carolina Coastal Council look forward to the coordination with the South Carolina Wildlife and Marine Resources Department in the management of the ACE Basin National Estuarine Research Reserve.

South Carolina
Coastal Zone Education Center

April 3, 1991

Dear Sirs:

My name is Bruce C. Lampright, and I serve as the Project Administrator and Coordinator of Public Education for USC-Beaufort's Coastal Zone Education Center in Bluffton, SC. I believe the ACE Basin's value as an outdoor classroom cannot be overated. There is a great need state^{wide} and nation-wide to increase public awareness and understanding of the estuarine environment and to provide opportunities for public education and interpretation. The four existing coastal education facilities found along SC's coast cannot now meet the demand for programs placed upon them. The proposed visitor/interpretive center at Bear Island WMA has the potential to help meet these needs and demands for educating the public of South Carolina, the Nation and beyond.

The USC-Beaufort Coastal Zone Education Center supports ~~the efforts of the~~ ^{EFFORTS TO} ACE Basin Project and recommends ~~that~~ the lower ACE Basin ~~be~~ designated as a National Estuarine Research Reserve (NERR).

8.1

8.1 Comment noted; no response necessary.

*Sincerely,
Bruce C. Lampright*



P.O. Box 22524
Hilton Head Island, South Carolina 29925
(803) 837-4848





UNIVERSITY OF SOUTH CAROLINA
AT BEAUFORT

800 Carteret Street
Beaufort, SC 29902
(803) 524-7112

Suite 300, Kiawah Bldg
10 Office Park Road
Hilton Head Island, SC 29928
(803) 785-3995

Response to the University of South Carolina at Beaufort

April 3, 1991

TO: ACE Basin Committee

FROM: Ed Caine *Ed Caine*
Director of Coastal Zone Education Center and
Professor of Marine Science, USCB

RE: Support of the ACE Basin Project

USC Beaufort supports the concept of environmental sanctuaries. Environmental sanctuaries provide refuges for plants and animals. Sanctuaries also provide refuges for people: a place to escape from the confines of work, cities, and suburbia; a place to explore and experience; a place to become acquainted and reacquainted with nature.

USC Beaufort especially supports the unique educational opportunities that can be provided by the ACE Basin ^{NEER} project. Interpretive centers, guided tours, and programs can be generated to support both formal and informal education. We believe that formal education programs incorporating use of ACE Basin ^{NEER} facilities represent a special opportunity for students in the lowcountry of South Carolina. Proper development and coordination are essential during the planning stages of development in order to maximize the utility and diversity of learning experiences, but this should pose no problem. If USC Beaufort's involvement is solicited then USC Beaufort and the Coastal Zone Education Center stand ready to assist in any manner that we are able to provide.

9.1

9.1 Comment noted; The University of South Carolina at Beaufort and the Coastal Zone Education Center have been added to the list of groups with an interest in conducting research and educational programs on pages 57-60.

National Audubon Society

FRANCIS BEIDLER FOREST
(FOUR HOLES SWAMP), RT. 1, BOX 600, HARLEYVILLE, SOUTH CAROLINA 29448
(803) 462-2150 FAX (803) 462-2150



Response to the National Audubon Society

4/3/91

Walterboro, South Carolina

Statement - The National Audubon Society--ACE Basin Natural Estuarine
Research Reserve

I am Norman L. Brunswig, Assistant Director of Sanctuaries for the National Audubon Society, and Manager of the Francis Beidler Forest, a 6,000 acre sanctuary in Four Holes Swamp, located near Harleyville, SC. My statement this evening is on behalf of the 548,000 members of The National Audubon Society, which includes 6,000 South Carolina residents in eight SC chapters).

Four Holes Swamp, in which our Beidler Forest Sanctuary is located, is a tributary of the Edisto River. Audubon also owns two salt marsh sanctuaries on Edisto Island, and we patrol The Alexander Sprunt Sanctuary, a shore and wading bird nesting colony located in the mouth of the North Edisto River. In support of these land based programs, but also because Audubon believes that the ACE Basin is one of the finest, if not the finest, large undeveloped wildlife and wildland areas on the East Coast, our organization and its members strongly supports the comprehensive protection of the ACE.

10.1

10.1 Comment noted; no response necessary.

Almost since its birth in 1903, Audubon has championed wetlands protection. Today, one of its four, only four, high priority campaigns is nationwide wetlands protection! In line with the goals of that campaign, tonight, we specifically support the establishment of The ACE Basin National Estuarine Research Reserve. Further, we endorse the draft management plan and environmental impact statement.

In closing, we believe that only by dramatic and broadly supported conservation action such as the establishment of this reserve, can the magnificent natural values and important traditional uses of the ACE be maintained. One need only visit the Chesapeake Bay or Long Island Sound to observe what no action, or to little action to late, can produce.

Thank you for this opportunity to speak.

Norman L. Brunswig

AUDUBON



April 12, 1991

Response to the South Carolina Electric and Gas Company

Ms. Cheryl Graham
Sanctuaries and Reserves Division
Office of Oceans and Coastal Resource Management
National Oceanic and Atmospheric Administration
1825 Connecticut Avenue, N.W.
Room 714
Washington, DC 20235

Re: ACE Basin NERR

Dear Ms. Graham:

On behalf of South Carolina Electric & Gas Company, I am pleased to have the opportunity to submit comments on the Ashepoo-Combahee-Edisto (ACE) Basin National Estuarine Reserve draft Environmental Impact Statement and draft Management Plan (the "Plan".) South Carolina Electric & Gas Company ("SCE&G") supports the development and management of the ACE Basin Reserve. The achievement of the goals of establishing the Reserve are important goals. However, as a member of South Carolina's Industrial Community and as a Company concerned with the economic well-being of our citizens, we must express some reservations about the Plan. We believe these reservations can be addressed in a way that will not diminish the probability of achieving the goals of the Reserve, while at the same time not causing undue constraints upon the potential for economic development.

Recognizing that South Carolina Electric & Gas Company is only one voice in the economic community, we strongly suggest that the ACE Basin NERR Advisory Committee include industrial and economic development representation. The absence of any commercial, industrial, or economic representation on that Board other than the commercial fishing industry is glaring. This is particularly significant since the Plan contains a number of absolute prohibitions which are certain, if not softened, to impair economic development of an area of our State already economically depressed. We suggest also possibly adding another governmental entity: The South Carolina State Development Board.

There are a number of provisions in the Management Policies section of the Plan which, as currently worded, have the potential for causing significant problems. I shall list and discuss each seriatim:

1. Paragraph (e)7 (Soils) is too broad. As presently worded, it could interfere with even normal agricultural operations. The provision may be intended to address commercial activities, i.e., commercial mining etc. It should be made clear.

2. Paragraph (e)9 (Air Quality) prohibits industrial activities which have the "potential" to cause air pollution which exceeds acceptable air quality standards. . . . (underlining added) Virtually any industrial activity has the "potential" to cause such air pollution, at least in a limited area. The Department of Health and Environmental Control addresses this through the permitting process. If it is not possible for an industrial activity to occur without causing exceedances of air quality standards, then the Department of Health and Environmental Control will not issue

11.1 The South Carolina State Development Board has been added to the Advisory Committee on pages 42-43, as requested.

11.2 Comment noted; Paragraph (e)7, on page 31, has been changed to Mining and Excavation to clearly define the intent of the policy.

11.3 Comment noted; This policy statement does not establish additional air quality standards, instead it endorses those standards determined by the S.C. Department of Health and Environmental Control.

a permit. If it is the intent of this Section to prohibit any industrial activity whatsoever, then it should be clearly stated. If it is the intent of this Section to establish more stringent standards for industrial sources in this area, then those standards should be clearly stated.

3. Paragraph (e) 10. (Shorelines). The prohibition against using "manmade structures" to control erosion in the proposed Reserve core area is overly broad. If there are roadways or dikes suffering from erosion, those responsible must have the option of controlling the erosion by whatever reasonable means available. If there is a particular type of structure which is to be avoided, i.e., seawalls or bulkheads, then the prohibition should be aimed at those structures, and not every imaginable manmade structure. An earthen dike is a manmade structure. Is it to be absolutely prohibited?

11.4

11.4 Comment noted; This paragraph has been rewritten to more clearly define its purpose.

4. Paragraph (e) 11. (Dredging and Filling Activities). The absolute prohibition against filling "wetland, pond or waterway" is overly broad. Normal agricultural and silvacultural activity may involve some incidental filling or manipulation of wetlands. Construction of public roads, if permitted, likely will require some incidental filling of wetlands. Again, the intent of this Section is not clear.

11.5

11.5 Comment noted; The intent of this policy to prevent all fill of wetlands in the core area except for existing dredge disposal areas maintained by the U.S. Corps of Engineers. Under present rules and regulations of the Coastal Management Act, incidental filling of wetlands is not permitted without a permit.

5. Paragraph (e) 14. (Industrial Activities.) The prohibition against "industrial activities" should be better defined. What is an "industrial activity"? Is a roadside convenience store an industrial activity? Would it make a difference if this store has gas pumps? Care should be taken not to make the prohibition overly broad.

11.6

11.6 This statement has clarified that both commercial fishing and timber management are "industrial activities" that will continue in accordance with BMPs and existing laws governing such practices. Facilities, such as roadside convenience stores, are not located within the core and have not been proposed. Additionally, the core is only accessible by boat.

6. Paragraph (e) 16. (Rights of Way). This is a provision which SCE&G has particular interest in. This Section would be more acceptable if it were to read as follows:

"Reasonable steps will be taken during the construction and maintenance of all rights-of-way to minimize adverse environmental impacts. All such activity shall comply fully with the terms of permits from appropriate regulatory authorities including, but not limited to the SCCC. The use of herbicides or pesticides in managing rights-of-way in the proposed cores area will be limited to those circumstances where it is determined that the environmental impact will be less severe than manual or mechanical means."

11.7

11.7 Paragraph (e)16, Rights-of-Way , has been revised with the recommended text on page 33.

The absolute prohibition against the use of herbicides or pesticides could actually result in an increase in physical damage to the environment since there are only a limited number of alternatives, all of which require the use of some type of

Ms. Cheryl Graham
Sanctuaries and Reserves Division
Office of Oceans and Coastal Resource Management
National Oceanic and Atmospheric Administration
April 12, 1991
Page 3

Response to the South Carolina Electric and Gas Company
(Page 3)

mechanical equipment. Of course, any herbicides or pesticides used would have to be used strictly in accordance with EPA label requirements. The total ban on use of regulated pesticides and herbicides reflects a philosophy that all such substances are bad for the environment in all circumstances. This is not a responsible position.

SCE&G encourages adding language which recognizes that construction of homes, businesses and even environmental research facilities, requires a degree of disturbance in order to allow the necessary infrastructure to be put in place. They all require electricity, transportation avenues, telephone, sewer and water, and sometimes gas. Those public and private entities responsible for providing these services and facilities must not be put in a position where they cannot meet their statutory, public service obligations. The preservation of ecological purity should not be at the expense of the preservation of economic depression. There can be and should be a balance, even in the ACE Basin National Estuarine Reserve. SCE&G agrees that there should be a higher standard of care, but we suggest that there are ways to implement a reasonable program without absolute, inflexible prohibitions which have the real potential to do harm to the human environment.

11.8

11.8 Comment noted; no response necessary.

Should you or any member of your staff desire additional information, please call.

Very truly yours,



Deborah C. Blanks

DCB/msd

Charleston Natural History Society

NATIONAL AUDUBON CHAPTER

P.O. Box 504 Charleston, SC 29402

Founded 1905 • Official Bulletin: *The Lesser Squawk*



Response to the Charleston Natural History Society

1718 Afton Ave.
Charleston, SC 29407
12 May, 1991

Cheryl A. Graham
NOAA National Ocean Service
Sanctuaries and Reserves Division
Office of Coastal and Resource Management
Room 714
1825 Connecticut Avenue NW
Washington DC 20235

Dear Ms Graham,

The Charleston Natural History Society (CNHS) is the local chapter of the National Audubon Society with a membership of approximately 1300 in the Charleston area. Our society would very much like to see the establishment of a National Estuarine Research Reserve in the Ashepoo-Combahee-Edisto (ACE) Basin. Intense development pressure on the South Carolina coastline has created a definite need both for public education on the value of these estuarine areas and a control estuary region against which the impact of this development can be measured. South Carolina, by its' 1977 Coastal Zone Management Act, has established a system that relies heavily on informed public input for the management of its' estuaries. An Estuarine Research Reserve could provide a standard by which development choices in other areas could be judged. Proposed educational functions of the reserve could contribute greatly to well informed public input in this process. The recognized pristine condition of the ACE basin make it uniquely suited to this purpose. Extensive damage and habitat alteration by hurricane Hugo to coastal areas north of Charleston have greatly increased the significance of the ACE basin to wintering waterfowl. It is used by a number of listed endangered and threatened species.

CNHS strongly supports the establishment of this reserve via public acquisition of significant core properties within the ACE basin. We also support the preferred management alternative that places responsibility for the management of this reserve with the South Carolina Department of Wildlife and Marine Resources. This agency has the experience and means to properly manage the reserve and is well respected for its public education programs. The environmental impact of this reserve appears to be overwhelmingly positive with no negative impacts.

Respectfully,
Hayes H. Patterson Jr.
Hayes H. Patterson Jr.
Vice-President and Conservation
Chairperson, -CNHS

12.1

12.1 Comments noted; no response necessary.

South Carolina Aquarium
April 4, 1991

Statement in Support of the Ashepoo-Combahee-Edisto River Basin National Estuarine Research Reserve Designation and Management Plan as proposed in the Draft Environmental Impact Statement dated February, 1991 by the S. C. Wildlife and Marine Resources Department.

Submitted at the public hearing held in the Colleton County Courthouse on April 4, 1991 by Rhet Wilson, SCA Project Coordinator.

Thank you for the opportunity to speak here this evening on behalf of the South Carolina Aquarium which is currently being developed in Charleston, SC. The efforts of the South Carolina Wildlife and Marine Resources Department and the South Carolina Coastal Council as well as those of the U. S. Fish and Wildlife Service, the Nature Conservancy, Ducks Unlimited, numerous individual landowners and the efforts of others are hereby recognized and those organizations and individuals are heartily commended and respected for their vision, planning and foresight in seeking the designation of the Ashepoo-Combahee-Edisto Basin as part of the National Estuarine Research Reserve System.

The primary goal of the South Carolina Aquarium is to educate the citizens of South Carolina to understand and appreciate the importance and beauty of the aquatic environments of our state. Therefore, on behalf of the South Carolina Aquarium, I speak with particular interest in the designation of the ACE Basin Reserve. This designation is more than the simple act of establishing for research and monitoring some of the most significant estuarine ecosystem left in the Southeast, it is the continued commitment of state and federal agencies to the importance of this estuarine system to the future of our state. That is a commitment to continued stewardship of our natural resources, and more importantly, to the education of the people of our state. Despite immense strides in recent years, education of the students and the citizens of South Carolina is still lacking, particularly in science education. The programs proposed as part of the Wildlife Department's Management Plan for the ACE Basin address this need.

Under the auspices of key state agencies involved in coastal research, management and education, the ACE Basin Reserve promises to be one of the most important steps in science and environmental education for the people of South Carolina. The area now known only by the most informed groups and teachers will become a resource for many, particularly for school and education groups. By emphasizing the link between research and management decisions, by telling the public about the methodology, the rational and the applied results of research and by introducing them to the wonder of this environment, the ACE Basin education programs will help address the goals of science education in our schools.

This designation is a major step for South Carolina, a commitment to our future, to the understanding by our citizens of the importance of scientific research, natural resources management and environmental awareness and stewardship. On behalf of the South Carolina Aquarium, the designation of the ACE basin and a National Estuarine Research Reserve is wholeheartedly endorsed.

Response to the South Carolina Aquarium

13.1

13.1 Comment noted; The SCWMD, SCCC and NOAA look forward to developing a working relationship with the new South Carolina Aquarium and its staff.

SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL

1 SOUTHPARK CIRCLE, SUITE 306

Telephone (803) 571-4366
Fax (803) 769-4520

CHARLESTON, SC 29407-4699

Roy O. Williams, Chairman
Susan Shipman, Vice Chairman

Robert K. Mahood, Executive Director

March 14, 1991

Ms. Susan E. Durden, Regional Manager
Sanctuaries and Reserves Division
Office of Ocean and Coastal Resources Management
NOS/NOAA
1825 Connecticut Avenue, N.W.
Suite 714
Washington, D.C. 20235

Dear Ms. Durden:

The South Atlantic Fishery Management Council (SAFMC), one of eight Regional Councils established by the Magnuson Fishery Conservation and Management Act of 1976, is charged with developing and monitoring management plans for fisheries from the territorial waters of North and South Carolina, Georgia and Florida's east coast offshore to the 200-mile limit. In this regard, the SAFMC ensures that the United States obtains the best use of the fishery resources in its geographical area of responsibility. Any loss or degradation of estuarine habitat is of concern to the Council because most offshore fishery resources are directly or indirectly dependant upon these habitats.

Recognizing that all species are dependent on the quantity and environmental quality of their essential habitats, it is the policy of the SAFMC to protect, restore and develop habitats upon which all species fisheries depend, to increase their extent and to improve their productive capacity for the benefit of present and future generations. For purposes of this policy, habitat is defined to include all those things physical, chemical and biological that are necessary to the productivity of the species being managed. Objectives of the SAFMC policy are to protect the current quantity, environmental quality and productive capacity of habitats supporting all species fisheries along the Atlantic coast. This objective will be accomplished through the recommendation of no net loss or significant environmental degradation of existing habitat. The SAFMC pursues, through state, federal and local levels, the restoration and rehabilitation of the productive capacity of habitats which have already been degraded, in addition to recommending the creation and development of productive habitats where increased fishery production will benefit society. The Council assumes an aggressive role in the protection and enhancement of habitats important to all species. It actively enters Federal decision-making processes where proposed actions may otherwise compromise the productivity of fishery resources of concern to the Council.

The SAFMC is directed by the Magnuson Fishery Conservation and Management Act (MFCMA) to consider protection of habitat essential to fisheries under Council jurisdiction. The MFCMA allows the SAFMC to address habitat concerns in two fashions: through the expansion of habitat sections of fishery management plans; and through commenting directly to agencies regarding ongoing or proposed activities affecting essential habitat.

To address habitat concerns, the SAFMC has established a Habitat and Environmental Protection Committee composed of Council members who meet to review and comment on specific proposals or projects that may affect critical habitat. On March 1, 1991 on a recommendation from the Habitat Committee, the SAFMC voted to go on record as endorsing the Ashepoo-Combahee-Edisto (ACE) Basin National Estuarine Research Reserve in South Carolina. The SAFMC feels that the preservation of essential estuarine nursery habitat through the reserve program is not only supported by the habitat policies of the Council but will also positively impact the goals and

Response to the South Atlantic Fishery Management Council

14.1

14.1 Comment noted; no response necessary.

Page 2
Susan Durden
March 14, 1991

objectives of management actions presented in fishery management plans and amendments to those plans. This program will encourage needed research and increase public awareness of the vital role estuaries play in supporting inshore, nearshore and offshore fishery resources. Included in this parcel are copies of fishery management plans and amendments prepared by the SAFMC that include sections identifying important fishery and habitat research needs.

Conservation and management of our nations fishery resources in the Exclusive Economic Zone is the mandate of the Council. Without wise stewardship of habitat that supports these fisheries, the goals and objectives of Fishery Management Plans approved by the Secretary of Commerce cannot be achieved. Thank you for the opportunity to comment.

Sincerely,



Roy O. Williams
Chairman

cc: SAFMC Members
SAFMC Habitat AP
Kemmerer/Mager SERO
Hall NMFS/NOAA
Graham DOC/NOAA

Response to the South Atlantic Fishery Management Council
(Page 2)

WRITTEN COMMENTS AND RESPONSES
Private Individuals

THE EDISTO ISLAND COMMUNITY ASSOCIATION

Post Office Box 269
Edisto Island, South Carolina 29438

Response to the Edisto Island Community Association

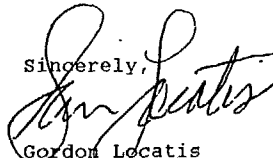
NATIONAL ESTUARINE RESEARCH RESERVE
HEARING
APRIL 3, 1991
WALTERBORO

The Edisto Island Community Association, representing 130 members fully endorses the proposal to establish the reserve in the Ace River Basin. The Association further approves of the plan to purchase eight islands in Colleton County, thereby fulfilling the well conceived concept of a research reserve nucleus. Our members have rigorously pursued the clean water classification for the waters surrounding Edisto Island and the development of the Ace Basin Reserve system is seen as broadly enhancing this vital clean water resource.

We are also pleased to see the well coordinated interaction between state, federal and private organizations. This cooperation stands as a guarantee for the checks and balances which will result in an outstanding research and conservation project that will widely benefit the general public.

Please count the citizens of Edisto Island as strong backers of the proposed research reserve.

Sincerely,



Gordon Locatis
President

15.1

15.1 Comment noted; no response necessary.

The [REDACTED] and Standard

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POST OFFICE BOX 1248
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April 5, 1991

Cheryl Graham
Sanctuaries and Reserves Division
Office of Ocean and Coastal Resource Management
NOAA
1825 Connecticut Avenue, N.W., Room 714
Washington, D.C. 20235

Dear Cheryl Graham:

The public hearing on the proposed ACE Basin NERR was informative and well-conducted. I was surprised at how much public sentiment had changed since the ACE Basin NERR was first proposed.

Please send me a copy of the Draft Environmental Impact Statement and Draft Management Plan. I picked up a copy of the executive summary, but I would be interested in seeing the complete document.

I noticed two typographical errors in the list of members of the ACE Basin NERRS Advisory Committee. If the list is part of a permanent document, it can be corrected for the final printing. 1) Charlie Sweat of Walterboro spells his name with one "t." I think there is an environmentalist at Sullivan's Island who spells his name Charles Sweatt. 2) Another member from Walterboro is Dr. Luke Erwin, not Edwin. He is a landowner in the ACE Basin as well as a prominent member of the Colleton County community.

Thank you for sending me the draft documents.

Sincerely,


Dan Johnson
Managing Editor

Response to Dan Johnson, Managing Editor, The Press and Standard

16.1

16.1 Copy of the document was forwarded on April 22, 1991.

16.2

16.2 Corrections have been made.

Response to Mr. Norris L. Laffitte, Hampton, South Carolina

April 5, 1991

Cheryl Graham
Sanctuaries and Reserves Division
Office of Oceans and Coastal Resources Management, NOAA
1825 Connecticut Avenue, N.W.
Room 714
Washington, D.C. 20235

RE: 04-03-91 ACE BASIN PUBLIC HEARING

Dear Ms. Graham:

While the panel did much to address the positive, no one mentioned the negative. What is the negative side? Or is this one of those "win-win" situations where the I'll scratch your back if you scratch mine mentality prevails. What is it going to cost? What are the disadvantages?

What are the cost? How many tax dollars from the federal and the state tax treasury are going to try to support this project? Is it worth it? How much more bureaucracy is it going to take to make it work? In how many offices? How much duplication will take place with so many offices involved?

17.1

What are the disadvantages of this proposed project? How much effect will the NERR status on the proposed project have on the tax base of Colleton County? How many present tax dollars are affected and how does this equate to future property tax revenue? Where is the difference going to come from? Does not the idea of promoting a pristine, unique area by building roads, parking lots, building, walkways around the dunes and in the marsh seem counter-productive?

17.2

While the hearing was "public," it did not appear that way. Of the sixteen to twenty people who chose to speak in the public forum, the vast majority were from a state or federal bureaucracy promoting more bureaucracy, e.g., PRT, S.C. Aquarium, S.C. Marine Educators Association, etc.; two individuals on USC-B payroll; two members from the ACE Basin NERRS Advisory Committee who were asked to speak by the chairman of SCWMRD who also is on the advisory committee. Most individuals are reluctant to speak in public.

I am not sure we are managing what we have created in the past as well as we should be before we create more. Are the commercial shrimpers behind this so more shrimp can be raised and therefore harvested at the expense of raping the ocean floor and the ocean of ten times as much by-catch. Are the property owners of Edisto desirous of the project so there will not be any more development near them?

17.3

17.1 The National Estuarine Research Reserve program is a state and Federal cooperative program where the state is the managing agency of the reserve and the Federal role is one of coordination, evaluation and national program policy and direction. Federal matching awards area available to coastal states to develop and manage a national system of estuarine research reserves. Existing regulations for the program require a 30% state match for basic program activities, including research and educational projects. A 50% state match is required for land acquisitions and facility development. As to prevent duplication, staffing needs have been presented in the "Administration Plan", pages 34-42 and 44-47. Many of the proposed positions will be filled with existing state personnel.

17.2 Pages 99-104 of this document addresses these questions. Roads, parking lots, buildings, walkways, etc. around the dune and in the marsh are not proposed.

17.3 The shrimp by-catch issue is a legitimate concern which may be addressed through the research program of the ACE Basin NERR. As indicated at the public hearing, the Edisto Community Association endorses the proposed ACE Basin NERR as a valuable resource for research.

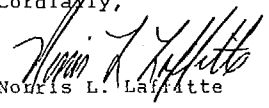
NORRIS LIGHTSEY LAFFITTE
POST OFFICE BOX 81 HAMPTON, SOUTH CAROLINA 29924

With this proposed NERRS project and the idea of a large-scale ACE Basin wildlife sanctuary, are Colleton County, the Low Country Council of Governments and the multi-county industrial park located on the edge of the proposed ACE Basin, supposed to quit looking for industrial development? Would an industry even think of locating close to this project? This project appears to dictate that Beaufort, Jasper, Hampton, Charleston and Colleton counties not bring in industry which will help the tax base because pollution is created by man. And one the other side, while one DHEC regulated industry by itself may not pollute enough to notice, an industrial park located near the edge of the basin with many facilities may.

The county is growing ever so slow. The area has not yet been disturbed. The landowners appear willing to allow researchers the opportunity to do their work without governmental expense. Few people were aware of its beauty before all the fuss started.

Leave it alone so it can stay wild.

Cordially,


Norris L. Laffitte

Response to Mr. Norris L. Laffitte, Hampton, South Carolina
(Page 2)

17.4

17.4 Designation of the ACE Basin NERR does not dictate the location of industrial development. However, any development would have to comply with required SCCC and SCDHEC permits and procedures, including public input. Depending upon the potential impact of the proposed development on the resources, the ACE Basin NERR would be represented at any public meetings or hearings.

THOMAS DEWEY WISE

P.O. DRAWER 0

CHARLESTON, S.C. 29402

HOME ADDRESS:
82 RUTLEDGE AVE.
CHARLESTON, S.C. 29401

OFFICE: 803-577-7032
HOME: 803-722-7770

Response to Mr. Thomas Dewey Wise, Charleston, South Carolina

April 11, 1991

Ms. Susan E. Durden, Regional Manager
Sanctuaries & Reserves Division
Office of Ocean & Coastal Resource Management
National Ocean Service/NOAA
1825 Connecticut Avenue, N.W.
Suite 714
Washington, DC 20235

In Re: **Ace Basin - Environmental Impact Statement &
Management Plan : Draft**

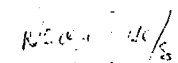
Dear Ms. Durden:

I am responding to your request regarding review of the above-captioned document. I spoke at the public hearing held last week in Walterboro, South Carolina. I would appreciate you incorporating the comments that I made at that public hearing into your considerations.

In addition, I have only one suggested amendment to the Management Plan at this point. On page 19, under paragraph 2 entitled "Buffer Zone", the last sentence should be changed to read "It excludes the uplands and wetlands now held in private ownership unless specified in the Management Plan". The word "mainland" should be changed to "uplands" to be consistent with earlier references. I have passed along that suggested change to Mike McKenzie and he has agreed to put it in the next draft.

Thank you for allowing me to comment on this matter.

Very sincerely,


Dewey Wise
TDW:sea

CC:
Mr. Mike McKenzie
S.C. Wildlife & Marine Resources Dept.
PO Box 12559
Charleston, SC 29412

18.1

18.1 Comments from the public hearing have been incorporated in the next section with appropriate responses.

18.2

18.2 Corrections with regards to the use of "uplands" versus "mainland". The recommend text has been added to the first paragraph of Buffer Zone, on page 14.

Response to Ms. Paula Keener-Chavis

April 15, 1991

Ms. Susan E. Durden, Regional Manager
Sanctuaries and Reserves Division
Office of Ocean and Coastal Resource Management
National Ocean Service/NOAA
1825 Connecticut Avenue, N.W.
Suite 714
Washington, DC 20235

Dear Ms. Durden:

I believe that you have already received comments from Ms. Rhet Wilson, Project Manager for the South Carolina Aquarium, regarding the South Carolina Marine Educators' Association's endorsement of the proposed designation of the Ashepoo, Combahee and Edisto River Basin (ACE Basin) as a National Estuarine Research Reserve System. As president of that organization, as a marine education specialist and as a private citizen, I would like to comment further in favor of this fragile ecosystem being set aside and protected under the proposed designation as a National Estuarine Research Reserve System.

Prior to my professional involvement in marine education, I was a marine biologist working on a federally-funded offshore research project geared toward monitoring and assessment of South Carolina's commercially-important fish populations. Although I loved the research and being out at sea, I also wanted to share some of the more fascinating aspects of marine biology with members of the general public, teachers and students. After being able to accomplish this desire for the past two and a half years, it has become increasingly evident to me why the need for environmental education needs to be one of the top priorities in education today.

This decade will be one in which we, as individuals, will be required to alter our behavior patterns in an effort to minimize the all too often negative impact that our actions have upon our environment. Environmental education creates public awareness and prompts responsible public involvement in environmental issues. This public awareness is most effectively developed through education programs that should, ideally, begin in pre-school and continue into adulthood. The outer coastal plain ecosystem of the ACE Basin provides a perfect setting for environmental education programs not only because of its pristine environment, but also

Response to Ms. Paula Keener-Chavis
(Page 2)

because it is an outdoor classroom in which one can teach the public about the connections between inland and coastal habitats and how our actions inland directly affect what takes place in our coastal and offshore waters. Couple this with the massive influx of people into residential coastal communities throughout the country and you have the underlying, fundamental reason for doing all that we can to protect the very few remaining pristine fragile ecosystems like the ACE Basin.

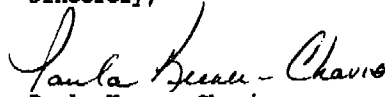
I strongly urge all who are involved to establish the ACE Basin as a National Estuarine Research Reserve System so that we can have the opportunity to share this very precious coastal environment with our children. At the same time, there are those of us who are committed to increasing the awareness of and appreciation for this fragile coastal environment among our young future leaders so that they may have the insight to protect an environment that all too many of us have taken for granted.

19.1

19.1 Comment noted; no response necessary.

For your information, I have enclosed a copy of an article that I wrote for the most recent issue of the newsletter for the South Carolina Marine Educators' Association which you may find of interest. Thank you for the opportunity to comment on the proposed ACE Basin project.

Sincerely,


Paula Keener-Chavis
Marine Education Specialist

(article in files)

April 15, 1991

Cheryl Graham
Sanctuaries and Reserves Division
Office of Oceans & Coastal Res. Mgt., NOAA
1825 Connecticut Avenue, N. W.
Room 714
Washington, D. C. 20235

Dear Ms Graham:

The following comments were presented by Lafayette Lyle at the ACE Public Hearing in Walterboro, S. C., on April 3, 1991.

The basic thrust of the National Environmental Policy Act is that it is a "full disclosure law," implying that both positive and negative ramifications of a given proposed action should be explored in complete detail.

This EIS has dealt with the National Estuarine Research Reserve on a core area and buffer zone basis. The Executive Summary says the core area is 16,040 acres of highland and marsh. The buffer zone is a total of 135,554 acres. All this area is east of the abandoned Seaboard Coastline Railroad. Nothing in this EIS should negate the responsibility of the U. S. Fish and Wildlife Service from a full disclosure EIS on the proposed refuge up Combahee River. However, the Affected Environment section of this EIS includes all of the ACE Basin Watershed, to an elevation of 650 feet, and for some reason includes the Coosawhatchie River.

According to NEPA, this lays the ground work for expounding jurisdiction throughout the entire watershed.

To truly be a full disclosure document, expanding jurisdiction should be addressed. For example, The Fish and Wildlife Refuge would touch Hampton County - since the Coosawhatchie River is included in this EIS. Therefore, Hampton County would come under the Coastal Zone Management Act, which is overseen by the South Carolina Coastal Council. This means that you would need a Coastal Council Permit to fill a highway ditch for a driveway, if the ditch is in wetland. Then, by the system of networking explained in the EIS - there is nothing to protect the landowner from having to sign a conservation easement in order to get the "network" to agree for the Coastal Council to issue a permit.

20.1

20.1 The USFWS has determined that an EIS for the proposed National Wildlife Refuge is not required under NEPA. However, an Environmental Assessment was issued in March 1990. The Refuge is outside the proposed NERR boundaries and is a separate project altogether and should not be considered a part of this document.

The Coosawhatchie River was included as a dominant physiographic feature which influences the ecology of the lower ACE Basin through freshwater drainage. It is well outside the proposed ACE Basin NERR boundary.

20.2

20.2 Property will be acquired only from those landowners willing to participate in the program. Hampton County is outside the proposed ACE Basin NERR boundary.

Current regulations are found in the Clean Water Act. 33CFR 320.4 (h) & (i) "Activities in Marine Sanctuaries" says, No permit may be issued until the Sec. of Comm. provides certification.

Section 323.4 is the Ag. and Silvicultural Exemptions.

The draft EIS does discuss these exemptions on lands with a conservation easement; but, it does not give any assurance that the activities could be continued except by instrument of a conservation easement.

Some assurance must be addressed that conservation easement acquisition will not be used as leverage against landowners carrying on "normal activities" under best management practices.

Under definition of terms - #(1) Wetland - is not correct. Wetland should be defined according to the singular federal definition and delineated according to the Federal Manual for Identifying and Delineating Jurisdictional Wetlands.

The EIS did not adequately describe the Management Plan and EI Statement development found in the Federal Register dated Monday, July 23, 1990, sec. 921.13. (6) says construction plan including cost schedule, general description of proposed developments, and proposed drawings. Information should be provided for proposed minor construction projects in sufficient detail to allow evaluation of these projects. Also, the proposed plan must include an identification of ownership within the proposed research reserve boundaries.

The plan has not included a list of ownership and did not include drawings of construction activities. With regard to the preferred site being Bear Island, it is doubtful that the facilities, parking lots, access roads, etc., could be situated to avoid filling jurisdictional wetlands. It is doubtful that the facilities could be supported by a suitable sewerage effluent system to avoid adverse impacts on the aquatic environment. Therefore, under B, other alternatives considered; 4, the preferred alternative is not conclusive.

Under the same regulations, it states: The methods of acquisition in which the state proposes to use acquisition including less than fee simple input, interest, conservation easement, fee simple property acquisition or a combination of these approaches.

Number (5) ranks in order of the cost effectiveness in selecting a preferred method for establishing State control over each parcel examined. The State shall give consideration to the least costly methods of obtaining the minimum level of long term control required. There is no such economic alternative analysis in the Draft EIS. The islands proposed for acquisition are land locked, regulated, inaccessible, regulated and likely won't perc., regulated, requiring permits from Coastal Guard COE-SCCC and EHEC. Therefore, the Purpose and Need for Action section of this EIS is questionable.

Response to Mr. Lafayette Lyle, Walterboro, South Carolina
(Page 2)

20.3 Activities on privately owned lands in the ACE Basin are not under jurisdiction of the ACE Basin NERR unless so stated in a conservation easement or other legal agreement. In such cases, these lands would be managed exclusively according to said agreement. Other landowners will be encouraged to manage according to BMPs. However, no "leverage" will be used against them. Again, the management plan stresses cooperation among willing participants only.

20.4 Comment noted; The Definition of Terms has been deleted from the document.

20.5 The Facilities Development Plan, pages 46-50, has been amended to include the following statement:

"Prior to construction or renovation of a visitor center, an environmental assessment or categorical exclusion checklist will be prepared and submitted to NOAA before any Federal funds may be expended. All architectural and engineering plans, including specifications, must be approved by NOAA for any proposed construction. This includes facility development, boat ramps, nature trails, etc."

A list of major land owners in the ACE Basin NERR region has been added as Appendix D.4.

20.6 The Land Acquisition Plan, on pages 11-24, has been revised to indicate the specific methods that are proposed to gain adequate state control over key land and water areas in the proposed core area of the reserve. Without adequate state control sufficient to provide long-term protection for reserve resources and ensuring a stable environmental for research and education, the reserve would not be eligible for funds for operations, research or education.

PUBLIC HEARING - APRIL 3, 1991
Walterboro, South Carolina

Place: Colleton County Courthouse
Walterboro, South Carolina

Time: 7:00 pm

Hearing held by:

Dr. Paul Sandifer, Director
SC Wildlife and Marine Resources Department

H. Stephen Snyder
South Carolina Coastal Council

Michael D. McKenzie
SC Wildlife and Marine Resources Department

Cheryl Graham, Program Specialist
Sanctuaries and Reserves Division, NOAA

Hearing attended by:

1. Norris L. Laffitte	30. Ray Barso
2. Everett D. Crosby	31. Lee Baughman
3. Paul Wise	32. *James E. Frank
4. Mark Tucker	33.**Beth McClure
5. Ted Kinard	34. *Dana Beach
6. William H. Shouse	35.**Lafayette Lyle
7. Harold Rhoades	36.**Edsel Caine
8. Eugene F. Duncan	37.**Bruce C. Lampright
9. Ellis Brown	38. *Becky Lee
10. Jim Cope	39. *Linda Rackley
11. Dan Johnson	40. *Mary Ann Burt
12. Les Zielke	41. *James P. Harrelson
13. Joe Grigg	42. *Gordon Locatis
14. Tony L. Bebb	43.**Rhet Wilson
15. Boris Hurlbutt	44. Robert Lee Frank II
16. Keith A. McGraw	45. *Dewey Wise
17. Robert E. Breland	46. Eugene duPont, III
18. Cindy Tucker	47.**Sally Murphy
19. Dwayne E. Porter	48. Robert E. Marvin
20. Mel Marvin	49. *Richard P. Baldwin
21. John W. Evans	50. *W.S. Baldwin, Jr.
22. J. Lin Houck	51. Genevieve G. Smith
23. H.B. Limehouse	52.**Norman L. Brunswig
24. Melvin M. Stroble	53. Earle R. Marvin
25. Bobby Harrell	54. James A. Timmerman
26. Candace Cummings	55. Linda Linguist
27. Johnny Hiers	56. Mike Prevost
28. Claude E. McLeod, Jr.	57. Buford S. Mabry, Jr.
29. H.B. "Chip" Limehouse	58. Joe Henderson

COMMENTS AND RESPONSES
Public Hearing

Mr. James E. Frank, private landowner

My main concern is as a private landowner. We own some land on Pine Island and apparently they are not going to condemn or take your land from you, as I understand. That was my main concern.

But now is there going to be any further restrictions placed on use a private landowners? We are willing to help and cooperate, I am and my family is, but are there going to be further restrictions on, say like, if you want to build a done on your land or add to a house or building that you may already have there, not to develop or anything but just for your own personal use?

You have answered most of the things I had in mind. I think it looks good. Thank you.

Ms. Beth McClure, South Carolina Department of Park, Recreation and Tourism (SCPRT)

I represent the SCPRT. Not only are we a state agency but we are a landowner as well. Our executive director could not be here this evening. I would like to read a brief statement that he has sent.

[For the record, this letter is included in the previous section with appropriate responses.]

Mr. Dana Beach, South Carolina Coastal Conservation League

I am the Executive Director of the S.C. Coastal Conservation League. We are based in Charleston and we have over 1,000 members primarily in Charleston County, Colleton, Beaufort, Dorchester and Berkeley.

I was also an Advisory Board member or am an Advisory Board member on the NERR's program and have been extensively involved with commenting on earlier drafts. There is not really much more I can say because this draft to me represents a very complete document describing the important of protecting this area and I think it was done painstakingly by the department and the details are very accurate and well placed.

What I did want to comment on tonight, though, is rather than what is in the ACE Basin, I would like to comment on what is not in the ACE Basin and why this absence in this case, population, represents an extraordinary opportunity for Colleton County and the public. South Carolina is growing at a breathtaking rate as everyone knows. Every two and one half years, the State adds the equivalent of another City of Charleston to its population, about 80,000 people, and the bulk of that growth is here along the coast. Berkeley County, just a little north, is the fifth

Response to Mr. James E. Frank

A.1

A.1 The proposed ACE Basin NERR is not a regulatory program, but moreover a program to protect pristine areas for use as natural field laboratories for research and education. Therefore, existing requirements for local, state and Federal constructions permits would be observed and normal application procedures would be followed.

Response to Mr. Dana Beach

fastest growing coastal county in the southeast. By the year 2010, Charleston County is projected to be the 12th most densely populated coastal county in the southeast. Squeezing up from the northern boundary of the ACE Basin is Beaufort which is growing at a rate that is one of the highest in the State and is expected to double its population in the next twenty years - more than double. Our only competitors in the population field are counties in Florida. These figures, incidently, come from NOAA's most recent publication on population growth on the nation's coast.

The increased population has created a number of problems and in South Carolina we have not done a very good job of dealing with those problems. More than 40% of the state's shellfish beds are closed because of human pollution from sewage discharges and runoffs. Wildlife is increasingly crowded out of important habitats and fisheries face a variety of growth related stresses. As I mentioned earlier, the ACE Basin does not have those problems because it does not have the population pressures yet sprawling up and down its rivers and roads. As a result, it harbors an estuarine system that is virtually pristine. It is an important natural system today but in the future, as populations increase, it is going to be priceless because the public is increasingly losing the opportunity to visit these types of complete estuaries. The relative value of the ACE will increase exponentially over the next twenty years and this is going to be a good thing for Colleton County. Because, beside protecting the ACE for people who live in Colleton, it is bound to bring increased attention from the rest of the country from people who are interested in nature-based tourism, hunting, fishing and boating.

Aldo Leopold, who was one of the founders of the modern conservation movement, called protection of wilderness "humanity exercising self-control". The ACE Basin is the closest thing we have in South Carolina to wilderness. The future generations will look back on what we are doing here tonight and what the groups who have been involved with this project to date have done, and I think, will admire the self-control that we have had to leave this area in its pristine condition, for having the foresight to protect the system today that probably would not offer us that opportunity much longer in the future.

I would like to thank the Department and NOAA for doing a very good job of putting this program together and I think on behalf of the public who is interested in nature, this is one of the most exciting projects that I am aware of in the country. Thank you very much.

B.1

B.1 Comment noted; no response necessary.

B.2

B.2 Comment noted; no response necessary.

Mr. Lafayette Lyle, local resident

[For the record, Mr. Lyle submitted his comments in writing and these comments are included in the previous section with appropriate responses.]

Mr. Ed Caine, Director, Coastal Zone Educational Center

[For the record, Mr. Caine submitted his comments in writing and these comments are included in the written comments section with appropriate responses.]

Mr. Bruce Lampright, Project and Education Coordinator, Coastal Zone Educational Center

[For the record, Mr. Lampright submitted his comments in writing and these comments are included in the previous section with appropriate responses.]

Ms. Becky Lee, private landowner

I'm Becky Lee. I am a private landowner in the ACE Basin. I have a very simple interest: a personal interest in wild flowers of the area and there seems to be no one that is making any particular effort to protect the wild flowers. As a matter of fact, at about this time last year - April or May - all the roads and ditches in the ACE Basin were sprayed with herbicides and I would like to see that no longer happen.

C.1

Response to Ms. Becky Lee

C.1 Comment noted; Although this area is not within the realm of the proposed management plan for the ACE Basin NERR, your concerns have been forwarded to the S.C. Department of Highways and Public Transportation.

Ms. Linda Rackley, Sierra Club

Good evening. I am here representing the Sierra Club. The Sierra Club would like to thank the SCWRMD, the SCCC and NOAA for this opportunity to publicly express our support of the acquisition of the eight islands located in the ACE Basin for designation as a National Estuarine Research Reserve.

D.1

Response to Ms. Linda Rackley

D.1 Comment noted; no response necessary.

The unspoiled beauty of the ACE Basin will provide an ideal research area and educational center. The research will increase understanding of the fragile fresh and saltwater wetlands. The addition of the environmental education center within the reach of area schools will greatly enhance the opportunity for introducing tomorrow's voters to the value of the estuarine habitat.

Thank you.

Ms. Mary Ann Burttt, local resident

Mr. Chairman, members of the panel, I am Mary Ann Burttt. I am a native of Walterboro and now a resident again of Walterboro and although tonight I speak as an individual, I think the views I express reflect a prevalent opinion in this community of Colleton County about the ACE Basin.

In the years I have spent away from South Carolina, I have worked as a professional on land use preservation, mainly the reservation of million of acres in Alaska in the National Park and Wilderness System; also the addition of the Channel Island and Mineral King, and Santa Monica Mountains to the National Parks System, as well as other wilderness areas. I have also served as an environmental consultant to big business and to government and it is from that point of view that I commend you tonight on this plan.

I wholeheartedly agree with the conclusion that the environmental impact of this proposal will be entirely positive. I think it will be positive for the protection of this particular area and I think that the research and education, which will take place in this area, will be essential to protecting other resources in South Carolina. Thank you.

E.1

Response to Ms. Mary Ann Burttt

E.1 Comment noted; no response necessary.

Mr. James P. Harrelson, private landowner

I'm James P. Harrelson. I am like Will Rogers, the only thing that I know is what I read in the papers. I saved some maps that you drew a line around me and a few hundred acres of mine. I've got some wetlands of which I want to keep so I just checked that thing [DEIS/DMP] because I didn't want to be left out, in case I did have something to say. But I speak out of an abundance of ignorance. The concept is good, I still don't know all the answers.

F.1

Response to Mr. James P. Harrelson

F.1 Comment noted; no response necessary.

Mr. Gordon Locatis, Edisto Island Community Association

My name is Gordon Locatis. I represent the Edisto Island Community Association and we have 120 members - a very diverse group of people from retired farmers, who have lived on the island all their life, to retired school teachers, active citizens of the island who care about mother nature.

We have a lot of retirement people there and our group supports the idea of the research reserve wholeheartedly. Our group sought to upgrade the water in this area to the highest classification and we cannot think of a better way to preserve the clean water surrounding Edisto Island than to establish this reserve.

Response to Mr. Gordon Locatis

As you can see from the map, Edisto will be a neighbor of this reserve and the ACE Basin and I would like you to know that many of the residents, especially in our group, want to see this area remain undeveloped.

We applaud your efforts and we think you have done an outstanding job. In fact, we are very happy that all of these agencies are interacting together because we think with so many people looking over each other's shoulders, would be a good checks and balance situation. We will also have an outstanding educational resource for the general public.

G.1

G.1 Comment noted; no response necessary.

Thank you very much again.

Ms. Rhet Wilson, South Carolina Aquarium, South Carolina Marine Educators Association

Response to Ms. Rhet Wilson

My name is Rhet Wilson. I am speaking for two groups tonight, so I will read the statements one after another, if I may.

[For the record, Ms. Wilson submitted her comments, as the South Carolina Aquarium Project Coordinator, in writing and these comments are included in the previous section with appropriate responses.]

On behalf of the South Carolina Marine Educators Association: The South Carolina Marine Educators Association acknowledges and fully supports the SCWMRD, the Nature Conservancy, Ducks Unlimited Foundation, and USFWS and private landowners in their efforts regarding the proposed designation of the ACE Basin as a NERR site.

H.1

H.1 Comment noted; no response necessary.

The South Carolina Marine Educators Association further recognizes the continued efforts of the South Carolina Coastal Council in the management of South Carolina's coastal resources and in the proposed designation of the ACE Basin as a NERR site.

As the State Chapter of the National Marine Educators Association, the primary goal of the South Carolina Marine Educators Association is to establish a communications network for those interested in aquatic education throughout South Carolina. This group of innovative educators and naturalists fully recognizes the importance of estuarine education and the vital role that it plays in linking together scientists and educators and members of the public in an effort to increase public awareness and appreciation of our coastal environment. It is our collective responsibility to educate our youth about the vitally important roles that these fragile estuarine systems play. After all, these young people are our future leaders and protectors of the environment that all too many of us have unfortunately taken for granted.

Therefore, be it known the South Carolina Marine Educators Association hereby endorses the proposed National Estuarine Research Reserve system plan for the ACE Basin and through its statewide and national network of educators and naturalists, the association will promote the establishment of this irreplaceable ecosystem as a NERR site. Thank you.

Mr. Dewey Wise, private landowner

Thank you, Mr. Chairman. My name is Dewey Wise. I am an affected landowner in the ACE Basin, but I am here tonight not only as an individual, but also because Mr. Timmerman asked Dana Beach and I to speak on behalf of the Advisory Committee. I suppose that he thought if he asked Mr. Beach and myself he would cover the waterfront in the spectrum of philosophies about this. I don't think there is any difference between Mr. Beach and I in our respective comments to environmental protection and conservation. It probably is a significant difference between our respective philosophies in how it should be accomplished.

I am a skeptic of governmental intervention and governmental programs. Two years ago in this very same room, before a similar committee, most of you were here, I said the same thing then. I am honored to be on the Advisory Committee. A lot of work went on in that committee. A great deal of credit goes to Mike McKenzie and other of the staff for integrating the various comment and drafts that were passed around. I think I attended every meeting during the last two years that the committee met, and I think the document we came out with is a document that I can support, both as an individual and as a committee member.

The reason that I can support it is because there are seven commitments that were made on behalf of the individuals and agencies who are promoting the NERR system. I believe those seven commitments are included in this document.

The first commitment is that there would be no condemnation. Land purchased would be purchased from willing sellers only and that has been referred to earlier and is in the document.

The second is that there would be on private land, neither in the core area or the buffer zone without the owner's consent and that is in the document.

Third is that there would be no interference with traditional uses such as hunting, fishing, agriculture and forestry, and that is in the document.

The fourth is a personal sticking point that there would be no additional licenses or permits needed except for research in the reserve. In other words, if someone owns property in the ACE Basin, he should not have to jump through five extra hoops to get a dock permit, or a fishing license, or a hunting license; and

Response to Mr. Dewey Wise

I.1

I.1 Comment noted; no response necessary.

I.2

I.2 Comment noted; no response necessary.

that concept is in this document.

The fifth is that the reserve itself and the lands in the reserve and the management of the reserve be concentrated with State of South Carolina rather than the Federal government. I think the wildlife department is an excellent run department. Dr. Timmerman is doing a fine job and if there is one person who's word you can take to the bank and deposit it, it is his and he is committed to these concepts and these things. I believe that having the islands that are already bought transferred to the Wildlife and Marine Resources Department is an excellent idea.

I.3

I.3 Comment noted; no response necessary.

Sixth is that the management plan, the final management plan that comes out, cannot be changed by Washington or some other agency but that rather if there are changes that are needed, that public hearings and public input would take place prior to those changes being put in place.

I.4

I.4 Comment noted; no response necessary.

Finally, that an Advisory Committee of local folks, be it me or some locals from here in Walterboro and other places, will continue to serve in an advisory capacity and monitor the compliance with the management plan.

Now those are the seven things that I think were made in the way of a commitment by the agencies to those of us that had concerns and I believe they are in the plan. If they are not in the plan, as the preacher says "its time to speak now or forever hold your peace". I think they are in the plan.

Two years ago I stood here very skeptical about this project. I think it obviously has some very positive things about it and I think it will be a very successful project. I think the people who are behind it, have the very best intentions and with these protections for those of use who are landowners and the local folks down here; who are either agriculture or forestry. If you have concerns about it, I think they are concerns, hopefully for the most part, that have been allayed by this document.

So on behalf of the committee and on behalf of myself as an individual, I want to endorse the draft management plan. I am sure that out of this hearing tonight, there will come other suggestions for improving the document to a final form and I hope to participate in that. Thank you, Mr. Chairman.

Mr. W.S. Baldwin, Jr., private landowner

I'm representing Hutchinson Island. At this point we do not want to be included int he core area or the buffer zone. We do not oppose it. We just would like to see how the estuarine project goes. Thank you.

J.1

Response to Mr. W.S. Baldwin, Jr.

J.1 Comment noted; Boundaries for the reserve have not been finalized, but will be as part of the Final Management Plan.

Ms. Sally Murphy, South Carolina Wildlife Federation

I am Sally Murphy. As a member of the Board of Directors of the South Carolina Wildlife Federation, I am here to present a statement on behalf of Betty Spence, the Executive Director.

[For the record, this letter is included in the previous section with appropriate responses.]

Mr. Norman Brunswig, National Audubon Society

[For the record, Mr. Brunswig submitted his comments in writing and these comments are included in the previous section with appropriate responses.]

Mr. Richard P. Baldwin, private landowner

I am Richard P. Baldwin. I am like Dewey Wise was a few years ago, I was skeptical about this whole idea. But when the Department finally came up with the plan, I read the plan and if they stick with the plan, I think it sounds like a good idea. I am going to endorse it.

There are a couple of things I am going to suggest or ask. I am a commercial fisherman and I think we should have some representation on some of these committees.

I also think maybe they ought to put an extra lane on the highways for the bird watchers, because more and more every year, they stop in the middle of the road. When you come around those curves you have to dodge them. You need to keep that in mind.

Response to Mr. Richard P. Baldwin

K.1

K.1 Comment noted; Commercial fishermen will be represented on the Advisory Committee and the membership has been revised on pages 42-23, as requested.

K.2

K.2 Comment noted; Although this area is not within the realm of the proposed management plan for the ACE Basin NERR, your concerns have been forwarded to the S.C. Department of Highways and Public Transportation.