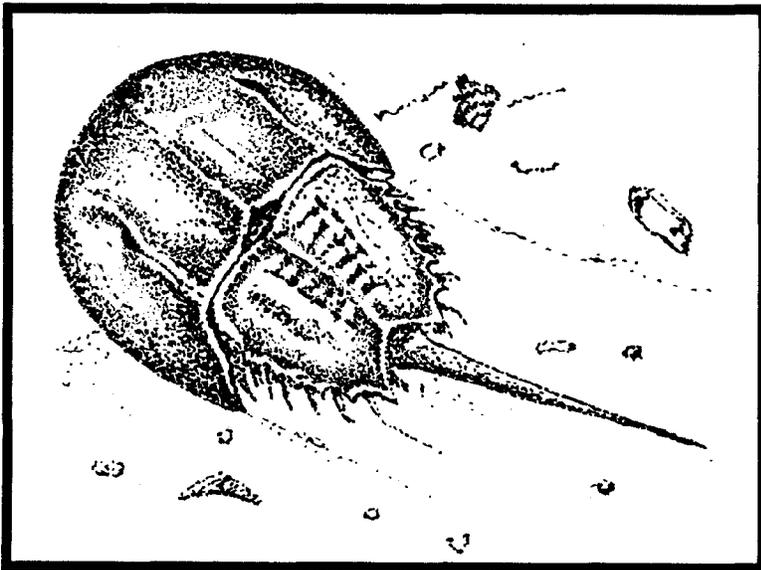


**Delaware**

**National Estuarine**

**Research Reserve**

**Management Plan**



# Delaware

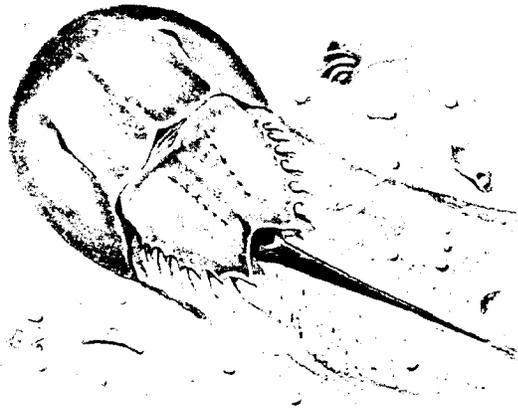
**National  
Estuarine  
Research  
Reserve  
System**



STATE OF DELAWARE

**U.S. Department of Commerce**

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1993



# THE HORSESHOE CRAB

*The Horseshoe crab is one of Delaware's oldest and most intriguing marine residents. Each spring, during the high tides of the new and full moons (called springtides), thousands of Horseshoe crabs come ashore to spawn. Their ancient mating ritual has fascinated generations.*

## **A CRAB BY ANY OTHER NAME . . .**

The horseshoe outline of their shells gave the "crabs" their name. About the size of an overturned soup plate, the Horseshoe crab is really not a crab at all. If you were to look under its hood, you would find it more closely resembles an oceangoing spider. Horseshoe crabs are in a classification of their own (Class Merostomata), and are related to scorpions, ticks, and land spiders.

There are four species of Horseshoe crabs worldwide. The Delaware Bay region is the population center for the American Horseshoe crab (*Limulus polyphemus*).

Although common along the Delaware coast, Horseshoe crabs are not found in very many other places in the world. They live along the western shores of the Atlantic, from Nova Scotia to Yucatan, and in the coastal waters of Indonesia and the Philippines . . . and nowhere else. How these helmet-headed little creatures managed to settle in two widely separated areas, and nowhere in between, is a puzzle.

## **MORE THAN A PRETTY FACE . . .**

Horseshoe crab eggs are an important source of food for the thousands of migratory shore birds that pass over the Delaware Bay during the crab's mating season. Horseshoe crab eggs provide these birds with needed energy to complete their northward migration.

Fish search the shallows for the lowest nests, and also reap the fruits of the crab's reproductive efforts.

In the 1900s, Horseshoe crabs were harvested near beaches and dried for use as fertilizer and as a poultry food supplement. But the advent of artificial fertilizers put an end to the industry.

An extract made from the Horseshoe crab's blue, copper-based blood, called lysate, is used to test the purity of medicines. Properties of the crab's shell have been found to speed blood clotting and can be used to make absorbable sutures.

## **A CRAB WITH A FUTURE . . .**

The future holds new challenges for this master design of nature. Perhaps the greatest will be to successfully deal with man's increasing influence over the Horseshoe crab's environment. Whatever the odds, it is hard to imagine this ancient mariner steered off its timeless course.



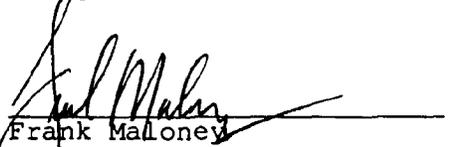
**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
NATIONAL OCEAN SERVICE  
OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT  
Washington, D.C. 20235

DESIGNATION OF THE DELAWARE  
NATIONAL ESTUARINE RESEARCH RESERVE  
LOWER ST. JONES RIVER AND UPPER BLACKBIRD CREEK COMPONENTS

Consistent with the provisions of Section 315 of the Coastal Zone Management Act, 16 U.S.C. 1461, the State of Delaware has met the following conditions to establish the Lower St. Jones River and Upper Blackbird Creek as components of the Delaware National Estuarine Research Reserve.

- 1) The Lower St. Jones River and Upper Blackbird Creek are representative estuarine ecosystems that are suitable for long-term research and contribute to the biogeographic and typological balance of the National Estuarine Research Reserve System.
- 2) Delaware state law provides long-term protection for reserve resources to ensure a stable environment for research.
- 3) Designation of the Lower St. Jones River and Upper Blackbird Creek as reserve components will serve to enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation.
- 4) The State of Delaware has complied with the requirements of the regulations relating to designation of a National Estuarine Research Reserve.

Accordingly, I hereby designate the areas of the Lower St. Jones River and Upper Blackbird Creek as components of the Delaware National Estuarine Research Reserve, the boundaries of which are specified in the Final Management Plan.

  
Frank Malloney  
Acting Director  
Office of Ocean and Coastal  
Resource Management

JUL 21 1993



DELAWARE NATIONAL ESTUARINE RESEARCH RESERVE

Final

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U.S. DEPARTMENT OF COMMERCE NOAA  
COASTAL SERVICES CENTER  
2234 SOUTH HOBSON AVENUE  
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JUNE 1993

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## ACRONYMS

AICUZ	Air Installation Compatible Use Zone, Dover Air Force Base
BMPs	Best Management Practices, established by the Delaware DNREC
CFR	The Code of Federal Regulations
CZMA	Federal Coastal Zone Management Act of 1972, as amended
DEIS	Draft Environmental Impact Statement
DMP	Draft Management Plan
DNERR	Proposed Delaware National Estuarine Research Reserve
DNREC	Department of Natural Resources and Environmental Control
DNS	Delaware Nature Society
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FMP	Final Management Plan
MOU	Memorandum of Understanding
NEP	National Estuary Program, EPA
NERR	National Estuarine Research Reserve
NERRS	National Estuarine Research Reserve System, NOAA
NMFS	National Marine Fisheries Service, NOAA
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
OCRM	Ocean and Coastal Resource Management, office of, NOAA
SCS	Soil Conservation Service, U.S. Department of Agriculture
SRD	Sanctuaries and Reserves Division, NOAA
USFWS	U.S. Fish and Wildlife Service, Department of Interior

# DELAWARE NATIONAL ESTUARINE RESEARCH RESERVE

Final

## MANAGEMENT PLAN

### EXECUTIVE SUMMARY

Section 315 of the Federal Coastal Zone Management Act of 1972, as amended, established the National Estuarine Research Reserve System (NERRS) as a state/federal cooperative venture. Federal cost sharing grants are available to coastal states to develop a national system of estuarine research reserves which are representative of the various regions and estuarine types of the United States. Long term annual NOAA development and operational grants are available at the ratio of 70% federal and 30% state. In addition, competitive funding 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 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 reserves are representative and that a variety of ecosystem types are included. The Delaware National Estuarine Research Reserve (DNERR) is representative of the Middle Atlantic (Sandy Hook to Cape Hatteras, excluding the Chesapeake Bay) sub-region of the Virginian biogeographic region.

The Delaware NERR includes the St. Jones River site and the Blackbird Creek site as components of a multi-site system with the Department of Natural Resources and Environmental Control (DNREC) as the lead agency. Because these two sites are complementary in their representation of the Middle Atlantic biogeographic categories, the State of Delaware manages the sites as one Reserve.

For many years DNREC along with the Department of State's Division of Historical and Cultural Affairs have recognized the values of the lower St. Jones River and its surrounding area. The site adjoins the City of Dover and is only 6 miles from the State capitol complex including headquarters of DNREC, yet it remains undeveloped farm and woodlands as it has been for more than 300 years. However, the upper less brackish reaches of the St. Jones River have been intensely developed, therefore the addition of the upper Blackbird Creek site is a complementing component to

the Reserve. The NERRS is viewed as a compatible tool to provide for natural and cultural resource protection, long-term management and opportunities for estuarine education and research.

Boundaries for the DNERR encompasses key land and water areas (or "core area") and a buffer area. The core area includes all of the tidal wetlands of the lower St. Jones River and upper Blackbird Creek sites for a total of approximately 2300 acres. The buffer area includes the lands surrounding the core consisting of wooded fringe, farmed crop and woodlands and freshwater wetlands totaling approximately 1500 acres for the two components. Actual acquisition of core and buffer areas will be less than the maximum defined due to the voluntary nature of the program and the expected cooperation of landowners in less than fee simple participation in the Reserve objectives.

The purpose of the DNERR is to establish and manage the Reserve as natural field laboratories and to develop a coordinated program of education and research for the Reserve. The DNREC fish and wildlife scientists will be brought together with other environmental scientists, educators and managers to operate their estuarine and coastal management programs from a modern Education and Research Center located in the Reserve. A collaborative management approach will be used, involving advisory committees, landowners, private organizations, and local, state and federal agencies. The DNREC will continue to serve as the lead agency.

Reserve staff includes a program manager, education and research coordinators, an estuarine educator, and a clerical position. Many others will be located at the DNERR Education and Research Center whose responsibilities will enhance the DNERR objectives through their normal estuarine and coastal management assignments. Other staff that will be located at or operate programs from the Center will have dedicated DNERR assignments that compliment their regular duties including a volunteer coordinator, a resource protection specialist, cultural preservation specialist, folklorist, aquatic coordinator and others, especially visiting researchers and educators.

There is a committee composed of representatives of agencies and organizations that have interests in the programs of the DNERR that will serve in an advisory capacity to DNREC on matters concerning resource protection, education, research and monitoring. The DNERR program manager will coordinate administrative functions and operations of the Reserve's programs and act as liaison with state and regional estuarine programs, NOAA and other NERRS.

The Reserve research and education programs will gather and make available information useful for improved understanding, appreciation, and management of estuarine systems especially of the State and Middle Atlantic region. Reserve activities augment the many on-going conservation and management activities.

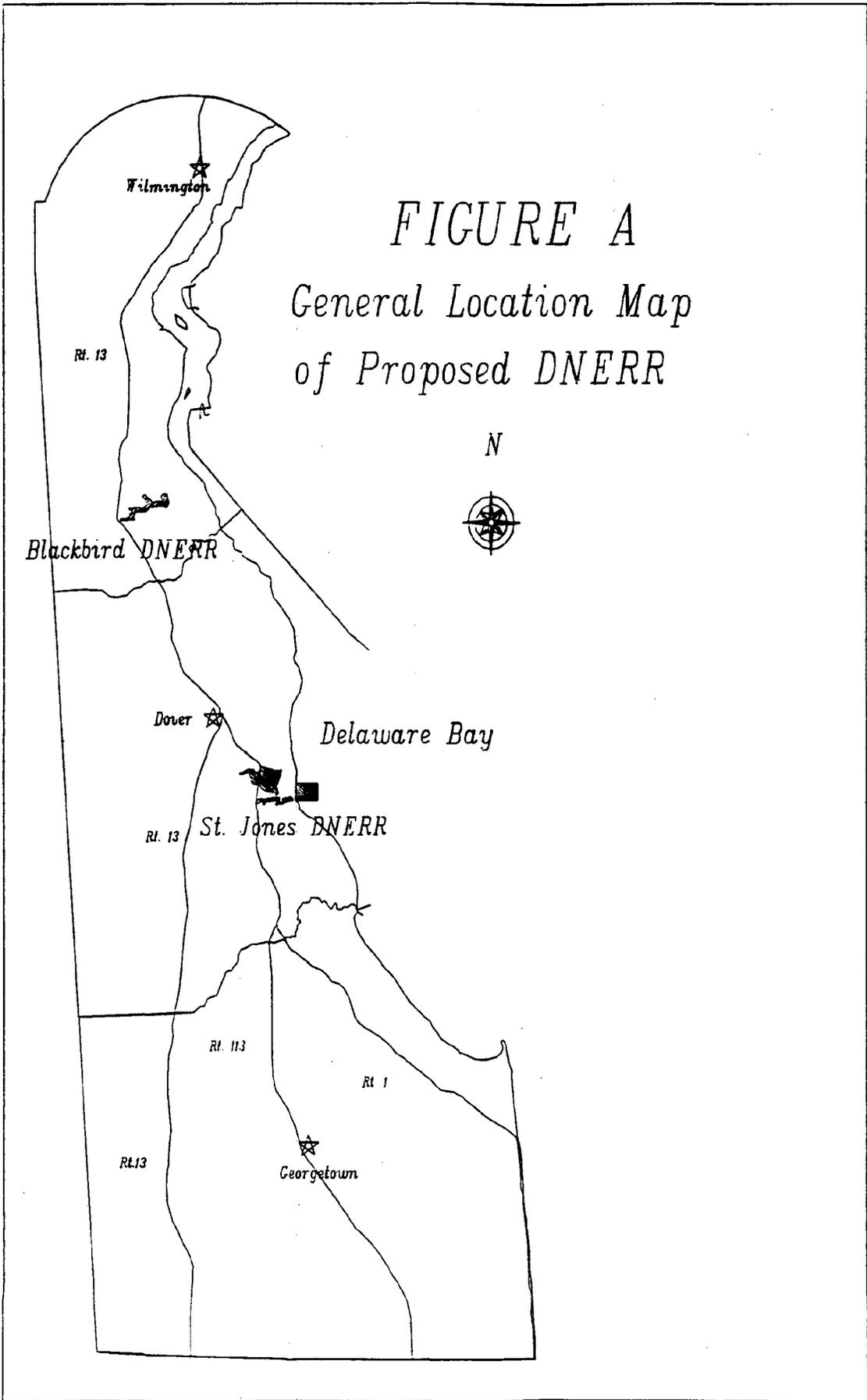
Facilities will be developed as necessary to aid in research and education and to serve as a focal point for visitors to the Reserve.

Valuable natural and cultural resources are protected for long-term research and education by implementation of the Management Plan. Natural resources of the Reserve include diverse, highly productive estuarine systems comprised of tidal and non-tidal 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 Reserve. In addition to such rich diversity of natural resources, the Reserve is also endowed with significant archaeological and historical sites and landscapes.

Traditional uses in the Reserve include commercial and recreational fishing, shellfishing, hunting, trapping, wildlife observation, boating, agriculture, and forestry. The DNERR is planned to accommodate traditional uses. The Management Plan is designed to allow these uses on lands acquired for DNERR as long as the safety of visitors and staff is not jeopardized.

The DNERR program is voluntary and non-regulatory. The policies and rules that this Plan contains will only affect lands that have been acquired from willing landowners. All other landowners within the area of the Reserve will have their rights respected by the DNERR.

The Management Plan is in accordance with all relevant state, local, and federal land use plans, policies and controls for the areas under consideration.



*FIGURE A*

*General Location Map  
of Proposed DNERR*

N



## I. SCOPE OF THE MANAGEMENT PLAN

This document establishes a management plan for the Delaware National Estuarine Research Reserve (DNERR) that is agreeable to the landowners of properties within the DNERR boundaries, a benefit to the state of Delaware, and acceptable to the National Oceanic and Atmospheric Administration (NOAA) for inclusion in the National Estuarine Research Reserve System (NERRS).

The mission of DNERR is to establish natural research areas which are representative of the diversity of coastal ecosystems found within the Middle Atlantic Region. Valuable natural and cultural resources will be protected for long term research and education by designation of the Reserve. The two components of the Delaware National Estuarine Research Reserve are managed by the Department of Natural Resources and Environmental Control (DNREC) in cooperation with relevant local, state and federal agencies.

This management plan has been developed according to NOAA regulations (15 CFR Part 921), using information derived from specific site information and public involvement. It is consistent with the congressional intent of Section 315 of the Coastal Zone Management Act of 1972 (as amended) and the provisions of the Delaware Coastal Management Program.

### A. THE NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM (NERRS)

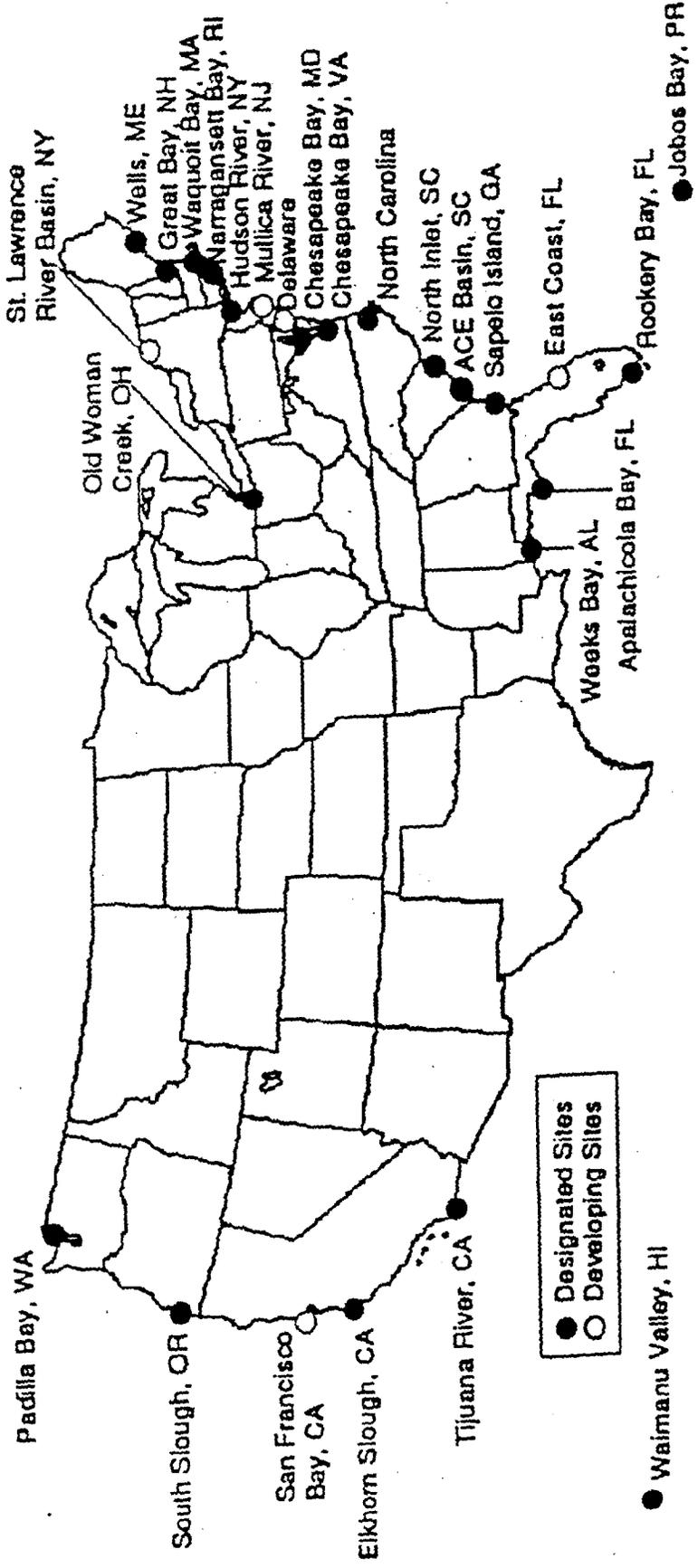
Congress recognized a need to address threats to the country's important and sensitive estuarine areas. The goal of the federal program is to create a system of reserves that represents distinct estuarine ecosystems found nationally, and to manage these reserves for long-term environmental research and education. Although the program is national in scope, individual states are responsible for implementing and administering their own program, with NOAA providing overall coordination.

Delaware will be joining 21 National Estuarine Research Reserves that have been designated across the country (Fig. 1). These Reserves are:

<u>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



# The National Estuarine Research Reserve System



ReserveBiogeographic Classification

Narragansett Bay Newport County, Rhode Island	Virginian
Hudson River Hudson River, New York	Virginian
Chesapeake Bay, Maryland	Virginian
Chesapeake Bay, Virginia	Virginian
North Carolina	Virginian/Carolinian
North Inlet/Winyah Bay South Carolina	Carolinian
ACE Basin Colleton County, South Carolina	Carolinian
Sapelo Island McIntosh County, Georgia	Carolinian
Rookery Bay Collier County, Florida	West Indian
Jobos Bay, Puerto Rico	West Indian
Apalachicola River/Bay Franklin County, Florida	Louisianan
Weeks Bay Baldwin County, Alabama	Louisianan
Tijuana River San Diego County, California	Californian
Elkhorn Slough Monterey County, California	Californian
South Slough Coos Bay, Oregon	Columbian
Padilla Bay Skagit County, Washington	Columbian
Old Woman Creek Erie County, Ohio	Great Lakes
Waimanu Valley Island of Hawaii, Hawaii	Insular

Additional NERR Sites are in the designation process for New York, California, Florida, and New Jersey.

This management plan is consistent with the revised regulations for NERRS which were adopted July 1990. According to the regulations (15 CFR Section 921.40), after designation, NOAA will conduct periodic performance evaluations of a reserve at least once every three years. 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 regulations, and particularly whether the operations and management of the reserve are consistent with and further the mission and goals of the NERRS.

Federal officials will conduct the performance evaluations. When necessary, NOAA may request federal and non-federal experts to participate in the evaluations. Performance evaluations will be conducted in accordance with procedural and public participation provisions of CZMA regulations. If performance evaluations reveal that the operation and management of the reserve is inconsistent with the DNERR approved Management Plan, the eligibility of the reserve for federal financial assistance may be suspended until the situation is remedied. If major deficiencies are not remedied within a reasonable amount of time, NOAA may initiate a process to withdraw designation of the reserve.

Federal financial assistance for acquisition, development, operations and management will be requested by the State of Delaware. These funds, accompanied by the required 50 percent state match for acquisition and 30 percent state match for development and operations, will be used for basic program activities, including educational and research projects; acquisition of key lands and water; the design, engineering, and site preparation for the DNERR Education and Research Center; and for other facilities required to implement the Delaware National Estuarine Research Reserve.

#### **B. THE NERRS PROGRAM IN DELAWARE**

Delaware's participation in the NERR System will help strengthen the federal program by establishing the first System located in the NERRS' Middle Atlantic sub-region (Sandy Hook, N.J. to Cape Hatteras, exclusive of Chesapeake Bay) of the Virginian biogeographic region. Nationally, there are 27 biogeographic sub-regions recognized by NOAA's classification system. In terms of benefiting Delaware, the federal NERR System will provide financial assistance awards to the State to acquire, develop and operate estuarine areas as natural field laboratories and environmental education centers. Additionally, a NERRS program in Delaware will help to conserve open, undeveloped spaces, protect valuable resources, and provide areas for outdoor recreation, all done in a manner which accommodates conservation-compatible, traditional resource uses.

#### **Background and History of the NERRS Effort in Delaware**

During the early 1980's, the Delaware Department of Natural

Resources and Environmental Control (DNREC) examined the NERR System's precursor, the National Estuarine Sanctuary Program, established in Section 315 of the Coastal Zone Management Act of 1972. While the old Sanctuary Program had several desirable attributes, it did not have enough flexibility or utility within the context of Delaware's resource needs to warrant the State's support. However, during the mid-1980's, the Estuarine Sanctuary Program evolved into today's NERRS program, having a greater emphasis on applied research and environmental education, while allowing more flexibility in the administration of the reserve components to accommodate multiple uses and to respond to management needs. This change occurred when the Coastal Zone Management Act was re-authorized in 1986, in which Section 315 of the Act was changed to the NERRS program with its new emphasis. With this new direction at the federal level, the DNREC again became interested in the program for Delaware, and in 1988 started an optimistic inquiry.

### Site Selection Process

Delaware initially identified 16 potential sites for preliminary considerations in the selection process. Based upon environmental representativeness and program utility, the State chose 6 sites for more intensive review. Using intensive site selection criteria, which assessed ecological representativeness, values for environmental research and education, and acquisition and management considerations, a ranking was established for the 6 sites. Information used in the ranking process came from documented sources, field site visits, and professional expertise of the site selection committee members. The top 3 sites were presented to the landowners of the sites and the general public. Primarily from the willingness of the landowners to participate in the NERRS program, 2 sites were selected and nominated to NOAA by Governor Michael N. Castle to be a multiple-site Reserve.

The St. Jones River site was selected to be the primary component of the DNERR. Due to the urbanization of the upper reaches of the St. Jones River, the upper Blackbird Creek site was selected as a second component to provide lower salinity estuarine areas which complement the St. Jones River component. The minimum area of the components is a representative estuarine ecosystem of the Middle Atlantic subsection of the Virginian Biogeographic Region that is suitable for long term research.

### Expectations of Delaware's NERRS Program

Delaware's participation in the NERRS program will permit the acquisition and long-term management of selected estuarine areas to provide outdoor laboratories for studying ecological structure, functions and processes, and man/land relationships, including both cultural adaptation and the effects of human-induced alterations or stresses. The Reserve will be a valuable laboratory for the two EPA National Estuary Programs in the Mid-Atlantic Region (the Delaware Bay NEP and the Delaware Inland Bays NEP). DNERR components will also serve to educate students

and the general public about the environmental roles and values of estuarine areas. Additionally, the protection of relatively undisturbed natural areas will permit the wise use of these natural resources to continue, typically in association with outdoor recreational activities. The protection of buffer areas which include adjacent uplands will serve to protect significant cultural resources.

Upon NOAA's approval of the Management Plan and successful completion of the requirements of the NEPA/EIS and Section 106 of the National Historic Preservation Act of 1966, as amended, the final phases of property acquisition, facilities development, and program implementation can begin.

Lands will be included in the DNERR only through the voluntary cooperation of the landowners; there will be no land condemnation procedures associated with the establishment of the Delaware NERR. Lands included in the DNERR may be publicly-owned or publicly-administered properties (at the state, county or municipal levels) and privately-owned properties. The participation of private landowners in helping to manage DNERR sites can take various forms, with the landowner deciding what is best for him/her, whether this decision be based on economics, personal desires for land-use practices and patterns, or both. Private landowner interaction with the DNERR to help activate or participate in the program might consist of fee-simple sale to the DNERR of property at fair market value; other types of property sales to the DNERR (e.g. bargain sale, installment sale, sale with reserved life estate, right of first refusal); various forms of land donations (e.g. outright donation, donation by devise, donation with reserved life estate); dedication as a State Nature Preserve; participation by conservation easements; granting of long-term leases (e.g. 50-year lease); etc.

The Delaware NERR program will be administered by the DNREC in accordance with Federal guidelines. The NOAA office overseeing the establishment and management of the Delaware NERR is the Sanctuaries and Reserves Division (SRD) of the Office of Ocean and Coastal Resource Management (OCRM) within the National Oceanic Service. Even though the DNERR is composed of two selected components, the sites will still be administered and managed as a single Reserve.

## **II. MANAGEMENT PLAN PURPOSES**

The purpose of the Delaware National Estuarine Research Reserve is to establish and manage the areas within the boundaries as field laboratories and to develop a coordinated program of research and education for the reserve. The Management Plan contains information on the natural, prehistoric, and historic resources of the components; local and regional influences on the components (e.g., climate, hydrology, geology, land use, and population trends); and historical and traditional uses of the components (hunting, fishing, trapping, silviculture, research, education, etc.). In addition, the plan contains a

discussion of management issues affecting the reserve and specific policies and activities to address the issues. The policies are resource protection oriented and the activities address needs related to research, monitoring, education, volunteers, public access, administration, facilities development, and acquisition.

The Reserve research and education plans include information necessary for improved understanding, appreciation, and management of the Middle-Atlantic estuarine systems in general. Reserve activities will augment, not replace, the conservation, research, education and other programs of the reserve property owners. Facilities will be developed as necessary to aid in research and education. DNERR access policies will be developed and enforced to protect the integrity of the reserve.

### III. OBJECTIVES AND GOALS

The ultimate goals of the Reserve are long-term and somewhat open-ended, focusing on desired conditions rather than specific actions. The objectives are short-term, measurable steps that can be taken to fulfill the goals. The various activities and programs recommended for implementation under this plan are aimed at achieving the objectives.

#### Resource Protection Goal

Protect the natural and cultural integrity of the ecosystem(s) within the Reserve and associated historic properties from disruptive activities occurring inside and outside of the reserve's boundaries.

#### Resource Protection Objectives

- Acquire and protect key land and water areas which approximate an entire ecological unit and comprise the research core and adjacent buffer areas through conservation easements, management agreements, land trusts, or land acquisition.

- Coordinate existing surveillance and enforcement activities and establish a mechanism to increase resource protection, when necessary;

- Provide for adequate public participation as a means to promote compatible uses of the reserve and awareness of the need to protect sensitive resources;

- Rehabilitate reserve habitats where necessary to restore natural bio-diversity and prevent further degradation of resources;

- Promote the protection of historic properties contributing to an understanding of the human processes which have occurred within the estuary; and

- Include historic properties, especially undisturbed areas in land protection decisions.

The objectives will be accomplished by implementing this long-term management plan which is tailored to the components' specific resources and management needs. The Management Plan contains an analysis of management issues, a synopsis of existing laws and regulations which protect the reserve components, and a discussion of DNERR management policies which will add additional resource protection. In addition, DNREC and the Conservation Districts will work with affected landowners to develop site-specific conservation plans which can be implemented through conservation easements, management contracts, or long-term leases. Conservation plans will also be developed for properties donated to or purchased by the State for the reserve program.

#### Research Goal

Utilize the research reserve for long-term studies to gain a better scientific understanding of natural and human processes occurring within the estuaries and to develop information for improved coastal decision-making.

#### Research Objectives

- Promote long-term base line studies to characterize flora and fauna within the Reserve and gain an understanding of the ecological interrelationships between organisms and their environments;

- Promote a better understanding of tributary water quality conditions, particularly spatial and temporal dynamics, requirements for growth and survival of living resources, and contribution and effects of point and nonpoint pollution;

- Promote a better understanding of physical processes operating within the estuary, such as tidal influence, circulation dynamics, freshwater inflow, stratification patterns, and sediment dynamics;

- Encourage studies that make effective use of past research and address data gaps in the Reserve's information base;

- Encourage studies that promote a better understanding of human use of the estuaries in the past, including the processes by which human groups have adapted to changes in the estuarine ecology, as well as understanding the changes which have occurred in the estuaries as a result of human activities; and

- Provide for effective use and communication of research results.

The Reserve's components will serve as natural laboratories for field studies in fundamental and applied estuarine sciences and cultural ecology and will provide a linkage between the

scientific community and resource managers. The Reserve will be utilized, as appropriate, both for short-term studies to assist in the development of management strategies and long-term studies to improve understanding of ecosystem processes in the Delaware Bay and its tributaries. The Reserve will provide a basis for determining the "health" status of coastal habitats in relation to population growth and development within Delaware and the Middle Atlantic Region.

#### Education Goal

Enhance public awareness, understanding, and wise use of estuarine resources in the Middle Atlantic Region and encourage an environmental ethic among all users.

#### Education Objectives

- Promote knowledge of the Reserve, its resources, and its programs as well as knowledge of broader coastal issues and concerns related to estuarine management and protection;

- Provide educational and interpretive services at appropriate Reserve components directly to students, managers and visiting public;

- Use information on past lifeways to make members of the public more aware of the importance of estuarine ecology and to promote balanced use of estuarine resources;

- Promote the preservation of historic properties through public education efforts;

- Provide opportunities for teacher training, student projects, internships, and assistantships where enrollees work jointly with scientists, gain field experience, and learn about the importance of research resources;

- Provide appropriate facilities which contribute to educational interpretative, volunteer, and research uses of reserve sites; and

- Provide an understanding and appreciation for appropriate traditional uses of the reserve components, including hunting, fishing, trapping, and boating.

The Reserve will be utilized, where appropriate, as outdoor instructional areas for educational studies in estuarine ecology. The reserve program will help foster a long-term commitment to the restoration and protection of the Delaware Bay system and its resources through education about the Bay system, the problems facing it, and the policies and programs designed to help the Bay by providing opportunities for interpretive, recreational, and leisure activities (hiking, bird watching, canoeing, etc.). These activities will be promoted at appropriate reserve sites where the natural area character of the reserve and ongoing research will not be adversely affected.

#### IV. RELATIONSHIP OF DNERR COMPONENTS

##### A. REGIONAL CONTEXT

The goal of the NERRS Program is to have at least one estuarine reserve representing each biogeographic region of the U.S., and within each region, to represent the major estuarine types found. Currently no other sites exist in the Middle Atlantic region. New Jersey attempted to establish a Reserve along the Mullica River several years ago. New Jersey has recently begun to re-study the Mullica river through a site investigation for nomination to NOAA.

As the focal component of the DNERR, the Lower St. Jones River estuary has several attributes that are desirable for Regional representation: 1) good access and utility for environmental education and research; 2) a relatively undisturbed tidal marsh representative of the moderate to high salinity emergent wetlands found along the Delaware Coast; 3) adjacent State Wildlife Areas on several sides, permitting studies of manipulative and non-manipulative habitat management techniques; 4) a surrounding upland that surprisingly is still agrarian or forested in nature, presenting opportunities to examine the impacts of agriculture on estuaries; 5) close proximity to the growing City of Dover along the upper St. Jones River, yielding opportunities for the study of man's urbanized impacts on estuarine systems; 6) close proximity to the oyster grounds of the open Delaware Bay; 7) proximity to shoreline segments of Delaware Bay that are crucial foraging habitat for the international migratory shorebird resource; 8) a rich, well documented history of man's use and interactions with the estuary (e.g. the Dickinson Mansion would be part of the DNERR complex); 9) readily available administration and professional management expertise, since DNREC headquarters is within 6 miles and there is good potential to house pertinent DNREC technical personnel at this component and have them assume some of the DNERR management responsibilities as part of their routine duties; 10) good opportunities for outdoor recreation and educational exhibits convenient to a growing metropolis.

The Upper Blackbird Creek estuary component nicely complements the environmental attributes of the Lower St. Jones River estuary, since the Upper Blackbird is primarily a low salinity or freshwater tidal marsh, containing a varied mixture of open water, tidal mud flats, and highly diverse emergent wetlands and forested fringes. Desirable attributes of the Upper Blackbird Creek for the Region include: 1) the area is ecologically representative of the landward ends of many regional estuarine rivers and creeks, and is still relatively undisturbed; 2) contains a high diversity of plant and animal life; 3) aesthetic beauty; 4) provides opportunities for outdoor

recreation in a relatively remote setting; 5) surrounding land use is primarily agricultural, so provides additional opportunities to assess impacts of farmland practices on estuaries; 6) is near extensive stands of Phragmites along the lower Blackbird Creek, so will provide outstanding opportunities for applied research on the biology and control of this problem species; 7) is in close proximity to ecologically interesting, non-tidal forested wetlands, in particular the Delmarva Bays of Blackbird State Forest.

The two sites are managed as a multi-component Reserve due to the complementary nature of the components. The urbanization of the upper reaches of the St. Jones River estuary caused by the City of Dover limits the opportunity to acquire an ecological unit without the complementary upper Blackbird Creek site. The minimum defined boundaries of the two components together provide the ecologically key land and water areas of the research Reserve.

## **B. RELATIONSHIP TO OTHER COASTAL PROGRAMS**

These two DNERR components are within Resource Areas designated as Lands of State Significance by the Governor's Greenspace for Delaware's Future Committee (1990). Additionally, the Blackbird Creek wetlands have been designated by the U.S. Fish and Wildlife Service, in their draft (1989) Regional Wetlands Concept Plan supplemental to the National Wetlands Priority Conservation Plan (1989) to help actuate the Emergency Wetlands Resources Act of 1986, as priority wetlands for protection and acquisition. The Delaware Estuarine Reserve should also provide opportunities to help strengthen, and in turn be strengthened, by interactions with the Delaware Coastal Management Program and the EPA/DNREC Delaware Estuary Program, since the Delaware Estuary (River and Bay) was designated by the EPA in 1988 as part of the EPA's National Estuary Program.

### DCMP Policies that support DNERR proposals

The purpose of the DCMP "is to provide a systematic approach to decisions regarding the use of Delaware's resources which will provide for reasonable growth and development while conserving and protecting our irreplaceable resources". The DCMP's first objective of four objectives to achieve this overall purpose is: "Develop methods to evaluate coastal land and water uses so that informed decisions can be made". This objective is supported, among others, by the following DCMP policies:

#### Section 5.A.1. Wetlands

Policy 1. The productive public and private wetlands in the State shall be preserved and protected to prevent their despoliation and destruction.

Policy 2. Activities in or adjacent to wetlands shall be conducted so as to minimize wetlands destruction or degradation, to preserve the natural and beneficial values of wetlands, and to protect the public interest therein.

Policy 8. In considering the environmental impacts of a proposed activity in wetlands, the Department (DNREC) shall consider the cumulative impact of individual projects.

#### Section 5.A.2. Beaches and Shoreline

Policy 1. The public and private beaches of the State shall be preserved, protected, and enhanced to prevent their destruction and despoliation.

Policy 2. Publicly owned beaches and shorelines shall be managed and maintained to assure adequate and continued public access to these areas within the carrying capacity of the resource.

#### Section 5.A.3. Coastal Waters

Policy 2. The water resources of the State shall be protected from pollution which may threaten the safety and health of the general public.

#### Section 5.A.4. Underwater Lands and the Coastal Strip

The policies of this section depend upon good understanding of the values and impacts that proposed activities may have on the estuarine environment of the Coastal strip.

#### Section 5.B.1. The "Public Lands"

Policy 5. DNREC shall manage these lands for public recreation purposes and for the conservation and preservation of their natural resources and beauty. A management priority shall be the maintenance of public access to the beach and ocean where such access can be accommodated without serious damage to the primary resources...

#### Section 5.E.G. Coordination Policies

Policy 2. State agencies responsible for implementation of the CMP shall coordinate their CMP implementation responsibilities with each other to the extent necessary to assure well informed and reasoned program decisions.

### BACKGROUND

#### COASTAL ZONE MANAGEMENT ACT

Congress has declared that it is the national policy "to preserve, protect, develop, and where possible, to restore or enhance, the resources of the Nation's coastal zone"...and "to

encourage and assist the states to exercise effectively their responsibilities in the coastal zone through the development and implementation of management programs to achieve wise use of the land and water resources of the coastal zone, giving full consideration to ecological, cultural, historic, and esthetic values as well as the needs for compatible economic development"...(CZMA Section 303).

#### **DCMP "ENHANCEMENT AREAS"**

The Delaware Coastal Management Program, funded under a grant from NOAA, provides guidance for staff members throughout DNREC as they work to preserve and enhance Delaware's coastal zone, the dynamic zone between land and sea.

In Section 309 of the CZMA, Congress articulated improvements states could make to enhance their approved coastal zone management programs. Congress named eight subject areas in which states can work to improve their coastal zones:

- \* Protecting, restoring, enhancing or creating coastal wetlands.
- \* Preventing or reducing threats to human life and property in coastal areas.
- \* Increasing public access.
- \* Reducing marine debris.
- \* Controlling coastal growth and development.
- \* Preparing and implementing "special area management plans."
- \* Planning for the use of ocean resources.
- \* Siting facilities, such as energy facilities, which may be of "greater than local significance."

Many of these eight subject areas are addressed in this management plan by directing research and education efforts toward these subjects which will provide additional information in the decision making processes for better coastal resource management.

#### **C. RELATIONSHIP TO NERRS**

The establishment of the Delaware National Estuarine Research Reserve within the framework of the National Estuarine Research Reserve System provides a means of addressing environmental problems in the State's coastal waters, wetlands

and contributing watersheds. A fully implemented DNERR will offer protected components where environmental research and education can focus on natural estuarine processes and man-induced alterations within our coastal habitats, typical of the Middle Atlantic Region. Research and Education projects that are selected will help decision makers in addressing critical coastal management issues. The administrative network that is established under the National Program will promote an exchange of research findings and education efforts for Delaware's estuarine waters, the Middle Atlantic Region, as well as from other estuaries of the United States.

The management plan evaluation and review in this section primarily addresses NOAA's interest in a network of estuarine reserves that are maintained at a level that will be valuable to the national interest in estuary management. The benefit to Delaware in joining this network of reserves is the sharing of estuarine education, research, and management techniques and the grants that are available to a designated reserve that is meeting the objectives of the national program. Because DNREC's interest in estuarine management complements NOAA's national interest, the reserve program operates as a State/Federal partnership. The management of DNERR is the long-term responsibility of DNREC, and NOAA cooperates with and assists Delaware on a regular basis. NOAA will perform formal reviews to ensure that DNREC is in compliance with federal NERRS goals, the Management Plan, and NOAA grant work plans.

## V. MANAGEMENT ISSUES

There are issues pertinent to Delaware that are in and around the DNERR that must be recognized and addressed. The Management Plan is based on a strategy that is focused sufficiently to minimize the negative impacts of these particular issues as well as maximizing the positive impacts that many of these issues will provide. The Management Plan also provides the flexibility to address issues that may arise over the long term nature of the Reserve. Following are the current management issues:

- Population Growth
- Highway construction; RT 1 Relief Route; RT 9 & 113 alterations
- Channel alignment & dredging
- Fish & Wildlife management; Hunting, fishing, habitat improvement
- Public access; Restricted areas (e.g. long term research, education, and facility areas)
- Refinement of boundaries; To be determined when management issues are addressed
- Traditional uses; State owned - DNERR objectives top priority; Easements - Landowners wishes first priority
- Research management on non-state areas will be permissible by concurrence of the private sector first
- Zoning; Land uses: USAFB flight & noise; Wildcat super fund site; City of Dover; Conservation Zones; Agriculture; Sludge & animal waste land/wetlands application
- Maintenance of freshwater flow: State stormwater management law; water quantity/quality
- Maintenance of natural conditions within site designated areas
- Protection of significant natural & cultural resources
- Delineation of research agenda to promote DNERR intent
- Monitor activities
- PCB's in fish flesh of the St. Jones River
- On-site vs. off-site program
- Representative of Middle Atlantic sub-region
- Need to implement reserve program that provides better management tools for coastal programs
- Research protection activities (Habitat manipulation or alteration)
- Controlled flexibility (all plans need to include desired activities & undesired activities)
- Administrative oversight
- Support long-term studies
- Resource data base
- Link DNERR with scientific community
- Transfer & translation of scientific information to coastal decision-makers & users
- Peer review of proposals and technical reports
- Tailor education, interpretation & other visitor use programs to component needs & constraints
- Coordinate Estuary research, education & cultural efforts

in Delaware

- Cultural resources; Cultural resources protection needs to be integrated with whole program
- Establish research, education, & cultural center
- Encourage environmental ethic among all estuary users

### The DNERR and Delaware Bay

Even though the DNERR lands consist primarily of tidal wetlands, wetlands rivers or creeks, and adjacent upland fields or woods, a substantial focus of the DNERR (for both environmental education and research) will be on ecological habitats, environmental processes, economic problems, or societal issues associated with the open estuarine waters of Delaware Bay. Topics of interest to the DNERR in the large estuary of Delaware Bay are widely varied -- e.g. hydrology of Delaware Bay; estuarine water quality; heavy metals and toxics; marine sediments; coastal geomorphology; nutrient cycling and microbial processes; plankton communities; benthic organisms; estuarine fisheries; neritic waterbirds; marine shipping and commerce; dredging impacts within the DNERR's limits of physical accessibility to Delaware Bay. Significant programmatic emphases in education or research will be placed on Bay-related topics.

## VI. HABITAT MANIPULATION

NOAA regulations provide that habitat manipulation subject to certain restrictions and conditions can occur in NERRS sites, as long as the ecological or representative integrity of a reserve is not compromised. Activities encompassed by the phrase "habitat manipulation" may vary widely in scope and scale, from gross alterations of topography, hydrology or vegetation patterns; to minor modifications of soil, drainage patterns or plant cover; to introductions or control of animal species; to applications of chemicals or radioactive tracers. Specifically, 15 CFR Section 921.1(d) recognizes the need to allow and accommodate habitat manipulation for research purposes, as long as the manipulative research activities are specified in the management plan, they are consistent with the mission and goals of the NERRS program and the affected reserve, and they are limited in nature and extent to the minimum manipulative activity necessary to accomplish the research objective. Manipulative research activities having significant or long-term impacts on reserve resources require prior approval from the state and NOAA. Habitat manipulation for purposes of restoring degraded areas to provide better representations of estuarine ecosystems are also permissible, addressed in 15 CFR Section 921.1(e). Restoration activities involving habitat manipulation to improve the representative character and integrity of a reserve must be carefully planned and approved by NOAA through the management plan. Restoration of degraded estuarine areas will often provide excellent opportunities to do management-oriented research, as stated in 15 CFR Section 921.1(e).

Habitat manipulation for resource management is generally not permitted at NERRS sites, except for purposes of research or environmental restoration. However, NOAA may allow exceptions to these prohibitions, as stated in 15 CFR Section 921.1(d), if manipulative activity is necessary for the protection of public health, or to preserve or protect other sensitive resources identified under relevant federal or state authority (e.g. endangered or threatened species, or historical or cultural resources). If habitat manipulation is determined to be necessary to protect public health or sensitive resources, then these activities shall be stated in the management plan and limited to reasonable actions which have the least adverse and shortest term impacts on a reserve's representative and ecological integrity.

The DNERR plans to manipulate habitats, or sees a potential need to manipulate habitats, for four primary purposes: 1) environmental research; 2) restoration of degraded ecosystems; 3) prevention or avoidance of new environmental degradations, or prevention or avoidance of undesirable changes in the representative characteristics of the reserve; 4) protection of public health (e.g. mosquito or biting-fly control). Secondary effects resulting from such manipulative actions may include maintenance, restoration or enhancement of fish and wildlife

populations, or improved management and control of the reserve's hydrological or vegetative characteristics to maintain representative integrity. All DNERR habitat manipulation will be done in a manner consistent with NERRS regulations, which includes their identification and description in the management plan, plus pre-approval and post-review by NOAA.

Anticipated or potential habitat manipulation in each DNERR component include the following six (6) activities:

**1) Insecticide Use.**

Because of each Reserve component's proximity to populated areas, and the potential for mosquitoes causing on-site and off-site nuisances and carrying diseases that could cause human illnesses, such as Eastern Equine Encephalitis, saltmarsh mosquitoes that are produced on the Reserve must be controlled. Fortunately, much of the Reserve's tidal wetlands are regularly-flooded habitats where mosquito production is not too severe. However, there are irregularly-flooded zones behind the creekside natural levees or near the upland fringes that necessitate occasional control efforts. When warranted, these areas are treated by the Delaware Mosquito Control Section (part of the DNREC's Division of Fish and Wildlife) with aeri-ally-applied larvicides before the adult mosquitoes emerge, done at a frequency of 2-6 times per pest season (May-October). Quite infrequently, it may also be necessary to aeri-ally-apply adulticides along the field-and-forest border of the wetlands' upper fringe. All insecticides used are chosen and applied with environmental safety and compatibility foremost in mind, in terms of using the best products at the lowest rates to achieve both efficacious abatement while avoiding or minimizing non-target impacts. Because of the nuisance and human disease problems associated with the far-ranging saltmarsh mosquitoes, these insecticide control efforts must continue within the Reserve after its designation. Essentially, the need in the DNERR for insecticide use, types of insecticides, methods of application, areas of treatment, and frequency of treatments will be the responsibility and decision of the DNREC's Mosquito Control Section in consultation with the Reserve manager.

Other pest populations of non-culicid biting flies (e.g. greenhead flies, deer or sheep flies, biting gnats or no-see-ums) occur on the Reserve components, and at times they can be very annoying. However, because of their localized distribution and short flights, they are normally not controlled. This policy may have to be re-examined dependent upon the nuisance or health problems that establishment and operation of a Reserve program may engender.

## 2) Open Marsh Water Management (OMWM)

The State is actively pursuing a program to lower its dependence on chemical insecticides to control saltmarsh mosquitoes, by substituting the biological control technique of Open Marsh Water Management (OMWM) as fast as the State's resources and landowner cooperation permit. The environmentally-compatible OMWM source reduction technique uses selective excavation of ponds and ditches to usurp ovipositioning sites and to increase larvivorous fish access. In order to reduce the need statewide to use insecticides, the State has included the lower St. Jones River basin for future OMWM implementation, just as has been planned for many other pest-problem production areas within Delaware's coastal marshes. It is anticipated that no more than 20% of the tidal marsh surface area within the lower St. Jones River reserve component would have to be treated with OMWM, primarily confined to "salt hay" zones behind creekside levees or near upland edges. An additional advantage of the OMWM technique is that a parallel-grid-ditched marsh which is treated with OMWM has wildlife habitat of pools and pannes restored to a marsh which was dewatered by the parallel-grid ditches.

Production of saltmarsh mosquitoes in the Blackbird Creek reserve component is not too much of a problem because of the brackish and freshwater habitats found in the upper Blackbird Creek, so this site is not a probable candidate for OMWM treatment. However, production of other mosquito species (and biting flies) can locally be severely annoying and a potential health problem, so use of insecticides must continue since a practical source reduction method is not available.

## 3) Restoration of Parallel-Grid-Ditched Marsh.

Parallel drainage ditches, about 150 feet apart and 30 inches wide by 30 inches deep, were installed in over 70% of Delaware's tidal marshes during the 1930's for purposes of saltmarsh mosquito control. The ditches partially drained breeding areas and provided access at high tides for larvivorous fishes for mosquito abatement. However, many breeding sites (i.e. potholes) were not drained by the geometrically-located grid ditches, so mosquito control was often less than satisfactory; additionally, parallel-grid-ditches were often located in non-breeding marsh areas, unnecessarily altering wetlands, and frequently larger marsh pools and pannes of high habitat quality for waterbirds and aquatic organisms were drained. The parallel-grid-ditch network in Delaware was maintained

("cleaned") and even somewhat expanded by additional excavation projects in the early 1950's and mid-1960's.

Parallel-grid-ditching is extensive in the tidal wetlands of the Lower St. Jones River component, but the Upper Blackbird Creek component is not heavily affected. As such, restoration of wetlands hydrology in the St. Jones site, which would involve reversing the effects of parallel-grid-ditching, might be a desirable future undertaking. An intensive restoration plan might involve filling the grid-ditches with "appropriate" soils, but such an effort would involve much traversing and temporary alteration of marsh to accomplish, and uncertainty exists about the source and suitability of soil to use as fill material. (Note: in many locations, grid-ditches are naturally filling via tidally-borne sediments, but such processes take several decades to start to have functional effects.)

If restoration of grid-ditched marsh is undertaken, it is more probable that earthen plugs up to 50 feet long will be placed in the grid-ditches near the ditches' intersections with tidal creeks; the ditch plugs would fill short segments of ditch channels to marsh surface elevation, thus restoring wetlands hydrological patterns (particularly subsurface water tables) upstream from the plugs. Plugging those grid-ditches which would most likely restore marsh ponds or surface pannes would be given top priority. Parallel-grid-ditches that are still necessary for mosquito control purposes would not be restored (i.e. not plugged). However, when areas are treated with OMWM, grid-ditches are often plugged to incorporate them into certain types of OMWM systems, helping to restore wetlands hydrology. Thus, restoration of parallel-grid-ditch hydrological effects could be accomplished by plugging grid-ditches, either remote from or in association with OMWM systems.

#### 4) Phragmites Control

The rapid spread of phragmites over many areas of Delaware's coastal wetlands has had a net detrimental impact on the quality and quantity of the marsh's resources. While the extent of phragmites cover in the lower St. Jones River reserve component is not yet severe, there is the potential that this problem might someday need control measures on the Reserve. About 11% of Delaware's coastal wetlands are densely infested with phragmites, and about 1/3 of all of the State's tidal marshes have this species' cover at lower densities. Areas of the Ted Harvey Conservation Area, adjacent to the St. Jones River site, had unacceptable phragmites incursions and were treated for marsh restoration. If phragmites control is required in

order to maintain or restore a balanced representative ecosystem, the State's control program, relying on selective application of glyphosate herbicide followed by prescribed burning, is the preferred option.

The Upper Blackbird Creek reserve component has about 20% of its seaward marsh area severely infested with phragmites, with vast expanses of phragmites-dominated marsh extending downstream from the Reserve all the way to Delaware Bay. Because of the Blackbird Creek component's incipient problem and close proximity to extensive phragmites stands, the need to respond to future unacceptable incursions must be recognized.

#### 5) Research Manipulation.

Habitat modifications or alterations may be made for purposes of environmental research. Such experimental manipulations are usually small-scale or have only temporary effects. Examples of potential habitat manipulations for research include, but are not limited to, the following:

- a) Clip-and-harvest of aboveground vegetation plots.
- b) Placement of animal enclosure or inclosure cages.
- c) Taking soil cores, boring soil holes, excavating observation wells or profile pits, etc.
- d) Placement of sampling apparatus (and supporting structures) for aquatic biotic surveys, such as drop nets or fyke nets.
- e) Construction and operation of hydrological monitoring stations, involving devices such as tide gauges and stillwells, current meters, pumps, or electrical probes and sensors.
- f) Marking study plots, boundaries, sampling stations, transects, etc. with stakes, flags, tape, signs, twine, etc.
- g) Construction and use of wildlife observation blinds.
- h) Placement of small footbridges or boardwalks to allow access to research areas.
- i) Installation of small water control structures for hydrological studies, such as weirs, flumes, canal-checks, riserboards, etc.
- j) Additions of chemical fertilizers, injections of radioactive tracers, release of tracking dyes, spraying experimental pesticides, etc.

6) **Snow Geese Grazing.**

Over the past 15 years, snow geese populations in Delaware have rapidly expanded. Migratory and wintering snow geese flocks have now become so large that these birds are overgrazing many areas of Delaware's tidal wetlands, denuding patches of emergent vegetation up to several dozen acres in size per patch, with a preference for Spartina alterniflora marsh herbivory. Repetitive grazing of an area for just a few seasons has caused permanent conversions of previously emergent wetlands to mudflats or subaqueous bottoms.

At present, snow geese overgrazing is not a problem at either reserve component. However, the potential exists for future problems, particularly at the lower St. Jones River site. If it becomes desirable to prevent or discourage snow geese overgrazing in the reserve, corrective methods such as structural deterrents, special hunting practices, or other harassment measures could be used.

In order to show the extent of anticipated or potential habitat manipulations within the DNERR, the following table presents estimated maximum percentages (by surface area) of what will be permissible manipulation, for both core and buffer areas.

<u>Habitat Manipulation</u>	<u>St. Jones</u>		<u>Blackbird</u>	
	<u>Core</u>	<u>Buffer</u>	<u>Core</u>	<u>Buffer</u>
Insecticide Use	80 (1)	25	50 (2)	25
OMWM	20	NA	NA	NA
Restore Ditched Marsh	80	NA	30	NA
Phragmites Control	*	NA	*	NA
Research Activities	25	70	25	70
Snow Geese Responses	*	NA	*	NA

Codes

- Core = Primarily tidal wetlands and associated water features.
- Buffer = All non-core areas.
- NA = Not applicable
- \* = Unknown maximum (probably if and as needed)
- (1) = If OMWM is performed, then larviciding for mosquito control would be eliminated in core.
- (2) = In comparison to St. Jones site, done infrequently at Blackbird site, only once or twice per year or not at all.

In order to insure the long-term representative and ecological integrity of the DNERR, it is important that accurate record-keeping and tracking be done for all previous or ongoing habitat manipulations, and that all newly proposed manipulations be given thorough review and prior approval by the State and NOAA. Records of cumulative surface areas (acreages) affected by the various habitat manipulation practices will be kept and continuously updated, in order to confine and perform needed manipulative activities without exceeding the identified maximums. If (or as) maximum limits are approached in the future, it will become more and more important to sparingly approve new manipulations in previously non-manipulated areas, and to direct where possible new manipulation proposals into already manipulated areas (i.e. recycle or reuse formerly manipulated sites when possible).

Review procedures and requirements by the State and NOAA for specific habitat manipulation activities are addressed later in the plan, in the sections dealing with environmental research and monitoring or with environmental restoration.

## **VII. BOUNDARIES AND ACQUISITION PLAN**

### **A. KEY ECOLOGICAL AREAS**

Boundaries for DNERR include an adequate portion of the land and water areas of the natural system to form an ecological unit which ensures effective conservation. These areas are discrete enough to be effectively managed, and large enough to make long-term research possible. To help focus management efforts, site boundaries encompass core and buffer areas.

NOAA regulations 15 CFR Section 921.11 define core areas as areas which contain "ecological units of a natural estuarine system which preserves, 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 core area 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...[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 area is defined as an "area adjacent to or surrounding key lands and water areas and essential to their integrity. Buffer zones protect the core area and provide additional protection for estuarine-dependent species". The buffer area may include an area for research and education facilities.

Site surveys were conducted to establish boundaries for each DNERR component. Acquisition strategies to establish adequate State control have been established to provide long-term protection for reserve resources within these boundaries. Expenditure of federal and state funds will be minimized by giving priority to non-fee simple acquisition strategies, such as Memoranda of Understanding (MOUs), conservation easements and long term leases when possible. Fee simple acquisition was used, and is expected to be used, to obtain some privately owned parcels of land. The state will acquire control of land and water areas from willing sellers and participants only. No condemnation procedures will be used.

### **B. PRIORITY ACQUISITIONS**

#### **1. Lower St. Jones**

The Lower St. Jones River DNERR component is located in east-central Kent County, approximately 6 miles southeast of

downtown Dover (Fig. 2). The proposed maximum boundaries include landowners with title to about 5000 acres, with most of the area east of Rt. 113 (at Barkers Landing), on the north side of the St. Jones River (Fig. 3). The other portion of the component east of Rt. 113 is on the south side of the St. Jones River, extending up Trunk Ditch to Rt. 113, with the remainder of the component on both sides of the St. Jones River west of Rt. 113, extending up Cypress Branch to C.R. 363 (Fig. 3).

#### ST. JONES SITE BOUNDARIES

The component is between the Logan Lane tract on the east, which forms the state-owned, 2019-acre Ted Harvey Conservation Area and the 176-acre Roberts tract on the west, also part of the State Wildlife Area system managed by the DNREC's Division of Fish and Wildlife. The Wildlife areas proximity to the Reserve nicely complement the component's conservation, research and educational activities.

The distance along the main channel of the St. Jones River between the Reserve's upstream, western boundary and Delaware Bay is about 5 1/2 miles. The river continues upstream past the landward boundary of the DNERR component for another 5 miles, flowing out of Silver Lake near downtown Dover. The DNERR component encompasses the John Dickinson Mansion (north of the St. Jones River and east of Rt. 113), managed by the Delaware Division of Historical and Cultural Affairs. The component is partially adjacent to the Dover Air Force Base on the north, and the main body of the component is two miles west of the Delaware Bay shoreline. The DAFB is not within the Reserve. Known or potential hazardous sites at the DAFB are not located on the St. Jones River and are not expected to cause any potential harm to research activities. The St. Jones component does not lie within the flight line of DAFB and any noise levels will be taken into account when designing DNERR facilities. River area to the Bay is included in the component as well as the section of the Delaware Bay from the mouth of the St. Jones north and along the shore boundary of the Logan Lane tract to near its limit along the shore and extending bayward a distance of two miles.

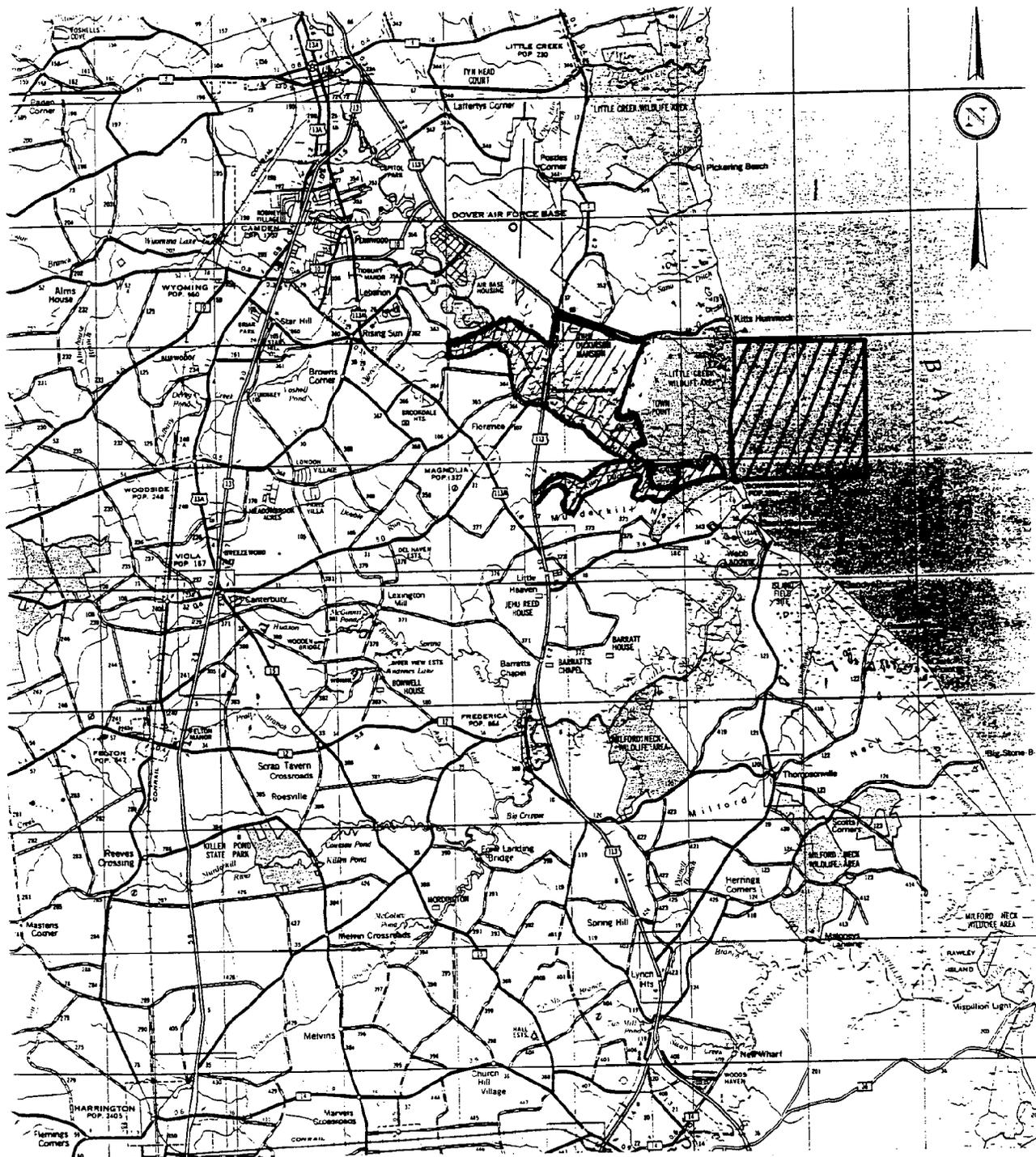


FIGURE 2

General location of the proposed Lower St. Jones River DNERR Component, in east-central Kent County

# Delaware National Estuarine Research Reserve

## St. Jones Component

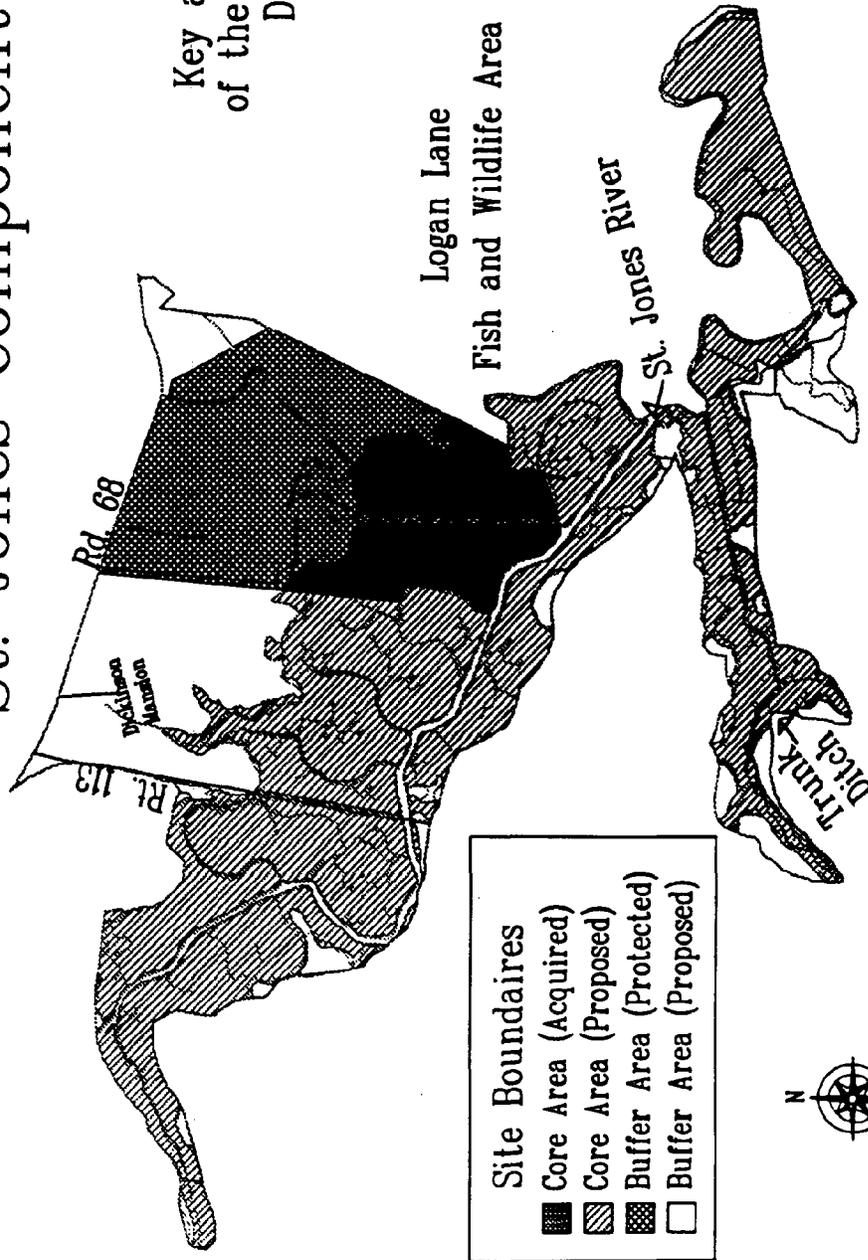


Figure 3.  
Key areas and boundaries  
of the Lower St. Jones River  
DNERR component.

- Site Boundaries
- Core Area (Acquired)
  - ▨ Core Area (Proposed)
  - ▩ Buffer Area (Protected)
  - Buffer Area (Proposed)



Delaware Bay

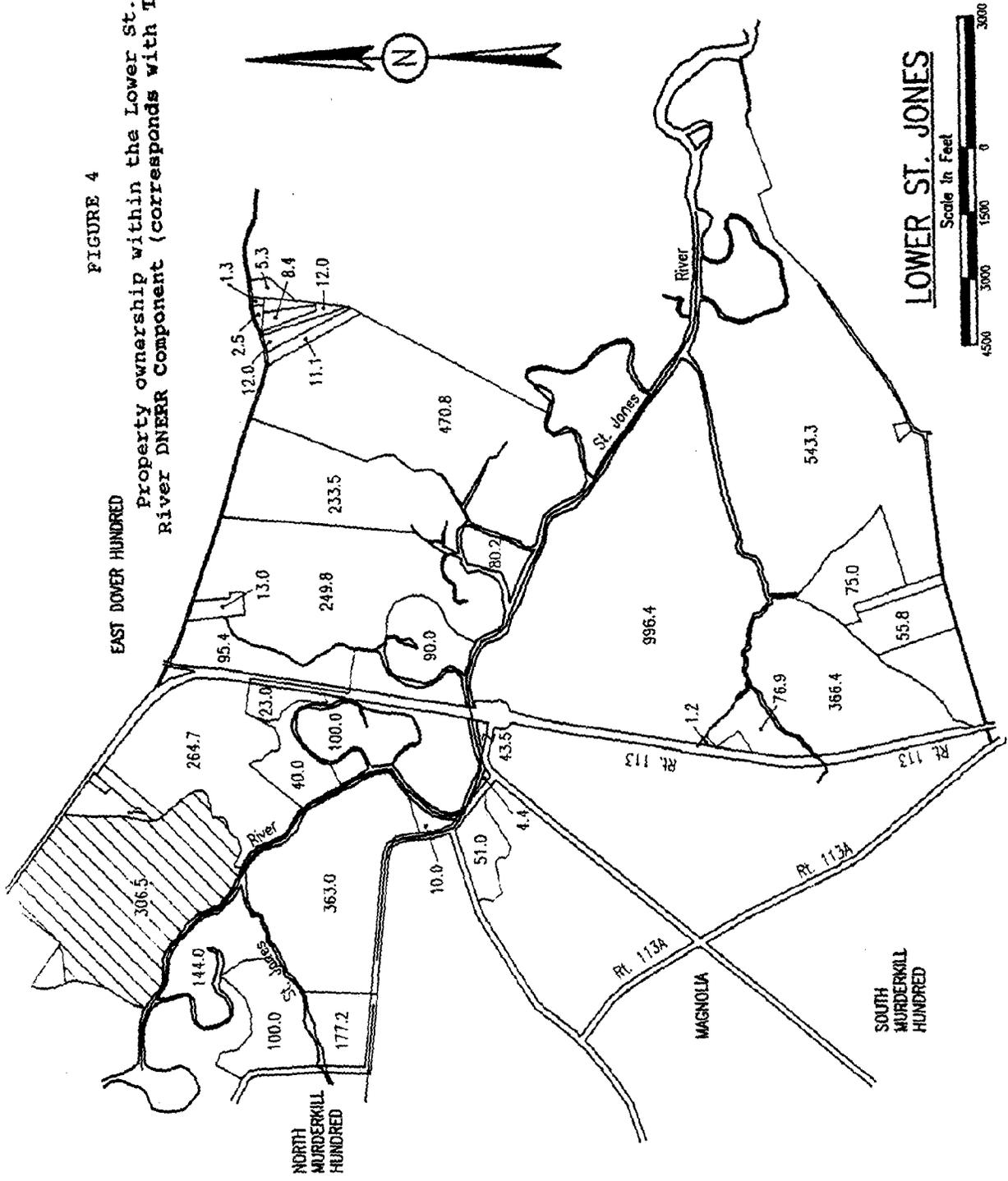
Powers Beach

TABLE 1

Land Ownership in the Lower  
St. Jones River DNERR Component

MAP	PARCEL	ACREAGE	OWNER
<u>East Dover Hundred</u>			
96	20	95.4	Adele Conner
	19	264.7	George & Lunch, Inc.
	15	306.5	Delmarva Land Co.
	21	13.0	State of Delaware, Dept. of State
106	23	5.3	Thomas B. Farr Estate
	8	1.3	David J. & Sharon Lewis
	7	2.5	Joan M. & Mabel I. Jones
	6	12.0	Robert Clouser
	5	8.4	Alexander Auchterlonie
	3	12.0	Fraternal Order of Police
	2	11.1	Delmarva Power & Light
	24	124.6	Alvin G. & Loretta Wilson
	1	142.6	Alvin G. & Loretta Wilson
		431.3	State of Delaware, DNREC
105	7	249.8	Delagra Corp.
	10	90.0	James McIlvaine
	8.01	23.0	State of Delaware
	8	100.0	King Cole Farms, Inc.
	1	40.0	Marjorie Lane
<u>South Murderkill Hundred</u>			
114	1	543.3	David Vance & Wm. George Morris
113	17	76.9	The Island Farm, Inc.
	34	366.4	King Cole Farms, Inc.
	15.01	1.2	King Cole Farms, Inc.
	16	996.4	King Cole Farms, Inc.
	43	75.0	John Wilkins
	41	55.8	Ester & James Orvis (lifetime Est.)
105	23	43.5	King Cole Farms, Inc.
	13	4.4	Capital Office Equipment
	12	51.0	Henry Zimmerman
	27	80.2	King Cole Farms, Inc.
<u>North Murderkill Hundred</u>			
96	03	100.0	John Farrow
	04	144.0	State of Delaware, DNREC
105	3	10.0	Henry Zimmerman
	2	363.0	Calvin Meyers
	1	177.2	Calvin Meyers

FIGURE 4  
 Property ownership within the Lower St. Jones  
 River DNERR Component (corresponds with Table 1)



### Local Interest and Participation

The Lower St. Jones River received the most local support and interest of any site that was examined. Significant interest in the Lower St. Jones River area for its research and educational potential was expressed by both Delaware State College and Wesley College. Letters of support for the Lower St. Jones site were sent by the Principle Planner for Kent County, and by the Mayor of Dover. A joint letter of support for the St. Jones site from the Mayor of Dover and the President of the Kent County Levy Court was sent to Governor Castle. A local historical society, the Friends of Dickinson Mansion, was supportive. Town officials from Bowers Beach expressed interest in having the DNERR program help in land-use planning to conserve rural characteristics along the south side of the lower St. Jones River. The formation of a Lower St. Jones River-DNERR Landowners Management Association, with three property owners elected to serve as Association Officers, was quite encouraging. One of the private landowners within the site, an owner of about 700 acres of contiguous key parcels, has expressed a strong interest in helping to establish the program (the landowner has sold 431.3 acres to the State for the Reserve and has signed a Conservation Easement to keep the remainder of his lands in farm and woodlands).

### Land Ownership

The Lower St. Jones River site boundaries encompass 35 parcels of land representing 24 landowners (Table 1 and Fig. 4). The figure of 5022 acres for this site is a maximum value, since it includes upland areas for parcels containing wetlands where not all of the upland may need to be included in the DNERR component, although some upland area is needed for buffers and support facilities. In terms of percent ownership, 12.2% is owned by the State; 6.1% by a construction company doing sand-and-gravel excavation on its adjacent property; 0.2% by a fraternal organization; 33.1% by a corporate farm; 5.0% by another corporate farm; and the remaining 43.4% by 16 private landowners, with four of these private landowners owning 40.8% of the component.

#### **a. Core Areas**

The minimum core area of the St. Jones component, which includes a complete State owned ecological unit, consists of approximately 50 percent of the estuarine wetland complex located on the north side of the river between the Logan Lane Tract of the Ted Harvey Wildlife Area and Route 113. This complex includes the tidal marshes, tidal creeks and guts, and the open waters. Excepted from this wetland complex are: the old wharf site immediately behind the Dickinson Mansion in the edge of the tidal marsh; the boardwalk sites and the wetlands upstream of the boardwalks; and other areas surrounded by upland. The minimum core and buffer areas were acquired by the State from Alvin G. and Loretta Wilson in the purchase of parts of two tracts, in November 1991 the Slaughter tract of 343.8 acres fee simple and 124.58 acres of conservation easement (development rights) and in

April 1992 the Wilson tract of 87.5 acres fee simple and 142.63 acres conservation easement (development rights).

The maximum core area includes all of the estuarine wetland complex on both sides of the river from the Delaware Bay to the Delmarva Land Company located 1.75 miles west of the Barkers Landing Bridge.

#### **b. Buffer Areas**

The buffer areas of the component includes the present agricultural and wooded areas immediately adjacent to the core areas. Included in the buffer areas are the freshwater marshes surrounded by upland. The old wharf site and the areas around the boardwalks are part of this buffer. The other areas located south of the St. Jones River east of Route 113 and on both sides of the St. Jones River west of Route 113 will be within the buffer of the minimum defined core. Adequate buffer areas were acquired in the Slaughter and Wilson tract purchases.

#### **c. Market values**

Market values will be established by appraisal reports in conformance with the "Uniform Appraisal Standards for Federal Land Acquisitions." "Fair Market Value" is defined as the amount in cash, or on terms reasonably equivalent to cash, for which in all probability the property would be sold by a knowledgeable owner willing but not obligated to sell to a knowledgeable purchaser who desired but is not obligated to buy. More than one appraisal may be necessary where negotiations stall. Only appraisers who can meet these standards will be used.

## **2. Upper Blackbird**

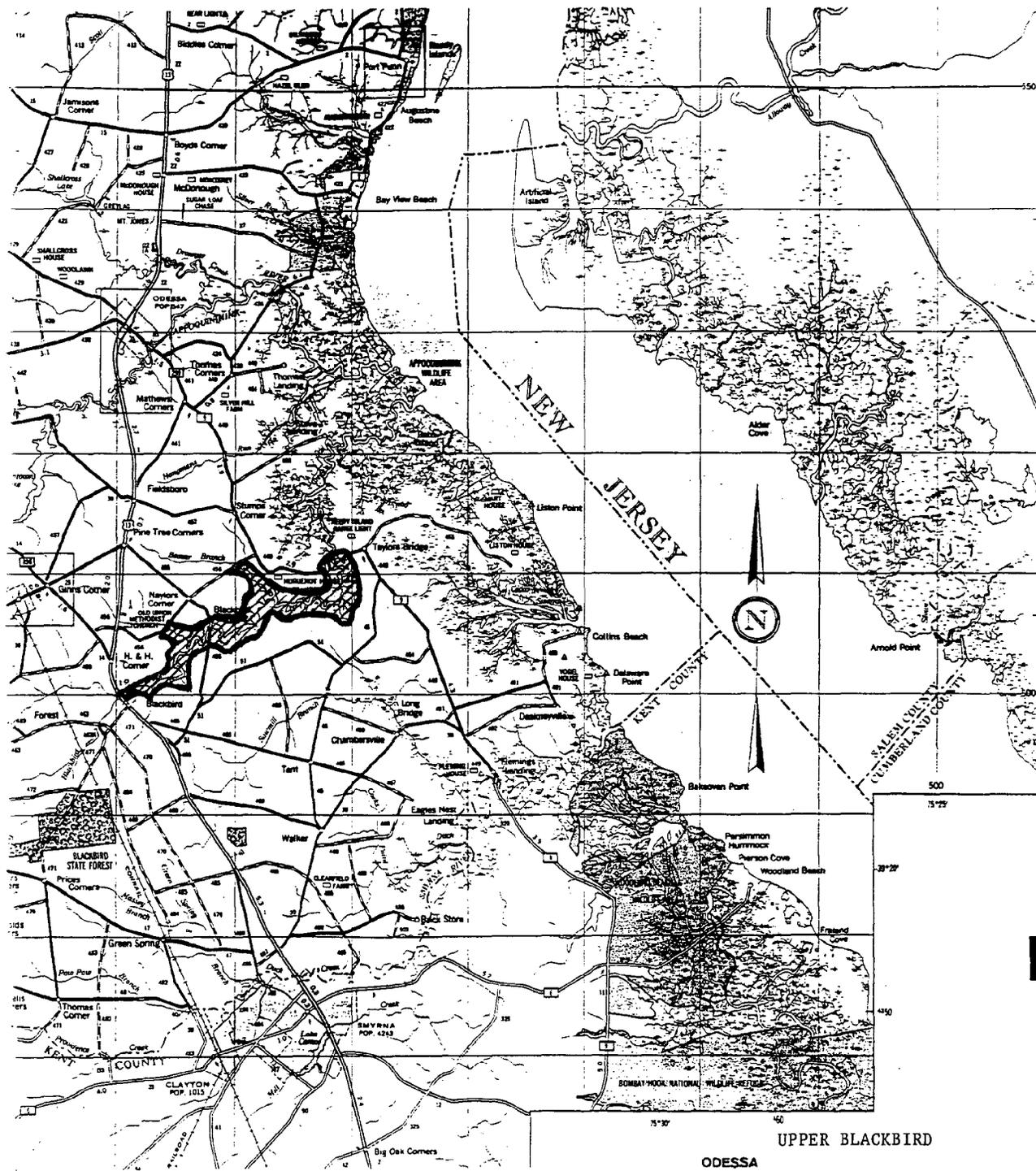
The DNERR component for the Upper Blackbird Creek estuary is located in southeastern New Castle County to the east of Rt. 13, about midway between Odessa to the north and Smyrna to the south (Fig. 5). This component of the DNERR is located about 20 miles (or a 35-minute drive) north of the DNERR focal component on the Lower St. Jones River.

#### BLACKBIRD COMPONENT BOUNDARIES

The Upper Blackbird Creek component's maximum proposed landowners have title to about 3688 acres on both the north and south side of Blackbird Creek, from the Rt. 9 bridge at Taylors Bridge upstream to near Rt. 13 at Blackbird (Fig. 6). The major tributary of this upper creek segment is Beaver Branch, entering on the north side of Blackbird Creek about midway within the proposed Reserve. The main channel of Blackbird Creek stretches over 5.7 miles throughout the center of the component. Downstream of the seaward end of the Reserve component, from Taylors Bridge to Delaware Bay, the lower Blackbird Creek runs for another 5.8 miles, passing by Red Bank and Stave Landing on its way to the Bay. The upper third of the Reserve is crossed by C.R. 455 at Blackbird Landing.

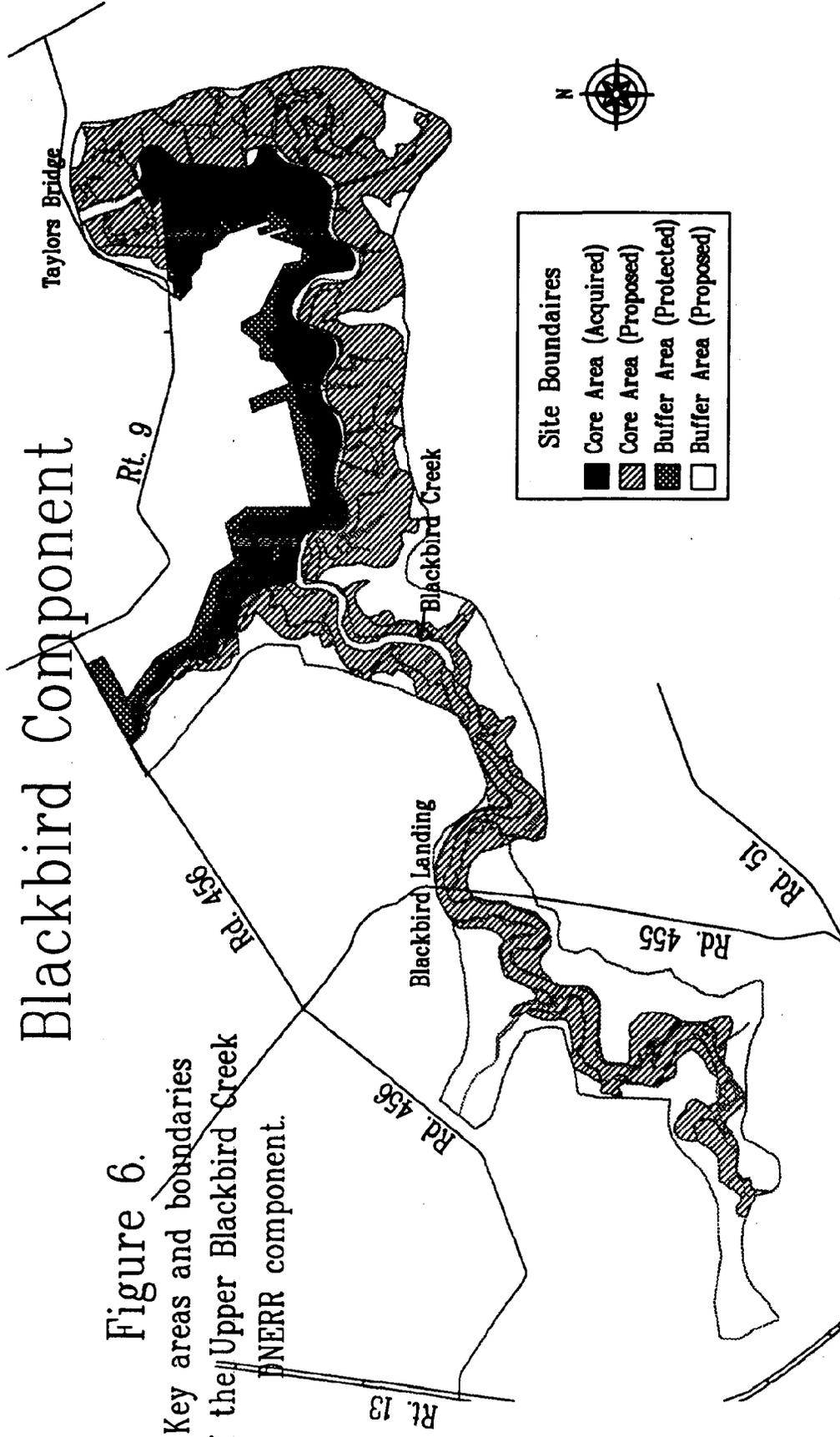
FIGURE 5

General location of the proposed Upper Blackbird Creek  
DNERR Component, in southeastern New Castle County



# Delaware National Estuarine Research Reserve Blackbird Component

Figure 6.  
Key areas and boundaries  
of the Upper Blackbird Creek  
DNERR component.



### Local Interest and Participation

Members of the DNERR Advisory committee were very enthusiastic about Upper Blackbird Creek, since it offers ecological characteristics different from but highly complementary to the Lower St. Jones River component. The entire Blackbird Creek estuary has been recognized by the State Office of Nature Preserve as an outstanding Natural Area worthy of protection. The New Castle County Department of Planning has indicated that the component is appropriate for a NERRS-type of use. A DNERR Landowners Management Association was formed in October, 1989, consisting of three officers who are site landowners who were elected to help in development of the Reserve Management Plan. Finally, a key parcel on the north side of Blackbird Creek, east of Beaver Branch, was purchased by the State in January, 1990, making this property an integral part of the Upper Blackbird Creek DNERR. The acquisition of this 212-acre parcel, composed primarily of brackish tidal wetlands with a narrow upland buffer and access strip, was made possible by the cooperation and fore-sight of Mr. Holger H. Harvey.

### Land Ownership

The 3688 acres owned by the landowners of the Upper Blackbird Creek DNERR component are divided into 50 parcels owned by a total of 48 landowners (Table 2). Similar to the Lower St. Jones River site, the total acreage figure of 3688 acres is a maximum number, since many of these parcels contain more upland area than what would be needed to provide the creek corridor and adjacent wetlands with adequate buffers. Of the total 3688 acres, Delaware Wildlands, Inc. (a private conservation organization) owns 703 acres (19%), and the State of Delaware's new acquisition is 212 acres (6%). The remaining 2773 acres are owned privately by 46 landowners; however, only 8 landowners own parcels totaling more than 100 acres per owner, and in aggregate these 8 landowners own 1879 acres (51% of the proposed Reserve). Most of the 36 owners of the smaller parcels are clustered around Blackbird Landing or are west of C.R. 455 (Fig. 7).

TABLE 2

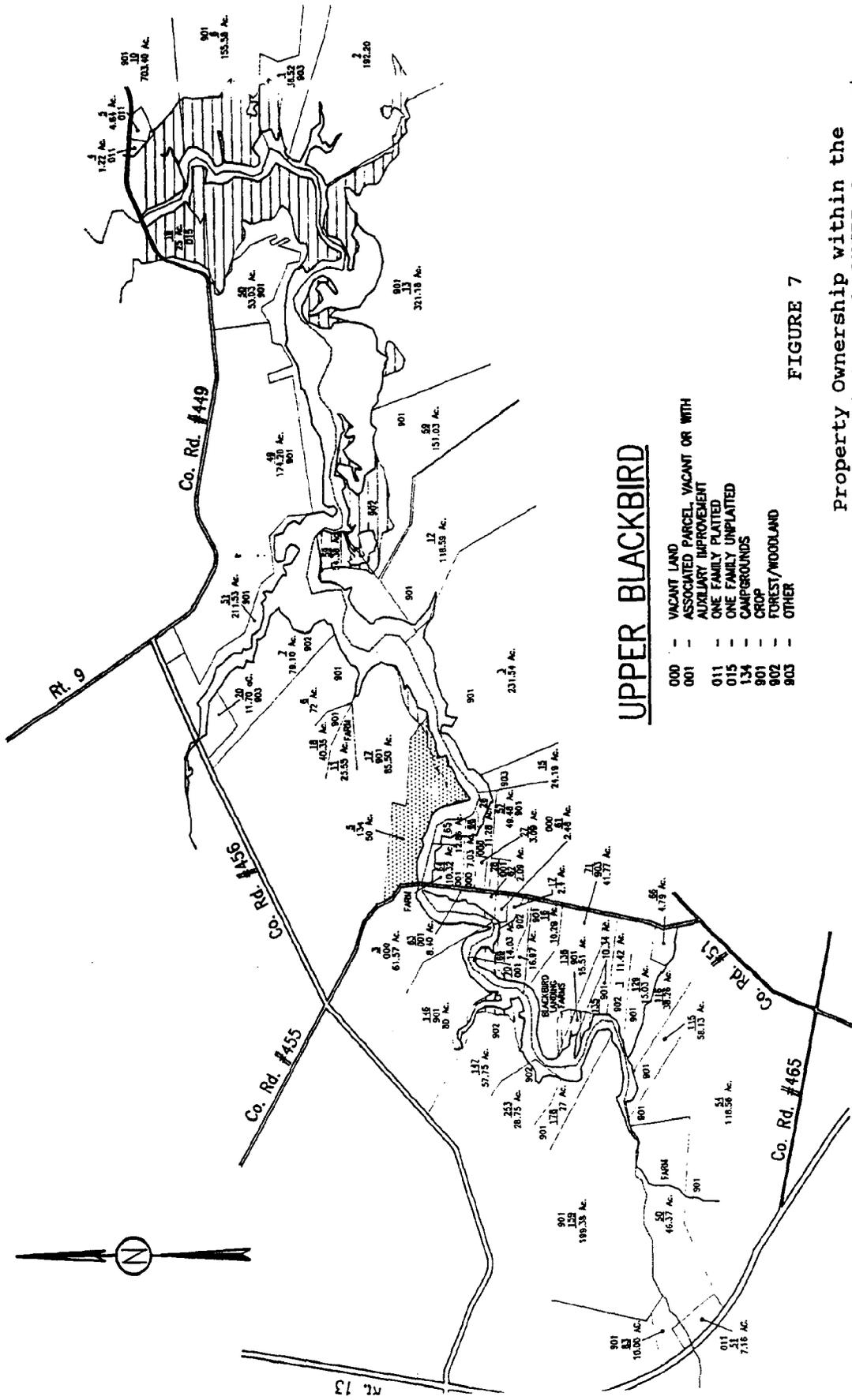
Land Ownership in the Upper Blackbird  
Creek DNERR Component

## BLACKBIRD HUNDRED

MAP	PARCEL	ACREAGE	OWNER
<u>Blackbird Hundred</u>			
10	54	118.56	Liborio 3 LP
	50	46.37	Earl Leasure
	51	7.16	Richard & Carroll Parsons
11	129	15.03	Douglas D. Pointer
	1	11.42	Todd J. Savidge
	135	10.34	Charles J. Benedict
	136	15.51	John I. Ciancio
7	57	49.48	John F. Coleman
	71	41.77	Charles F. Barton, Jr.
	16	10.29	Harvey W. Straughn
	70	16.97	John W. Bingham
	69	14.03	William A. Weatherlow
	17	2.40	William C. Shane
	61	2.48	Paul A. Rynkiewicz
	62	2.09	Edward P. Riehm
	63	8.4	Norman Rushton, Jr.
	64	10.32	Ronald F. Schocie
	65	12.86	Michael R. Atkinson
	66	7.03	William A. Slawter
	26	11.28	Lena C. Unruh
	15	24.19	Gerald K. Heinold, Sr.
	3	231.18	Charles F. Stites, Jr.
	12	118.59	Vernon E. & Kenneth A. Kershaw
	58	54.38	Vernon E. & Kenneth A. Kershaw
	59	151.03	Vernon E. & Kenneth A. Kershaw
	13	321.18	Mary T. Lynch
	27	3.09	Robert C. Smith
8	1	46.35	Henry J. Stellar
	2	192.2	Virginia M. Bell et al, c/o W. Paul Bradley
3	4	1.22	Mary A. Stellar
	5	4.64	Reynolds E. Mercer
4	6	155.58	T. William Lingo
	10	703.40	Delaware Wildlands, Inc.

(continue table 2)  
 APPOQUINIMINK HUNDRED

MAP	PARCEL	ACREAGE	OWNER
<u>Appoquinimink Hundred</u>			
20	83	10.00	Frank Anderson
16	159	199.38	Corbit D. Collins
	178	27.00	Donald R. Wood
	253	28.75	David M. Truesdale
	147	57.75	Chester Gove, Jr.
	146	80	George E. Parsons
17	3	61.57	William J. Cornelius
	5	50.0	Earl Swanson
	17	85.50	William Manwaring
	18	40.35	Hans F. Haug
	6	72.0	David H. Donovan
	7	79.10	Harry Fisher, Jr.
	49	161.43	Holger H. Harvey et al
	50	53.3	F. Thomas Unruh
	51	211.53	State of Delaware, DNREC
13	20	11.70	Geoffrey G. Perry
	19	25	Elsie & Pauline Shockley
	26	12.77	John & Alice McPeake



#### **a. Core Areas**

The minimum core area of the Upper Blackbird, which includes a complete State owned ecological unit, consist of the tidal marsh, tidal creeks and guts, and the open water of the Blackbird Creek between Taylors Bridge and private lands to the North, the Blackbird Creek to the East and South, and Beaverdam Branch to the West. This core area was acquired by The State of Delaware in January 1990 as a cooperative purchase from the heirs of Louise Nowland.

#### **b. Buffer Areas**

The woods along the tidal marsh provide a buffer to the core. Moreover, the uplands immediately adjacent to the woods bounding the core area have been restricted to agricultural use or single family residential use with no residential lot less than 10 acres to ensure little if any impact to the buffer and core areas. The core and buffer areas consisting of 211.53 acres were acquired in fee simple by The State of Delaware for the DNERR program. Additional property interests may be acquired to add to both the core and buffer areas.

#### **c. Market Values**

Market values will be established by appraisals in conformance with the "Uniform Appraisal Standards for Federal Land Acquisitions." More than one appraisal report may be necessary to determine the proper market value. Appraisal reports for donations of land will not be required, although an appraisal report may be necessary in negotiating a donation.

### **C. STRATEGIES FOR ACQUISITION**

#### **1. Fee simple**

Fee simple title is the acquisition of all rights in the property. Fee simple title will be acquired for the minimum core areas. Through landowner contacts acquisition of the minimum defined core by fee simple title has been determined the only way to ensure the measures required to obtain and maintain the critical estuarine ecological units. Fee simple title will also be acquired for key buffer areas where other lesser property interests cannot be negotiated.

#### **2. Conservation Easement**

A Conservation easement (7 Delaware Code, Ch. 69) may be used to restrict the use of a property to its traditional uses and for this program. An owner can retain title to the property and may continue to use the property for any use not inconsistent with this program. Each conservation easement will be tailored to meet the traditional uses and features of the property.

### **3. Memorandum of Understanding**

A Memorandum of Understanding is an agreement between the private owner or other governmental agency and the State to allow the research and education under the DNERR program on property for which no title interest is being acquired. The Memorandum of Understanding must address utilization of the property and run for a term sufficient to complete research projects.

### **4. Long-term Leases**

Long term leases or agreements may be negotiated when easements or other methods of acquisition fail. These leases are intended to extend over a fifty year period to allow sufficient time for research projects to be completed.

### **5. Alternatives**

Rights of first refusal may be negotiated and executed when other commitments from private owners fail. A right of first refusal gives the State an opportunity to meet the purchase price offered by any prospective purchaser of the private land when a change in title occurs. This is an important tool where land has remained in a particular family for a long time, and the owner wants it to remain. This first refusal helps to ensure the opportunity for the State to acquire the land if the ownership changes or the use of the property changes by rezoning or subdivision.

### **6. Donations**

Donations of land should not be overlooked and should be accepted either in fee simple title or conservation easement. In some instances, donations with reserved life estate may be used to incorporate the land into the program while allowing the owner to continue the traditional uses of the property during the owner's lifetime.

## **D. SCHEDULE**

Contact has begun for the core areas in both the St. Jones component and the Upper Blackbird component. The minimum core and buffer areas in the Blackbird component have been obtained with the acquisition of the 212 acre tract in January 1990. Settlement has occurred with the owner of 698 acres (431 acres fee simple and 267 acres conservation easement) for the minimum core and buffer areas in the St. Jones component. Negotiations will continue with the private owners within the Reserve boundaries.

The following page lists the tracts that have been acquired along with the conservation easements which restrict development.

DELAWARE NATIONAL ESTUARINE RESEARCH RESERVE

LANDS AND WATER

ACQUIRED

PURCHASED lands & water	St. Jones = 431.3
	Blackbird = <u>211.53</u>
	TOTAL 642.83 ACRES
tidal wetlands = 413.7 acres	
core = 398.7 acres	
non-core = 15.0 acres	
uplands = 229.13 acres	
woodlands = 99.16 acres	
agricultural = 117.97 acres	
facilities = 12.0 acres	
CONSERVATION EASEMENT	St. Jones = <u>267.21 ACRES</u>
<u>TOTAL RESERVE</u>	<u>910.04 ACRES</u>

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Blackbird - NOWLAND TRACT

PURCHASED lands and water	211.53 ACRES
tidal wetlands = 152 acres	
core = 152 acres	
non-core = 0 acres	
uplands = 59.53 acres	
woodlands = 49.53 acres	
agricultural = 10.0 acres	

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St. Jones - SLAUGHTER TRACT

PURCHASED lands & water	343.8 ACRES
tidal wetlands = 217.36 acres	
core = 207.36 acres	
non-core = 10.0 acres	
uplands = 126.44 acres	
woodlands = 32.83 acres	
agricultural = 93.61 acres	
CONSERVATION EASEMENT	<u>124.58 ACRES</u>
TOTAL	468.38 ACRES

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St. Jones - WILSON TRACT

PURCHASED lands & water	87.5 ACRES
tidal wetlands = 44.34 acres	
core = 39.34 acres	
non-core = 5.0 acres	
uplands = 43.17 acres	
woodlands = 16.8 acres	
agricultural = 2.37 acres	
facilities = 24.0 acres	
CONSERVATION EASEMENT	<u>142.63 ACRES</u>
TOTAL	230.07 ACRES

The strategy of the acquisition schedule is to continue to acquire the key lands and water within the St. Jones component which has been identified as those lands and water on the north side of the River, east of U.S. Route 113, and west of the DNREC owned Logan Lane Tract. This may be accomplished in the following approach:

**Fee Simple Title**

Nowland tract wetlands and upland buffer - 1/90  
Slaughter tract wetlands and upland buffer - 11/91  
Wilson tract wetlands and upland buffer - 4/92  
King Cole Farms wetlands  
Delagra tract wetlands and upland buffer  
Conner tract wetlands and upland buffer  
McIlvaine wetlands

**Conservation Easement**

Slaughter farmlands and woodlands - 11/91  
Wilson farmlands and woodlands - 4/92  
Morris wetlands  
Wilkins wetlands  
Delmarva Lands wetlands  
King Cole Farms wetlands  
Meyers wetlands  
Zimmerman wetlands  
Lane wetlands

It is stressed again that property will be acquired only from those private landowners willing to participate in the program. There will be no condemnation of land. Donations of lands and water will be considered for either fee simple title or conservation easement in addition to the other alternatives described earlier.

**Fee Simple Title**

THE NOWLAND TRACT was purchased in January 1990 by the DNREC from the Louise Nowland heirs. The tract consists of 152 acres of wetland core area, and 59.53 acres of upland buffer for a total of 211.53 acres of key lands and water. The tract is located at the downstream end of the Blackbird Creek component on the north side of the Creek and the east side of Beaver Branch. Public access is off of Rd. 456 with sufficient upland for parking and minimal facilities.

The Nowland tract includes sufficient key lands and water to represent an estuarine area of lower salinities to adequately compliment the St. Jones Reserve for the DNERR representation of the Middle Atlantic biogeographic region. For this reason, the acquisition of additional lands and water along the Blackbird Creek will generally follow the acquisition of the St. Jones component's priority areas.

THE SLAUGHTER TRACT was purchased from Alvin G. and Loretta Wilson in November 1991 by the DNREC from funds allocated by the first action of the newly created State Open Space Council. The tract consists of 217.36 acres of core wetlands, 32.83 acres of woodland buffer, and 93.61 acres of farmland as buffer area for a total of 343.8 acres of key lands and water. The tract is located at the downstream end of the St. Jones component on the north side of the River. It is bounded on the east by the 2000 acre Logan lane tract, owned by DNREC, other lands of Alvin and Loretta Wilson on the north and the Wilson tract on the west. Public access will be from the Logan lane on the east and from the Wilson tract on the west. The farmland and family hunting on the rented farmland has been leased back to the Wilsons on a renewable basis.

THE WILSON TRACT was purchased from Alvin G. and Loretta Wilson in April 1992 by the DNREC as a second parcel adjoining the Slaughter tract. The tract consists of 44.34 acres of core wetlands, 16.8 acres of woodland, and 14.37 acres of cleared land where the DNERR Education and Research Center is to be located. The tract lies in the heart of the key lands of the proposed Reserve with a peninsula of upland extending into the wetlands for the location of the Center. It is bounded on the south by the St. Jones River, on the east by the Slaughter tract and other lands of Wilson, on the north by Rd. 68, and on the west by Delagra Corporation. Public access will be provided by a mile long entrance road to be constructed to the Center. Trails have been constructed to provide access from the east and west including 1300 feet of boardwalk just a couple hundred feet from the Center. The Boardwalk includes education stations and a canoe dock for access to the St. Jones River.

#### Conservation Easement

THE SLAUGHTER FARM development rights were acquired with the purchase of the Slaughter tract from Alvin G. and Loretta Wilson in the form of a conservation easement to allow the continuation of the traditional activities of farming and hunting of the remainder of the Slaughter farm consisting of 124.58 acres.

THE WILSON FARM development rights were acquired also with the purchase of the Wilson tract consisting of 142.63 acres. The combined Wilson/Slaughter Conservation Easements restrict development to only 4 additional dwellings on the 267.21 acres of the easement. The Wilson/Slaughter acquisition includes nearly all of the watershed that drain through the core areas of the proposed Reserve, therefore ensuring maximum control and protection of long term research and education projects in the core areas.

The work schedule presented represents the extent of funding

available for acquisition. It is anticipated that additional areas desired in addition to the minimum eligible Reserve area acquired so far will come under State protection through donations of key wetlands in the focus area and NOAA funded acquisitions. With the State's expenditure of over \$1.1 million to date for acquisition and \$-0- to date from NOAA, \$200,000 request denied by NOAA, and \$-0- expected in the near future, it is difficult to predict any additional acquisitions.

Phase I Environmental Assessments are completed for any property acquired by the State. This Phase I Environmental Assessment examines the current use of the property, its history, an on-site inspection, improvements, tanks, old pipes, odors, depressions or mounds, evidence of dumping, vegetation under stress, standing water, discoloration of soil or water, use of adjacent property, record of violations and any known spills or releases of chemicals or hazardous substances. If the Phase I audit reveals evidence of contamination, a Phase II Environmental Audit is ordered from an independent contractor.

## **VIII. PUBLIC ACCESS PLAN**

### **A. POLICY**

Public access shall be permitted on a site specific basis. The objective of regulated access is to maintain each component's integrity for research, long term resource protection, and education while permitting traditional uses which do not conflict with reserve goals.

Entering or remaining on lands under the jurisdiction of the DNERR when such lands are closed or entering or remaining within any building, structure, or facility when such building, structure or facility is closed, shall be prohibited without a written permit from the Reserve Manager.

No structure, facility, building, or area administered by DNERR will be used for any activity other than that for which it was intended without prior written permission of the Reserve Manager.

The Reserve Manager may limit or close specific public use areas, lands, waters, and facilities and/or temporarily prohibit certain activities when such action is deemed necessary for resource management, research, education and/or when it is in the best interest of health, safety, and the general welfare of the public.

### **B. SPECIFIC COMPONENT ACCESS**

#### **1. Public Visitation**

##### **St. Jones Component**

The general public will be permitted access to outdoor facilities such as trails, boardwalks, etc., from 8 a.m. to dusk on a year round basis, except as restricted for special uses. Access to the John Dickinson Plantation exhibits, etc. will coincide with the regular operation of the mansion as determined by the Division of Historical and Cultural Affairs. General public visitation of the St. Jones Center will be from 8 a.m. to 4:30 p.m., Monday through Friday excluding holidays. All access will be for identified facilities only. Free roaming through the component is not permitted without written approval of the reserve manager.

##### **Traditional Uses**

The Lower St. Jones River estuary has a rich, intensive tradition of consumption of renewable natural resources. Waterfowl hunting, upland game hunting, muskrat trapping, and commercial fisheries (e.g. crab and eel potting, gill netting) all occur within the main channel of the St. Jones River, its tributaries, or throughout the contiguous wetlands. The recreational fishing pier at the State-owned St. Jones River

Access Area (on the south side of the River, west of Rt. 113 at Barkers Landing) is used by local citizens primarily for crabbing and fishing for white perch and catfish. A private trap-and-skeet shooting club leases several acres of upland fringe and tidal wetlands adjacent to the Rt. 113 bridge, just to the east of the bridge on the south side of the River. These and other traditional outdoor activities should be accommodated by the Reserve program.

#### **Current Public Access**

Controlling public access to the Reserve component should not be too difficult even though the area is along a linear corridor divided by a river. To the east of Rt. 113, extensive upland buffer zones on both sides of the St. Jones River could be created, since there are only a few property owners and the area is almost exclusively agricultural. On the west side of Rt. 113, the north side of the river has only a few property owners, bordered by the upland sand-and-gravel pit operations. The area of the Reserve where access might be most difficult to control is on the south side of the River west of Rt. 113, where two county roads bring the public right to the River's edge for a portion of the River's frontage.

Boat access to the River corridor itself is somewhat limited, with the main access being a well-used, State-owned ramp for small boats at Barkers Landing, on the south side of the River just west of Rt. 113. A small boat access from the proposed DNERR facilities center on the River's north side east of Rt. 113, via a natural tributary running from the main channel to a new backmarsh landing, has been developed. There is no public access for motorized boats to the River upstream of the Barkers Landing ramp, although Dover residents launch canoes and car-top-style boats from upstream shorelines and from a canoe ramp near Court Street in Dover. Because water depths over the sediment and oyster bars at the River's mouth may be less than a foot at low tide, access into the Lower St. Jones River from Delaware Bay is limited near low tides to only shallow-draft boats.

The use of the River by commercial boats or larger recreational craft is presently limited due to lack of upstream access and downstream shoaling problems. A seven-foot deep channel from Delaware Bay to Dover was completed by the Army Corps of Engineers by 1933, but subsequent dredging was abandoned because of lack of demand and no place to dump the excavated spoil. There are no current plans or designs for upstream marinas or downstream dredging.

#### **Delaware Bay Area**

Land access to the Delaware Bay's shorefront from the DNERR's St. Jones component will be attained via cooperative agreement with the DNREC's Division of Fish and Wildlife, utilizing a developing Greenway which crosses the Division's Ted Harvey Conservation Area (the "Logan Lane" tract), providing

access to almost two miles of publicly owned Delaware Bay shorefront. Potential berthing and easy access to Delaware Bay for larger vessels exists at either Port Mahon (about 6 miles directly northeast of the proposed Education and Research Center) or Bowers Beach (about 3 miles by road directly southeast of the proposed Center).

### **Blackbird Component**

The general public will be permitted access to outdoor facilities such as trails and boardwalks from 8 a.m. to dusk on a year round basis, except as restricted for other special uses. These special uses will be posted. All access will be for identified facilities only. Free roaming through the component is not permitted without written approval of the reserve manager.

### **Traditional uses**

Several of the management considerations associated with the Lower St. Jones River component also apply to the Upper Blackbird Creek component. In particular, concerns with accommodation of waterfowl hunting and muskrat trapping are addressed.

### **Current Public Access**

Upper Blackbird Creek has very little boat traffic, and what does occur is essentially associated with waterfowl hunting, muskrat trapping, and recreational fishing. Boat access along the entire course of Blackbird Creek is very limited, with only a few unimproved, private access points. There are no expectations of the creek's future use for commerce, both because of its very shallow depths upstream at low tide and the lack of driving economic forces in the adjacent uplands. The creation of a downstream water access area for motorized small boats, in conjunction with a headwaters canoe launch area, are very desirable improvements to consider.

## **2. Group Use**

### **St. Jones Component**

All groups should contact the DNERR Estuarine Educator to arrange for programs, guided tours, or other use of the center or Reserve.

### **Blackbird Component**

Groups not needing special program assistance may use the Blackbird component on the same basis as the general public. Groups wishing program assistance must contact the DNERR Estuarine Educator to arrange an appropriate program schedule.

### **3. Access for boat or canoe launching**

#### **St. Jones and Blackbird Components**

Access for canoe or kayak launch or retrieval is permitted only in designated locations and during times permitted for general public visitation. Launch or retrieval of other boats by the public is not permitted without written permission of the reserve manager.

### **4. Fishing, Hunting and Trapping**

Traditional activities of fishing, hunting and trapping will be permitted up to levels currently permitted under local and State laws (unless these uses interfere with a research or educational activity that cannot avoid a conflict with these traditional uses).

### **5. Other Uses**

Access for uses other than those listed will be permitted on a case by case basis. The reserve manager's written authorization must be received prior to initiating any of these other uses.

## **IX. ADMINISTRATIVE PLAN**

### **A. ADMINISTRATIVE AUTHORITY**

NERR programs are administered as a State/Federal partnership under the authority of the federal Coastal Zone Management Act (CZMA) of 1972, as amended. The Delaware NERR program will be administered by the Delaware Department of Natural Resources and Environmental Control (DNREC), Office of the Secretary, Management and Operations. At the federal level, the administrative authority is the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), Office of Ocean and Coastal Resource Management (OCRM), Sanctuaries and Reserves Division (SRD).

### **B. STAFF ROLES**

#### **1. Administration**

The administrative framework for the Reserve recognizes the need for cooperation and coordination in order to achieve the objectives of the Management Plan. The administration for the Reserve ensures that the functions required to implement this plan - education and research activities, land acquisition, facilities development, resource protection - are coordinated with the necessary agencies/organizations/landowners which are presently active within the Reserve's components.

Administrative responsibility for the management of the DNERR is through the Delaware DNREC for several reasons. Wetlands regulations, the Coastal Management and Delaware and Inland Bays National Estuary Programs, the Delaware Coastal Zone Act, the Beach Preservation Act, the Erosion and Stormwater Management Program, the Non Point Source and Point Source Programs, hunting and fishing regulations, and natural resource management in general are within DNREC and are the obvious reasons for this administrative lead.

Some of the other activities, authorities, and programs that enhance the Reserve's values include: the Delaware State Department's Division of Historical and Cultural Affairs for the history, education and research attributes as well as their museums programs which will address the general public's interest in the Reserve; Wesley College, Delaware State College and the University of Delaware for their Education and Research programs; the Kent County and New Castle County governments for their land use zoning, building codes, recreation programs and other pertinent local authorities; the USDA Soil Conservation Service for their technical services and Plant Materials Center research; the Kent, New Castle and National Conservation Districts programs; the St. Jones and Blackbird Landowners Associations; the St. Jones River Watershed Association; the Delaware Department of Agriculture; and the various environmental and cultural organizations including the Friends of Dickinson Mansion

and the Delaware Nature Society. Many of these groups anticipate co-locating their estuary programs to the DNERR Education and Research Center. This interaction of associated agencies, organizations and governments presents the opportunity for coordination and collaboration. However, it presents an administrative structure that requires defined duties, authorities, and responsibilities of a more disciplined nature than a program that is operated by a single entity.

#### DNERR ADMINISTRATOR

The Secretary of DNREC is the Administrator of the DNERR. The DNERR program is assigned to the Director of Management and Operations within the Office of The Secretary located at the Richardson and Robbins building within the Capital complex in the City of Dover. The DNERR Program Manager is in the Office of The Secretary and is responsible for the overall coordination and operations of the Reserve with the guidance of the Director of Management and Operations. The Program Manager will be located at the DNERR Education and Research Center at the St. Jones component which is only 6 miles from the Capital complex. The State's staff assigned to the DNERR will be responsible for the Programs of both of the Reserve components.

#### DNERR EDUCATION AND RESEARCH CENTER

The DNERR Program Manager and/or the DNERR Estuarine Educator will be responsible for the Reserve Center operations and maintenance. The Supervisor in charge of each cooperating agency located at the Reserve Center will be responsible for the management and operations of their programs and employees.

#### VISITORS BARN

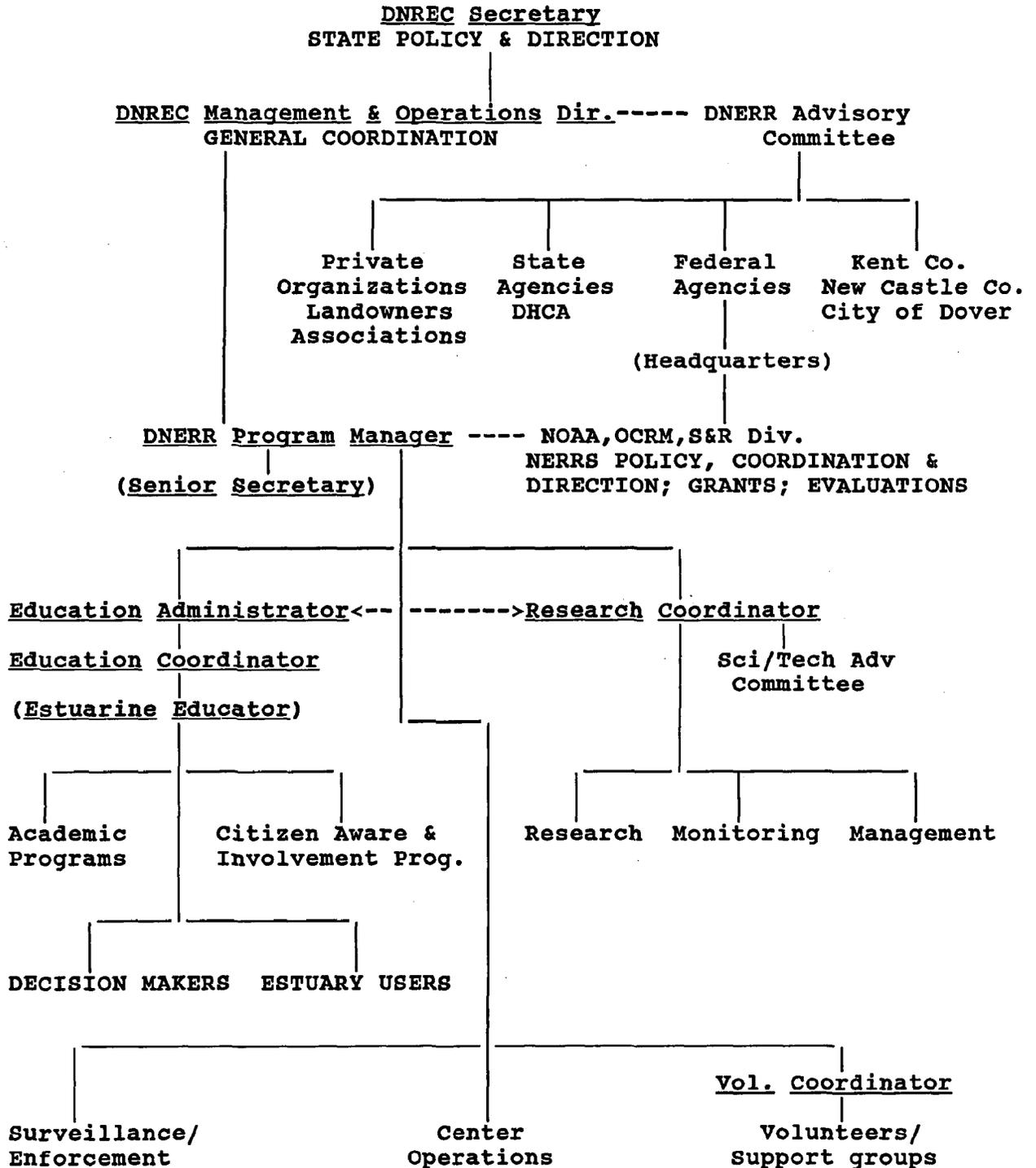
The Department of State's Division of Historical and Cultural Affairs', Bureau of Museums and Historic Sites will be solely responsible for the operations of the Visitors Barn at the John Dickinson Mansion.

#### AGENCY COORDINATION AND COOPERATION

The development and implementation of the sections of the Management Plan requires the leadership of personnel from all the Divisions of DNREC and a Division of the Delaware Department of State. Staff roles are required in research, education and interpretation, and surveillance and enforcement. In addition, staff roles are required to establish and maintain assistance to affected and bordering landowners, to perform land acquisition and resources inventories, and to protect and restore valuable resources. The specialists required to perform these functions are important to the degree of success of the DNERR local, regional and national significance. For this reason the authoritative chain of command has been sublimated with a coordinated multi-agency approach that through mutual cooperation has resulted in a collaborative Management Plan with an administrative structure supported by a broad based foundation.

**DNERR ADMINISTRATIVE STRUCTURE**

The following structure is the authoritative chain that will be followed to resolve conflicts among intra- and inter-agency policies, programs, and directions:



<-----> - indicates a close working relationship between units and coordinated supervision of following functions.

Landowner assistance and citizen involvement is aided by the Volunteer Coordinator under the leadership of the DNERR Program Manager. This interaction with landowners is very important to the success of the DNERR in that all but 11 acres of the 4000 acres nominated were in private ownership requiring an understanding, cooperation and a willingness of the owners of key lands and waters to voluntarily participate in the program for the Reserve to be established.

The acquisition of land is led by the Real Estate Office in the Division of Parks and Recreation of DNREC. This office is responsible for developing and implementing a strategy for adequate long-term state control over the ecologically key land and water areas that have been identified by the Reserve's resource protection, education, research, and facility needs. Through integrating this strategy with the other land acquisition priorities of the DNREC, the Real Estate Office will identify ownership, perform negotiations, and carry out settlement responsibilities.

Resource inventories, protection plans, and restoration are the most dependent upon a well developed coordinated staffing approach. Staff assistance is required from DNREC's: Division of Parks and Recreation - Natural Heritage program, Land Preservation, Cultural Resources, and Heritage Planning; Division of Fish and Wildlife - Planning, Wildlife Research, Fisheries Research, Wetlands Research, Waterfowl Management, Wildlife Management, Finfisheries, Shellfisheries, and Enforcement; Division of Water Resources - Wetlands and Aquatic Protection, and Water Quality Management; Division of Soil and Water Conservation - Coastal Management Program, Non Point Source Program, and Conservation Districts. The Department of State's Division of Historical and Cultural Affairs' staff assistance is particularly important to the understanding of the past uses of the Reserve and the collaborative approach to the management of the DNERR.

The fish and wildlife scientists are the first series of specialists that are to move into the Education and Research Center. They are the first group that will be provided the opportunity to integrate their normal estuary management functions with the enhancements of the DNERR estuarine, research, and education programs.

#### **DNERR CENTER STAFF**

##### Pre-designation (Development of Draft Mgmt. Plan/EIS)

- Program Manager (85% time; 100% state funded)
- Research Coordinator (20% time; 100% state funded)
- Education Coordinator (20% time; 100% state funded)
- Realty Specialist (20% time; 100% state funded)
- Res. Prot. Specialist (20% time; 70/30 state/NOAA funded)
- Cult. Cons. Program Manager (20% time; 100% state funded)
- Landowner Assistant (30% time; 100% NOAA funded)

### 1st year (following plan approval)

- Program Manager (100% time; 100% state funded)
- Research Coordinator (30% time; 100% state funded)
- Education Coordinator (30% time; 100% state funded)
- Estuarine Educator (100% time; 100% NOAA funded)
- Senior Secretary (100% time; 100% NOAA funded)
- Realty Specialist (20% time; 100% state funded)
- Res. Prot. Specialist (20% time; 70/30 state/NOAA funded)
- Cult. Cons. Program Manager (20% time; 100% state funded)
- Volunteer Coordinator (30% time; 100% state funded)
- Folklorist (30% time; 100% Interior funded)

### DNERR EDUCATION AND RESEARCH CENTER STAFF

### 2nd year through 5th year

- Program Manager (100% time; 100% state funded)
- Research Coordinator (80% time; 100% state funded)
- Education Coordinator (60% time; 100% state funded)
- Estuarine Educator (100% time; 100% state funded)
- Senior Secretary (100% time; 100% state funded)
- Realty Specialist (20% time; 100% state funded)
- Res. Prot. Specialist (20% time; 100% state funded)
- Cult. Cons. Program Manager (20% time; 100% state funded)
- Landowner Assistant (30% time; 100% state funded)
- Volunteer Coordinator (30% time; 100% state funded)
- CMP Specialist (100% time; 100% NOAA-CMP funded)
- F&W Scientist III (30% time; 100% NOAA-CMP funded)
- \* - Folklorist (100% Interior funded)
- Project WILD Coordinator (100% NOAA-CMP funded)
- Aquatic Coordinator (100% USF&W funded)
- 3 F&W Program Manager (100% state funded)
- F&W Program Manager (50/50 state/USF&W funded)
- 3 F&W Scientist II (100% state funded)
- 5 F&W Scientist II (100% USF&W funded)
- F&W Scientist II (90/10 state/USF&W funded)
- F&W Scientist II (100% NOAA-CMP funded)
- F&W Scientist I (100% NOAA-CMP funded)
- F&W Scientist I (100% USF&W funded)
- 2 F&W Technician (100% USF&W funded)
- 2 F&W Technician (100% state funded)
- Boat Captain (100% state funded)
- Secretary (50/50 state/USF&W funded)

\* This position and all others that follow do not have dedicated time assigned specifically to DNERR projects. Rather these positions present every day assignments that will enhance the Reserve's programs, and the Reserve and the tools that it produces will be valuable to their projects.

## **2. Research**

Research is the foundation of the National Estuarine Research Reserve System. Information must be collected and made available to increase understanding of the processes of estuarine ecosystems and the effects of human activity on these processes. This understanding is essential for the best management of these important ecosystems.

A Research Coordinator designated from the DNREC's Division of Fish and Wildlife will be responsible for research and monitoring activities for DNERR. This staff person is currently located at the field unit in Little Creek along with the other Fish and Wildlife scientists that are to move to the DNERR Education and Research Center. Besides the responsibility of the research activities of DNERR, the Research Coordinator is responsible for coordinating many of the DNREC research activities that would relate to the goals and objectives of NERRS. This will enable the Research Coordinator the best opportunity to integrate many research agendas, maximize the use of the Reserve, and obtain multiple sources of funding for the betterment of the Middle Atlantic estuarine systems.

## **3. Education/Interpretation**

The education and interpretation functions are the highest priority of the DNERR program initiatives. An important element is the dissemination of research and monitoring results, and their management implications, to local, state, regional, and national decision makers. Teaching children and adults about the values of estuarine ecosystems and what roles they can have individually and collectively to help protect these important resources is a major undertaking of DNERR and very timely with the needs of environmental education throughout the State of Delaware.

An Education Coordinator will be responsible for coordinating educational and interpretive activities for the DNERR Program. This staff person will be located at the DNREC headquarters and will operate programs from the DNERR Education and Research Center when completed. With Delaware being 95% coastal plain it is important that a State-wide Estuarine Education Program be well developed and integrated if not fronting the State's Environmental Education efforts. It is the responsibility of the Education Coordinator, using multi-sources of funding and leading a multi-agency team, to develop the DNERR Education Program that will be regionally representative and of national significance to estuarine management. Specifically, under the guidance of the Education Coordinator, an Estuarine Educator will take the lead in initiating the translation and transfer of scientists' research and monitoring results to resource professionals, decision makers, estuarine users, and the public.

#### **4. Surveillance and Enforcement**

The DNERR Estuarine Educator will provide additional surveillance to and rely on the coordination among state, federal, and local agencies' regulations and authorities to be enforced by the applicable agency for on-site and surrounding areas at least to the extent of the Reserve's contributing watersheds. On-site DNERR staff, capital police of the Department of Administrative Services, Fish and Wildlife enforcement officers, and environmental protection officers (EPO's) will be responsible for surveillance and will enforce access and activity control according to the Management Plan for DNREC owned lands and to the extent authorized by land owners that have provided access to their properties. Current access control will continue by private landowners.

The core areas will be monitored for the greatest surveillance efforts and maximum enforcement allowable under the rights DNREC will have as the owner of core areas. DNERR staff will limit activities on the buffer areas that would impact the designated core areas in order to maintain the integrity of a naturally influenced estuarine system.

DNERR staff will continue to work with the Delaware Coastal Management Program (DCMP) in order to improve the effectiveness of addressing cumulative impacts of various land use activities. The DCMP's policies and supporting authorities will be important in the enforcement of the DNERR Management Plan.

#### **5. Volunteers**

The operation of many of the programs of the Reserve will be enhanced by a well structured volunteer effort. A DNREC Volunteer Coordinator will be responsible for the recruitment and assignment of volunteers to the various needs of the Reserve. The Reserve Manager along with the Education Coordinator, Estuarine Educator, and the Research Coordinator will develop the programs, leadership, work assignments, training, equipment, and supplies that the volunteers will need to enhance the DNERR's program. Two of the more prominent roles for volunteers will be trail guides and citizen monitoring through the State's established "Streamwatch Program".

### **C. ADVISORY COMMITTEE STRUCTURE AND RESPONSIBILITIES**

#### **1. Oversight Committee**

The DNERR Advisory Committee is structured to represent many of the Federal, State, county and local agencies, commissions, societies and organizations that may have an interest, impact or be impacted by the development and management of the Reserve.

The oversight committee will meet at least annually and more frequently as required to represent the cooperating and affected

groups of the DNERR.

The DNERR Advisory Committee for the review of the draft Management Plan included representation from the following:

- Delaware Department of Natural Resources and Environmental Control:

- A. Office of the Secretary
  - B. Division of Fish and Wildlife
  - C. Division of Parks and Recreation
  - D. Office of Information and Education
  - E. Wetlands Branch
  - F. Delaware Estuary Program, Div. of Water Resources
  - G. Division of Soil and Water Conservation
- Office of the Governor, Delaware Development Office
  - Dept. of State, Div. of Historical and Cultural Affairs
  - Delaware Dept. of Agriculture
  - Delaware Dept. of Transportation
  - Department of Public Instruction
  - NOAA Sanctuaries and Reserves Division, NERRS Program
  - County Planners
  - Conservation Districts
  - Local Federal and City Agencies
    - A. Bombay Hook National Wildlife Refuge
    - B. U.S. Soil Conservation Service
    - C. U.S. Army Corps of Engineers, Phila. District
    - D. Dover Air Force Base
    - E. City of Dover Planning Office
  - Academic Community
    - A. Delaware State College
    - B. University of Delaware
    - C. Wesley College
  - Citizen Advisory Councils
    - A. Advisory Council on Game and Fish
    - B. Advisory Council on Tidal Finfisheries
    - C. Advisory Council on Shellfisheries
    - D. Natural Areas Advisory Council
  - Conservation/Environmental Education/Outdoors/Sportsmen Organizations
    - A. Wildlife Federation of Delaware
    - B. Ducks Unlimited, Inc. (Delaware)
    - C. Delaware Saltwater Sportsmen Association

- D. Delaware Mobile Surf-Fishermen, Inc.
- E. Delaware Bass Federation
- F. Delaware Watermen's Assoc.
- G. Delaware State Trappers Assoc.
- H. Delaware Wild Lands, Inc.
- I. Delaware Nature Society
- J. Society of Natural History of Delaware
- K. Delmarva Ornithological Society
- L. Sussex Bird Club
- M. Delaware Audubon Society
- N. Delaware Sierra Club
- O. Delaware River and Bay Shoreline Committee
- P. Delaware Nature Conservancy
- Q. St. Jones River Watershed Association

- Historical Societies

- A. New Castle Historical Society
- B. Kent County Archaeological Society
- C. Friends of Dickinson Mansion
- D. Daughters of the American Revolution
- E. Archaeological Society of Delaware
- F. Delaware Historical Society

- DNERR Landowner Associations

- A. St. Jones DNERR
- B. Blackbird DNERR

- DNERR Work Groups

- A. DNERR Facility
- B. Resource Plan Work Group Members

The role of the DNERR Advisory Committee is to provide assistance to the DNERR program in the decisions required to implement the Management Plan. Assistance will be especially valuable in the operations of the Reserve's programs. The administration of the DNERR Education and Research Center has been structured to accommodate as many estuarine programs of the advisory and cooperating agencies and groups that would benefit from co-location or shared facility resources.

## 2. Scientific/Technical Advisory Committee

The DNERR Scientific/Technical Advisory Committee will include representatives from various State and Federal agencies, and the academic and scientific communities. Committee members will provide advice on research and technical matters relevant to the achievements of the DNERR Research goals and objectives. The committee will meet on an annual basis or more frequently at the call of the Research Coordinator to review research proposals and research needs and results for the Estuarine Reserve.

The Scientific/Technical Advisory Committee will include at least eight PH.D. level scientific experts. The scientific experts will be selected from the following disciplines:

- Estuarine hydrographer
- Chemical oceanographer

- Geohydrologist
- Environmental microbiologist
- Wildlife biologist
- Fisheries biologist
- Plankton ecologist
- Benthic ecologist
- Wetlands ecologist
- Soil scientist
- Archaeologist

### **3. Education/Interpretation Advisory Committee**

The Education/Interpretation Advisory Committee will be responsible for providing guidance for the implementation of a comprehensive estuarine education program, a long outstanding need in Delaware. Most of the respondents to the DNERR facility survey were very interested in the role that the Reserve program and the Education and Research Center could provide to the growing concern for estuary management.

The Education/Interpretation Advisory Committee will be composed of at least eight members which will meet annually or more frequently as needed. These members will be selected from various environmental education interests in the State. These interests include:

- State Office of Environmental Education
- Nature education organization/center
- Elementary level education
- Secondary level education
- College level education
- Adult education
- Cultural education
- Applied environmental education
- Habitat based education
- Teacher training

### **4. Landowners Associations**

The Landowners Associations are made up of property owners within the two DNERR components. They have met during the site selection phase, resulting in the formation of the St. Jones Landowners Association and the Blackbird Landowners Association. An election was held to select officers to represent the component owners.

A Landowner Assistant acted as the recording secretary at the DNERR Committee Meetings and then updated landowners about important information through correspondence and newsletters. The Assistant was the contact person within DNREC for the landowners during the planning phase and has worked through the conservation districts. In this way, the landowners stay abreast of important news concerning the DNERR program.

The Associations have proven invaluable as the most effective and efficient means of communication, decision making,

and control from the landowners point of view, the required public involvement, and government needs to develop a Management Plan that will be supported.

#### **D. FEDERAL GOVERNMENT - NOAA REVIEW**

The NERRS is intended to operate as a federal/state partnership. Although the management of a reserve is a state's responsibility, NOAA cooperates with and assists the states on a periodic basis, and reviews state programs regularly. The purpose of the NOAA review is to ensure that a state is complying with federal NERR goals, approved work plans, and reserve management plans. The primary mechanisms used by NOAA to review state programs, as well as NOAA responsibilities pertaining to reviews, include the following:

NOAA staff, in particular the program specialist for a state's reserve, communicates directly and regularly with state reserve staff. Communication builds a level of trust between federal and state staff, and familiarizes both NOAA and state personnel with reserve management procedures and policies. This cooperative approach is needed for a reserve to be successful. Both oral and written communication are necessary, and site visits are advisable.

Another mechanism available to NOAA is its reserve funding program. NOAA provides different categories of grant funding to a reserve, and for each grant, quarterly progress reports and a final report are required. NOAA personnel carefully review the grant reports and associated communications to ensure compliance with program policies and specific grant conditions.

The site designation process is also a primary avenue through which NOAA reviews actions. A state's site nominations must be assessed and endorsed by NOAA prior to formally beginning the designation process. As part of this preliminary stage, the site selection and public participation process are evaluated by NOAA. When the DMP and DEIS have been completed they must also be approved by NOAA before the final versions of each document are written. NOAA staff have the responsibility of working with the state to select and designate national estuarine reserve sites.

Pursuant to CZMA enabling legislation (Sections 312 and 315), NOAA must conduct performance evaluations of the operation and management of each reserve while federal financial assistance continues. If deficiencies in the operation or types of research conducted at a reserve are found, NOAA may withdraw financial assistance to the reserve until remedies are in place. National Estuarine Research Reserve designation can be withdrawn by NOAA when a reserve is found to be deficient and fails to correct deficiencies within a reasonable time.

#### **National Historic Preservation Act**

Under Section 106 of the National Historic Preservation Act of 1966, as amended, Federal agencies are required to take into

account the effects of agency undertakings on historic properties, and to afford the Advisory Council on Historic Preservation (Advisory Council) a reasonable opportunity to comment on such undertakings. An undertaking is any project, activity, or program that can result in changes in the character or use of historic properties. Historic properties are any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places. Any undertaking that is under the direct or indirect jurisdiction of a Federal agency or licensed or assisted by a Federal agency is subject to the provisions of Section 106.

Because NOAA is a Federal agency, any project, activity, or program affiliated in any way with the DNERR program is subject to the provisions of Section 106. The Delaware Department of Natural Resources and Environmental Control agrees to comply with all of the requirements of Section 106 of the National Historic Preservation Act, as amended, and all regulations and guidelines issued thereunder. In Delaware, Section 106 is administered by the Delaware State Historic Preservation Office (DE SHPO). The DNREC Cultural Heritage Program serves as the DNERR liaison with the State Historic Preservation Office. It is anticipated that a Programmatic Agreement between the DE SHPO, the Advisory Council, and NOAA will be developed to ensure the compliance of all aspects of the DNERR program with regulations implementing Section 106.

## **X. ENVIRONMENTAL RESEARCH AND MONITORING PLAN**

Estuaries are important to the nation's economy and recreation, and are an integral part of the Earth's environment as a whole. Understanding and protecting this important resource has become increasingly important due to unsound land use practices and the rise of populations in coastal areas, which contribute to the degradation of estuaries. There is a need for management-oriented research to define management strategies which allow multiple land uses, but which minimize detrimental environmental and ecological impacts on estuaries.

The NERRS emphasis on management-related or management-oriented research is provided in 15 CFR Part 921, Subpart F.

A major priority of the Reserve is to coordinate, facilitate, and conduct management-oriented research which will provide information useful for local, regional and national coastal management decision making. The creation of permanent field sites for management-oriented research is an important step toward a more comprehensive and integrated program of research, monitoring and management.

The Delaware National Estuarine Research Reserve's (DNERR) two components will expand researchers' opportunities to perform long-term studies in representative ecological zones of the Delaware Estuary. The components provide the opportunity to observe and explain basic functions of and changes in the natural systems, and apply this information to other estuarine systems along the mid-Atlantic coast. These areas will be managed in part to maintain their relatively undisturbed character to serve as controls to compare with other areas, and in part may be modified or manipulated to accommodate research needs and maximize their research utility.

### **A. GOALS OF ENVIRONMENTAL RESEARCH AND MONITORING**

The goals of the Research Reserve's environmental research and monitoring program are to:

- \* Establish and manage key (core) areas of the Reserve for long-term use as outdoor field laboratories, maintained for such purpose by the help of buffer areas.
- \* Coordinate research projects with other research efforts in the Delaware Estuary and Delaware's Inland Bays to streamline scientific efforts, maximize efficient use of resources and funds, and avoid unnecessary duplication of efforts.
- \* Enhance scientific understanding of estuarine ecosystem processes and functions to enable better identification of management issues and response options.
- \* Gather and make available information needed by Reserve

managers and coastal decision makers for improved understanding and management of estuarine ecosystems.

- \* To better our understanding of ecological values and processes of estuaries nationwide, by comparing the Delaware Estuary to other estuarine areas.
- \* Identify priority natural resources, gather baseline information on them, and establish indicators of change.
- \* Identify priority habitat management needs, gather information about how to best meet the needs, and provide technical guidance to implement the desired actions.
- \* Monitor the impacts of human stresses on the estuarine environment and the effectiveness of pollution control strategies.
- \* To better our understanding of human exploitation of the estuarine environment through time.
- \* Identify critical habitat requirements of living natural resources.
- \* Evaluate land use practices and management strategies in terms of their impacts and effectiveness.
- \* Publication of research results.

**Specific objectives to aid in achieving these goals include:**

- \* Collecting and building baseline databases for use in long-term and interdisciplinary studies, and for monitoring differences over time and for making comparisons with other areas.
- \* Develop an on-site library of research and reference materials for use by staff and other approved users.
- \* Become a repository for data collected on-site and at other National Estuarine Research Reserves.
- \* Promoting the Reserve's components in the research community as long-term field laboratories to be used by State or Federal agencies, academic institutions, and local or private environmental organizations.
- \* To involve the public by using volunteers to achieve research and monitoring goals.
- \* To encourage staff contributions in technical conferences and workshops.
- \* Developing laboratory facilities, field monitoring stations, and scientific equipment and gear as necessary

to support the research and monitoring efforts.

- \* Seeking agreements with other research organizations or institutions to facilitate and augment research and monitoring projects.

## **B. RESEARCH TOPICS AND PRIORITIES**

### **1. National Research Priorities**

In 1991-92 NOAA decided that a more focused system of research priorities was needed for the most effective use of the limited OCRM funds available for research.

NOAA/OCRM research funds are primarily used to support management-related research that will enhance scientific understanding of reserve environments, provide information needed by reserve managers and coastal decision-makers, and improve public awareness of estuaries and estuarine management issues. Research projects may be oriented to specific reserves; however, projects that will benefit more than one reserve in the national system will be given a higher emphasis for OCRM funds than reserve-specific projects.

The OCRM ten-year primary research objective is the study of natural and anthropogenically-induced change in the ecology of estuarine and estuarine-like ecosystems that comprise the NERRS. All research funded through OCRM should be designed to provide information of significant value to the development and implementation of management policy governing the U.S. coastal zone for which OCRM has management and regulatory responsibilities.

Five research priority categories will serve as foci for the OCRM competitive research program for two years each, over this ten-year period. The first of the OCRM re-focused two year research priorities will begin in FY93 (see Below). Every two years, beginning in FY94, OCRM will review (and if necessary, re-evaluate) its next ten-year set of research priorities. This system will ensure a continuous decade-long research agenda which, in turn, will provide the basis for long-term research and monitoring in the NERRS program. This system will also facilitate long-term interaction with other Federal and State agencies, as well as the academic research community.

#### OCRM NERRS Research Priorities for FY 1993-2002

FY 1993, 1994: Non-point Source Pollution - (non-focused or non-identifiable sources of pollution inputs and alterations within the watersheds).

FY 1995, 1996: Habitat Restoration - (restoration of coastal habitats that have been altered by anthropogenic activities and/or inputs).

FY 1997, 1998: Alterations in Habitat Utilization by Coastal Biota - (exotic species, commercial species, non-commercial species).

FY 1999, 2000: Alterations in Water Circulation, Transportation and Quality - (tidal exchange, fresh water diversion, hydrological budgets, ground water intrusion, biotic species transportation).

FY 2001, 2002: Anthropogenic Inputs and Activities - (focused and identifiable - i.e., dredge spoils, Hazmat, recreational uses, commercial uses)

Each year's OCRM research proposals will be designated to answer the same standardized, management-oriented question. For example, in FY 1993 & 1994 the question is: "How will non-point source pollution affect estuarine ecosystems in terms of:

a) functional biodiversity, b) functional ecology, c) functional health, d) eutrophication, and e) commercial fisheries."

## **2. Special Studies**

### **a. Environmental Resources**

Special environmental 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 NERRS Monitoring Program, and site-specific management needs. Special studies may identify and examine relationships between human stresses and ecological effects; these studies may include historical and archaeological perspectives on these issues.

Studies may include manipulative experiments appropriate to better management of estuarine systems. The environmental effects of approved manipulations should be temporary or reversible and not substantially affect adjacent core areas. What activities constitute "substantial" habitat manipulations, and what manipulations may be considered to be "temporary" or "reversible," will have to be evaluated on a case-by-case basis as they are proposed, done in consideration of ecological impacts and responses and of the long-term utility of the DNERR's lands for the goals and objectives of the DNERR. Designated areas where major habitat manipulations may occur will be contained within confined sub-watersheds of the Delaware Reserve, not spread over the Reserve's areas in patchy or mosaic fashion. Experimental habitat manipulation in the designated areas requires prior approval by the State, NOAA and, where applicable, by the Reserve property owners. Of course, any habitat manipulations requiring Federal or State environmental permits must be granted such prior to implementing the perturbations.

## **b. Cultural Resources**

Cultural resources research within the DNERR may include prehistoric and historic archaeological excavations, historical research, and folklore and oral history studies. Paleo-environmental research, including soil studies, geomorphological studies, and pollen studies, may be conducted to provide the environmental background for these studies. Studies conducted under the auspices of the DNERR program should focus on the relationship between the estuarine environment and the human groups which have exploited and changed it through time. Providing information to meet education goals will be a priority.

## **3. DNERR Research Priorities**

DNERR research priorities will be developed by a DNERR Scientific/Technical Advisory Committee, done in coordination with other DNERR advisory committees. These priorities may be modified based on Reserve and site-specific management needs gained from initial baseline surveys and environmental monitoring. The DNERR research priorities will reflect both NERRS National Research Priorities and more specialized regional or local needs.

Examples of more generalized research topics for initial consideration are listed below:

- \* Sediment/water column nutrient fluxes
- \* Effectiveness of agriculture BMP's
- \* Analysis of living resource data sets
- \* Stock assessments of exploitable species
- \* Sublethal responses to toxins
- \* Hydrographic studies of circulation and mixing processes
- \* Trophic level interactions
- \* Ground-water flow and contamination
- \* Impacts of specific land use practices on aquatic, wetland and riparian habitats
- \* Remote sensing and delineation of wetland types and boundaries
- \* Plankton community composition and dynamics
- \* Benthic community composition and dynamics
- \* Non-point source pollution impacts
- \* Habitat restoration techniques
- \* Impacts of human population growth
- \* Environmental history of both components
- \* Natural community classification
- \* Plant community composition and dynamics

The DNERR will identify and promote specific study Research Reserve topics of particular interest to coastal resource managers in Delaware or the middle Atlantic region. Given the environmental setting of the DNERR and Delaware's coastal resource issues and needs, the following three areas of research

might be emphasized by the DNERR:

- \* Development and refinement of environmental management techniques necessary to restore, maintain or enhance high quality estuarine habitats and their living resources;
- \* Development and assessment of management techniques necessary to limit non-point-source aquatic pollutants;
- \* Adaptive and non-adaptive responses of biotic populations and communities to natural and human-created environmental stressors.

Examples of special studies topics encompassed by the three focus areas suggested above include:

- \* Estuarine environment impacts caused by aircraft noise at the St. Jones component.
- \* Seaward wetlands loss and landward wetlands formation relative to sea level rise; impacts of sea level rise on primary production of wetlands emergent vegetation.
- \* Status and dynamics of the oyster bar communities in Delaware Bay and its tributary tidal rivers.
- \* Effectiveness of various agricultural BMP's in reducing run-off of fertilizers, animal wastes, sediments, and pesticides into estuarine waters.
- \* Effectiveness of various urban stormwater BMP's in reducing run-off of sediments, hydrocarbons, heavy metals, dissolved nutrients, and pesticides into estuarine waters, with emphasis on the upper St. Jones River watershed.
- \* Population dynamics and stock assessments within the Delaware Estuary of important estuarine aquatic species: weakfish, summer flounder, bluefish, striped bass, white perch, American shad, anadromous herrings, blue crab, American oyster.
- \* Vegetation composition and waterbird use of managed impounded marshes, with emphasis on the lower St. Jones River watershed.
- \* Temporal and spatial variability in the use of tidal creek/marsh habitats as nursery areas for finfish and crabs; effects of managed impounded marshes on fish nursery habitats, with emphasis on the lower St. Jones River watershed.
- \* Biology, ecology and control of Phragmites grass, with emphasis on the lower Blackbird Creek watershed.

- \* Ecologically-sound saltmarsh mosquito control techniques, examining both the abatement efficacy and non-target effects of insecticides (both chemical and bacterial), source reduction (e.g. Open Marsh Water Management), and other control methods (e.g. introduced pathogens).
- \* Biology and control options for tabanid biting flies and ceratopogonid gnats.
- \* Creation or restoration of tidal ponds in dewatered marshes to enhance waterbird and aquatic habitats.
- \* Population dynamics and occurrences of horseshoe crabs, and their trophic linkage and importance for migratory shorebirds, with emphasis on the Delaware Bay shoreline adjacent to the mouth of the St. Jones River.
- \* Population dynamics and habitat utilization of waterbirds (waterfowl, wading birds, shorebirds).
- \* Ecological structure and function of tidal freshwater wetlands, with emphasis on Upper Blackbird Creek.
- \* Population dynamics and foraging ecology of muskrats.
- \* Population dynamics and foraging impacts of snow geese.
- \* Development of sampling and monitoring techniques to better assess water quality parameters.
- \* Hydrology (surface and ground-water) and ecology of the Delmarva Bays (swale freshwater-nontidal wetlands) in the upper watershed of Blackbird Creek.
- \* Causes and significance of shellfish bacterial contamination and finfish PCB accumulation.
- \* Development of better environmental indicators associated with archaeological research.
- \* Develop a better understanding of adaptation to the estuarine environment by prehistoric and early historic human populations.
- \* Water column ecological processes in the open waters of Delaware Bay (e.g. plankton community composition and dynamics, inorganic nutrient cycling, turbidity impacts, meso- and micro-circulation effects).
- \* Causes and significance of late summer fishkill events in tidal rivers and creeks; hypoxia/anoxia problems.
- \* Impacts of borrow pit operations (sand and gravel mining) on estuarine wetlands and waters, with emphasis on the middle section of the St. Jones River corridor.

- \* Impacts of bridge and highway construction on tidal freshwater and brackish wetlands, with emphasis on upper Blackbird Creek.
- \* Comparison of created and restored wetlands with natural ones. The relative ecological functions and values could be studied between the DNERR undisturbed wetlands and those created such as those resulting from the Wildcat Landfill Superfund site remediation and those restored such as the Route 113 bridge wetland restoration effort.
- \* Impacts of vertical and lateral leaching of pollutants from abandoned landfills, with emphasis on the middle section of the St. Jones River corridor.
- \* Eutrophication problems and corrective actions in headwater millponds, with emphasis on the upper St. Jones River watershed.
- \* Management and recovery of rare species.
- \* Impacts of the development of commercial fishing and hunting in the 19th century on aquatic species populations.
- \* Impacts of cultivation beginning ca. 1670, on wetland quality.
- \* Impacts of major environmental episodes on floral and faunal composition of estuarine settings.
- \* Impacts of environmental change on human patterns of exploitation of estuaries.

It is anticipated that the DNERR Research Program will be of most help in addressing coastal issues which need more technical information that is best obtained via scientific methodology (e.g. controlled testing of alternative hypotheses); or via descriptive survey, particularly if the issues require inventory of biotic populations or assessments of ecological systems or environmental processes.

#### Research Values of the St. Jones Component

The Lower St. Jones River estuary offers several attractive features for estuarine research, primarily because of its accessibility and the juxtapositioning of an urbanized, developed upper watershed with an agrarian, relatively undisturbed downstream component.

Being adjacent to intensively managed State Wildlife Areas offers opportunities to develop and evaluate habitat enhancement or restoration methods. It is probable that most of the habitat management manipulations would occur on the proactively-managed

Wildlife Areas, with much of the DNERR component serving a control function. However, carefully planned and sited habitat manipulations would still occur in the DNERR component on a limited scale for research purposes. It is anticipated that the primary habitat management research topics (on-site or off-site) would focus on the restoration and management of impounded marshes for multiple resource objectives; on mosquito abatement practices; on phragmites control; on management of waterfowl, migratory shorebirds, and upland game species; on muskrat management and furbearer harvest; on management for endangered or rare species; and on the effects of sea-level rise on emergent wetlands. Basic ecological studies on the structure and function of mesohaline-polyhaline emergent wetlands could be an important component of the research program.

Studies on commercial fisheries for blue crabs, oysters, shad, white perch, weakfish, striped bass, and eels could be conducted in the adjacent open waters of Delaware Bay and in the lower end of the St. Jones River. Since June, 1988, a health advisory for human consumption of fish caught in the St. Jones River has been in effect because of PCB contamination in sampled fish tissues (no sediment samples taken from the St. Jones River contained PCB's above a detection limit of 40 ppb). Since the source of this PCB is a mystery, it will be a priority to DNERR researchers.

The close proximity of the Reserve component to the major oyster beds of Delaware Bay should make an ideal location for study of this important benthic community type. The primary natural oyster seed beds of Delaware Bay are 10-20 miles north of the mouth of the St. Jones River, while Delaware's leased oyster grounds lie offshore only 2-10 miles north from the River's mouth. Boat access to the open Bay could come from a state-owned dock and ramp at the mouth of the Mahon River (about 8 miles north of the Reserve), or from a state-owned ramp and commercial dock facilities at the mouth of the Murderkill River in Bowers Beach, only 1/2-mile south of the mouth of the St. Jones River. There is also a state-owned small boat ramp and parking area on the St. Jones River itself, within the Reserve boundaries about 1/4-mile west of Rt. 113 at Barkers Landing. In addition to studies of the Delaware Bay oyster beds, research on the oyster bar community within the most seaward mile of the lower St. Jones River warrants effort, since its decline and degradation mirrors what has happened to the oyster communities at the mouths of almost all tidal rivers and creeks emptying into Delaware Bay, from north of Woodland Beach south to the Broadkill River near Lewes. At present, high bacteria levels keep all of these river- or creek-mouth oysters off-limits for human consumption, and most of the beds do not have high enough densities for commercial harvesting even if consumption was permissible.

An important research program for Delaware that may be housed at the Lower St. Jones River DNERR component is the assessment of the control efficacy and non-target impacts of mosquito control insecticides, either developmental or

operational. Such a program would involve "micro-marsh" controlled breeding habitats and hand-application of products, with the research done in conjunction with other agencies and the product manufacturers. Additionally, research projects directed at the mass culture of larvivorous fishes such as Gambusia, or studies of other mosquito control biological agents such as bacteria, fungi or nematodes, would be encouraged.

Research opportunities in the lower St. Jones River basin also exist to assess the impacts of farming practices on the estuary, particularly in terms of non-point source run-off of nutrients, sediments and pesticides, going either into the headwaters of tidal tributaries or into the upper wetlands fringes. New or innovative farm management practices designed to lessen these problems could be implemented and evaluated.

Because of the rich historical and cultural database already existing for the Lower St. Jones River, the component will lend itself to analyses of estuarine impacts or uses associated with many of man's past activities.

With the upper end of the St. Jones River watershed heavily developed by the growing city of Dover, there are excellent opportunities along about a 5-mile segment of the River, just upstream from the Reserve's western boundary, to examine the impacts of urbanization on the estuary. Research emphasis could be given to the impacts of commercial and residential development on non-point source pollution into the headwater tributaries and upper wetlands fringes, particularly from stormwater run-off; on point-source discharge impacts from industry, consisting of a power plant and two manufacturers who do permitted discharging; on aesthetic and associated problems from trash dumping into the wetlands, particularly of old tires and appliances; on groundwater and estuarine surface water pollution problems associated with vertical and lateral leaching from an abandoned landfill (the Wildcat Landfill, a Superfund clean-up site); on the impacts of sand-and-gravel excavation operations occurring in adjacent uplands; etc. A federal EPA grant to implement a non-point source sediment-and-pollution control plan for the headwater areas above Silver Lake in Dover could be of interest for DNERR monitoring. Silver Lake itself has troublesome problems with bacteria levels, nutrients, and algal blooms.

There may also be an opportunity to do aquaculture research, since the sand-and-gravel excavation business has just initiated an effort to culture hybrid striped bass in some of the company's abandoned borrow pits.

A major asset to the DNERR research program will be the establishment of support facilities on the Reserve component that will house the working offices and laboratories of DNREC professional technical staff. Key field-oriented staff professionals from the Divisions of Fish and Wildlife, Parks and Recreation, Soil and Water Conservation, and Water Resources may have their operational base housed in the Reserve's new support

facilities, and as such could easily become directly involved, for a portion of their time, in the DNERR research programs for a wide range of activities (e.g. planning, survey, monitoring, assessment, evaluation, analyses, etc.). Additionally, administrative or technical staff from the Kent Conservation District might also be interested in locating on the Reserve. The potential influx and close association of operational technical personnel with the day-to-day research activities of the Reserve should greatly strengthen the quality, quantity and applicability of the research performed by or through the DNERR program.

### Research Values of the Blackbird Creek

The diversity of estuarine habitats found in Upper Blackbird Creek, and how they differ from those found at the Lower St. Jones River component, are major attributes for environmental researchers. Some of the least understood estuarine zones, in terms of their ecological structure and function, are brackish and tidal freshwater marshes. The interconnectiveness of upland and marine environments starts in these zones, so a better comprehension of oligohaline-limnetic systems should yield benefits to our overall understanding of estuarine ecosystems. The Upper Blackbird Creek component provides outstanding examples of these transitional habitats.

Other research opportunities within or near the Upper Blackbird Creek component include studies of agricultural practices in terms of their effects on estuarine biota or processes, and studies in land-use planning in terms of contending with burgeoning residential development. In the most seaward portion of the Reserve, and then for several miles downstream of this area, there are some of the State's most dense and extensive phragmites stands, providing substantial opportunities for basic and applied research studies of this problem species. The proximity to complexes of swaled freshwater wetlands, the Delmarva Bays, should be of interest to hydrologists, botanists and herpetologists.

The Upper Blackbird component also provides opportunities for archaeological and historic research. The Blackbird drainage is north of the prehistoric range of oyster. and provide a significantly different environmental setting for human groups.

Historical research for the Appoquinimink drainage, just north of the Blackbird component indicates significant impacts from cultivation-induced siltation within 20 years of first European settlement.

At the present time, research support facilities at the Upper Blackbird Creek component are not being considered (although a modest educational/visitor facility might be developed). Because of the proximity to the Lower St. Jones River component's proposed facilities center (about a 35-minute drive), researchers would commute and use the Upper Blackbird

Creek component primarily as a field laboratory. Hydrographic monitoring stations might be established in the lower and upper portions of the component's main channel, consisting of continuously-recording tide gauges to monitor water heights, continuously-recording instruments for salinity and temperature, and rain gauges. Of course, similar hydrographic monitoring stations would be established for the Lower St. Jones River. Research support need that must be developed for Upper Blackbird Creek is an access site(s) for motorized small boats.

### C. DNERR POLICIES AND PROCEDURES FOR RESEARCH

Research at the DNERR will investigate the natural processes of the estuarine system and human impacts on these processes. One of the highest priorities is to coordinate, facilitate and conduct research to provide useful information for coastal management decision-making.

The DNERR program makes both components available to researchers as long-term field laboratories which are especially suitable for studying estuarine problems.

The DNERR program offers:

- \* Long-term opportunity for temporal and spatial sampling in wetland, upland, and open water estuarine habitats.
- \* Greater opportunity for use of observational and analytical techniques in protected or controlled estuarine subsystems.
- \* The chance for long-term accumulation of comparative data at the Reserve components.

Through State ownership or long-term agreements with each component's property owners, the State has the opportunity to encourage and support certain research projects in these estuarine systems.

To assist new researchers at the Reserve, information packets will be available from the Reserve research coordinator. These packets will contain background information pertaining to each component and an area map, designating the 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 high priority within the reserve boundaries. Traditional uses of public areas will continue as regulated under federal, state, or local authority. Reserve managers are responsible for carefully balancing uses of the reserve to ensure that the objectives of the reserve program are protected and sustained.

Research opportunities are available to any qualified scientist, faculty member, undergraduate, or graduate student affiliated with any college, university or school; non-profit, non-academic research institution (e.g. research laboratory, independent museum, professional society); private profit organization; or state, local or federal government agency. These opportunities are also available to any individual who has the resources and capabilities needed to perform the work required.

Research opportunities will be available to all applicants without regard 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 through Delaware's Department of Natural Resources and Environmental Control, the NOAA Office of Ocean and Coastal Resource Management, NOAA Sea Grant, the National Park Service Historic Preservation Fund, the Environmental Protection Agency, and other sources. Researchers not seeking financial support may apply to do research at any time. Researchers seeking financial support from NOAA must follow NOAA's research and monitoring time table.

All research proposals are evaluated by the reserve manager and the research coordinator for consistency with DNERR goals and to ensure that the proposed research will not unduly interfere with other research or activities at the reserve. A DNERR Scientific/Technical Advisory Committee (STAC) will be formed to provide advisory input to the reserve manager and research coordinator concerning the importance, suitability, and practicality of all research proposals proposed for the DNERR. The STAC will consist of personnel from the DNERR, other State agencies and programs, Federal agencies, and academic research institutions. Projects will be selected based on their importance to coastal zone management issues, scientific/educational merit, and technical approach. Other project selection criteria include: the environmental consequences of the project; immediacy of need; and the proposed project's relationship to other available information and studies. Under the Delaware Antiquities Act, archaeological research on the Reserve must also be approved by the Director of the Division of Historical and Cultural Affairs.

Each proposal will be reviewed to determine whether the project constitutes an undertaking as defined in regulations implementing section 106 of the National Historic Preservation Act of 1966, as amended. Any project that is determined to constitute an undertaking will also be reviewed by the Delaware State Historic Preservation Office under the provisions of that Act.

#### **1. Procedures for NOAA-Funded DNERR Research**

Proposals which call for NOAA funding will be evaluated by NOAA using established guidelines. These guidelines are in the NERRS' yearly "Announcement of Opportunities for Research Funding

in the National Estuarine Research Reserve System", which includes guidance for proposal preparation and submission, plus details of proposal review and evaluation, which identifies a peer review process. Proposals for NOAA-funded research to be done in association with the DNERR will also be evaluated by the DNERR Scientific/Technical Advisory Committee for advisory comments about a proposal's importance, suitability, and practicality. In order to qualify for NOAA funding, DNERR research proposals must address the given NERRS National Research Priority and fulfill the requirement of the appropriate Request for Proposals. NOAA funds are awarded on a competitive basis and proposals will be competing with other research proposals in reserves throughout the National Estuarine Research Reserve System.

The DNERR research coordinator is responsible for coordinating all research and monitoring activities for the Reserve. To facilitate this, NOAA will maintain close contact with the DNERR research coordinator and will keep him or her informed of the progress of NOAA-funded researchers. NOAA will send copies of any required progress reports, the final report, and any other research information which they receive to the DNERR in a timely manner. The DNERR will keep two copies of the final report at the DNERR central repository and the research coordinator will keep the third copy. The DNERR research coordinator will maintain regular communication with the NOAA-funded 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 NERRS goals of 1) "making available information necessary for improved understanding and management of estuarine areas" and 2) "enhancing public awareness and understanding of the estuarine environment", 15 CFR Section 921.1, NOAA-funded researchers may be requested to provide a presentation on their research findings at the Reserve facility, the DNREC Building in Dover, or other appropriate location.

## **2. Procedures for State-funded DNERR Research**

All proposals which do not target NOAA funding will be evaluated by the Scientific/Technical Advisory Committee. Specific procedures will be developed, and it is envisioned that desirable features of the review process already existing for NOAA funding will be incorporated into the STAC's procedures for evaluating proposals that might be funded by State money or other non-NOAA funds. The DNERR Scientific/Technical Advisory Committee will help determine appropriate research topics and protocols. 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 DNERR 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.

The DNERR requires that researchers provide the research coordinator with timely progress reports, three copies of the final report, and an abstract and one copy of any journal 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 DNERR will keep two copies of the final report at the DNERR central repository and the research coordinator will keep the third copy. In addition to a final report, the researcher will keep the research coordinator updated on the progress of the project by means of timely written progress reports. Records, data, reports, publications, and other relevant materials will be kept at the DNERR central repository. Research information will also be forwarded to NOAA, which will act as a central clearinghouse and the center of the information network of the NERR System.

After completion of the final report, a presentation may be developed by the researcher at request of the research coordinator to provide information on the project findings. This presentation will be given at the DNERR facility or other appropriate location at a time 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.

### **3. Procedures for DNERR Research (funded by sources other than NOAA or the State)**

The DNERR research coordinator will negotiate reporting and presentation requirements for research funded by sources other than NOAA or the State of Delaware with the reserve manager, the researcher and the funding source. For example, researchers who must provide progress reports to their funding agency may be asked to submit copies of those reports to the DNERR research coordinator. Similar to NOAA or State-funded research proposals, advisory input about the importance, suitability, and practicality of a research proposal for the DNERR will be solicited from the DNERR Scientific/Technical Advisory Committee.

## **D. MONITORING PROGRAM**

### **1. NOAA Phased-Monitoring Program**

In 1989, NOAA initiated a phased-monitoring program to assist reserves in developing a better understanding of their estuarine resources.

- 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, cultural resources, and the problems and issues confronting the reserve environment.

- 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;
- Phase III, Procedures and Requirements, which involves identifying parameters to be measured, procedures to be used (criteria for measurements, quality control, and standard procedures where they already exist), sampling strategy for selected parameters (spatial and temporal intervals), storage and retrieval of data (reporting, formatting and analytical requirements), manpower requirements, logistics, and cost; and
- Phase IV, Implementation, which involves, first, pilot projects and upon successful evaluation, full-scale monitoring of selected parameters.

The DNERR phased-monitoring program will be integrated where appropriate and beneficial with other environmental monitoring programs conducted by the State, federal agencies, and private organizations. The DNERR phased-monitoring program will follow NOAA guidelines for its development and implementation.

The reserve research coordinator will work to incorporate the following into all monitoring programs:

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

## **2. Recruitment for DNERR Research Programs**

Recruitment of researchers is important to building the DNERR data base and to establishing the components as long-term natural field laboratories. Recruitment of researchers with an established interest and capability will be one of the functions of the research coordinator. Recruitment strategies include:

- \* Coordination through scientific/technical advisory committees.
- \* Participation of DNERR staff in research symposia, conferences and workshops.

- \* Intern programs for graduate students or upper-class college students, funded by Federal, State or other sources.
- \* Annual announcements of research opportunities and NOAA research funds through NOAA's Sanctuaries and Reserve Division.
- \* Other research and monitoring funding.

### 3. Off-Reserve Research Projects

While it is expected that much of the DNERR research will occur on the Reserve's two components, it is also anticipated that substantial research efforts associated with the DNERR will occur outside the Reserve's boundaries. It is probable that many of the off-reserve studies will occur in close proximity to the components (e.g. in the nearby open waters of Delaware Bay, in the State Wildlife Areas along the lower St. Jones River, in the urbanized upper watershed of the St. Jones River, in the phragmites-dominated tidal wetlands of lower Blackbird Creek, in the Delmarva Bay freshwater wetlands in the upper watershed of Blackbird Creek). However, research studies supported or assisted by the DNERR may also occur somewhat distant from the components. In particular, research associated with the environmental problems of Delaware's Inland Bays (i.e. Rehoboth, Indian River, and Little Assawoman Bays) would be encouraged under DNERR auspices. While the extensive Delaware Bay system is an excellent representative of a drowned river, coastal plain estuary along the mid-Atlantic Coast, having expansive fringing wetlands and subestuaries, it is not characteristic of lagoon or bar-built estuaries which are also common in the middle Atlantic region. Delaware's Inland Bays are representative of lagoon or bar-built estuaries, and research attention paid to these systems would give the DNERR an active role in examining all of the middle Atlantic region's major estuarine habitat types. The environmentally stressed nature of Delaware's Inland Bays could be compared to similar but less degraded lagoon-type estuaries further south, from Chincoteague Bay southward behind the chain of the Eastern Shore barrier islands of Virginia. Additionally, it is anticipated that cooperative wetlands studies with the University of Delaware's College of Marine Studies would involve DNERR efforts in the Great Marsh near Lewes.

### 4. Coordination of Research Efforts

A major research benefit offered by the Reserve is the potential for coordination of research efforts. The Reserve offers permanent places where various research institutions can coordinate their projects and compare results to complement one another's work. Data will be compiled, assembled, and analyzed, and will be made available in the appropriate form, for use by other researchers, coastal managers and the public. Research coordination reduces unnecessary duplication and effectively decreases the cost of publicly-supported research.

### **a. Coordination Between DNERR Components**

The research coordinator will coordinate the research between the two DNERR components, with assistance from the advisory committees and NOAA.

### **b. Coordination with the NERR System**

The DNERR works closely with NOAA staff, especially their research coordinator, to develop and assess National Research Priorities. NOAA is also involved with the Reserve through research funding and proposal evaluation. The research coordinator will communicate with other estuarine research coordinators in other states, particularly mid-Atlantic states, and will work with NOAA and other research coordinators to establish a national information exchange network.

Data from the DNERR contributes to the national network long-term study to monitor the status and trends of estuarine ecosystems. Data from the National Estuarine Research Reserve System makes a substantial contribution to the understanding of long-term ecological effects on estuaries and are 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.

### **c. Coordination With Other Coastal/Estuarine Research Programs**

**(Federal and State agencies, academic institutions, and private organizations)**

Reserve staff will also assist in the coordination at the State level of NOAA's federal coastal and estuarine research programs, such as the Coastal Oceans Office; the Status and Trends Program; the Coastal Zone Management Program; and the National Sea Grant Program. How this coordination will occur will depend upon future needs and guidance from NOAA. Research coordination with non-NOAA agencies, Federal or State, will be undertaken to ensure that research is not being unnecessarily replicated by the DNERR, and to see if any research is being performed on those topics that are identified as high priority by the DNERR. It will be very important to coordinate DNERR research efforts with the U.S. Environmental Protection Agency's two National Estuary Programs in Delaware (the Delaware Estuary Program and the Inland Bays Estuary Program), for both development and implementation of each program's Comprehensive Conservation and Management Plans. Other federal agency programs with which coordination is highly desirable include the U.S. Fish and Wildlife Service's new environmental outreach program, located at Bombay Hook National Wildlife Refuge, and the Service's efforts to implement the North American Waterfowl Management Plan, achieved in part via the Private Lands

Initiative; the U.S. Soil Conservation Service's office in Dover, particularly for studies of non-point source pollution control methods; and the U.S. Geological Survey's office in Dover, particularly for hydrological studies of surface and ground waters. Coordination of research interests might also be appropriate for some fisheries topics between DNERR and the Mid-Atlantic Fishery Management Council (headquartered in Dover) for offshore federal waters, and also with the Atlantic State Marine Fisheries Commission for inshore state waters.

It will also be critical to coordinate research interests and efforts between State agencies. Within the Delaware DNREC, all five Divisions have various interests in applied estuarine research: the Divisions of Fish and Wildlife; Soil and Water Conservation; Parks and Recreation; Water Resources; and Air and Waste Management. In particular, coordination of research between the DNERR and the Delaware Coastal Management Program should be emphasized, and activities within the DNERR should be consistent with the DCMP. Coordination of research will also involve other State agencies: the Department of Agriculture's Forestry Section; the Division of Historical and Cultural Affairs' Bureau of Archaeology and Historic Preservation; and the Division of Highways. The Delaware River Basin Commission, a quad-state independent agency (DE, NJ, PA, NY), also sponsors applied research in the Delaware Estuary; coordination between the DNERR and the DRBC should yield mutual benefits.

Of primary importance for research coordination is interaction between the DNERR and nearby academic research institutions. In particular, research efforts should be coordinated between the DNERR and the University of Delaware's College of Marine Studies, from both its Lewes and Newark facilities with special attention to interactions with the Delaware Sea Grant College Program. Other research coordination of special interest between the DNERR and the University would involve the College of Agriculture (Departments of Entomology and Applied Ecology; Agricultural Engineering; and Plant and Soil Sciences), the School of Life and Health Sciences, the College of Arts and Sciences (Dept. of Anthropology Center for Archaeological research), and the College of Urban Affairs (Center for Historic Architecture and Engineering). Research coordination between the DNERR and Delaware State College in Dover would focus on the College's Department of Agriculture and Natural Resources and the Department of Biology. Research coordination with the Cooperative Extension Services at both the University of Delaware and Delaware State College for agricultural topics would be beneficial. Interactions with Wesley College in Dover would be through their undergraduate Environmental Sciences Program. On the New Jersey side of Delaware Bay, Rutgers University operates its Shellfish Research Laboratory in Bivalve, making for probable mutual interests between the DNERR and Rutgers University.

The last area necessitating DNERR research coordination is with private environmental organizations that perform either

independent or cooperative environmental research. Some of these organizations may also be able to provide volunteers to the DNERR to help with research projects or environmental monitoring. Examples of private organizations who perform various kinds and levels of environmental research include the Delaware Nature Society (e.g. the Stream Watch Program); the Nature Conservancy, particularly for plant and animal inventories; Ducks Unlimited, supporting studies of waterfowl populations and their habitats; the National Audubon Society and its local chapters, plus the Delmarva Ornithological Society, for avian population assessments; the member organizations of the Western Hemisphere Migratory Shorebird Reserve Network; marine conservation organizations such as the Atlantic Coast Conservation Association and the American Littoral Society; the Archaeological Society of Delaware; and the Friends of John Dickinson Mansion. These are but a few examples of private environmental organizations where coordination of applied research with the DNERR may be mutually beneficial.

Finally, the DNERR Scientific/Technical Advisory Committee members should promote the DNERR components as research facilities, and act as liaisons between the Reserve and agencies in coordinating research and monitoring efforts.

## 5. Information Dissemination

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

Both NOAA and the DNERR 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 DNERR will utilize several other avenues of information exchange including:

- Summary of research at Reserve;
- Workshops, conferences and teach-ins at Reserve;
- DNERR brochure, distributed with the annual call for proposals 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.

## XI. RESOURCE PROTECTION PLAN

Along with research and education, resource protection is a major component of the DNERR. Estuaries are among the most biologically productive systems on Earth. The productivity and integrity of the Research Reserve's resources must be protected in order to provide a stable environment for research and education programs which are used to address coastal management issues.

### A. GOALS

The goals of the Research Reserve's resource protection plan are to:

- \* Protect significant natural estuarine sites for research education and interpretation programs.
- \* Protect the habitats of fauna and flora as an integral part of the natural system.
- \* Protect the Reserve from unduly disruptive activities occurring inside and outside of its boundaries.
- \* Protect cultural resources which contribute to an understanding of human interactions with the estuarine system.

Specific objectives to aid in achieving these goals include:

- \* Acquiring and protecting key land and water areas identified in the site selection process.
- \* Controlling access to the Reserve to minimize adverse impacts on critical natural and cultural resources.
- \* Aiding in enforcement of permitted uses of the site.
- \* Being knowledgeable of and involved with land use issues in the vicinities of the Reserve that could impact it.
- \* Coordinating with neighboring property owners and local, state, and federal agencies in order to maintain a proper buffer to the Reserve's core areas.
- \* Coordinating research and education programs to minimize adverse impacts on critical natural and cultural resources.
- \* Providing for adequate public participation and use of the Reserve to inform and educate them as to the need to protect sensitive resources.

## B. GENERAL POLICIES

Resource protection relies on the coordinated efforts of the research and education programs and Management Plan policies. It also relies on a number of existing federal, State and local laws and regulations, plus Reserve and property owner policies, enforced by Reserve staff and property owners. It is also the responsibility of Reserve staff to be knowledgeable of and involved with land use issues in the vicinity of the components that could impact the Reserve.

NERRS regulations allow for multiple uses of reserves to the degree compatible with each reserve's management plan and consistent with the mission and goals of the NERRS. The DNERR Management Plan focuses on maintaining areas as field laboratories and on developing a coordinated program of research and education.

Public access is encouraged on those parts of the Reserve that are publicly owned or that have received private landowner permission, as long as it is not to the detriment of the resource or does not interfere with approved research. Public access may be restricted in key resource protection areas. Future research directed at identifying resources of concern (i.e. federal or state rare species, significant natural communities, critical cultural resources) will help delineate these protection areas as well as direct research, education programs and overall Reserve management. The Reserve manager will develop access policies and coordinate enforcement of regulations that will help maintain natural conditions and preserve cultural resources.

Traditional use activities (hunting, fishing, trapping) in the DNERR may continue up to levels currently permitted under local and State laws, or under regulations in place with property owners, as long as these uses do not unduly conflict with research or educational concerns and the harvests conform to legal practices and limits. Potential conflicts can best be avoided by coordination and reasonable compromise. Care should be given to managing the impacts of traditional use activities occurring in rare species habitats or in unique biotic communities. These activities are permitted only in designated areas.

All projects carried out in the Reserve for which standardized, authorized Best Management Practices have been developed will follow such BMP's to avoid degradation of the natural environment and of cultural resources. Any activity on State-owned land or private land done under cooperative agreements will adhere to a conservation plan acceptable to all cooperators. Resource protection will typically be addressed by restricting certain land use activities, for example, sand and gravel operations will not be permitted on DNREC controlled lands within the Reserve. Erosion and sediment control and stormwater management plans will be carried out to enhance water quality and quantity by limiting sediment, toxics, chemicals, and waste oil

runoff. The use of insecticides, herbicides, and other toxic substances when necessary will be carefully planned and their application will follow all required or appropriate procedures. Pesticides with rapid breakdown and negligible effects on the environment could be used when necessary with prior coordination with or approval of the Reserve manager.

DNERR staff will encourage any activities outside of and adjacent to the Reserve to be compatible with resource protection and conservation. Activities such as development, infrastructure concerns and any land disturbing action that occurs upstream from the Reserve or any of its tributaries will be monitored.

The planning of any construction or substantial site manipulation will include a heritage inventory survey for rare species and significant natural communities and a cultural resources survey. If critical resources are identified this information will be noted in the appropriate databases and plans may be altered as necessary to minimize adverse impacts.

Research proposals and education programs will undergo a review by appropriate agency, Advisory Committee or Reserve staff for their impacts on resource protection. The type and scope of project will be weighed against the need to maintain critical natural and cultural resources.

Research is a key use of the Reserve and is given a high priority in the management plan. Interference with research activities can disrupt the ability to achieve effective long-term management of the estuarine systems. Reserve staff will monitor research sites and will post signs identifying these sites. With the exception of samples taken for approved research and education programs, and fish and game taken from designated fishing, hunting, or trapping areas, nothing may be removed without prior approval of the Reserve manager. Plants, animals, minerals, cultural resources, or any parts of these must remain to protect the integrity of these key areas.

Because the DNERR falls under a number of different and sometimes overlapping jurisdictions of local, State and federal agencies, coordination and cooperation among all authorities is essential. Some of the State and local regulations directly affecting the Reserve are described below. The Reserve staff will coordinate activities with the appropriate regulatory agencies and other resource protection efforts. A clearinghouse will be created to help the Reserve coordinate with other agencies which propose projects potentially impacting the Reserve.

### **C. LAWS AFFECTING RESOURCE PROTECTION IN THE DNERR**

The following laws and regulations affect activities that may be carried out in and around the Reserve's watershed.

## TIDAL WETLANDS

Tidal wetlands in Delaware are protected by the State Wetlands Act of 1973 (7 Del. C. Chapter 66). The Act covers all "wetlands" defined as:

"Those lands above the mean low water elevation including any bank, marsh, swamp, meadow, flat or other low land subject to tidal action in the State along the Delaware Bay and Delaware River, Indian River Bay, Rehoboth Bay, Little and Big Assawoman Bays, the coastal inland waterways, or along any inlet, estuary or tributary waterway or any portion thereof, including those areas which are now or in this century have been connected to tidal waters, whose surface is at or below an elevation of 2 feet above local mean high water, and upon which may grow or is capable of growing any but not necessarily all of the following plants: [list of plants] and those lands not currently used for agricultural purposes containing 400 acres or more of contiguous nontidal swamp, bog, muck or marsh exclusive of narrow stream valleys where fresh water stands most, if not all, of the time due to high water table, which contribute significantly to ground water recharge, and which would require intensive artificial drainage using equipment such as pumping stations, drain fields or ditches for the production of agricultural crops."

The Department of Natural Resources and Environmental Control surveys and delineates its tidal wetlands; regulatory maps provide jurisdictional boundaries. Under a concurrent review process with the Army Corps of Engineers, the State requires a permit for any dredging, filling, or other alterations or construction, bulkheading, construction of piers, jetties, breakwaters, boat ramps, or mining, drilling or excavation in State mapped wetlands.

No permit may be issued until the county or municipality having jurisdiction has first determined that the activity is lawful according to zoning procedures. Proposed activities are evaluated considering the factors of environmental impact, aesthetic effect, the number and type of supporting facilities required and the environmental impact of such facilities, the effect on neighboring land uses, State, county and municipal comprehensive plans for the development and/or conservation of their areas of jurisdiction and economic effect.

Exemptions from permit requirements include mosquito control activities authorized by the Department, construction of directional aids to navigation, duck blinds, boundary stakes, wildlife nesting structures, grazing of domestic animals, haying, hunting, fishing and trapping.

Projects which would require wetland permits within both the lower St. Jones River and the upper Blackbird Creek components would include any impacts to tidal wetlands for the construction of boardwalks, piers, docks or boat ramps.

In addition to Delaware's Wetlands Act of 1973, all jurisdictional wetlands in the Reserve are federally protected by Section 404 of the Clean Water Act (passed in 1972 as the Federal Water Pollution Control Act Amendments, later renamed the Clean Water Act in 1977). Thus Federal Section 404 jurisdiction extends beyond just the primarily tidal wetlands protected by the State's Act, to encompass some remaining tidal wetlands at the highest reach of tide, plus all non-tidal or freshwater wetlands. However the scope of activities controlled by Section 404 is primarily limited to the discharge of dredged or fill material into wetlands (and to significant hydrological alterations that may be caused by such discharge), which cannot be done without a permit issued by the Army Corps of Engineers, with oversight provided by the U.S. Environmental Protection Agency. Processing of applications for both State and Federal wetlands permits is handled simultaneously in Delaware by the Joint Permit Processing Committee.

#### **DELAWARE COASTAL ZONE ACT OF 1971**

The landmark Delaware Coastal Zone Act of 1971 purpose is to control the location, extent and type of industrial development in order to better protect the natural environment of Delaware's bay and coastal areas. The law prohibits new heavy industry which is incompatible with protection of the natural environment in the designated coastal strip. The St. Jones component from U.S. Route 113 to and including the Delaware Bay are within this highly protected area.

#### **SUBAQUEOUS LANDS**

The purpose of the Subaqueous Lands Act, 7 Del. C., Chapter 72, is to protect against uses or changes which may impair the public interest in the use of navigable waters. "Subaqueous lands", including rivers, lakes, ponds, streams, embayments, lagoons and other navigable waterways, means "submerged lands and tidelands". By definition, the landward extent of jurisdiction in subaqueous lands is the mean high tide line, or the ordinary high water line in non-tidal waterbodies. The Act empowers the Secretary of the Department of Natural Resources and Environmental Control and the Governor (for commercial projects) to regulate the use of both public and private subaqueous lands. Permits, leases or letters of approval issued by DNREC's Wetlands and Aquatic Protection Branch are required to deposit material upon, remove material from, construct, modify, repair or reconstruct or occupy any structure or facility upon subaqueous lands, as well as new and maintenance dredging projects.

Regulations governing the use of subaqueous lands stipulate that no activity may be undertaken which might contribute to the pollution of public waters, adversely impact or destroy aquatic habitats or infringe upon the rights of public or private owners. Examples of activities regulated under this statute which may be proposed for the St. Jones River and upper Blackbird Creek components would include the construction of piers, utility or road crossings, docks, boat ramps or mooring facilities.

## **DELAWARE ANTIQUITIES ACT**

Prehistoric and historic archaeological sites on state-owned or controlled properties in Delaware are protected by an antiquities act (Chapter 54, Title 7, Delaware Code). Under this act, only the governor or the Director of the Division of Historical and Cultural Affairs may give permission to collect artifacts or to conduct archaeological surveys or excavations on state land. Any artifacts found on state land, regardless of where or by whom, are the property of the state, and are to be deposited with the Division of Historical and Cultural Affairs for curation and display. The unauthorized collection of artifacts or excavation of sites is punishable by a \$100 fine and/or a 30-day prison term.

Unmarked human remains are further protected by an amendment to the antiquities act. The provisions of this act apply to burials on both public and private land. Human remains that are not the subject of an investigation by the Medical Examiner can only be excavated by professional archaeologists with the approval of the director of the Division of Historical and Cultural Affairs and a Committee on Unmarked Human Remains, if the remains are determined to be those of a Native American. If the remains are those of a member of any other ethnic group, an effort must be made to obtain permission from the next-of-kin. After excavation, the remains may be studied by a skeletal analyst for 90 days before they are reinterred. Unauthorized acquisition, excavation, or display of human remains is punishable by a fine of not less than \$1000 or more than \$10,000 and/or imprisonment of up to 2 years.

## **NATURAL AREAS PRESERVATION**

The 1978 Natural Areas Preservation System Act (7 Del. C. Chapter 73) established a means to set aside and protect significant natural landscapes throughout the State. These areas may be the best examples of a particular habitat, rare species locations, or geological and archaeological sites. The Office of Nature Preserves within the Department of Natural Resources and Environmental Control administers this voluntary program. Efforts are directed towards public and private landowners of natural areas to conserve and protect the resources of concern through the placement of restrictions on the property. Once a natural area has these legally recorded restrictions applied to it, then it becomes a nature preserve and is afforded the highest level of protection for conservation lands in Delaware. The entire upper Blackbird Creek component is within a state-recognized natural area, and contains land that may be attractive for voluntary designation as Nature Preserves. Activities associated with the DNERR's process will be coordinated with natural areas protection efforts.

## **CONSERVATION EASEMENT**

A conservation easement as defined by Delaware law (7 Del.

C. Chapter 69) is a way for a landowner to voluntarily place permanent restrictions on the future use of the land, thereby protecting its natural attributes. The conservation easement is perpetual and binds all present and future owners of the land. For site acquisition/protection efforts, a conservation easement will be one of the methods used to help establish the DNERR.

#### **EROSION AND SEDIMENT CONTROL/STORMWATER MANAGEMENT**

On July 1, 1991 new state Erosion and Sediment Control and Stormwater Management Regulations went into effect. These regulations are aimed at significantly reducing pre- and post-construction sediment, nutrient and toxic loads to the State's waterways. Any facilities development associated with DNERR would come under these regulations. Also, any development outside of the DNERR boundary would be similarly regulated.

#### **RARE SPECIES AND NATURAL COMMUNITIES**

A proposed revision of the State's Endangered Species Law would provide additional protection to the many state-listed rare plants, animals and natural communities. Many activities in the DNERR, including research, would be evaluated against any adverse impacts to the listed species and communities and modified accordingly.

#### **WILDLIFE AND FISH MANAGEMENT**

All wildlife and fish management taking place within the DNERR will adhere to the most current hunting and fishing regulations and laws (7 Del. C. Chapters 1-27).

#### **SURFACE WATER QUALITY STANDARDS**

The maintenance of water quality standards consistent with public health, protection of fish and wildlife and other aquatic life within the DNERR will be according to the most current regulations of the Delaware Environmental Protection Act Del. Code. Chapter 60.

#### **DELAWARE COASTAL MANAGEMENT PROGRAM**

The Delaware Coastal Management Program of 1979 as approved under the rules and regulations of the Federal Coastal Zone Management Act includes the State laws listed above as its means of providing coastal protection. The activities described in this plan are not only consistent with, but also collaborative in achieving the goals and objectives of the Delaware Coastal Management Program.

#### **LAND USE AND ZONING**

All applicable state and county land use and zoning restrictions will apply to the DNERR.

## **XII. ENVIRONMENTAL RESTORATION PLAN**

### **A. NERRS AND ENVIRONMENTAL RESTORATION WORK**

Although restoration of environmentally-degraded areas is not a primary purpose of the NERRS, 15 CFR Section 921.1(e) recognizes the need or desirability to permit restoration activities "to improve the representative character and integrity of a reserve." In order to restore degraded areas or systems, which typically have undergone some type of adverse physical or ecological alteration, manipulative techniques are usually necessary to achieve the desired changes. Restoration goals should focus on returning degraded areas to their historical environmental status prior to degradation, in terms of either the original ecological structures or their functional equivalents.

### **B. DNERR AND ENVIRONMENTAL RESTORATION WORK**

The primary types of environmental degradations that have occurred in DNERR sites are in the tidal wetlands, where parallel-grid-ditches for mosquito control have dewatered marsh surface features and lowered subsurface water tables. Additionally, a combination of other factors have caused moderate expansion of phragmites cover at the expense of previously established, more desirable vegetation types. Upland buffer areas at both reserve sites have also been "degraded" if one considers conversions of forestlands to croplands (most of which occurred decades or centuries ago) to be degradations. However, such past agricultural conversions in upland buffers are not viewed as problems needing restoration.

Restoration activities in the reserve's tidal wetlands, which might be done to correct parallel-grid-ditch drainage effects or to eradicate phragmites encroachment, almost always involve manipulative techniques. Brief descriptions of the need for, types, extent and impacts of potential restoration practices are given in Section VI, Habitat Manipulations. As stated in Section VI, installation of Open Marsh Water Management (OMWM) systems for mosquito control often helps to compensate for structural or functional ecological degradations caused by the parallel-grid-ditches, and also helps to "restore" wetlands to a former, more pesticide-free state.

Most restoration activities will be directed at restoring in some fashion the physical features and biotic community of a site, and some restoration work may be performed and evaluated as research projects. In part, this would help improve habitat and species diversity and should prevent further degradation of the resource. Any species reintroductions would be historically native to the area. Restoration projects can provide a good baseline for long-term research and education needs. Restoration needing or resulting in substantial action or impacts will require prior approval by the State, NOAA and, where applicable, by the site property owner.

### C. OMWM AND ENVIRONMENTAL RESTORATION

At this point in time, the most probable future restoration work which might be proposed for the DNERR will be installation of OMWM systems in up to 20% of the tidal wetlands in the Lower St. Jones River site. It is probable that permission for such restoration activity will be formally requested within the next 5 to 10 years. Because of the high probability of this action being proposed, it is beneficial to review in the management plan why OMWM is desirable (as an alternative to the insecticide controls which are now needed and used); to discuss the environmental restoration functions of OMWM; and to discuss the agency review and approval process for using OMWM.

Both of the DNERR components produce pestiferous mosquitoes that require control for their off-site nuisance problems and disease-vector potential. Both of these potential problems can directly affect the quality-of-life in an area greater than 20 miles distance from the Reserve sites. The Lower St. Jones River component is of more mosquito-production concern, since it is only six miles from the capital in downtown Dover, and its more saline habitats produce more saltmarsh mosquitoes than do the upper Blackbird Creek marshes. Saltmarsh mosquitoes will routinely fly 10-15 miles inland from their marshes of origin, and are capable of causing problems as far as 40 miles away from their breeding grounds.

In order to satisfactorily contend with the mosquito problems, all ongoing mosquito control practices must continue in both Reserve components. Currently, this primarily involves the DNREC's Mosquito Control Section's surveillance of mosquito production levels, and selective application (as needed) of approved insecticides. Similar to its insecticide control efforts throughout the State, the Section will use insecticides on the Reserve in an environmentally-compatible manner.

In addition to using insecticides for saltmarsh mosquito control, the Mosquito Control Section has a policy of trying to reduce statewide its insecticide use as much as possible, primarily by relying on the source reduction method of Open Marsh Water Management (OMWM) wherever practical. The mosquito-breeding areas of the lower St. Jones River tidal wetlands are currently targeted for future OMWM treatment, part of the 15,000 acres (out of Delaware's total 83,000 acres of tidal marshes) of severe saltmarsh mosquito-production habitat identified in the State. The OMWM treatment effects are primarily the permanent installation or restoration of selectively-located ponds and ditches; temporary deposition of a thin layer of excavated spoil; and a long-term, substantial reduction in the need for insecticide use. A major corollary benefit of OMWM is the opportunity to provide or restore more permanent water habitats to marshes that have been dewatered wherever parallel-grid-ditching has been extensive (e.g. the lower St. Jones River marshes). The restoration or compensatory creation of tidal ponds that do not dry-out at low tide substantially restores and

enhances aquatic organism and waterbird habitats in grid-ditched tidal wetlands, in addition to significantly decreasing mosquito production and insecticide use.

Most of the potential OMWM work in the lower St. Jones River tidal wetlands is in salt hay patches or zones, located in narrow bands behind natural creekside levees or along the landward upper fringes of marsh. The design and installation of OMWM systems for the Lower St. Jones River component will carefully consider and accommodate the Reserve's needs and functions for research, education and resource protection.

OMWM planning and implementation in the lower St. Jones River marshes will include, in addition to thorough review and approval by Reserve and NOAA personnel, the normal permit and field reviews by the member agencies of the Delaware Mosquito Control Advisory Committee (i.e. the Army Corps of Engineers; U.S. Environmental Protection Agency; U.S. Fish and Wildlife Service; National Marine Fisheries Service; the DNREC's Sections of Mosquito Control, Wildlife, and Fisheries; and the DNREC's Wetlands and Aquatic Protection Branch). Potential OMWM impacts on cultural resources are monitored by DNREC's Cultural Heritage Program under a Memorandum of Agreement between the Army Corps of Engineers and the Delaware State Historic Preservation Office. OMWM systems would be installed in the lower St. Jones River marshes using the approved OMWM guidelines that the Mosquito Control Section follows statewide in its operations.

At this point in time, the Delaware Mosquito Control Section does not believe that OMWM is needed for the upper Blackbird Creek site, given the physical characteristics of the area and the amount and types of mosquitoes produced.

### **XIII. EDUCATION/INTERPRETATION PLAN**

The Education and Interpretation program along with Research and Resource Protection, are the three main sections planned for the management of the Reserve components. Successful DNERR management depends on the close interrelationship between each of these facets.

These programs broaden the public's understanding of the value of estuarine resources, increase citizen awareness and understanding of estuarine management, problems, and issues, advocate positive environmental practices, and interpret and disseminate useful research results to appropriate decision makers.

#### **ST. JONES COMPONENT**

##### Education Values

The Lower St. Jones River estuary, centrally located in Delaware, could become the focus of state environmental/cultural education efforts regarding estuarine systems. The Lower St. Jones River estuary is located approximately 6 miles from Dover, home of both Delaware State College and Wesley College. The Reserve would be about a one-hour drive from either the Newark main campus of the University of Delaware or from the University's Marine Studies Field Complex in Lewes. Additionally, its central location in the State would provide access to varied estuarine environments for elementary and secondary school groups, necessitating no more than a one-hour commute for almost all Delaware schools.

The component includes the John Dickinson Mansion, home to one of Delaware's colonial leaders and signer of the Declaration of Independence. The site, currently owned and operated by the State Division of Historical and Cultural Affairs, is a major interpretive center offering guided tours of the home and grounds. The plantation is a major tourist attraction and is frequented by school groups from throughout the state. The site was visited by a total of 8,237 people from the period June, 1991 to June, 1992, including 82 groups.

Interpretation at the site focuses on the life of John Dickinson as well as the lifestyle and culture of colonial Delaware and America. The St. Jones River served a crucial role during the Colonial period as a vital maritime link with the outside world.

Town Point, site of the oldest known European settlement in Kent County, is located in the Ted Harvey Conservation Area, a state-owned property adjacent to the DNERR component.

The Lower St. Jones River is especially well suited for educational purposes because of its proximity to the Delaware Bay. The adjacent Little Creek Wildlife Area offers access to

bayfront beaches suitable for interpretive walks, bird watching, seining and other nature-study activities. The Delaware Nature Society facility at Abbott's Mill near Milford is located approximately 15 miles south from the Lower St. Jones River.

The Management Plan includes the construction of a major educational and research center within the St. Jones DNERR component. Similar to the advantages for research efforts, the stationing of DNREC professionals at the Reserve's facilities center could greatly strengthen the operation of the environmental education program. The center will house nature exhibits, aquariums, interpretive displays and literature on estuarine issues, and serve as a base for field tours of the Reserve. Field access facilities such as interpretive trails, boardwalks, and observation towers will be constructed. A center will also serve to complement the existing facilities and exhibits housed at the Dickinson Plantation.

The diversity of habitat, from uplands to tidal marsh and finally beach and open waters of the Delaware Bay, presents a unique outdoor classroom setting and opportunity to provide a holistic view of estuarine systems.

#### **BLACKBIRD CREEK COMPONENT**

##### Education Values

The Upper Blackbird Creek, located in southern New Castle County, is an excellent representative of an inland portion of a Delaware Bay tributary. The headwaters of the creek are formed, in part, by some of the state's most valuable and unique freshwater wetlands. With the focus on freshwater wetlands at the state, regional and national levels, the Upper Blackbird area provides an excellent opportunity to highlight these resources through educational and interpretive programs.

The Upper Blackbird Creek could be utilized as a very convenient field trip site for many of the New Castle County school districts, as well as the Delaware Nature Society (DNS). Over 65% of the State's school children are in New Castle County. DNS contracts with the New Castle County schools in providing environmental education experiences. Students often visit Ashland Nature Center, operated by DNS, for interpretive programs. However, the DNS does not offer a center focused on estuarine or marine environments. In addition, DNS coordinates numerous field trips annually to natural areas throughout the state. There may be many opportunities at the Upper Blackbird Creek component to interact with the DNS for educational programs.

Stream Watch, a volunteer program which instructs citizens how to monitor and test surface water quality, is also coordinated by DNS through a grant provided by the Department of Natural Resources and Environmental Control. Major waterways

throughout the state have been "adopted" by Stream Watchers who report results of visual observations and tests for oxygen levels to DNREC. The Upper Blackbird, as well as the St. Jones River, could provide excellent opportunities for this type of active citizen involvement.

In terms of serving higher education needs, Upper Blackbird Creek is located about equidistant between the University of Delaware's main campus in Newark and Delaware State College and Wesley College in Dover. The Upper Blackbird Creek component offers estuarine habitat types not found near the University of Delaware's Marine Studies Field Complex in Lewes.

The primary education/interpretive center for the Delaware NERR is to be located at the Lower St. Jones River component. However, a modest educational facility might be established at the Upper Blackbird Creek component for visiting school or environmental groups. Such a facility might consist of a secure, one-room building with a permanent exhibit; an open-sided pavilion with tables and benches; and restrooms.

The establishment of DNERR educational/interpretive facilities, with components on the St. Jones River and Blackbird Creek, will be attractive destinations not only for Delawareans, but also for residents of nearby metropolitan centers such as Philadelphia, Baltimore, Washington, D.C. and Norfolk, all within a 150-mile radius of the DNERR.

#### **A. GOALS OF THE EDUCATION/INTERPRETATION PROGRAM**

##### Education Goal

Enhance public awareness, understanding, and wise use of estuarine resources in the Middle Atlantic Region and encourage an environmental ethic among all users.

##### Education Objectives

- \* Promote knowledge of the Reserve, its resources, and its programs as well as knowledge of broader coastal issues and concerns related to estuarine management and protection;
- \* Promote awareness of the National Estuarine Research Reserve System and the values of estuarine/marine protected areas;
- \* Provide educational and interpretive services at appropriate Reserve components directly to students, managers and visiting public;
- \* Use information on past lifeways to make members of the public more aware of the importance of estuarine ecology and to promote balanced use of estuarine resources;

- \* Promote the preservation of historic properties (including archaeological sites, buildings, and structures) through public education efforts;
- \* Provide opportunities for teacher training, student projects, internships, and assistantships where enrollees work jointly with scientists, gain field experience, and learn about the importance of research resources;
- \* Provide appropriate facilities which contribute to educational interpretative, volunteer, and research uses of reserve components; and
- \* Provide an understanding and appreciation for traditional resource uses, such as fishing, hunting, trapping, and boating.

Reserve components will be utilized, where appropriate, as outdoor instructional areas for educational studies in estuarine ecology. The reserve program will help foster a long-term commitment to the restoration and protection of the Delaware Bay system and its resources through education about the Bay system, the problems facing it, and the policies and programs designed to help the Bay by providing opportunities for interpretive, recreational, and leisure activities (hiking, bird watching, canoeing, etc.). These activities will be promoted at appropriate reserve sites where the natural area character of the Reserve and ongoing research will not be adversely affected.

#### **B. FRAMEWORK OF EDUCATIONAL PROGRAMS**

The International Conference on Environmental Education held in Belgrade (1975) and Tbilisi (1972) adopted the following goal:

"To develop a citizenry that is aware of, and concerned about the total environment and its associated problems, and which has the knowledge, attitude, motivations, commitment and skills to work individually and collectively toward solutions of current problems and the prevention of new ones."

We find this goal to be as valid today as when it was first written. Our role as the DNERR environmental education and interpretation program is to further this goal by being a part of a network of delivery systems in the state, nation, and world.

In furthering this goal the Delaware Environmental Legacy Report (1988) indicated that there should be two major environmental education efforts in Delaware, one for developing an environmental ethic in our youth and a second for recognizing that environmental education is a continuing process and should therefore also target adults.

The DNERR program will address both of these environmental education efforts. It can do this first, by recognizing that for

youth in kindergarten through 12th grade the effort should be to develop an awareness and attitude toward responsible environmental stewardship. Second, for adults, continuing education should occur for general public as well as for various selected groups such as the managers, professionals, decision makers, farmers, users, seniors, etc. and for support for higher learning. It should include the development of basic concepts about the environment as well as programming for specific environmental issues.

This program will use the DNERR resource base and participatory involvement to help people understand the interactions and interdependencies between people and the environment. With this knowledge people will understand the consequences of their actions and become motivated to act on them.

It is expected that the DNERR will provide programs which will progress from environmental awareness through environmental understanding to environmental action.

To meet the goals of the education program, both the Blackbird and the St. Jones components will be available for educational activities. The St. Jones component will be the site of the DNERR Education and Research Center and therefore will provide the resources for most of the educational programs.

Environmental education refers to the total environment including natural, cultural, and historical components. This program will include each of these components in its programming. The impact of humans on nature cannot be ignored and for society to solve its problems it must be addressed.

One major purpose of the educational program of DNERR is to provide educational programs that will facilitate the information exchange between the DNERR researchers and the end users and decision makers. It is the role of the educator not only to take the information discovered by the researchers and make the potential users and decision makers aware of this discovery, but also to assure that they have an understanding of the interrelationships involved so that they can then properly act on the discovery.

## **C. TYPES OF PROGRAMS**

### **1. Activities**

Both the Blackbird and St. Jones components will be able to provide a variety of educational opportunities. Activities at each component will be structured to take advantage of that component's resources. Examples of possible environmental education and interpretation programs include:

- \* Guided and self-guided tours that will emphasize natural,

cultural and historical features. Self-guided tours may be available for anyone including general public visitors while guided tours are usually scheduled.

- \* Participatory, interactive, and multi-sensory educational activities.
- \* Archaeological educational activities such as a sample archaeological excavation. These activities are designed to demonstrate the research techniques, as well as showing the continued interrelationships of people with this environment. With careful coordination with professional archaeologists, actual sites can sometimes be used however more commonly a simulated site is developed.
- \* Tours, demonstrations, and talks on research that is being or has been conducted at the Reserve. Researchers have a direct role in the education program and should frequently be involved in conveying this material to the appropriate audiences. Educators also help present research results.
- \* Guided tours and activities in the marsh, river, and bay portions of the estuary. These may use canoes or research and education vessels.
- \* Educational programs that help students understand the use of research procedures or "teach-ins" that may help educate end users or decision makers on estuarine research and systems.
- \* Educational materials, programs, and facilities that will aid institutions of higher learning in their use of DNERR.
- \* Internships for research and for education. The DNERR provides an ideal site for students to intern to develop their research and research application skills. Educational interns with the DNERR Educational Program will have opportunities to work with varied age groups in numerous settings providing an excellent opportunity for professional development.
- \* Teacher training workshops or "in-service" programs will provide teachers the opportunity to become aware of educational resources available to them as well as to continually upgrade teaching techniques. Delaware is currently considering requiring teacher training for re-certification. If adopted, this could create a significant demand for these programs. Most surrounding states in the region already have such a requirement.
- \* Production of interpretive and educational materials such as brochures, newsletters, articles, slide-shows, videos, etc.

- \* Outreach programs on estuarine systems for youth. Bus costs seem to be one of the main reasons why schools limit trips to environmental education sites. Outreach programs of taking the material to the school is often a substitute. In addition, when a school schedules a visit to the Reserve, the outreach program may develop pre-trip and post-trip visits to the school to provide a much more meaningful and complete experience.
- \* Adult programs for DNERR research efforts and findings, resource protection, management and educators can be presented on-site and as part of the outreach program.
- \* Educational program involvement in research efforts. This can often help both activities and will be encouraged where feasible.
- \* Programs (as well as facilities) will be especially developed to be accessible by the handicapped whenever possible. Special consideration will be given to activity location, activity selection, etc. to provide for maximum program accessibility.
- \* Activities emphasizing interaction with the resources such as seining, marsh sampling, bay study, marsh ecology, etc. along with related follow-up laboratory experiences.
- \* Center exhibits to provide an aid to the educational programs.
- \* Wayside exhibits on-site of specific resources to help explain the site, system, or the research being conducted there.

## **2. Exhibits**

The planned St. Jones component of the DNERR includes the John Dickinson Mansion & Plantation. This mansion is operated by the Delaware Division of Historical and Cultural Affairs. Due to the close proximity of the mansion to the DNERR Center and since the John Dickinson plantation historically provided a cultural link to the estuary, the mansion provides an extra opportunity for public accessibility of DNERR educational materials.

The plantation is open to the public daily (except Mondays) and provides public tours of the mansion. It is planned that as a part of DNERR an outbuilding of the plantation will be expanded to include DNERR exhibits. This exhibit theme will be the cultural link between people and the estuary in the past and continue the time to present environmental concerns.

Since the DNERR does not plan to emphasize general public casual visitation at its Center, the plantation exhibits will provide for much of this visitation. An additional benefit of this linkage is in cost savings. The plantation site is already

staffed during normal general public visitation hours including weekends. This will free DNERR education staff for regular estuarine educational programs.

It is expected that exhibits will also be housed at the Education and Research Center. These exhibits are intended to (1) continue the link developed at the plantation site and carry it to present environmental concerns and prevention of environmental problems, (2) support exhibits for the educational program e.g. teaching collections, live collections, concept development, etc., (3) exhibits relating to research being conducted at the DNERR components and (4) related exhibits developed by cooperating agencies.

Longevity of these exhibits are expected to vary greatly with some expecting to be long term support exhibits while others may be short term or seasonal ones.

Wayside exhibits are also planned for both the Blackbird and St. Jones components. These exhibits are located on the site of various resources that should be interpreted. They help viewers identify the items they are observing, understand the systems underlying the resources or may explain the research project under way for that site.

These wayside exhibits are typically fiberglass embedded signs, metal photo signs, or shelters.

### **3. Trails**

Trails will continue to be constructed on both the Blackbird and St. Jones components. Trails can provide for a unique recreational experience, an area for research and educational program access, and for access to and/or between points of interest.

DNERR trails will provide access to the marsh, water, research sites, educational teaching stations, vistas, etc. One trail will be constructed to provide access from the John Dickinson Plantation to the Education and Research Center. Boardwalks will be a necessary part of the trails to provide access over wet areas.

A Greenway trail has been started that will combine efforts from state, county, and city governments, private properties, as well as the DNERR. This function is compatible with the overall purpose of DNERR. The specific impact on the St. Jones component is a trail paralleling the river along the buffer area adjacent to the tidal wetlands. The trail includes boardwalk sections that cross over tidal marsh areas providing access to a small water course for small boats and canoes and education stations over the marsh. Access to this trail will be from the Dickinson Mansion to the Center site, then continuing along the tidal marsh to an historical structure known as Kingston-upon-Hull on the neighboring Fish and Wildlife Logan Lane Tract. The

trail continues through the Wildlife area to the Delaware Bay section of the Reserve.

Trails will be loops whenever possible. This will reduce maintenance costs as well as provide for increased user interest.

Unless specifically authorized, trails will be for pedestrian use only. No bicycle, horse, or motor vehicle use will be permitted without the written authorization of the reserve manager.

#### **4. Individual Components**

##### **a. St. Jones Component**

Since this component will house the Reserve Center, it will be the location for the majority of the education and interpretive programs conducted. The DNERR estuarine educator will operate from this center and will develop site specific programs and materials. Trails, boardwalks, and outdoor teaching stations will be located here and may provide extra facilities for convenient outdoor instruction. Boat docks with access for canoes as well as loading space for a research and educational vessel will also be on this component.

##### **b. Blackbird Component**

This area will emphasize self-guided, self-conducted tours and activities. Resources will be available for schools and other groups to utilize the facilities without the direct supervision of the DNERR education staff. Staff instructed programming will be conducted for this component to provide the appropriate contrasts for portions of an estuary with less salinity.

#### **5. Themes**

The major themes for the DNERR includes reserve awareness, natural resources, estuarine systems, interactions between people and the estuary, and Reserve management.

#### **6. Coordination**

##### **a. Coordination of DNERR**

An Education Coordinator will coordinate education programs for the DNERR. The DNERR Education Coordinator will be the Chief of Interpretive Services who operates educational and interpretive programming from five centers and in locations throughout Delaware. This position will assure coordination of the program with other educational programs, and may be located at DNREC Headquarters as well as operations from the DNERR Center.

An Estuarine Educator will direct the educational efforts at

both the Blackbird and St. Jones components. This position will be housed at the Education and Research Center and will be directly responsible for all interpretation, education programs, special events, etc. for the Reserve. See the Administration Plan for the organizational chart for these positions.

**b. Coordination with the NERR System**

Information publications will be distributed to the other NERR managers around the United States. Interpretive or Educational materials developed will also be made available upon request. Information will be provided to NOAA periodically for NERRS Status Reports. The Reserve Manager will communicate directly and frequently with NOAA for numerous purposes including education.

**c. Coordination with other educational programs**

The education coordinator will coordinate the DNERR education and interpretation program with the educational programs of public and private schools, governmental agencies, private organizations, and colleges and universities in Delaware. This coordination will attempt to further the overall goals of environmental education (mentioned previously) as well as the more specific estuarine educational goals of the DNERR.

There are numerous groups in the state currently involved in these estuarine education efforts. They include:

- Public Schools
- Private and Parochial Schools.
- Department of Public Instruction  
(Science and Environmental Education)
- Department of Agriculture (Project Learning Tree)
- DNREC - various programs
- Conservation Districts
- Delaware Nature Society
- Delaware Audubon Society
- Children's Beach House
- Bombay Hook National Wildlife Refuge
- and more

Colleges and Universities that have expressed interest include:

- Delaware State College
- University of Delaware  
(Cooperative Extension)
- Wesley College

#### XIV. VOLUNTEER PLAN

The Delaware Department of Natural Resources and Environmental Control (DNREC) has through its Divisions utilized volunteers in its programs for more than two decades. Recently DNREC had hired a volunteer coordinator to assist in the recruitment, placement, utilization, coordination, and recognition of volunteers. In addition the Division of Parks and Recreation has developed a volunteer corps for each of its full time interpretive and educational centers. These volunteers assist with conducting programs, staffing centers, maintaining trails, developing exhibits, preparing brochures, and many other facets of center work.

The Reserve is expected to develop a similar corps of volunteers to help with the various aspects of reserve work, assisting with research projects as well as educational volunteers. It has already included trail work, and is expected to include opening and closing the Reserve, security awareness, research efforts and so forth.

It is anticipated that the Department's volunteer coordinator be located in the DNERR Center. This will aid the development of the volunteer corps at the DNERR components by fostering a very close working relationship between staff and the volunteer coordinator.

## **XV. FACILITIES DEVELOPMENT PLAN**

Facilities enhance access and use of Reserves and provide support for education and research programs. The Department of Natural Resources and Environmental Control has a critical need for a facility to locate most of the Department's biologists. The goals and objectives of the DNERR program compliment the Fish and Wildlife scientists needs to better manage estuaries and the activities on adjacent lands that impact them.

### **A. CURRENT FACILITIES**

The most important facility that currently exists is the John Dickinson Mansion and outbuildings including a Visitors Barn located within the St. Jones River component. The facility is operated by the Bureau of Museums and Historic Sites and focuses on the historical and cultural aspects of the John Dickinson Plantation which boundaries nearly coincide with the DNERR St. Jones boundaries.

The only other facilities that currently exist within the Reserve's boundaries are 1300 feet of boardwalk, education stations, and boat dock on the north side of the St. Jones River and a boat ramp, fishing pier and parking lot on the south side of the St. Jones River operated by DNREC.

Other support facilities exist adjacent to the Reserve such as those located at the Logan Lane and Little Creek Fish and Wildlife areas as well as the education and research facilities and equipment located 6 miles from the Reserve at DNREC's headquarters. Some of their values are discussed in other sections, especially the Research plan.

### **B. PLANNING AND DEVELOPMENT FOR FUTURE FACILITIES**

An Education and Research Center is planned to serve as the focus of the Reserve and the facility to accommodate many of the State's field experts in estuarine management.

#### **1. Site Needs**

The first five years of the Management Plan will concentrate on the development of the Education and Research Center, the expansion of the John Dickinson Mansion's Visitors Barn, and associated public access needs such as trails, boardwalks, and boat access.

#### **DNERR EDUCATION AND RESEARCH CENTER**

A survey was sent to approximately 50 agencies, schools, environmental and cultural resource organizations. After interviewing the respondents who indicated an interest in co-locating in an estuarine education and research facility, it was determined that there is a need for a multi-purpose education and research facility of about 30,000 sq. ft. to enable the DNREC to

meet a variety of needs. These same needs also were outlined in the Department's strategic plan.

The facility will be located on the north side of the St. Jones river between the Dickinson Mansion and the Department's Logan Lane Tract. The estimated cost is projected based on Kent County building costs and would include: architectural and engineering costs for an expandable structure, septic, well, interior plumbing, electric, heating and air conditioning, finished interior walls and movable floor to ceiling partitions, ceiling and floors, as well as all site access, parking, and landscaping needs. The building will be in the Mansion's historic zone which will require the portion facing the Mansion to be "historically" in context, while the rear (facing the marsh and the St. Jones River) will be glass, open and highly functional.

The DNERR Center serves two key Department objectives: the need to replace the historic "Stone Tavern" with a modern efficient environmental field research and operations Laboratory; and the need to address the educational program required to develop an "environmental ethic" among all users of our fragile coastal ecosystems.

The Department does not have a facility which will permit the public display of the many programs offered for coastal resource management. The Department's Fish and Wildlife scientists are operating out of a building in excess of 150 years old with some individuals assigned to other remote locations. In addition, a wet laboratory is necessary, particularly for fisheries scientists who operate out of a totally inadequate, poorly functional space in the Tavern. When hazardous chemicals are used, the entire building is at risk of contamination. There is no space available for educational or interpretative needs and demands of academic institutions, public groups and organizations.

The development and operation of a Delaware Estuarine Reserve Education and Research Center provides a forum for collaboration of the State's efforts in Resource Protection, Environmental Education, Applied Research, and Historical and Cultural Preservation. Multi-departmental objectives will be accomplished. The federal NERRS financial and technical assistance will link Delaware's estuarine management efforts both regionally and nationally for the achievements that shared technology will bring.

The DNREC Cultural Heritage Program has conducted an archaeological survey of the facility location, and has recommended that a 19th century tenant house site be avoided. A prehistoric procurement site has also been identified and tested, but the site is entirely within the plow zone, and does not appear to be eligible for listing on the National Register of Historic Places.

The building will be phased with the laboratory wing and central services in Phase One with construction paid by state and federal funding. The State and federal funds will continue to be used for the Second Phase which will include the construction of the Education section and the finishing of offices, public display areas, auditorium, conference rooms, resource library, and other education and interpretation facility needs.

Federal funds are authorized to cost share with State funds at a rate of 70% Federal/30% State for the construction of NERRS facilities. The DNERR Education and Research Center will accommodate many estuarine specialists who will greatly enhance the DNERR and NERRS programs. Some of these specialists that will be located full time at the Center will have job duties outside of the objectives of the DNERR. Therefore, the State will fund the Center at more than 30% of the construction cost based upon a NOAA/State allocation plan.

**CONSIDERATIONS FOR PHASE ONE (Initial Architect's scoping plans)**

**DNERR Management and Operations**

	<u>TOTAL</u>	<u>DNERR</u>	<u>DNREC</u>
- 7 Offices =	700 sqft	400	300
- Library =	1000	1000	
- Storage, Halls, utility, displays, class/conf. rooms restrooms, etc =	3900	3750	150

**DNERR Research**

**Fish & Wildlife Scientists (including DNERR visiting researchers)**

	<u>TOTAL</u>	<u>DNERR</u>	<u>F&amp;W</u>
- Chemistry Lab =	800 sqft	400	400
- Biology Lab =	800	400	400
- 24 Offices =	2000	400	1600
- Storage, halls etc =	2400	1800	600

**DNERR Education**

	<u>TOTAL</u>	<u>DNERR</u>	<u>P&amp;R</u>
- Education Lab =	1000 sqft	1000	
- 8 Offices =	800	300	500
- Storage, halls, etc =	1000	900	100

**TOTAL =**                      14400 sqft      10350      4050

**DNERR FACILITY NEEDS**  
(based on DNERR survey results)

1. A. Display space 1 yes      no    B. Sales area 1 yes      no  
    Occasional Y                      Permanent Y
  
2. Group space
  - A. Conference rooms 2 yes      no ; capacity 50 each seats
  - B. Auditorium 1 yes      no ; capacity 200 seats
  - C. Classrooms 2 yes      no ; capacity 35 each seats
  - D. Library 1 yes      no ; size 800 sq ft
  - E. Outdoor classroom/Lab 4 yes      no
  - F. Amphitheater 1 yes      no ; capacity 200 seats
  - G. Observation
    - a. Deck 1 yes      no
    - b. Tower 1 yes      no
  
3. Office space Y yes      no  
    number of offices 25 ; approximate sq ft 5000  
    (for 50 FTE's; including swing & rental off.)  
    DNREC DM = 7 people (A, PM, EC, AQ, RC, VC, S,)  
    Div. of F&W = 25 people  
    Div. of P&R = 2 people  
    Rental = 12 people (NACD, Wesley, UofD Ag)  
    Swing = 4 people (DNS, SJRWA, other non-profits)
  
4. Laboratory space
  - A. Educational 1 yes      no ; 900 sq ft
  - B. Biological 1 yes      no ; 600 sq ft
  - C. Chemical 1 yes      no ; 400 sq ft
  - D. Visiting scientists 1 yes      no ; 200 sq ft
  
5. Storage space 1 yes      no ; 2000 sq ft
  
6. Dormitories
  - A. Youth      yes X no ; capacity \_\_\_\_\_
  - B. Adults      yes X no ; capacity \_\_\_\_\_
  
7. Outside needs
  - A. Parking 50 spaces ; B. visitors 100 maximum spaces
  - C. Loading dock 1 yes      no
  
8. Location needs (within St. Jones DNERRS Site)
  - A. Water access Y yes      no ; type of boat canoe
  - B. Wooded Y yes      no ; C. Open Y yes      no
  - D. Farmlands Y yes      no
  - E. Wetlands Y yes      no
  
9. Other needs (This is a listing of a variety of needs that may arise - please check all that might be of interest to you. Feel free to add any others.)
  - A. Y Special water purity
  - B. Y Climate control
    - a. Air conditioning Y

- b. Humidity Y
- c. Heating Y
- C. Y Computers
- D. Y Printers
- E. Y Photocopiers
- F. Y Laboratory equipment
  - a. Balances Y
  - b. Microscopes Y
  - c. Ovens Y
  - d. Furnaces Y
  - e. pH meters Y
  - f. Other Water analysis kits; Exhibit lighting; Tissue preparation machine; Walk-in freezer & refrig.;  
Weight scales 300 # cap. wf-lift \_\_\_\_\_
- G. Specialized major equipment such as :
  - a. Carbon-nitrogen-sulfur analyzer Y
  - b. Particle counter Y
  - c. Liquid scintillation counter \_\_\_\_\_
  - d. Electromagnetic current meter Y
  - e. Spectrophotometer Y
  - f. Fluorometer Y
  - g. Other Vacuum filter system; Chemical hood; Cryotome \_\_\_\_\_

---
- H. Small boats :
  - a. Size(length) 18 ft \_\_\_\_\_
  - b. Outboard size(h.p.) 40 \_\_\_\_\_
  - c. Carrying capacity(lbs.) 1800 \_\_\_\_\_
  - d. Primary uses Collection of data; I & E Tours \_\_\_\_\_
- I. Field Hydrological Monitoring :
  - a. Fixed station, continuously-recording tide gauge Y
  - b. Portable water level recorder Y
  - c. Fixed station, continuously-recording current meter Y
  - d. Portable flow meter Y
  - e. Fixed station, continuously-recording salinometer Y
  - f. Portable salinometer, refractometer Y
  - g. Fixed-station, continuously-recording thermometer Y
  - h. Portable dissolved oxygen meter Y
  - i. Portable pH meter Y
  - j. Secchi disks Y
  - k. Water collection bottles(Niskin, Kemmerer) Y
  - l. BOD sampler Y
  - m. Other Fixed station continuously recording dissolved oxygen meter \_\_\_\_\_

- J. Field collection gear :
  - a. Fish seines\_Y\_
  - b. Fyke nets,hoop nets\_Y\_
  - c. Otter trawls\_Y\_
  - d. Benthic grabs,corers,dredges\_Y\_
  - e. Benthic sieves,strainers\_Y\_
  - f. Plankton nets\_Y\_
  - g. Other\_Cannon or rocket nets; Radio telemetry equipment\_

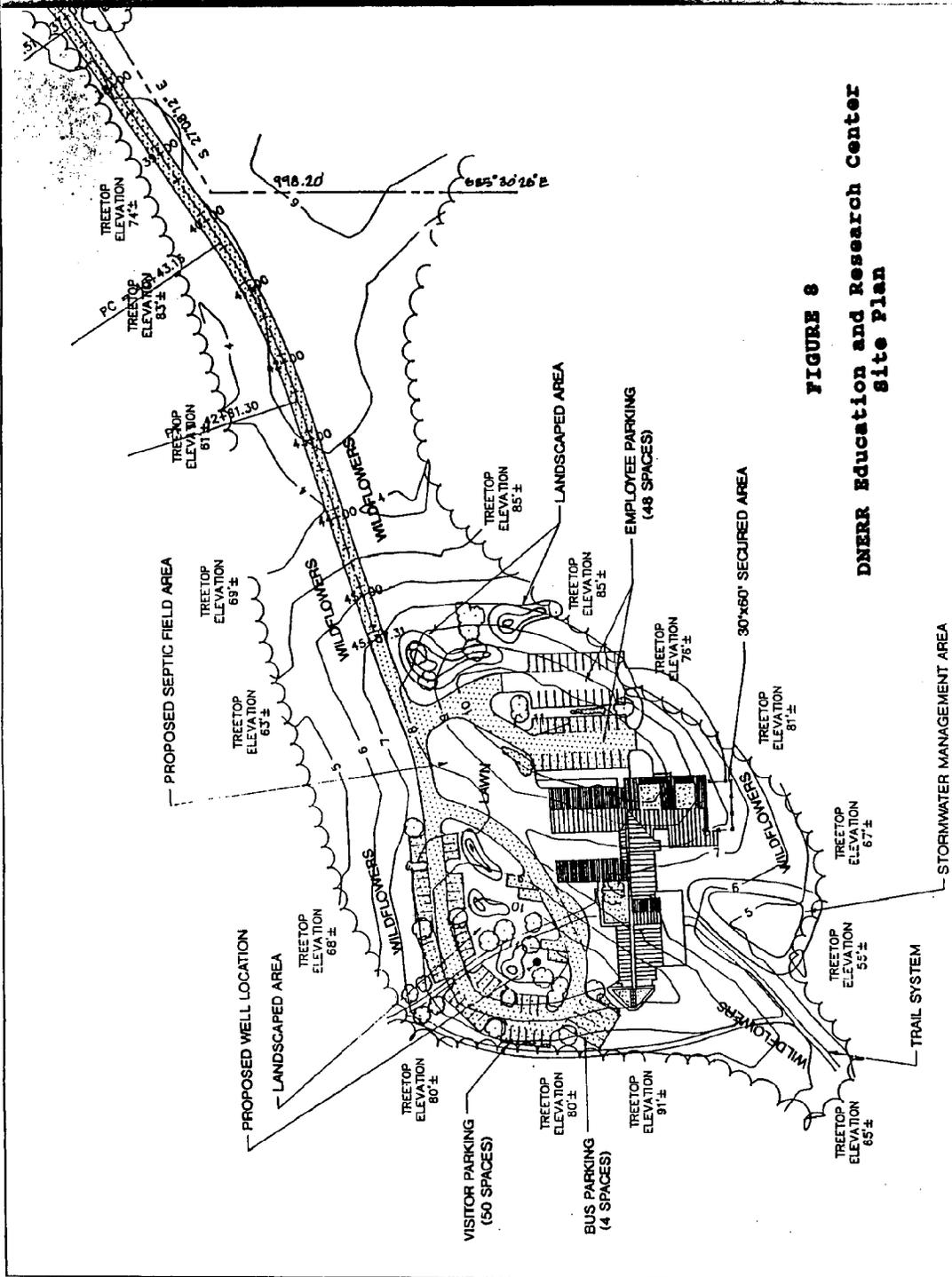
- 
- K. Weather station\_Y\_
  - L. Boat docking facilities\_Y\_;a.dry\_Y\_b.wet\_Y\_c. ramps\_Y\_
    - d.piers\_Y\_
  - M. Aquariums\_Y\_ a.salt\_Y\_ b.fresh\_Y\_
  - N. Plant & animal collections\_Y\_
  - O. Trails\_Y\_
  - P. Shelters\_Y\_
  - Q. Observation blinds\_Y\_
  - R. Information kiosks\_Y\_
  - S. Recreational equipment\_Y\_
  - T. Canoes\_Y\_
  - U. Ranger residence\_Y\_
  - V. Food service\_Y\_
  - W. Kitchen\_Y\_
  - X. Boats\_Y\_
  - Y. Vehicles\_ATV's\_
  - Z. Tractors\_Lawn\_mower\_\_Snow\_removal\_
  - AA. Heavy equipment\_
  - AB. Fuel storage\_Y\_
  - AC. Equipment storage\_Y\_
  - AD. Security\_Y\_;personnel\_Y\_equipment\_Y\_
  - AE. Other\_
- 

10. Comments :

Summary needs of the DNERR Education & Research Center:

22500 sq ft (Common space = halls - 2000; display-1000; sales - 200; auditorium/conf/classrms - 8000; restrms - 400; lobby - 1000; = 14600 sq ft + 9900 sq ft individual needs = offices - 5000; library - 800; ed lab - 900; bio lab - 600; chem lab-400; visitors lab - 200; storage - 2000).

Note: These figures have been modified by an architect's scoping of the Center. Further modifications have occurred during the detail design phase. (see figures 8 - 13 for design phase plans).



**FIGURE 8**  
**DNERR Education and Research Center**  
**Site Plan**

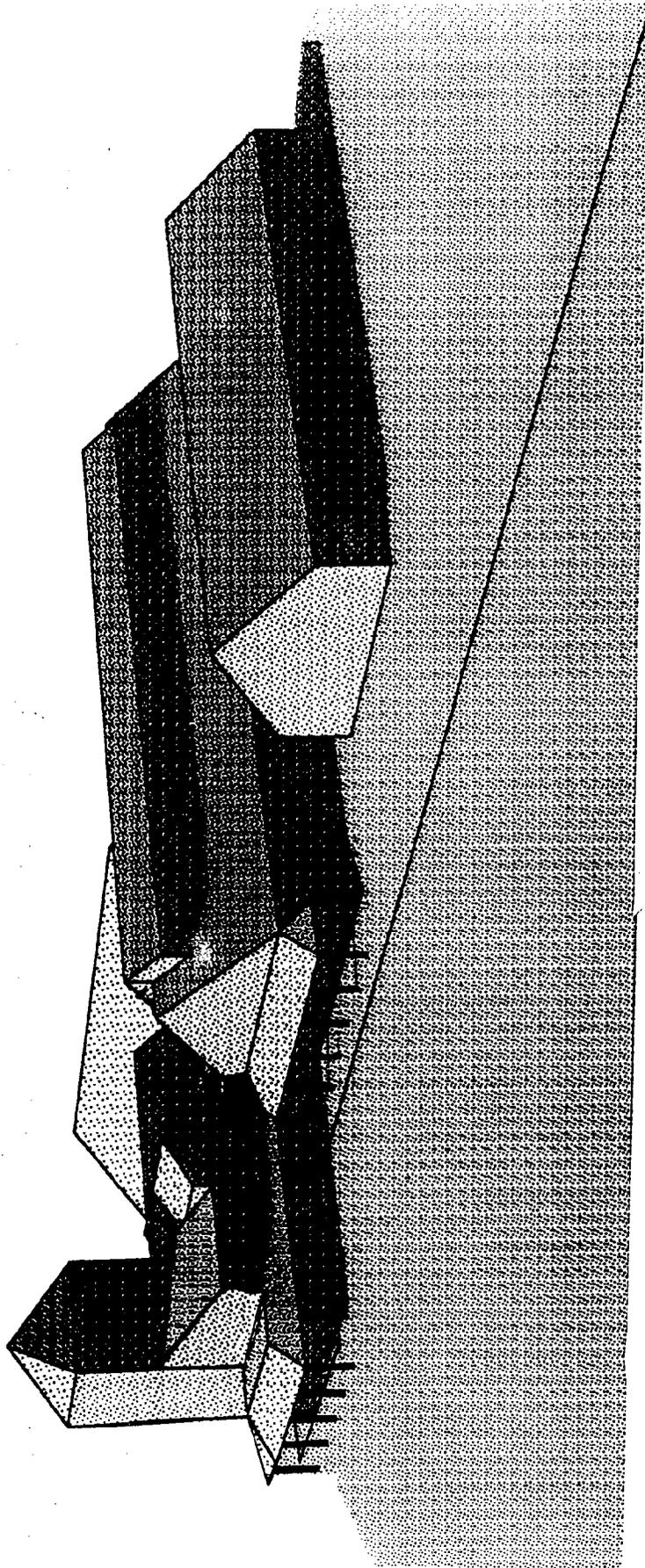


FIGURE 9

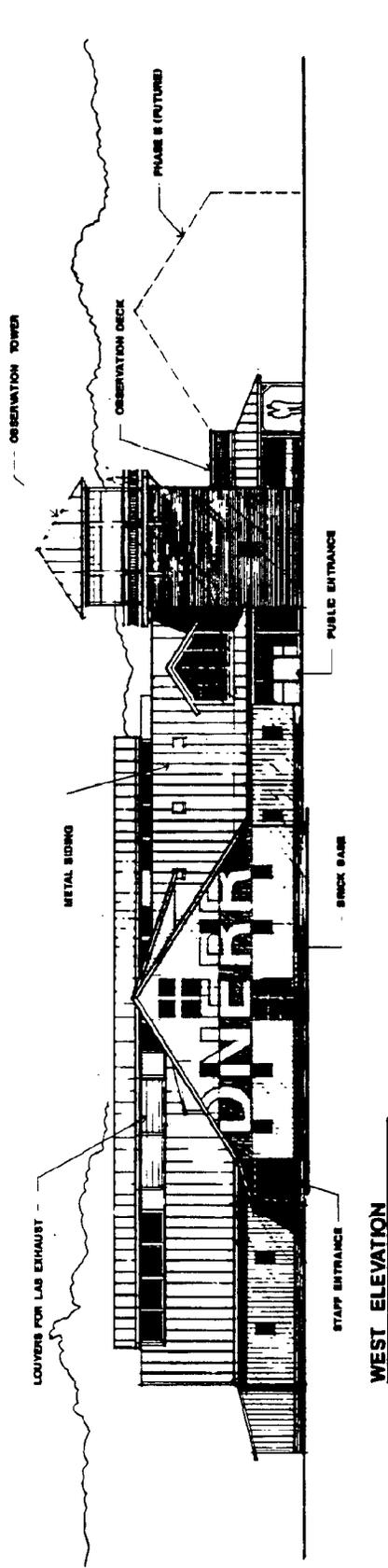
**PHASE I  
D.N.E.R.R. EDUCATION & RESEARCH CENTER  
ST. JONES NECK DOVER, DELAWARE**



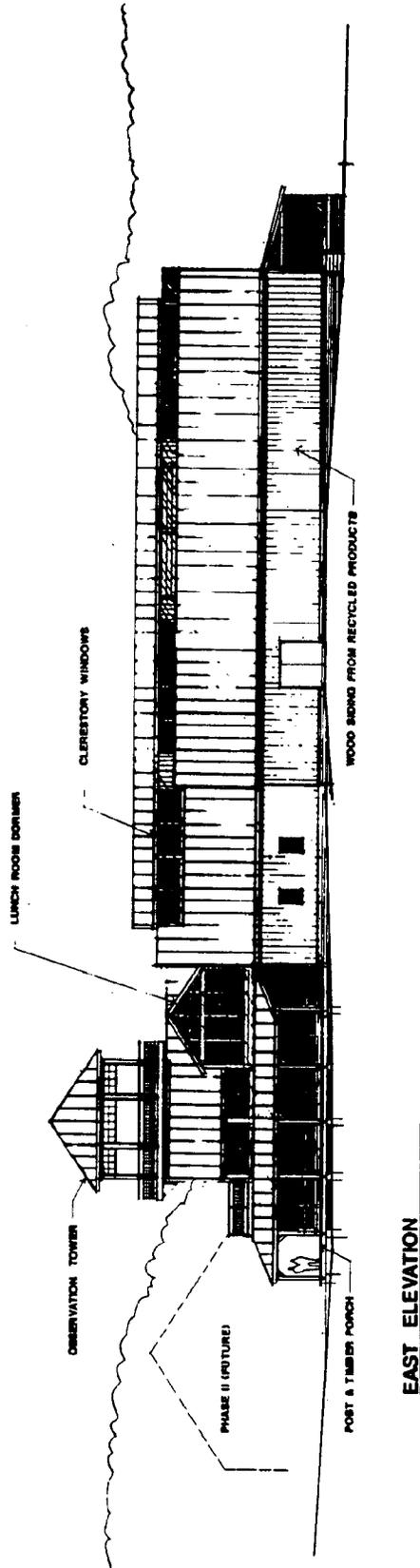
Anderson Brown Higley Associates

A B H A

101 N. Market Street  
Wilmington, DE 19801



**WEST ELEVATION**



**EAST ELEVATION**

**FIGURE 10**



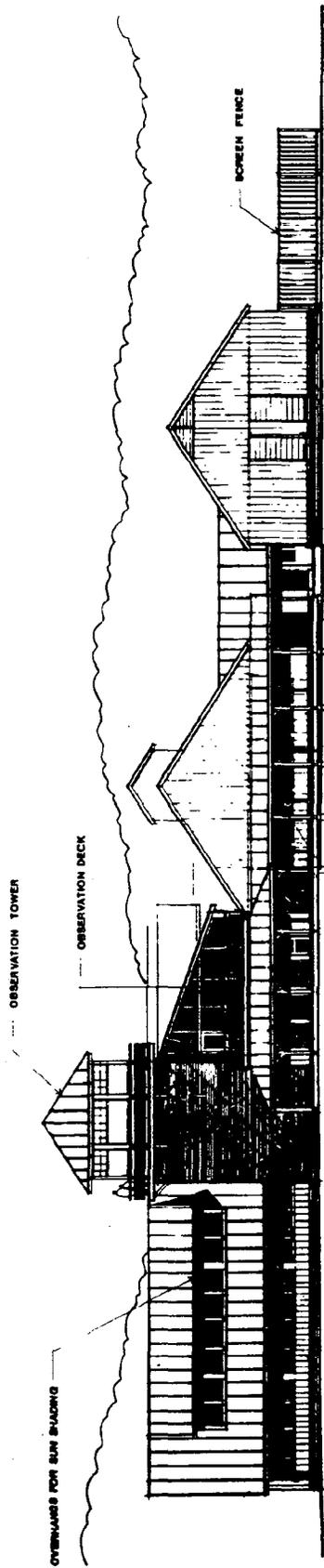
**PHASE I  
D.N.E.R.R. EDUCATION & RESEARCH CENTER  
ST. JONES NECK DOVER, DELAWARE**



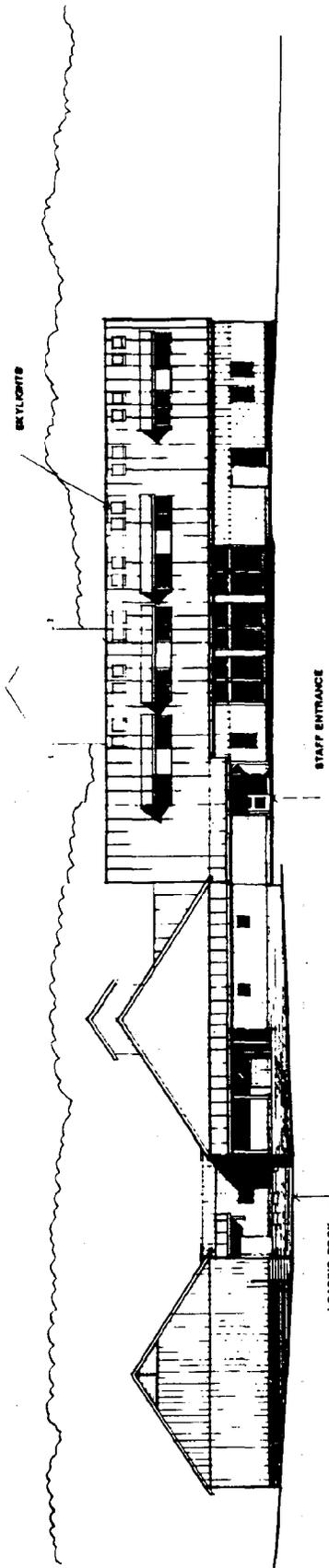
Anderson Brown Higley Associates

A B H

1021 N. Lincoln Road  
Wilmington, DE 19804



**SOUTH ELEVATION**



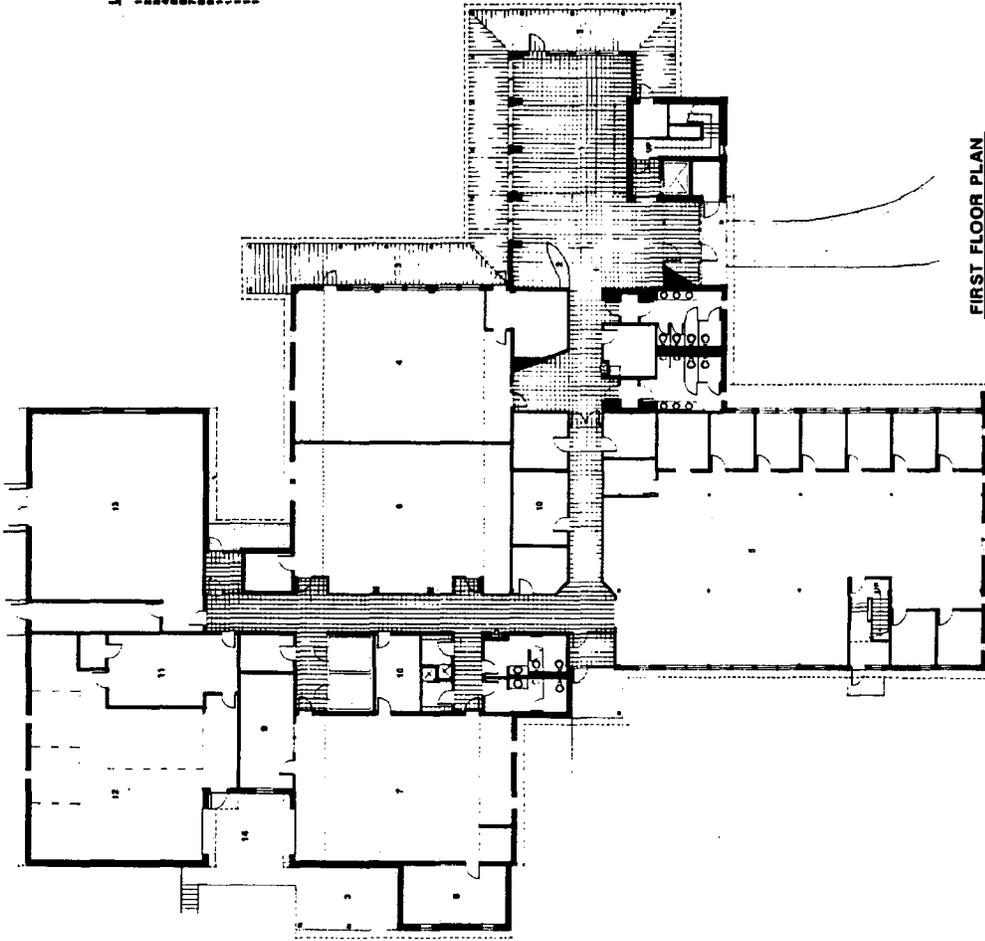
**NORTH ELEVATION**

**FIGURE 11**



Anderson Brown Higley Associates  
 ARCHITECTS  
 1421 N. Lincoln Street  
 Wilmington, DE 19804

**PHASE I  
 D.N.E.R.R. EDUCATION & RESEARCH CENTER  
 ST. JONES NECK DOVER, DELAWARE**



**LEGEND**

- 1. LIBRARY/STUDY DESK
- 2. STUDY
- 3. RECEPTION
- 4. RECEPTION LABORATORY
- 5. RECEPTION LABORATORY
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- 100. RECEPTION LABORATORY

FIRST FLOOR PLAN



FIGURE 12

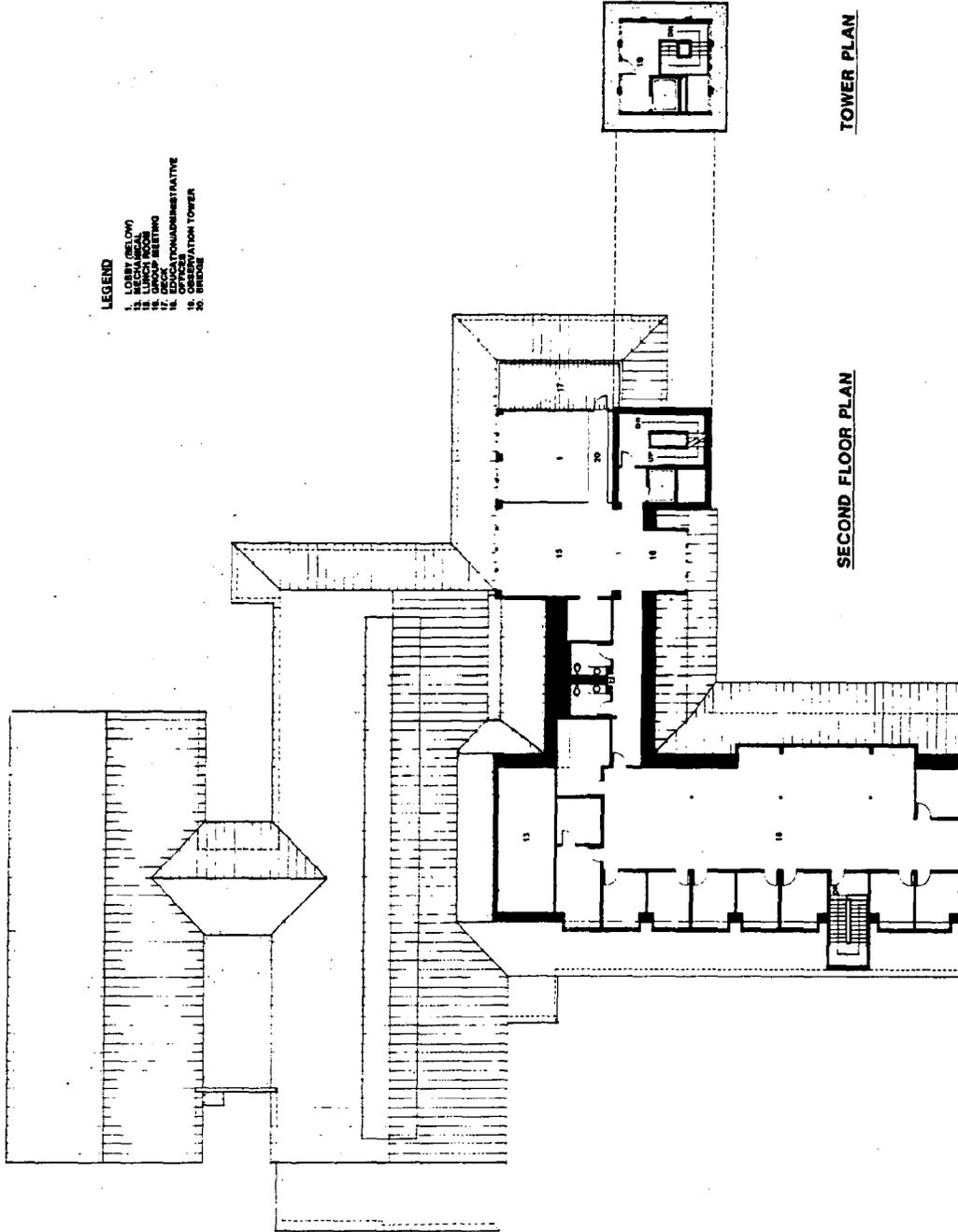
**PHASE I  
D.N.E.R.R. EDUCATION & RESEARCH CENTER**

ST. JONES NECK DOVER, DELAWARE



Anderson Brown Higley Associates

1414 LACKAWANNA  
WILMINGTON, DE 19804

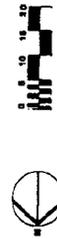


**LEGEND**

- 1. LOBBY (BELOW)
- 2. MECHANICAL
- 3. OFFICE
- 4. LUNCH MEETING
- 5. EDUCATION/ADMINISTRATIVE
- 6. OFFICES
- 7. TOWER
- 8. BRIDGE

**TOWER PLAN**

**SECOND FLOOR PLAN**



**FIGURE 13**

**PHASE I  
D.N.E.R.R. EDUCATION & RESEARCH CENTER**

**ST. JONES NECK DOVER, DELAWARE**



Anderson Brown Higley Associates

1421 N. Lincoln Street  
Wilmington, DE 19804

### VISITORS BARN EXPANSION

The John Dickinson Mansion's Visitors Barn is planned to be expanded to include an area that will be dedicated to the Reserve. The location of the Barn is within the St. Jones component and is ideal for receiving unscheduled visitors. The State Bureau of Museums and Historic sites will present a historical and cultural use of the Reserve with an overview of the estuarine values that have been important to these uses. This will allow the focus of the Education and Research Center to receive scheduled visitors who have particular interests in estuarine management.

### TRAILS, BOARDWALKS AND BOAT ACCESS

The trails of DNERR are the foundation of the Reserve's environmental, historical and cultural education programs. The DNERR has located within its boundaries two greenways of the State's Greenway Program and therefore eligible for funds to plan and construct trails within the Reserve.

The construction of the boardwalk will be by far the most costly of the trail system, however the benefit that the public will receive will exceed the costs and stimulate a much greater appreciation of the extensive trail system that runs through the buffering areas adjacent to this highly productive and culturally rich estuary. The boardwalk design was contracted with the USDA Soil Conservation Service which also included inspection by the SCS to insure proper installation. The boardwalk was designed to meet permit requirements which now call for at least 4 feet of elevation above the marsh sediments. The boardwalk is handicapped accessible, 6 feet wide and includes 2 lower education stations for an intimate experience with the marsh. The boardwalk will also cross a small gut that includes a canoe launching area to access the waterway trails that wind their way through the estuary.

Two brochures with a trail marking system will be developed to initiate the trail user to this environmental/cultural greenway. Both brochures will be available near the Logan House with the DNERR section starting from that point and proceeding to the proposed DNERR Center. When the Center is completed the trail will be reversed.

2. Costs

Education and Research Center

Construction.....	3,518,400
Architecture/Engineering.....	\$ 260,000
Surveying.....	9,000
Testing.....	15,000
Septic.....	41,000
Well.....	25,000
Electricity.....	200,000
Equipment.....	200,000
Telephone.....	25,000
Moving.....	8,000
Furniture.....	100,000
Landscaping.....	20,000
Paving.....	70,000
Misc.....	3,000
Conditional Site Approval.....	600
Planning.....	<u>50,000</u>
TOTAL.....	\$4,545,000

Visitors Barn Expansion

Architecture/Engineering.....	\$ 30,000
Construction.....	185,000
Contingency.....	45,000
Furniture.....	10,000
Displays.....	<u>185,000</u>
TOTAL.....	\$ 455,000

Trails, Boardwalks, and Boat Access

PHASE I - SECTION 2: DNERR E&R CENTER TO KINGSTON-UPON-HULL

UPLAND TRAIL CONSTRUCTION

LENGTH = 6,500 feet

3,000 feet = field edge; 3,500 feet = wooded edge

MATERIALS

stone dust = \$4.70/linear foot x 1500 = \$ 7,000

wood chips = \$1.80/linear foot x 5000 = 3,000

sign posts = \$500

grass seed = \$500

brochures & trail markers = \$ 6,000

EQUIPMENT = \$1,000

FOREMAN = \$1,500

PRISON LABOR = \$500

MISC. = \$500

TOTAL \$20,500

### BOARDWALK TRAIL CONSTRUCTION

LENGTH = 1,300 feet

ENGINEERING = \$6,000

INSPECTION = \$4,000

CONSTRUCTION = \$250,000

TOTAL

\$260,000

### **3. Environmental Assessment and Engineering Report**

The Education and Research Center will be located as close to the tidal wetlands of the St. Jones River as practical (there will be no wetlands disturbance and wetlands will be buffered). In order to achieve this desired location, the structure will be in or near the 100 year flood zone and near the effects of shoreline erosion. The facility will be designed to be located on upland that is currently cleared agricultural lands with a buffer zone that will protect the effects of the projected 100 year migration of the shoreline. The structure will be elevated above the projected 100 year flood elevation.

The Delaware State Historic Preservation Officer has been consulted throughout the process of developing plans for the Center because the Center will be partially visible from the John Dickinson Mansion, a National Historic Landmark. An archaeological survey has been conducted to identify archaeological sites which might be impacted by the construction. Design criteria have been developed to ensure that the Center will not have an adverse visual impact on the Dickinson Mansion. The site plan has been designed to ensure that the 19th century tenant site will be avoided. The DNREC Cultural Heritage Program is in the process of developing documentation to support a finding of No Adverse Effect.

The Center site location is between two runway approaches of the Dover Air Force Base. The Air Installation Compatible Use Zone (AICUZ) study prepared by the Base indicates that the preferred Center locations are not within accident potential zones nor within intolerable noise level areas. Also to be noted that the development of the Center and the operation of the Reserve will not increase hazards to the aircrafts such as increased bird populations that could cause problems to jet engines.

The temporary changes that were caused by the trails, boardwalks, and boat access were the disturbances in wetlands that resulting from the installation of the pilings for the boardwalks. The pilings were driven down to a firm foundation. The equipment traveled on mats causing damages to the vegetation, however no excavation or fill occurred leaving original marsh

sediments at existing elevations, allowing for moisture and nutrient availability for recovery of plant growth. The boardwalk met Dept. of the Army GP-20 permit conditions that allows light access to the disturbed areas under the boardwalk for plant needs.

The need to access water and marsh levels for education and research required lower elevations of platforms than that of the rest of the boardwalk. Sizing and spacing of boards will be installed to maximize light availability to the marsh. Some plant growth may be altered in these areas. This impact to the wetlands will present an opportunity to monitor the effects. Especially valuable may be the ramped docking area that may show changes in plant growth as the boardwalk lowers in elevation. This information should prove to be valuable in supporting the current policies or providing information to improve the decision making process for these types of activities.

The boardwalk may alter the travel patterns of larger mammals such as deer, however the four foot minimum elevation of the boardwalk may be sufficient to allow some travel patterns to continue or to develop.

Increased public access will disturb some of the wildlife, however this may be offset by decreased hunting that has occurred in this area (hunting this close to the DNERR Center will not be permitted).

Equipment required to drive the pilings used mats in order to reduce the potential for elevation changes in the marsh. Traffic across the marsh were confined to the area required to install the boardwalk and kept to a minimum amount of trips.

After completion of the project, the need for traffic on the marsh was reduced by use of the boardwalks.

### C. SCHEDULE FOR CAPITAL IMPROVEMENTS

#### YEAR 1

Education and Research Center	
Design & Engineering.....	\$ 175,000
Trails, Boardwalks, and Boat Access	
Design, Engineering & Construction.....	\$ 280,500

#### YEAR 2

Education and Research Center	
Site Preparation & Construction.....	\$3,529,000
Visitors Barn	
Design & Engineering.....	\$ 30,000

YEAR 3

Education and Research Center  
Construction, Furniture & Equipment.....\$1,016,000  
Visitors Barn  
Site Preparation & Construction,  
Furniture & Displays.....\$ 425,000

**D. MAINTENANCE**

Education and Research Center

Annual Operating Costs

Maintenance.....	\$ 22,200
Energy.....	34,200
Roads & Grounds.....	5,000
Custodial.....	<u>29,400</u>
TOTAL.....	\$ 90,800

Visitors Barn Expansion

Annual Operating Costs

Maintenance.....	\$ 1,000
Energy.....	1,500
Roads & Grounds.....	500
Custodial.....	<u>1,000</u>
TOTAL.....	\$ 4,000

## **XVI. AFFECTED ENVIRONMENT**

### **LOWER ST. JONES RIVER**

#### **A. ST. JONES COMPONENT PHYSICAL ENVIRONMENT**

##### **1. Climate**

Central Delaware has a climate with well-defined seasons. The Atlantic Ocean, Delaware Bay, and Chesapeake Bay exert considerable modifying influence on the climate. Easterly winds off the Atlantic Ocean and Delaware Bay tend to raise the winter temperature and to lower the normal summer temperature. This temperate, rather humid climate is typical of most coastal areas of the Middle Atlantic States.

The warmest period of the year is the last part of July, when the maximum afternoon temperature averages 89 degrees F. Temperatures of 90 degrees or higher occur on an average of 31 days a year. Extremes of 100 degrees or more can be expected 1 year in 4. The coldest period is the last part of January and the beginning of February, when the early morning temperature averages near 24 degrees. The average number of days when the minimum temperature is 32 degrees or lower is 90. Temperatures of 0 degrees or lower can be expected 1 year in 6.

The annual precipitation averages 46 inches. The monthly distribution is fairly uniform during the year. The average seasonal snowfall (October through April) totals 16 inches, with snowfall ranging from only a trace to more than 45 inches. Drought may occur in any season, but a serious drought is most likely in summer. Thunderstorms average 30 days a year with three-fourth occurring between May and August. Tornadoes average only one a year throughout Delaware causing little damage. Hurricanes occur in Kent County about once a year, usually in the period August through October with minor damages. The prevailing winds are from west to northwest most of the year but are more southerly in the summer. The average annual windspeed is about 9 miles per hour, but winds of 50 miles per hour or more accompany severe thunderstorms, hurricanes, and general winter storms (northeasters).

##### **2. Hydrology**

The Lower St. Jones River is tidally influenced, with a mean tidal amplitude at the river mouth of almost 5 feet. (U.S. Dept. of Commerce, 1989). Tidal amplitude is somewhat attenuated upstream in the area of Barkers Landing. River widths within the lower basin typically range from 125 to 200 feet, with channel depths of 5 to 15 feet at low tide.

The expansive tidal wetlands of the lower St. Jones River basin were parallel-grid-ditched for saltmarsh mosquito control during the 1930's, and these ditches were last reexcavated in the

mid-1960's. This grid-ditching radically altered wetlands surface hydrology. While the grid-ditches eliminated some mosquito breeding, the basic engineering concepts of grid-ditching for pest control efficacy were not sound, and today much of the grid-ditched marsh in Delaware must be treated with aerially-applied insecticides and is scheduled for further treatment with newer, more environmentally-compatible techniques having high pest abatement efficacy (e.g. Open Marsh Water Management). Much of the standing water habitat associated with pools and panes of the marsh surface was lost as a result of the parallel-grid-ditches (which were spaced about 150 feet apart). Today, even though the grid-ditches of the St. Jones River basin haven't been recleaned for 25 years, most of the marsh's aquatic habitat continues to be drained at low tide. Almost all tidal wetlands in Delaware have been parallel-grid-ditched, as have over 90% of the coastal wetlands from Maine to Virginia.

The entire St. Jones River watershed drains an area of approximately 54,000 acres of east central Kent County. Fifty-one percent of this drainage basin is agricultural, 11 percent urban, and 38 percent classified as "other" (primarily forest/woodland). Water quality within the Lower St. Jones River is subject to periodic degradation. Depressed dissolved oxygen levels are common to this section of the river during the summer months, possibly due to natural benthic demand or influx of naturally anoxic water from adjoining wetland areas (DNREC, 1988). Base nutrient levels (nitrogen and phosphorous) are considered to be low to moderate. After the advent in 1973 of the Kent County Regional Treatment Plant on the Murderkill River near Frederica, most all discharges of treated or partially treated sewage into the St. Jones River had ceased by the 1980's. However, PCB levels in fish flesh from the St. Jones River has prompted a human health advisory against fish consumption, in effect since 1988. Salinity levels throughout this section vary seasonally, with a typical range between 3 and 20 parts per thousand, dependent upon distance upstream from Delaware Bay and recent rainfall events.

### 3. Geology

The St. Jones component is within the Coastal Plain Province approximately 45 miles south of the Appalachian Piedmont Fall Zone. The Piedmont-type rocks are covered by a thick wedge of unconsolidated and semiconsolidated sedimentary rocks. The oldest and most extensive of these sediments are at the base of the Potomac Formation and are about 120 million years old. It consists of color-banded clays with interbedded sands which eroded off the ancestral Appalachian Mountains. The Magothy Formation was deposited next with its very distinct white sands and black lignite suggesting a transitional environment from stream deposits to marine, much like that found in a delta. Layered on top of the Magothy are marine formations of Cretaceous through Eocene age with the Piney Point Formation being the youngest. Above this is an unconformity which represents a gap in the sedimentary record during which no sediments have been

preserved (Oligocene age). Later, the sea again covered most of Delaware and deposited the Chesapeake Group (Miocene age). This group consists of interbedded silts and sands and reaches a thickness of 400 feet at the St. Jones. Many of the sandy layers contain important supplies of water for municipal and industrial use in the Dover area. The repeated advance and retreat of continental glaciers during the past one to two million years (Pleistocene age) caused drastic changes in relative sea level and the configuration of streams draining from the glaciers. The resultant Columbia Group and Formation consists of channel deposits from meltwater runoff which supplies most of the sands and gravel for construction. Sand and gravel are the most important mineral resources in Delaware with the most potential source for Kent County being in and around the St. Jones component area.

#### 4. Topography

The St. Jones watershed is a plain that slopes gently upward and westward from the Delaware Bay to the Chesapeake Bay watershed at a high of 72 feet creating a gradient of only 4 feet per mile over the length of the 15 mile watershed. At the reserve component the width of the watershed is only 2 miles with a maximum elevation of 20 feet causing only a slightly steeper gradual gradient.

### B. ST. JONES COMPONENT BIOLOGICAL ENVIRONMENT

#### 1. Flora

Much of the area adjacent to the river is vegetated by intertidal persistent emergent wetlands, typically extending 500 to 3500 feet from the river's edge. These wetlands are vegetated primarily by saltmarsh cordgrass, Spartina alterniflora, which is Zone I tidal wetlands as classified in An Atlas of Delaware's Wetlands and Estuarine Resources (Daiber et al, 1976). In the Lower St. Jones River watershed, over 90% of the tidal wetlands are Zone I habitat. Patches of Zone II wetlands, dominated by saltmeadow cordgrass (Spartina patens) and saltgrass (Distichlis spicata) which in combination form the salt hay community, are scattered throughout the higher elevations in Zone I. Big cordgrass, S. cynosuroides, and common reed, Phragmites australis, are found along creekside levees and in the backmarsh near the upland edge. Wetland areas upstream of Rt. 113 at Barkers Landing are vegetated primarily by mixed stands of S. alterniflora and S. cynosuroides. Wetland shrub species (groundselbush, Baccharis halimifolia, and marsh elder, Iva frutescens) also occur in tidal wetland areas of higher elevation. A limited amount of palustrine forested wetlands occur at the head of the numerous tidal creek tributaries to the St. Jones River. Wetland types in the Lower St. Jones River estuary, according to the classification scheme of the USFWS's National Wetlands Inventory, are given in Fig. 14. Some upland agricultural areas are also included within the component.



## 2. Fauna

The Lower St. Jones River site is the focal component of Delaware's dual-component Research Reserve. Its location adjacent to the intensively-managed Ted Harvey Conservation Area gives the area a diversity and abundance of fish and wildlife as great as any area in the State. In addition, the extension of the Reserve boundaries to include an area of nearby Delaware Bay bottom will further complement the diversity of fauna at this component. Based upon surveys conducted on the adjacent State Wildlife Area, nearly 100 species of birds may be found on the Reserve site, including ducks, geese, wading birds, shorebirds, raptors, upland game birds, and song birds. Particular importance is attached to black duck, mallard, gadwall, bluewinged teal, wood duck, bobwhite quail, ringnecked pheasant, American woodcock, mourning dove and recently reintroduced turkey because of their importance as game birds and their occurrence as nesting species in the wetlands and upland fringe. Avian species such as the blacknecked stilt, black tern, American avocet, and black skimmer are relative newcomers to the area, and their occurrence is believed to be closely allied to the construction of impounded tidal wetlands on the Ted Harvey Conservation Area. Many incidental or infrequent visitors have also been observed, and provide an annual attraction for many bird watchers from all over the eastern seaboard. Important raptors that have been seen on the site include osprey, peregrine falcon, Cooper's hawk, red-tailed hawk, rough-legged hawk, Northern harrier (marsh hawk), and great horned owl. In addition, at least 11 species of warblers and over 20 species of shorebirds frequent the site in varying numbers during migration periods. The critical nature of the Delaware Bay shoreline on the east side of the component as foraging habitat for migratory shorebirds, especially during late May and early June when the horseshoe crabs are spawning on the beaches, has led to the designation of this shoreline as part of the Western Hemisphere Migratory Shorebird Reserve Network.

All mammals common to Delaware can be found in the wetlands and forest fringes of the Lower St. Jones River. The white-tailed deer, cottontail rabbit, gray squirrel, raccoon, red fox, opossum, and woodchuck are abundant game animals, while muskrat, mink, and otter are the primary furbearers taken by trappers within the Reserve and adjacent marshes. Hunting and trapping are intensively regulated on the adjacent State Wildlife Areas for public enjoyment, with such activities on the private lands within the Reserve controlled by the property owners. Habitat management within the adjacent State Wildlife Areas has demonstrated successful techniques for maintaining high game populations consistent with an optimum annual harvest.

Many reptiles and amphibians occur on the component. Six species of turtles, several types of snakes, frogs and toads, and salamanders have been found, associated with habitats that range from uplands and forested wetlands to freshwater marshes and tidal ponds. Educational and research opportunities are good for this group of fauna.

The Lower St. Jones River and nearby Delaware Bay bottoms serve as nursery and feeding habitats for many estuarine fish and shellfish. Important commercial and sport fish include white perch, blueback herring, summer flounder, American shad, alewives, menhaden, catfishes, eels, mullet, weakfish, bluefish, and striped bass. Forage and mosquito-predacious fishes are abundant in the main river, tidal creeks and pools, including sticklebacks, sheepshead minnow, bay anchovy, mummichog, and silversides. Both the Lower St. Jones River and adjacent Delaware Bay bottom have historically supported extensive oyster beds which have been seriously depleted in recent years. The blue crab is currently important, both commercially and as a recreational source. There is an excellent opportunity to conduct research necessary to restore or maintain shellfish resources, both at and away from this component.

### **C. ST. JONES CULTURAL AND HISTORICAL RESOURCES**

The St. Jones DNERR component spans the interface between two environmental zones of importance in prehistoric settlement systems. Both the mid-drainage and coastal zones provided favorable settings for large and small settlements, and the diversity of floral and faunal species where these two zones come together provides a particularly rich resource base for hunting and gathering peoples. Sites in this area provide an opportunity to study human adaptation to a developing estuarine environment over more than 8,000 years. In the mid-drainage section of the study area, there is a medium probability of base camps and procurement sites from the Archaic Period (6500 B.C. to 3000 B.C.) and the Woodland II Period (A.D. 1000 to A.D. 1600). There is also a high probability for the entire range of Woodland I Period (3000 B.C. to A.D. 1000) sites. For the coastal segment, there is a medium probability of Archaic procurement sites and a high probability of Woodland I and Woodland II base camps and procurement sites.

A total of 32 prehistoric archaeological sites in the upland areas fringing the marsh along the St. Jones River DNERR component have been reported in the Cultural Resource Survey maintained by the Delaware Bureau of Archaeology and Historic Preservation. In 1978, the entire area was subjected to a reconnaissance level survey conducted by the Kent County Archaeological Society (KCAS), a chapter of the Archaeological Society of Delaware, under a survey and planning grant from the National Park Service. Professional supervision was provided by the Division of Historical and Cultural Affairs (HCA). The survey covered St. Jones Neck (on the north side of the St. Jones River) and the northern portion of Murderkill Neck (on the south side of the St. Jones River). Fieldwork for this survey included controlled surface collection by walking over cultivated fields in parallel transects about 10 meters apart. Each field containing artifacts was assigned a site number. Separate artifact concentrations in each field were defined as subareas and designated by letter.

As a result of this survey, significant archaeological sites

on the north side of the St. Jones River were nominated to the National Register of Historic Places as part of a multiple resource nomination for St. Jones Neck. The boundaries of the St. Jones Neck Historic District have been defined to include historical archaeological sites and buildings which preserve elements of the 18th and 19th century architecture and settlement pattern (see figure 15). Architectural survey south of the St. Jones River has been completed at the reconnaissance level, but evaluation is not complete.

In addition to these location/identification surveys, the area around the Lower St. Jones River component has been included in studies which focused on the development and testing of models for prehistoric settlement. The first of these studies was conducted by the University of Delaware Center for Archaeological Research (Custer and Galasso 1983), and was designed to test non-quantitative settlement models for Delaware's Low Coastal Plain. Site data from this study were used to develop a quantitative predictive model for site location using LANDSAT-generated environmental data (Custer, Eveleigh, and Klemas 1983). This LANDSAT-generated model was then tested in a later study (Gelburd 1988).

In the 1980's two studies were conducted that involved archaeological testing in the St. Jones DNERR component area. A survey of the proposed dualization of Rt. 113 between Little Heaven and Dover AFB was completed by the Delaware Department of Transportation (Cunningham 1980). Surface collections from five sites were reported and two sites were recommended for further testing. Site 7K-F-88 contained prehistoric and 17th century historic components, while site 7K-D-35 appeared to be an early Woodland I microband base camp with intact deposits below the surface.

Further research was carried out by the University of Delaware Center for Archaeological Research at the Barker's Landing site (7K-D-13) in 1983. Testing and controlled surface collections revealed that the artifact assemblage came primarily from mixed plowzone/surface contexts. The types of ceramics recovered however were diagnostic of the early Woodland I period and included Marcey Creek, Seldon Island, and Wolfe Neck wares as well as fragments of stone bowls made from steatite. These ceramics represent a time range from 2000-500 B.C. Concentrations of argillite were associated with adjacent fire-cracked rock concentrations. These features also contained steatite sherds, points and bifaces. The production of usable tool forms from argillite blanks was a major activity and may be related to the production of generalized fish processing tools (Custer 1984:10). The Barker's Landing site was located at the oligohaline boundary, or freshwater/saltwater interface, reconstructed for initial Woodland I times (Belknap and Kraft 1977, Custer 1989:223). The rich estuarine resources along the mid-drainage zone provided a highly predictable environment with a high potential for population growth. Consequently the Barker's Landing site became an important social center for the processing and redistribution of argillite in the early Woodland I exchange network.

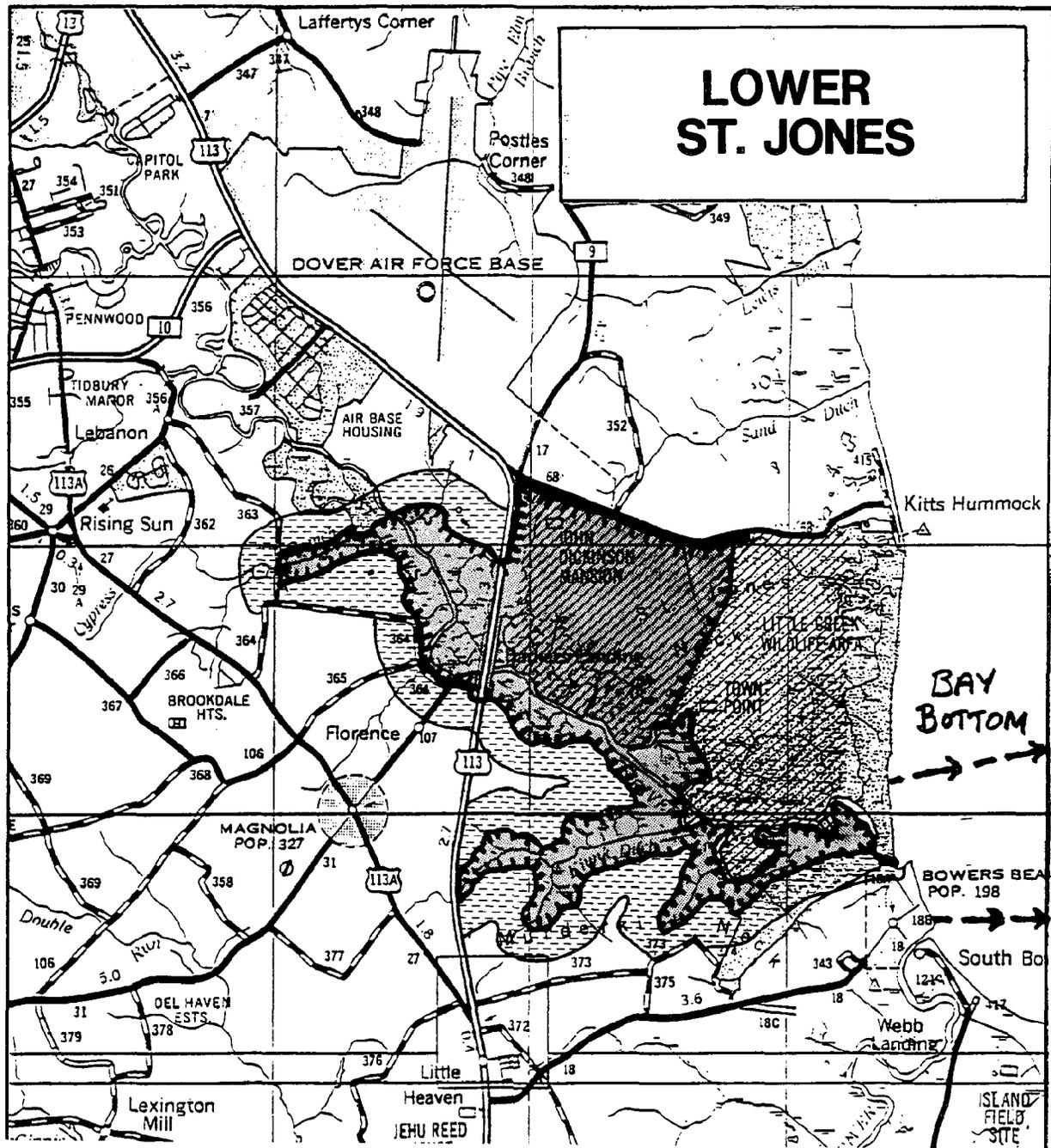


FIGURE 15

Historical and cultural characteristics of the Lower St. Jones River DNERR Component

- ▣ LOWER ST. JONES SITE
- ▨ LOWER ST. JONES NECK HISTORIC DISTRICT
- ▤ ADJACENT PRIVATE UPLAND

A review of site locations and existing collections from Murderkill Neck on the south side of the St. Jones was conducted by the Delaware Department of Natural Resources and Environmental Control (DNREC) in 1991 in order to provide a more complete evaluation of cultural resources from both sides of the St. Jones DNERR component. This review focused on the mapping and identification of prehistoric site collections from the 1978 KCAS study. Colonial period historic collections, often from the same locations as prehistoric sites, are currently undergoing analysis by Charles Fithian, Curator of Archaeology at the Island Field Archaeological Museum and Research Center. These historic period collections indicate intense occupation beginning in the last quarter of the 17th century.

The majority of the sites are multi-component micro-band base camps. Base camps included ceramics and a variety of stone tools, while procurement camps were more limited in the variety of tools and included no ceramics. At least 20 base camps and 10 procurement sites are present in the study area, while 2 site locations were based on information from local collectors with no other information available. Sites 7K-D-12 and 7K-D-13 are contiguous and represent the only macro-band base camp within the St. Jones DNERR component. Artifact concentrations and features from this site complex were scattered over a half mile wide area. No other sites are as extensive.

Based on the available surface collections, no sites produced any reliable projectiles diagnostic of the Archaic time period (6500-3000 B.C.). Site 7K-D-35 did produce an Eshback point which may be one of the earlier point styles found on St. Jones Neck. A total of 24 sites produced ceramics or projectile points diagnostic of the Woodland I period (3000 B.C. to 1000 A.D.), while 21 sites produced artifacts diagnostic of the Woodland II period (1000 A.D. to 1600 A.D.). A total of 6 sites were undefined as to temporal period because of the limited size or absence of the collection.

Because the Woodland I period spans so large a time period it is useful to separate this period by diagnostic changes that were occurring in the cultural complexes. These changes are most readily identified by differences in the methods of producing ceramics through time. The early Woodland I, or Barker's Landing complex (2000 to 500 B.C.) is identified with the use of steatite bowls or steatite tempered ceramics. Twelve sites included ceramics or stemmed points diagnostic of the early Woodland I period. This includes 7K-D-6, 7K-D-12, 7K-D-13, 7K-D-35, 7K-D-42, 7K-D-45, 7K-D-47, 7K-D-48, 7K-D-52, 7K-F-13, 7K-F-81 and 7K-F-97. The Barker's Landing site (7K-D-13) was a large macro-band base camp located at the oligohaline boundary c.a. 2000 B.C.. The remaining sites appear to be micro-band base camps.

The Wolfe Neck (500 B.C. to 0 A.D.) and Carey (0 A.D. to 500 A.D.) complexes appear to witness a slight contraction in the number of sites occupied. A total of six sites produced Coulbourn, Wilgus or Nassawango types of ceramics attributed to the Wolfe Neck complex (7K-F-21, 7K-F-81, 7K-F-93, 7K-D-45, 7K-D-47, and 7K-F-86). Eight sites produced Mockley ceramics

characteristic of the early Carey complex (7K-F-13, 7K-F-88, 7K-F-93, 7K-F-96, 7K-F-84, 7K-F-86, 7K-D-45, and 7K-D-47). Macro-band base camps for these respective complexes were relocated two and three miles further upstream as the freshwater/saltwater interface continued to move inland.

The Late Carey (500 A.D. to 1000 A.D.) complex brought a resurgence in the number of sites occupied in the Coastal Zone. A total of eleven sites produced Hell Island ceramics associated with this complex. These sites are 7K-D-6, 7K-D-47, 7K-D-48, 7K-D-58, 7K-F-13, 7K-F-21, 7K-F-81, 7K-F-88, 7K-F-86, 7K-F-93, and 7K-F-96. No macro-band base camps have been found located anywhere on the St. Jones River for this time period, or for that matter, in Kent County. Custer (1989:295) has interpreted the change in settlement patterns for the Late Carey complex as one of groups choosing fission over the social investment and controls necessary for further political evolution. Many questions remain to be resolved as to the ties and relationships between these groups. In particular, what were the critical factors that allowed expansion of social groups into the coastal zone again?

The Woodland II period (1000 A.D. to 1600 A.D.) continued the same pattern of population growth in the Coastal zone that had begun during the Late Carey complex. A total of 21 sites produced triangular projectile points or ceramics identified with this period of occupation. Of these sites, 16 included Townsend, Killens, or Minguanon ceramics; however twelve sites produced both the ceramics and diversity of tools associated with base camps. These were 7K-D-6, 7K-D-12, 7K-D-13, 7K-D-45, 7K-D-47, 7K-D-48, 7K-F-86, 7K-F-88, 7K-F-21, 7K-F-93, 7K-F-13 and 7K-F-96. A few small macroband base camps are located on the St. Jones River during the Woodland II period, but most of the larger sites of this time span are located further south along the rivers of the coastal zone. Settlement changes for this period included the disappearance of previous lithic exchange systems, the development of sedentary, or village lifestyles, and the appearance of agricultural food production.

While these studies have served to locate and identify a large number of prehistoric and historic archaeological sites, little has been done to study these sites in detail. None theless, it is clear that the prehistoric sites along the St. Jones River provide an opportunity to study human adaptation to a developing estuarine setting over more than 8,000 years. Ecological information preserved in datable archaeological contexts in these sites can contribute to a greater understanding of manner in which the St. Jones estuary developed. The historic period sites include the earliest settlements in Kent County (e.g. Kingston-Upon-Hull, Town Point), and offer an opportunity to study the early period of European settlement away from population centers such as New Castle and Philadelphia. The John Dickinson Plantation and Mansion, on the north side of the St. Jones River and east of Rt. 113, is within the boundaries of the DNERR. The mansion, furnished with antiques, was the childhood home of John Dickinson (1732-1808), "Penman of the American Revolution." The outbuildings and landscaping are done to

recreate the property as it was in the early 19th century, and as such the complex is a significant educational and tourist center. These sites also offer an opportunity to study the development of historic patterns of estuarine exploitation.

#### D. ST. JONES ZONING AND LAND USE

All zoning and land use in the Lower St. Jones River component is Agricultural-Conservation, with exception of an adjacent parcel of 306 acres which is zoned Industrial-General, owned by a sand-and-gravel excavation business, west of Rt. 113 and on the river's north side. This one exception to the Agricultural-Conservation zoning is shown by cross-hatching in Fig. 16. A conditional use permit for operation of a borrow pit for sand-and-gravel excavation was granted by Kent County Levy Court in January, 1990, for the upland area of the 265-acre parcel adjacent to the eastern side of the Industrial-General property. Another borrow pit application for a property west of Rt. 113 but on the south side of the river was not approved by the County in January 1991. All future requests for borrow pit operations in Kent County have been suspended from consideration until the County formulates and implements new regulations for the siting and operation of borrow pits.

The two borrow pit operations will be completely outside of the maximum boundaries identified for the St. Jones component. Only the wetlands and buffering woodland edge portions of the Industrial-General zoned parcels have been considered for inclusion in the Reserve. Sand and gravel operations will not be allowed within the State controlled Reserve.

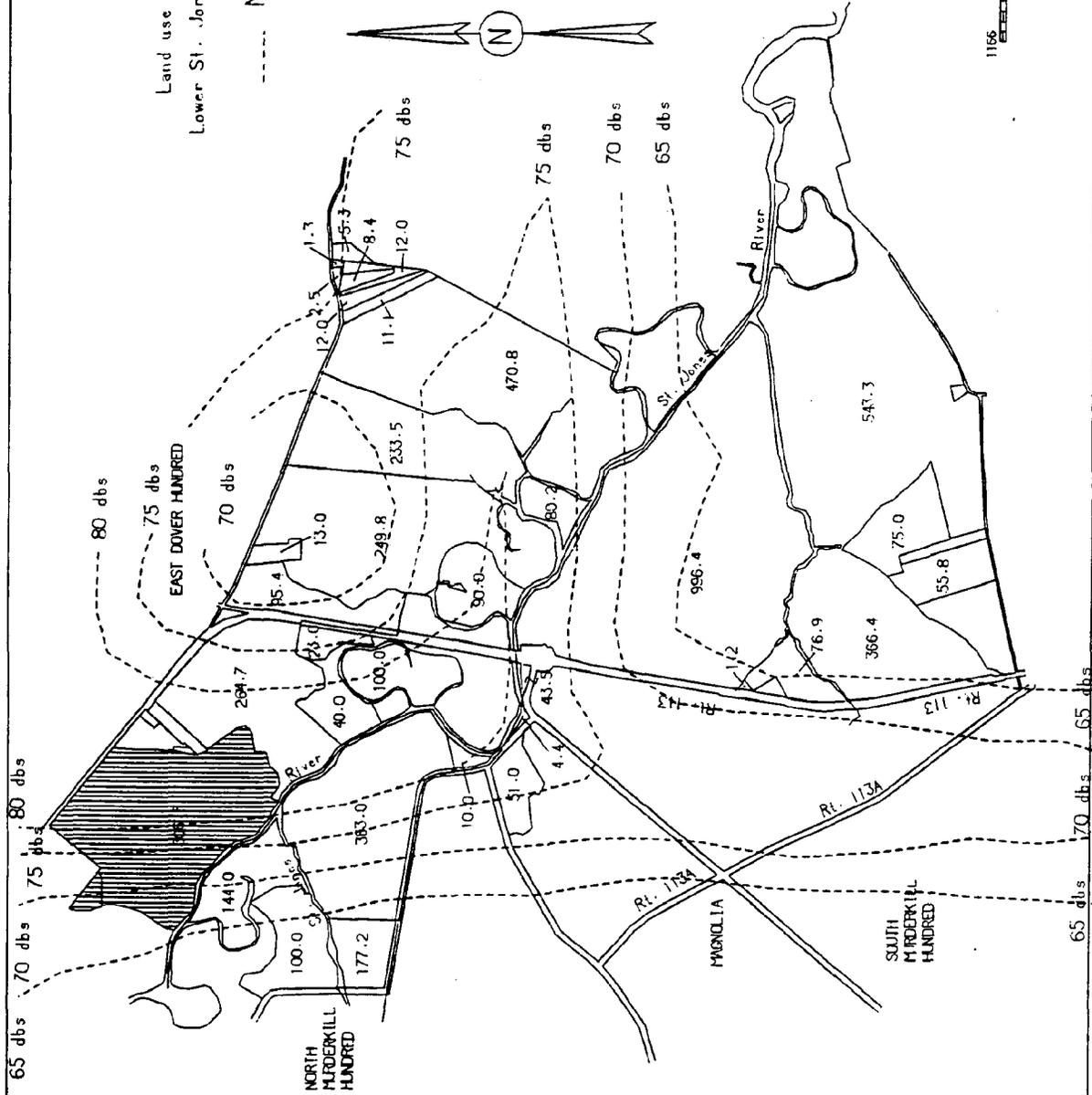
Two considerations that have been addressed for the Lower St. Jones River area are flight paths and noise levels of aircraft taking-off or landing at Dover Air Force Base. Only a very small portion of the DNERR component's buffer area is within the "Accident Potential Area" identified by the Base, and all of this area within the component is west of Rt. 113. An upland area within the Reserve boundaries east of Rt. 113 and on the north side of the river is the location for a education and research center and support facilities, and is within Noise Contours of 70 - 75 db (greater than 75 db is considered a "High Noise Zone") as identified by the Base (see Fig. 16). However, this noise level is similar to that heard by the staff and visitors of the Dickinson Mansion and current Visitors center. Measures to achieve noise level reductions of at least 35 db will be incorporated into the design and construction of structures where the public is received or in noise sensitive locations such as classrooms or research environments.

The predominance of the Agricultural-Conservation zoning over several thousand acres of the component, with the agricultural flavor that this imparts throughout the lower St. Jones River basin, in conjunction with consideration of air traffic patterns from Dover Air Force Base in terms of facilities sitings, should be conducive to and permit operation of a NERRS program in the Lower St. Jones River estuary.

FIGURE 16

Land use and zoning within the  
Lower St. Jones River DNERR Component

----- Noise Contours



LOWER ST. JONES

Scale In Feet

1166 0 1166 2332 3498 4664 5830 6996 8162

## **E. ST. JONES TRADITIONAL USES**

The Lower St. Jones River estuary has a rich, intensive tradition of consumption of renewable natural resources that must be recognized and accommodated by the DNERR program in development of the Management Plan. Waterfowl hunting, upland game hunting, muskrat trapping, and commercial fisheries (e.g. crab and eel potting, gill netting) all occur within the main channel of the St. Jones River, its tributaries, or throughout the contiguous wetlands. The recreational fishing pier at the State-owned St. Jones River Access Area (on the south side of the River, west of Rt. 113 at Barkers Landing) is used by local citizens primarily for crabbing and fishing for white perch and catfish. A private trap-and-skeet shooting club leases several acres of upland fringe and tidal wetlands adjacent to the Rt. 113 bridge, just to the east of the bridge on the south side of the River. These and other traditional outdoor activities should be accommodated by the Reserve program.

## **UPPER BLACKBIRD CREEK**

### **A. BLACKBIRD COMPONENT PHYSICAL ENVIRONMENT**

#### **1. Climate**

The Blackbird Creek component has a humid, continental climate that is modified by the Ocean and Bays. The component is only 20 miles north and along the Delaware Bay coast from the St. Jones component and experiences similar climatic conditions as that described for the St. Jones.

#### **2. Hydrology**

Much of the upper Blackbird Creek is tidally influenced. The mean tidal amplitude at Taylors Bridge is almost 3 feet (U.S. Dept. of Commerce, 1989). The most landward reaches of this upper segment are non-tidal. Typical creek widths within the upper creek range from 150 to 200 feet in the tidal section, to only several feet wide in the non-tidal areas nearer the headwaters. Salinities range from 0 ppt (freshwater) in the headwater areas to as high as 7 ppt at the lower end of the Reserve at Taylors Bridge (salinities at the mouth of Blackbird Creek connecting to Delaware Bay may go as high as 10 ppt). Water depths in Upper Blackbird Creek range from over 15 feet deep in the center channel at high tide near Taylors Bridge, to less than two feet in the upstream center channel at low tide. The upper Blackbird Creek is often characterized by wide mudflats in the creek corridor at low tide. Emergent intertidal wetlands dominate the areas along the tidal section of the creek. Wetlands edges along the non-tidal section of Blackbird Creek are dominated by palustrine forested wetlands.

The entire Blackbird Creek watershed has a drainage area of about 20,000 acres. Fifty-one percent of the basin is considered agriculture, 1% urban, and 48% "other" land uses (mainly forested). Basic water quality within the Blackbird Creek system is considered good. Bacteria levels are, however, sometimes considered excessive, apparently due to non-point sources (DNREC, 1988). Nitrogen and phosphorous are considered to be present at low to moderate levels.

The Upper Blackbird Creek is a relatively undisturbed section of a large, tidal wetlands system fringed by oak-beech-maple forest and open farmland. Waters of the Reserve vary in salinity from 0 ppt at the inland extreme to 7 ppt at the seaward end at high tide during low rainfall periods.

### 3. Geology

The Blackbird component is within the Coastal Plain Province approximately 25 miles south of the Appalachian Piedmont fall Zone and displays essentially the same geological characteristics as that described previously for the St. Jones.

### 4. Topography

The Upper Blackbird Creek watershed slopes gently upward and westward from the Delaware Bay to the Chesapeake Bay watershed at a high of 82 feet creating a gradient of 16 feet per mile over the length of the 5 mile watershed. At the reserve component the elevation varies from 0 to as much as 57 feet in as little as a quarter mile with gently rolling slopes for approximately 2 miles to the extent of the watershed.

## B. BLACKBIRD COMPONENT BIOLOGICAL ENVIRONMENT

### 1. Flora

The wetlands vegetation of the Upper Blackbird Creek estuary is characterized by two major zones as classified in An Atlas of Delaware's Wetlands and Estuarine Resources (Daiber et al, 1976). Zone I covers the easternmost seaward quarter of the component. This zone, known as the saltmarsh cordgrass marsh, is dominated by saltmarsh cordgrass (Spartina alterniflora). This stout, erect grass occurs as a tall-form near the water's edge, with a smaller dwarf-form behind it extending to the level of mean high water. Some fringes of this zone have common reed (Phragmites australis). Other associated species found at slightly higher elevations are saltmeadow cordgrass (Spartina patens), big cordgrass (Spartina cynosuroides), salt grass (Distichlis spicata), salt wort (Salicornia spp.), high tide bush (Iva frutescens), and groundsel bush (Baccharis halimifolia).

Most of the lower Blackbird Creek estuary has been overrun by phragmites, forming a dense, monotypic cover over vast expanses of wetlands. This incursion has also occurred upstream into some of the more seaward portions of the Reserve component.

The upper landward 3/4 of the component is characterized by the highly diverse Zone V transition marsh. No single species dominates this transition zone; it is a varied mixture of species grading from the cordgrass marsh to a freshwater marsh. Species found in this zone are saltmarsh cordgrass, big cordgrass, common reed, marsh mallow (Hibiscus palustris), three-squares (Scirpus spp.), cattails, (Typha spp.), wild rice (Zizania aquatica), arrow-arum (Peltandra virginica), pickerel weed (Pontederia cordata), and salt-marsh water hemp (Acnida cannabina). This area often has extensive mudflat habitats exposed within the creek corridor at low tide.

The upland fringe included in the component is a mixture of shrub and tree species. Typical of this area are white oak (Quercus alba), southern red oak (Quercus falcata), post oak (Quercus stellata), loblolly pine (Pinus taeda), red maple (Acer rubrum), sweet gum (Liquidambar styraciflua), American holly (Ilex opaca), black cherry (Prunus serotina), sassafras (Sassafras albidum), flowering dogwood (Cornus florida), tulip poplar (Liriodendron tulipifera), arrowwood (Viburnum spp.), and blackberry (Rubus spp.).

The wetlands types of the Upper Blackbird Creek according to the USFWS's classification scheme (National Wetlands Inventory) are given in Fig. 17.

While not part of the Reserve, the non-estuarine wetlands west of Rt. 13, further upstream of the Reserve, are interesting habitats for study, particularly in terms of their unique biotic assemblages and their unknown interactions with downstream, estuarine areas. Much of this non-tidal palustrine wetlands habitat is found in Blackbird State Forest and in other forested areas south of Townsend, all within about 5 miles from the center of the Reserve. While most of the wetlands of this area are dominated by maple-gum associations, there are dozens of Delmarva Bays scattered throughout this region. These topographic swales or depressions, none larger than a few acres, are wetlands unique in terms of their geology, hydrology, and biota.

## 2. Fauna

Its isolation from human disturbance, diverse freshwater food plants, and abundant aquatic invertebrate populations make it an attractive waterfowl breeding area. Black duck, mallard and wood duck are among the most common nesting species. During the spring and fall migration periods, extensive use is made of the area by most waterfowl in the mid-Atlantic region, including Canada geese, greenwinged teal, bluewinged teal, gadwall, pintail, wigeon and shoveler. Because of the habitat's particular importance to black duck, its protection from further degradation will help to maintain a species of special concern. Wading birds, shorebirds, and raptors also frequent the area for breeding, migration, feeding and resting. The most common species include great blue heron, great egret, snowy egret,



glossy ibis, yellowlegs, sandpipers, kestrels, marsh hawk, osprey and bald eagle. During a site selection field trip in April, 1990 to the Upper Blackbird Creek, a pair of bald eagles was seen perched in a tall tree on an island in the middle of the Reserve. They have since become residents of the reserve and the pair are one of seven pairs of bald eagles nesting in Delaware. Because of the inland location from the open tide marsh, use by most wading birds and shorebirds may be limited, but the extent of use of the broad mudflats at low tide is unknown at present. The area is probably of high importance to raptors because of its remote location and abundant prey populations. Numerous species of passerine birds also utilize both the wetlands and surrounding forest for food, cover and nesting.

Almost all mammals common in Delaware are found in the wetlands and wooded fringe of this component. The forests support deer, fox, raccoon, skunk, opossum, rabbit and squirrel, while large numbers of muskrat occur in the brackish and freshwater wetlands, together with beaver and river otter in lesser numbers. Trapping of furbearers, and waterfowl and deer hunting, are popular activities that annually remove a harvestable surplus. An excellent opportunity to view and photograph wildlife is afforded by a canoe trip down this very beautiful waterway.

The Blackbird Creek estuary provides important nursery and feeding habitat for several species of fish including white and channel catfish, weakfish, hogchoker, white perch, black drum, bay anchovy, menhaden, spot and eels, together with a diversity of benthic organisms including blue crabs. Sport fishing is also a popular activity at this component for species such as white perch, carp, yellow perch, and catfish. In the more landward recesses of the Reserve, where the waters are essentially fresh, the following fish species are frequently encountered: American eel, eastern mudminnow, redbfin pickerel, golden and spottail shiners, creek chubsucker, pirate perch, brown bullhead, white and channel catfishes, yellow perch, white perch, pumpkinseed and bluegill sunfishes, and tessellated darter. These fish populations and waterfowl both make use of numerous aquatic insects found here, including members of the families Corixidae, Notonectidae, Dyticidae, Gyrinidae, Gerridae, and Chironomidae. Numerous snakes, turtles, frogs and toads, and salamanders are resident of the component, utilizing both aquatic and terrestrial environments.

The Upper Blackbird Creek component represents a tidal brackish and freshwater habitat differing in estuarine plant and animal communities from the Lower St. Jones River component. As such, it offers unique and specialized opportunities for research, education, recreation and management. Its inclusion in the Delaware NERR System ensures representation of a broad group of estuarine habitats ranging from fresh to saline.

### C. BLACKBIRD PREHISTORIC AND HISTORIC RESOURCES

The Upper Blackbird Creek DNERR component spans the interface between two environmental zones of importance in prehistoric settlement systems. Both the mid-drainage and coastal zones provided favorable settings for large and small settlements, and the diversity of floral and faunal species where these two zones come together provides a particularly rich resource base for hunting and gathering peoples. Sites in this area provide an opportunity to study human adaptation to a developing estuarine environment over more than 8,000 years. In the mid-drainage section of the study area, there is a medium probability of base camps and procurement sites from the Archaic Period (6500 B.C. to 3000 B.C.) and the Woodland II Period (A.D. 1000 to A.D. 1600).

There is also a high probability for the entire range of Woodland I Period (3000 B.C. to A.D. 1000) sites. For the coastal segment, there is a medium probability of Archaic procurement sites and a medium to high probability of Woodland I and Woodland II base camps and procurement sites.

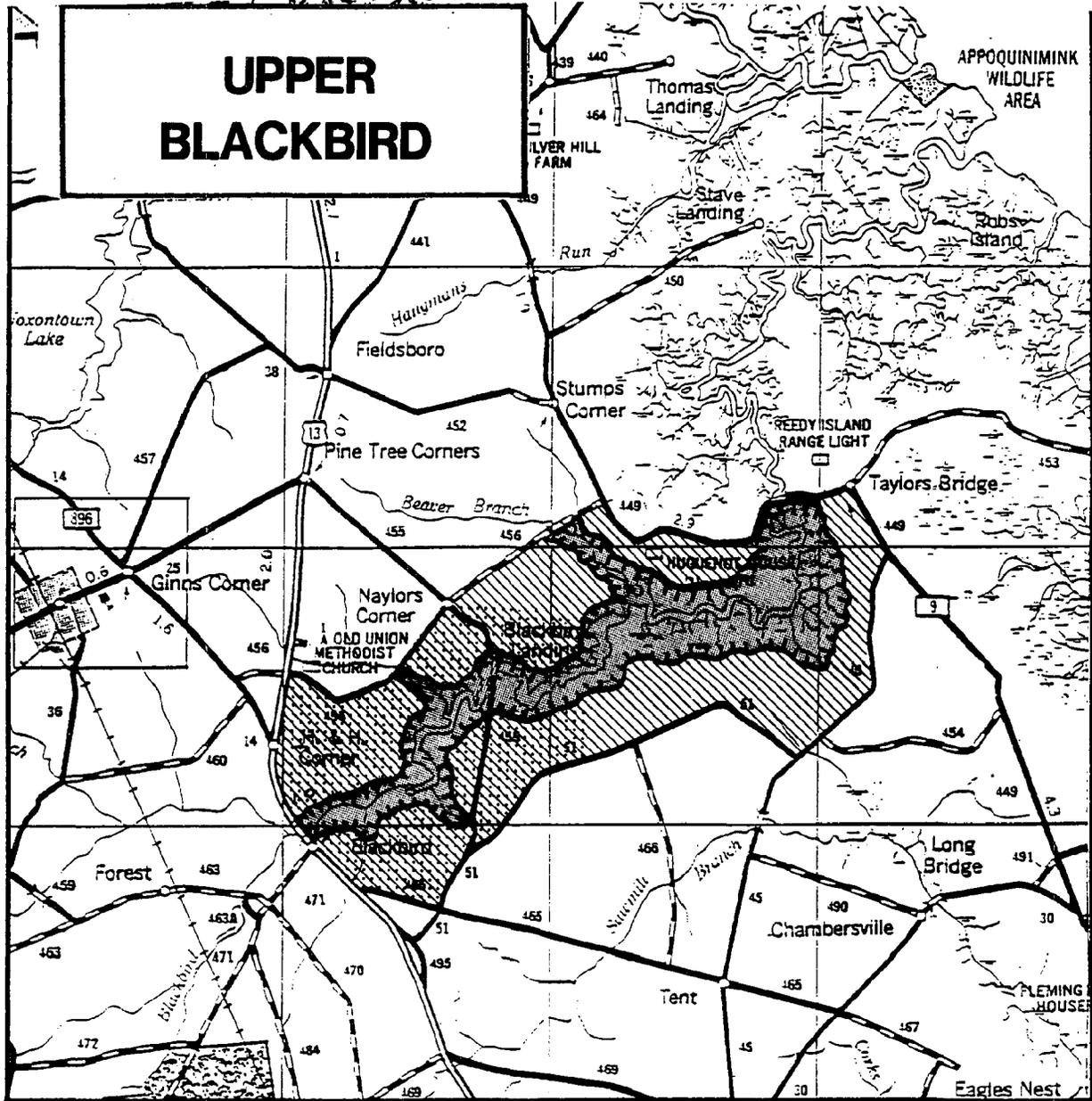
A total of 73 prehistoric archaeological sites in the upland areas adjoining the Upper Blackbird Creek DNERR component have been reported in the Cultural Resource Survey maintained by the Delaware Bureau of Archaeology and Historic Preservation. The western half of this upland area (Fig. 18) has been subjected to reconnaissance level survey for archaeological sites by the University of Delaware Center for Archaeological Research (UDCAR) as part of a planning study conducted for the Delaware Department of Transportation (DelDOT) (Custer and Bachman 1986). The eastern half of the upland area was surveyed by the Delaware Department of Natural Resources and Environmental Control (DNREC) in order to provide a more complete cultural resources inventory for the Upper Blackbird Creek DNERR component.

Fieldwork methods for both surveys relied extensively on surface survey techniques, although there are certain differences which must be kept in mind in comparing the results of the two surveys. In the UDCAR survey, the surface survey techniques were more controlled, and designed to determine the extent of sites as well as their presence. Furthermore, subsurface testing was used in areas where surface visibility was limited. This means that the site inventory is probably somewhat more complete for the western half of the study area. On the other hand, there were very few areas in the eastern part of the study area which would require subsurface testing to identify sites.

Although the boundary between the UDCAR survey and the DNREC was arbitrarily defined by the requirements of the DelDOT planning study, it also coincides with a change in topography. From west to east, the character of the stream valley changes from a narrow floodplain with steep boundaries to a broad marsh with more gradual upland edges beginning at the confluence of Blackbird Creek with Beaver Branch. East of the boundary, there

FIGURE 18

Historical and Cultural characteristics of the  
Upper Blackbird Creek DNERR Component



- UPPER BLACKBIRD SITE
- ▨ ADJACENT UPLANDS
- ▩ DOT SURVEY AREA

are few landforms which extend above the 50 ft. contour interval, while to the west topographic highs above 50 ft. are common. Bay/basin features are more common west of the boundary between the two studies. These differences are reflected in differences in the frequency and character of sites in the two survey areas. Six of the nine base camps in the UDCAR survey are found on landforms above the 50 foot contour interval and are adjacent to bay/basin features. East of the confluence with Beaver Branch there are few landforms above 50 feet and all six of the base camps in the DNREC survey are situated on ridges between the 10 and 30 foot contours bordering the floodplain.

In their analysis of the DelDOT study, Custer and Bachman (1986:130, 146) identified an extensive pattern of prehistoric use of bay/basin features as food provisioning and procurement sites. These closed hydrologic features were found to be especially prevalent on broad nearly level ridges from Blackbird Landing west to the headwaters of Blackbird Creek. Nearly 90 percent of the surveyed bay/basin features in the Blackbird segment of the UDCAR survey were associated with prehistoric materials and virtually all of them were exploited during the Woodland I time period (Custer and Bachman 1986:48,136).

The UDCAR survey identified 59 of the 73 sites identified within the DNERR study area. Fifty of these sites were small procurement stations containing a few flakes of broken and discarded tools. Nine sites were identified as base camps, which are found in settings where food resources are highly predictable during certain parts of the year. These sites are generally larger in size and in the concentration and diversity of artifacts than procurement sites. Base camps were further differentiated on the basis of size and the available resource acquisition area into micro-band and macro-band base camps when possible.

One of these base camps was occupied during the Archaic Period, from about 6500 to 3000 B. C., as indicated by the presence of bifurcate projectile points. Woodland I sites are identified by the presence of a variety of stemmed projectile point styles. Sites occupied during the latest of the prehistoric temporal periods, the Woodland II Period, are identified by the presence of triangular points. Ceramic styles are often more sensitive to patterns of temporal change, but none were found during the survey and they seem to be relatively rare for Upper Blackbird Creek as a whole (Custer and Bachman 1986:Table 2, Plate 6). Three base camps identified in the UDCAR survey had both Woodland I and II components, three base camps produced diagnostic Woodland I types of artifacts, and two base camps produced no diagnostic artifacts. In the DNREC survey, one site was identified as a Woodland II base camp, and four other base camps could be assigned to the Woodland I Period. A sixth base camp could not be clearly assigned to any prehistoric period, but was probably occupied at least during the Woodland I Period. Of the 56 procurement sites identified in the project area, only 5 produced diagnostic artifacts (Custer and Bachman

1986, App VII): one was multi-component, one was from the Woodland II period, and three were from the Woodland I period.

In summary, the Blackbird Creek uplands and stream courses were intensively exploited by Woodland I hunting and gathering groups in the period from 3000 B.C. to A.D. 1000. The large number of bay/basin features in proximity to the interface between mid-drainage and coastal settings favored the establishment of sites of large size and permanence at the convergence of these zones. Changes in settlement patterns by Woodland II (A.D. 1000 to A.D. 1650) times focused food acquisition strategies primarily on the estuarine resources in the floodplain rather than the uplands (Custer and Bachman 1986:128, 144, 150). Both the number of sites and the size of sites decreases during the Woodland II period in the High Coastal Plain physiographic province, of which Blackbird Creek is a part.

Nothing is known about the Contact Period in the Upper Blackbird area. This period spans the time from the first contact of Native Americans on the Delmarva Peninsula with Europeans (about 1600) to their disappearance as recognizable tribal groups in the first half of the 18th century. This area has been identified as a focus of European settlement in the 17th century, although no sites from this time period have been identified in archaeological collections. The earliest historic period settlement in the study area is represented by the Huguenot House, which is listed on the National Register of Historic Places. This house was built early in the first quarter of the 18th century, and was expanded by the second generation of owners. It is significant as an example of the prosperous farmer's residence of pre-revolutionary Delaware. The house and much of its surrounding acreage was purchased in early 1990 by Holger H. Harvey, who was instrumental in the State's acquisition (with State funds) for the DNERR program of a key parcel of wetlands having an associated upland buffer/access strip, both of which were partitioned from the tract previously forming the Huguenot House property bought by Mr. Harvey. The remaining standing structures in the area adjacent to the Upper Blackbird Creek component are agricultural complexes dating primarily to the 19th century. Reconnaissance level survey for this area is complete, although it is possible that some structures dating after 1860 were not recorded.

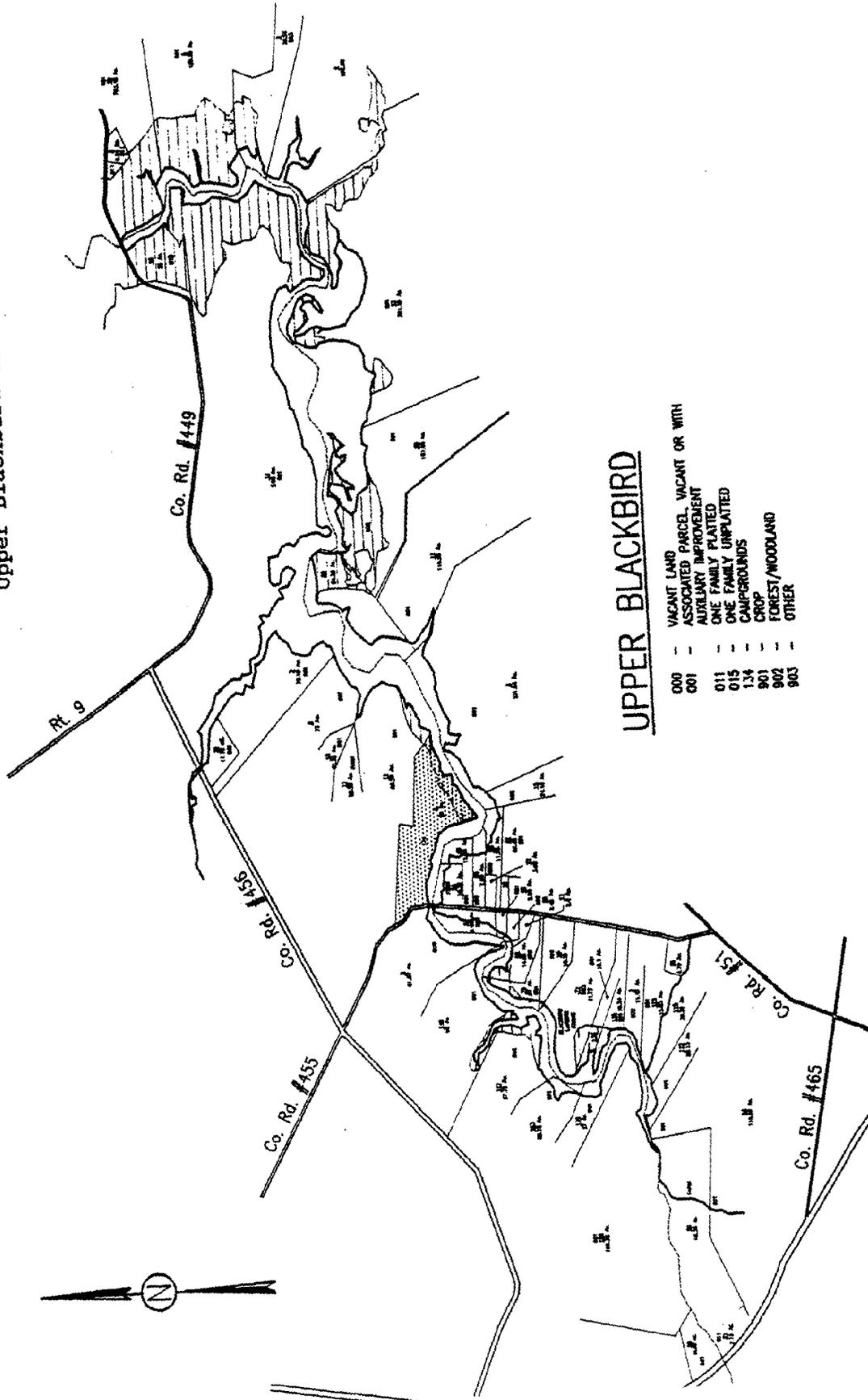
#### **D. BLACKBIRD ZONING AND LAND USE**

All of the properties within the Upper Blackbird Creek component and the surrounding properties are within a county agricultural district, and the zonings are either for farming or single family residential use (Fig. 19). None of the present uses appear to be detrimental or adverse to the operation of a DNERR component. Land use codes on Fig. 19 range from vacant lots to campgrounds to cropland as follows:

- 000 - Vacant Land
- 001 - Associated Parcel, Vacant or with  
Auxiliary Improvement

FIGURE 19

Land use and zoning within the  
Upper Blackbird Creek DNERR Component



- 011 - One Family Platted
- 015 - One Family Unplatted
- 134 - Campgrounds
- 901 - Crop
- 902 - Forest/Woodland
- 903 - Other

The Upper Blackbird Creek area is only about 26 miles from downtown Wilmington. This area, like much of southern New Castle County below the Chesapeake and Delaware Canal, is either undergoing rapid residential development or is on the verge of doing such. With the completion of the "Rt. 13 Relief Route," which will be built over the next several years, the rate of development of southern New Castle County will accelerate even faster, with the area serving essentially as a "bedroom community" for urban workers commuting to Wilmington, Newark, Dover or other urban centers. The DNERR can help to guide and lessen the environmental impacts of this inevitable development for lands around the Blackbird Creek watershed.

The planned route of the Rt. 13 Relief Route will affect the most landward portion of the Upper Blackbird Creek DNERR component. The Relief Route where it crosses Upper Blackbird Creek will do so at a location about 1000 feet to the east of the present location of Rt. 13 at the upper end of the Reserve. Discussions with the Delaware Department of Transportation (Division of Highways) indicate that most of the environmental impacts will occur during construction, and all steps will be taken to minimize detrimental impacts. The engineering design of the Relief Route where it passes over the upper Blackbird Creek corridor will be done in such a manner that minimum permanent loss of wetlands occurs. Essentially, when the Relief Route is completed, the environmental ambiance now associated with Rt. 13 will have moved about 1000 feet to the east.

In order to provide a positive benefit to the Upper Blackbird Creek DNERR component, the Delaware Division of Highways was receptive to the idea of creating a canoe access site for the Reserve in conjunction with the Relief Route. This might be done at the uppermost end of the Reserve, on the east side of the present location of Rt. 13. This would greatly help provide an appropriate type of water access to upper Blackbird Creek. Water access throughout the Reserve is limited, so it will also be necessary to explore creation of an access point for motorized small boats, perhaps at Blackbird Landing, Taylors Bridge or another location. The Division of Highways might also be of assistance with this effort.

#### **E. BLACKBIRD TRADITIONAL USES**

Several of the management considerations associated with the Lower St. Jones River component also apply to the Upper Blackbird Creek component. In particular, concerns with accommodation of waterfowl hunting and muskrat trapping must be addressed.

**XVII. ACKNOWLEDGMENTS**

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XIX. BASE RESOURCE INFORMATION

A. PLANT SPECIES LISTS

1. St. Jones River

PLANT SPECIES IDENTIFIED IN THE ST. JONES RIVER COMPONENT

<u>Scientific name</u>	<u>Common Name</u>
Acer rubrum	red maple
Alnus serrulata	common alder
Amelanchier arborea	downy juneberry
Amelanchier canadensis	oblong leaf juneberry
Antennaria plantaginifolia	plantain-leaved pusseytoes
Apios americana	groundnut
Ascyrum hypericoides	St. Andrew's cross
Asplenium platyneuron	ebony spleenwort
Aster novi-belgii	New York aster
Baccharis halimifolia	groundsel bush
Cakile edentula	sea rocket
Carpinus caroliniana	ironwood
Celtis occidentalis	American hackberry
Clethra alnifolia	sweet pepperbush
Cornus florida	dogwood
Diospyros virginiana	persimmon
Distichlis spicata	saltgrass
Erigeron annuus	daisy fleabane
Eupatorium hyssopifolium	hyssop-leaved boneset
Eupatorium serotinum	late-flowering boneset
Fagus grandifolia	American beech
Gaylussacia dumosa	dwarf huckleberry
Gaylussacia frondosa	tall huckleberry
Hamamelis virginiana	witch-hazel
Heterotheca subaxillaris	camphorweed
Hibiscus palustris	swamp rose mallow
Ilex opaca	American holly
Ilex verticillata	winterberry
Impatiens capensis	spotted touch-me-not
Iris versicolor	larger blue flag
Iva frutescens	marsh elder
Juniperus virginiana	red cedar
Kalmia latifolia	mountain laurel
Kosteletzkya virginia	seashore mallow
Leersia oryzoides	rice cutgrass
Lobelia cardinalis	cardinal flower
Lonicera japonica	Japanese honeysuckle
Lycopus americanus	water horehound
Magnolia virginiana	sweetbay
Mikania scandens	climbing hempweed
Nyssa sylvatica	sourgum
Oenothera biennis	common evening primrose
Osmunda cinnamomea	cinnamon fern
Phragmites australis	common reed

Scientific Name

Common Name

Pilea pumila	clearweed
Pluchea purpurescens	saltmarsh fleabane
Polygonum punctatum	water smartweed
Prunus serotina	blackcherry
Quercus alba	white oak
Quercus falcata	spanish oak
Quercus michauxii	basket oak
Quercus palustris	pin oak
Quercus phellos	willow oak
Quercus prinus	chestnut oak
Quercus rubra	red oak
Rubus sp.	blackberry
Sagittaria latifolia	common arrowhead
Salix nigra	blackwillow
Sassafras albidum	sassafras
Saururus cernuus	lizard's tail
Scirpus robustus	stout sedge
Smilax rotundifolia	common greenbrier
Solanum carolinense	horse nettle
Solanum nigrum	black night shade
Solidago bicolor	silverrod
Solidago rugosa	rough-stemmed goldenrod
Spartina alterniflora	saltmarsh cordgrass
Spartina cynosuroides	big cordgrass
Spartina patens	saltmeadow cordgrass
Vaccinium corymbosum	common highbush blueberry
Viburnum nudum	possum haw
Viburnum recognitum	northern arrowwood

**2. Blackbird Creek**

PLANT SPECIES IDENTIFIED IN THE UPPER BLACKBIRD COMPONENT

Scientific Name

Common Name

Acer rubrum	red maple
Acnida cannabina	salt-marsh water hemp
Amelanchier canadensis	swamp shadbush
Apios americana	groundnut or wild bean
Asclepias incarnata var. pulchra	swamp milkweed
Baccharis halimifolia	groundsel tree
Bidens laevis	larger bur marigold
Carex stricta	a sedge
Cephalanthus occidentalis	buttonbush
Clematis virginiana	virgin's bower
Cornus amomum	silky dogwood
Cornus foemina ssp racemosa	gray dogwood
Cornus florida	flowering dogwood
Cuscuta gronovii	common dodder or love vine
Distichlis spicata	salt grass

Scientific NameCommon Name

Echinochloa walteria	a barnyard grass
Eleocharis fallax (ambigens)	a spike-rush
Eupatorium dubium	Joe-pye weed
Fraxinus pennsylvanica	green ash
Galium obtusum	a bedstraw
Gratiola neglecta	clammy hedge hyssop
Helenium autumnale	sneezeweed
Hibiscus mosheutos	a rose mallow
Hibiscus palustris	marsh mallow
Ilex opaca	American holly
Ilex verticillata	winterberry
Impatiens capensis	jewelweed
Iris versicolor	larger blue flag
Iva frutescens	high tide bush
Juncus acuminatus	a bog-rush
Kosteletzkya virginica	seashore mallow
Leersia oryzoides	a cutgrass
Leucothoe racemosa	fetterbush
Lilium superbum	Turk's cap lily
Liquidambar styraciflua	sweet gum
Liriodendron tulipifera	tulip poplar
Lobelia cardinalis	cardinal flower
Lycopus americanus	water horehound
Lycopus rubellus	a water horehound
Mikania scandens	climbing hempweed
Nuphar luteum (advena)	yellow pond lily
Onoclea sensibilis	sensitive fern
Osmunda regalis	flowering fern
Oxypolis rigidior	cowbane
Panicum virgatum	a panic grass
Peltandra virginica	arrow arum
Phragmites australis	common reed
Pinus taeda	loblolly pine
Pluchea purpurascens	salt-marsh fleabane
Polygonum arifolium	halberd-leaved tearthumb
Polygonum punctatum	water smartweed
Polygonum sagittatum	arrow leaved tearthumb
Pontederia cordata	pickerelweed
Prunus serotina	black cherry
Ptilimnium capillaceum	mock bishop's weed
Quercus alba	white oak
Quercus falcata	red oak
Quercus stellata	post oak
Rorippa islandica	marsh yellow cress
Rosa palustris	swamp rose
Rubus spp.	black cherry
Rumex verticillatus	swamp dock
Sagittaria calycina	an arrowhead
Sagittaria latifolia	common arrowhead
Sagittaria subulata	an arrowhead

Scientific Name

Common Name

Salicornia spp.	saltwort
Sassafras albidum	sassafras
Saururus cernuus	lizards tail
Scirpus pungens	a bulrush
Scirpus robustus	a bulrush
Scirpus validus	a bulrush
Scutellaria lateriflora	a skullcap
Spartina alterniflora	saltmarsh cordgrass
Spartina cynosuroides	big cordgrass
Spartina patens	saltmeadow cordgrass
Stachys tenuifolia	common hedge nettle
Taxodium distichum	bald cypress
Thalictrum polygamum	tall meadow rue
Tilia heterophylla	white basswood
Typha latifolia	common cattail
Ulmus americana	American elm
Viburnum prunifolium	black haw
Viburnum recognitum	arrowwood
Zizania aquatica	wildrice

## B. FISH AND WILDLIFE

This section is intended to present some of the traditional uses of the St. Jones River and Blackbird Creek estuaries that are expected to continue in and around the Reserve and may need particular policies established to reduce the potential for conflicts. It has been determined that hunting, trapping, shellfishing, fishing, boating, and agricultural practices are the major traditional activities of these areas. Other traditional activities have not been listed such as bird watching, canoeing, hiking, etc., since they are activities that are covered in the public access plan of this document.

With the increase in public access to these estuaries and a desire to maintain traditional activities, there is a need to recognize potential conflicts that could result. As much as practical, policies will be established that will allow traditional activities to continue on the Reserve.

Therefore public access will be controlled so that traditional activities will continue with minimal disturbance to both the traditional user and the Reserve activities. Limited access policies, guidelines and general awareness information will need to be developed to provide for the safety of the public.

Fisheries management and determination of harvest practices for finfish and shellfish in DNERR waters will be through the guidance, assistance and responsibilities of DNREC's Division of Fish and Wildlife. Likewise, wildlife management and determination of harvest practices for upland game, waterfowl or furbearers in DNERR lands will be through the guidance, assistance and responsibilities of DNREC's Division of Fish and Wildlife. At times, and at some locations, certain traditional activities may be restricted to allow educational and/or research activities to take place. The DNERR Program Manager shall be responsible for establishing a procedure that will regulate both the traditional activities and the educational and research activities to minimize their conflicts. This procedure shall be reviewed annually to assure the optimum blend of all activities.

The following listing of traditional activities is provided in tabulation form to present only an approximation of activities, seasons, dates, times, and conflict potentials. The activities are representative of the area in and around the Reserve boundaries. Some activities may have never occurred within the areas that will be acquired by the Reserve or may not have occurred throughout the seasons, dates or times given.

This information is to be valued as a commitment of the DNERR to continue traditional activities with the realization that conflicts will be reduced by providing guidelines and policies as public access is increased and specific education and research projects are implemented.

**TRADITIONAL USES OF THE DNERR  
ESTUARINE RESOURCES**

ST. JONES DNERR COMPONENT

<u>ACTIVITY</u>	<u>SEASON</u>	<u>DATES</u>	<u>TIMES</u>	<u>CONFLICT POTENTIAL</u>
<b>Agriculture</b>				
Corn	May-Sep			Public Trespassing
Soybean	Jun-Oct			Public Trespassing
Potatoes	Apr-Aug			Dust
Pasture	year			Public Trespassing
Truck Crops	Spring			Dust
Forestry				Visual

Agriculture has been the greatest land-use activity of the St. Jones component for over 300 years with consistent boundaries for at least the last 200 years. With proper buffering of the estuary to the normal activities of farming, the Reserve will be effected by the occasional noise, dust, odors, chemicals and sights of this primary traditional activity. The operations of the Reserve will need to maintain good public access control to prevent straying into farm operations for public safety and public damage to the fences, fields, crops, livestock, and equipment of the Reserve's neighboring farmers.

<u>ACTIVITY</u>	<u>SEASON</u>	<u>DATES</u>	<u>TIMES</u>	<u>CONFLICT POTENTIAL</u>
<b>Hunting</b>				
<u>White-tailed deer</u>	(with the exception of waterfowl, no other hunting is permitted during the shotgun and muzzleloader seasons for white-tailed deer)			
Archery	Sept to end of Jan except during muzzleloader and shotgun season		1/2hr before sunrise to 1/2hr after sunset	Restriction of hunting to fixed sites compat- ible with other uses will prevent conflicts
Shotgun	8 days mid-November 2 days mid-January		Same	Same
Muzzleloader	3 days mid-October 3 days mid-January		Same	Same
<u>Wild Turkey</u>	late April-early May		1/2hr before sunrise to 1:00pm	Season not yet set for DNERR components. All other activities should be excluded in areas open to turkey hunting when a season is estab- lished except in defined no hunting zones

<u>ACTIVITY</u>	<u>SEASON</u>	<u>DATES</u>	<u>TIMES</u>	<u>CONFLICT POTENTIAL</u>
<u>Small Game</u> Gray Squirrel	mid-Sept to mid-Jan		1/2hr before sunrise to 1/2hr after sunset	Exclusions will be re- quired in some sections (ie around Center; trails & observation points
Cottontail Rabbit	mid-Nov to mid-Jan		Same	Same
Bobwhite Quail	mid-Nov to Feb 28		Same	Same
Woodchuck	no closed Season		Same	Same
Raccoon	Sept 1 to Feb 28		Same- except some nights	Same
Opossum	Same		Same	Same
Red Fox-(chase only)	Oct 1 to April 30		1/2hr before sunrise to 1/2hr after sunset	Same
Frog	May 1 to Sept 30		Same	Same
Snapping Turtle	June 16 to May 14		Same	Same

Hunting should be accommodated over most of the Component. Numbers of hunters using area at one time may need to be restricted by daily sign-in or another method. No conflicts are anticipated if hunting is properly zoned and regulated.

Migratory Birds

Mourning Dove	last 3 weeks of Sep last 2 weeks of Oct mid-Dec to mid-Jan		Noon to sunset	Same restrictions apply as upland Game
Rails	3rd week of Oct		Same	Same
Woodcock	mid-Nov - early Jan		Same	Same
Common Snipe	mid-Nov to Jan 31		Same	Same
Gallinules	Sept 1 to early Nov		Same	Same
Crows	mid-June - March 30		Same	Same

<u>ACTIVITY</u>	<u>SEASON</u>	<u>DATES</u>	<u>TIMES</u>	<u>CONFLICT POTENTIAL</u>
Waterfowl	Nov to	Feb	1/2hr before sunrise to sunset	

All waterfowl hunting must be restricted to fixed blinds and pits established and maintained by DNERR staff.

Numbers of hunters will have to be restricted depending upon number of hunting sites that are established.

<u>ACTIVITY</u>	<u>SEASON</u>	<u>DATES</u>	<u>TIMES</u>	<u>CONFLICT POTENTIAL</u>
<b>Trapping</b>				
<u>Marshes, Streams &amp; Ditches</u> (leghold or conibear traps-aquatic sets only) Muskrats, mink, otter, raccoon, or opossum	early Dec-	mid-March		None as long as trapper's "coming-and-going" is known to the Reserve Manager in order to coordinate with educa- tional/research uses
<u>Upland Areas</u> (box or leghold traps) Raccoon		all year-N side of St Jones; leghold not allowed on S side from mid-March to early Dec		
(box trap) Opossum & rabbit		only during legal hunting season in late fall & winter		

<u>ACTIVITY</u>	<u>SEASON</u>	<u>DATES</u>	<u>TIMES</u>	<u>CONFLICT POTENTIAL</u>
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NOTE: Seasons indicated for commercial/recreational finfishing or shellfishing are traditional times, not legally set periods - most have no legal closed seasons in the tidal rivers for recreational or commercial finfishing nor recreational crabbing(ex. noted)

<b>Fishing-comm</b> (no commercial shellfishing is allowed in tidal rivers or creeks-no crabs, oysters, clams, mussels)				
White perch fixed gill nets (no fixed nets in Delaware Bay within 1/2 mile from tidal river mouths) no nets > 200 ft (nets < 200 ft long for Recreational netting)	Feb-May	mid-May to late-September		None as long as nets do not obstruct navigational channel- no more than 1/3 distance from shore
American eel (eel pots)	early spring to	late fall		Floats to mark pots could cause navigational obstacles if placed too densely

<u>ACTIVITY</u>	<u>SEASON</u>	<u>DATES</u>	<u>TIMES</u>	<u>CONFLICT POTENTIAL</u>
Horseshoe Crab (shoreline - collection)	closed season: May 1 - June 7 (except for those with comm. lic., who can harvest with no limits on Wed, Thur, or Fri); rest of year = 6 crabs/day for those without comm. lic.			Applicable only to State or Federal lands
<b>Fishing-recr</b>	(no recreational oystering or clamming allowed)			
Blue crabs (crab pots, 2/person)	late-May to late-October			Densely placed floats could cause navigation obstacles
White perch (drifting or anchored boat, shoreline)	early April to June			None
White perch, cat- fish, crabs (Barkers Landing fishing pier)	Spring to Fall			None Recreational Finfishing Allowed All Year
Bluefish, weakfish striped bass, white perch, etc.	(mouth of St. Jones River-shoreline/surf) Spring to Fall			None
Snapping turtles (may also be sold)	mid-June to mid-May (legal seasons)			None
Female diamond- back terrapins	mid-July to early October (legal seasons)			None
<u>ACTIVITY</u>	<u>SEASON</u>	<u>DATES</u>	<u>TIMES</u>	<u>CONFLICT POTENTIAL</u>
<b>Boating-comm</b>				
Barge (sand & gravel)	Year around			None - unless major dredging is proposed
<u>ACTIVITY</u>	<u>SEASON</u>	<u>DATES</u>	<u>TIMES</u>	<u>CONFLICT POTENTIAL</u>
<b>Boating-recr</b>				
Drifting or anchored sport- fishing in St. Jones River	Spring to Fall			None
Transit for sport fishing of small boats from Barkers Landing to Delaware Bay	Spring to Fall			None

**TRADITIONAL USES OF THE DNERR  
ESTUARINE RESOURCES**

BLACKBIRD CREEK DNERR COMPONENT

<u>ACTIVITY</u>	<u>SEASON</u>	<u>DATES</u>	<u>TIMES</u>	<u>CONFLICT POTENTIAL</u>
<b>Agriculture</b>				
Corn	May-Sep.			Public Trespassing
Soybean	Jun-Oct			Public Trespassing
Pasture	year			Public Trespassing

Agriculture is the greatest land-use activity of the Blackbird Creek component. However, development pressures are stressing this tradition. With proper buffering of the estuary to the normal activities of farming, the Reserve will only be effected by the occasional noise, dust, odors, chemicals and sights of this primary traditional activity. The operations of the Reserve will need to maintain good public access control to prevent straying into farm operations for public safety and public damage to the fences, fields, crops, livestock, and equipment of the Reserve's neighboring farmers.

<u>ACTIVITY</u>	<u>SEASON</u>	<u>DATES</u>	<u>TIMES</u>	<u>CONFLICT POTENTIAL</u>
<b>Hunting</b>				
<u>White-tailed deer</u>	(with the exception of waterfowl, no other hunting is permitted during the shotgun and muzzleloader seasons for white-tailed deer)			
Archery	Sept to February except during muzzleloader and shotgun season		1/2hr before sunrise to 1/2hr after sunset	Restriction of hunting to fixed sites compatible with other uses will prevent conflicts
Shotgun	8 days mid-November 2 days mid-January		Same	Same
Muzzleloader	3 days mid-October 3 days mid-January		Same	Same
<u>Wild Turkey</u>	late April-early May		1/2hr before sunrise to 1:00pm	Season not yet set for DNERR components. All other activities should be excluded in areas open to turkey hunting when a season is established except in defined no hunting zones

<u>ACTIVITY</u>	<u>SEASON</u>	<u>DATES</u>	<u>TIMES</u>	<u>CONFLICT POTENTIAL</u>
<u>Small Game</u> Gray Squirrel	mid-Sept	to mid-Jan	1/2hr before sunrise to 1/2hr after sunset	Exclusions will be re- quired in some sections (ie around Center; trails & observation points
Cottontail Rabbit	mid-Nov	to mid-Jan	Same	Same
Bobwhite Quail	mid-Nov	to Feb 28	Same	Same
Woodchuck	no closed	Season	Same	Same
Raccoon	Sept 1	to Feb 28	Same- except some nights	Same
Opossum	Same		Same	Same
Red Fox-(chase only)	Oct 1	to April 30	1/2hr before sunrise to 1/2hr after sunset	Same
Frog	May 1	to Sept 30	Same	Same
Snapping Turtle	June 16	to May 14	Same	Same

Hunting should be accommodated over most of the Component. Numbers of hunters using area at one time may need to be restricted by daily sign-in or another method. No conflicts are anticipated if hunting is properly zoned and regulated.

Migratory Birds

Mourning Dove	last 3 weeks of Sep last 2 weeks of Oct mid-Dec to mid-Jan	Noon to sunset	Same restrictions apply as upland Game
Rails	3rd week of Oct	Same	Same
Woodcock	mid-Nov - early Jan	Same	Same
Common Snipe	mid-Nov to Jan 31	Same	Same
Gallinules	Sept 1 to early Nov	Same	Same
Crows	mid-June - March 30	Same	Same

<u>ACTIVITY</u>	<u>SEASON</u>	<u>DATES</u>	<u>TIMES</u>	<u>CONFLICT POTENTIAL</u>
Waterfowl	Nov to	Feb	1/2hr before sunrise to sunset	

All waterfowl hunting must be restricted to fixed blinds and pits established and maintained by DNERR staff.

Numbers of hunters will have to be restricted depending upon number of hunting sites that are established.

<u>ACTIVITY</u>	<u>SEASON</u>	<u>DATES</u>	<u>TIMES</u>	<u>CONFLICT POTENTIAL</u>
<b>Trapping</b>				

Same as St. Jones, except upland trapping for raccoon with either box or leghold traps can occur year around on both sides of the creek (vs. year around only on the north side of the St. Jones; on the south side of the St. Jones, leghold trapping for raccoon can occur only from early December to mid-march).

**Fishing-comm**

Same as St. Jones, except not closed to commercial or recreational harvest of oysters, clams or mussels - this is because these shellfish are not found here in harvestable quantities.

<u>ACTIVITY</u>	<u>SEASON</u>	<u>DATES</u>	<u>TIMES</u>	<u>CONFLICT POTENTIAL</u>
<b>Fishing-recr</b>				

Similar to St. Jones, but no pier or surf fishing; also, more sportfishing in small boats may be occurring in the upper Blackbird for largemouth bass, pickerel, perch, crappie, sunfish, etc. than occurs in the upper St. Jones.

**Boating-comm**

None

**Boating-recr**

Similar to St. Jones, but not as much small boat traffic to-and-from Delaware Bay.

**XX. APPENDICES**

- A. DNERR PROPOSED IMPLEMENTATION TIMETABLE**
- B. BIOGEOGRAPHIC CLASSIFICATION AND TYPOLOGY**
- C. MEMORANDUM OF UNDERSTANDING**
- D. DELAWARE COASTAL MANAGEMENT PROGRAM CONSISTENCY**
- E. NERRS REGULATIONS**

## APPENDIX A

### DELAWARE NATIONAL ESTUARINE RESEARCH RESERVE

#### PROPOSED IMPLEMENTATION TIMETABLE

##### Pre-designation

###### STAFF

- Program Manager (85% time; 100% state funded)
- Research Coordinator (20% time; 100% state funded)
- Education Coordinator (20% time; 100% state funded)
- Realty Specialist (20% time; 100% state funded)
- Res. Prot. Specialist (20% time; 70/30 state/NOAA funded)
- Cult. Pres. Specialist (20% time; 70/30 state/NOAA funded)
- Landowner Assistant (30% time; 70/30 state/NOAA funded)

###### ACTIVITIES

- Develop draft management plan/FEIS
- Some baseline studies, monitoring and species inventories
- Begin detailed design of Education and Research Center
- Acquire minimum key lands and water
- Develop final management plan
- Sign MOU NOAA/DNREC
- Sign MOU DNREC/DH&CA
- Begin DNERR trail & boardwalk at E&R Center; design, layout, construction, interpretive signs & brochure
- Initiate public access
- Secure components
- Initiate volunteer program
- Develop coordinated education and research outreach effort
- Begin outdoor on-site education program
- Research program integration with Sea Grant researchers
- Perform restoration, exotic species control, or any other manipulative activities required (none scheduled or funded as of this writing - OMWM and phragmites control are only known potential)

##### 1st year (following plan approval)

###### STAFF

- Program Manager (100% time; 100% state funded)
- Research Coordinator (30% time; 100% state funded)
- Education Coordinator (30% time; 100% state funded)
- Estuarine Educator (100% time; 100% NOAA funded)
- Realty Specialist (20% time; 100% state funded)
- Realty Assistant (10% time; 100% state funded)
- Res. Prot. Specialist (20% time; 70/30 state/NOAA funded)
- Cult. Pres. Specialist (20% time; 70/30 state/NOAA funded)
- Landowner Assistant (20% time; 100% NOAA funded)
- Volunteer Coordinator (30% time; 100% state funded)
- Folklorist (30% time; 100% Interior funded)

###### ACTIVITIES

- Planning for 2nd year

- Continue acquisition of Reserve lands and water
- Construction of E&R Center site preparation
- Planning for Center occupancy at end of second year
- Install DNERR signs
- Begin monitoring & baseline NOAA funded studies
- Coordinate trail development to Bay via neighboring DNREC Fish and Wildlife property
- Continue environmental/cultural trail to Dickinson Mansion
- Design visitors center expansion
- Coordinate NF&WS Aquatic education program with DNERR for overnight facilities for visiting researchers/educators at M&M lodge (located between DNERR components)
- Initiate active interaction of DNERR/DCMP
- Begin interaction of DNERR with EPA/NEP's
- Collect and develop curricula materials for Reserve
- Field test curricula materials
- Begin NOAA funded research program
- Annual report

## 2nd year

### STAFF (2nd year through 5th year)

- Program Manager (100% time; 100% state funded)
- Research Coordinator (80% time; 100% state funded)
- Education Coordinator (60% time; 100% state funded)
- Estuarine Educator (100% time; 100% state funded)
- Secretary (100% time; 100% state funded)
- Realty Specialist (20% time; 100% state funded)
- Realty Assistant (10% time; 100% state funded)
- Res. Prot. Specialist (20% time; 100% state funded)
- Cult. Cons. Program Manager (20% time; 100% state funded)
- Landowner Assistant (30% time; 100% state funded)
- Volunteer Coordinator (30% time; 100% state funded)
- CMP Specialist (100% time; 100% NOAA-CMP funded)
- F&W Scientist III (30% time; 100% NOAA-CMP funded)
- Folklorist (100% Interior funded)
- Project WILD Coordinator (100% NOAA-CMP funded)
- Aquatic Coordinator (100% USF&W funded)
- 3 F&W Program Managers (100% state funded)

The following positions will be located at the E&R Center but will not have dedicated time assigned specifically to DNERR projects. Rather these positions present every day assignments that will enhance the Reserve's programs, and the Reserve and the tools that it produces will be valuable to their projects.

- F&W Program Manager (50/50 state/USF&W funded)
- 3 F&W Scientists II (100% state funded)
- 5 F&W Scientists II (100% USF&W funded)
- F&W Scientist II (90/10 state/USF&W funded)
- F&W Scientist II (100% NOAA-CMP funded)
- F&W Scientist I (100% NOAA-CMP funded)
- F&W Scientist I (100% USF&W funded)
- 2 F&W Technicians (100% USF&W funded)
- 2 F&W Technicians (100% state funded)
- Boat Captain (100% state funded)
- Secretary (50/50 state/USF&W funded)

## ACTIVITIES

- Staff participation in research and education workshops
- Planning for 3rd year
- Continue acquisition of Reserve lands and water
- Acquire some operational equipment (mowers, computers, canoes/boats, etc.)
- Year-round monitoring of Reserve
- Begin monitoring of contributing watersheds
- Continue coordination of Reserve education & research programs with other compatible efforts
- Initiate a DNERR awareness program
- Continue development of curriculum materials for various age groups
- Continue on-site educational programming
- Initiate formal volunteer program
- Cultivate support groups
- Protect historic barn on slaughter tract
- Continue construction of E&R Center
- Construct boardwalk canoe launch & pier
- Develop brochures
- Annual report

### 3rd year

## ACTIVITIES

- Planning for 4th year
- Continue acquisition of Reserve lands and water
- Prepare the final site & architectural design for Dickinson Plantation/DNERR Visitors center
- Establish field use of Reserve by E&R Center staff
- Establish guided and self guided tours
- Seek State funding for Federally funded DNERR staff
- Investigate additional sources of funding for special projects
- Integrate DNERR education program with the State parks Nature Centers
- Develop wayside exhibits for Dickinson/Center trail
- Annual report

### 4th year

## ACTIVITIES

- Planning for 5th year
- Review 5 year management plan for revisions
- Continue acquisition of Reserve lands and water
- Begin construction of Dickinson Plantation/DNERR Visitors center
- Design indoor exhibits
- Develop and field test out-reach programs
- Continue to augment research and education
- Establish cultural and archaeological educational & research activities
- Continue to strengthen ties with other middle Atlantic estuarine research projects
- Annual report

**5th year**

**ACTIVITIES**

- Planning for 6th year
- Revise DNERR management plan
- Continue acquisition of Reserve lands and water
- Begin fabrication of indoor exhibits
- Initiate educational out-reach program
- Continue to augment research and education
- Develop stronger ties with other NERRs in research, monitoring, and education
- Annual report

Implementation timetable is subject to changes due to available resources and appropriations of State and Federal funds.

APPENDIX B

BIOGEOGRAPHIC CLASSIFICATION AND TYPOLOGY

BIOGEOGRAPHIC CLASSIFICATION

Virginian Region

4. Middle Atlantic Subregion (Sandy Hook to Cape Hatteras)

TYPOLGY

Class I - Ecosystem Types

Group I - Shorelands

- A. Maritime Forest-Woodland  
3. Temperate Deciduous Biome

Group II - Transition Areas

- A. Coastal Marshes - Tidal, Non-tidal & Tidal Freshwater  
B. Coastal Swamps  
C. Intertidal Beaches  
D. Intertidal Mud and Sand Flats  
F. Intertidal Algal Beds  
2. Southern Latitudes

Group III - Submerged Bottoms

- B. Subtidal Softbottoms  
C. Subtidal Plants

Class II - Physical Characteristics

Group I - Geologic

- A. Basin Type  
3. Bay  
5. Tidal River  
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
2. Non-stratified

B. Tides

2. Semidiurnal
3. Wind/Storm Tides

C. Freshwater

1. Surface water
2. Subsurface water

Group III - Chemical

A. Salinity

1. Positive estuary
3. Salinity zones
  - c. Mixohaline
  - (2) Polyhaline
  - (3) Mesohaline
  - (4) Oligohaline

B. pH Regime

Circumneutral

## APPENDIX C

### MEMORANDUM OF UNDERSTANDING

Memoranda of understanding (MOUs) are important with various agencies, groups and organizations in the management of DNERR. Some of these agreements will involve two main management issues: the uses, administration, operations and maintenance of facilities and components; and the interaction of the Reserve with other cooperative programs.

An MOU between DNREC and the Division of Historical and Cultural Affairs will be necessary to operate and manage the Dickinson Plantation Visitors Barn's DNERR section.

Other MOUs will be appropriate as the uses of the Reserve become integral tools to other agencies, schools, groups and organizations that will depend on the attributes of the DNERR to enhance their estuarine programs and the values that their efforts will provide to the Estuarine Reserve System. The Friends of the John Dickinson Mansion, the St. Jones River Watershed Association, the Kent Conservation District, the Delaware Nature Society, Wesley College, the University of Delaware, Delaware State College, the Cooperative Extension Service, USFWS, USDA-SCS, NMFS are a few of the groups that MOU's may be important to the successes of the DNERR.

These MOU's will be developed during the first five years of program implementation.

The following is the MOU between DNREC and NOAA/OCRM regarding the Federal-State relationship during the establishment and development of DNERR. This MOU commits DNREC to long term maintenance and management of the DNERR consistent with the national objectives.

MEMORANDUM OF UNDERSTANDING

BETWEEN

THE STATE OF DELAWARE

AND

THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

**The State-Federal Roles in the Delaware National Estuarine Research Reserve.**

Preamble

This Memorandum of Understanding ("MOU") is made this day of JUL 27 1993, 1993 by and between the State of Delaware to the benefit of the Department of Natural Resources and Environmental Control ("DNREC"), having an address at the Office of The Secretary/DNREC, 89 Kings Highway, Richardson and Robbins Building, Dover, Delaware 19903 and the National Oceanic and Atmospheric Administration, Department of Commerce ("NOAA"), having an address at the Sanctuaries and Reserves Division, Office of Ocean and Coastal Resource Management, National Ocean Service/NOAA, 1305 East West Highway, Silver Spring, Maryland 20910 and concerns the establishment and administration of the Delaware National Estuarine Research Reserve ("DNERR").

WHEREAS, DNREC has determined that the waters and related coastal habitats of the DNERR components provide representative opportunities to study natural and human processes occurring within an estuarine ecosystem; and

WHEREAS, it is the finding of DNREC that the resources of the St. Jones River and Blackbird Creek DNERR components, and the values they represent to the citizens of Delaware and the United States will benefit from the management of these components as a multiple site 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. 92-583, 16 U.S.C. 1461, and in accordance with implementing regulations at 15 CFR 921.30, may designate the areas of the lower St. Jones River and the upper Blackbird Creek as components of the multiple site Delaware National Estuarine Research Reserve; and

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

NOW, THEREFORE, in consideration of the mutual covenants contained herein it is agreed by and between DNREC and NOAA, effective on the date of the designation of DNERR, as follows:

ARTICLE I: State-Federal Roles in Reserve Management

A. DNREC, as the principal contact for the State of Delaware in all matters concerning the Reserve, will serve to ensure that the Reserve is managed in a manner consistent with the CZMA, and in particular the goals of the National Estuarine Research Reserve System ("NERRS") under Section 315 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 agencies involved in the management of the Reserve, including but not limited to:
  - a. The administration of facilities, programs, and tasks related to Reserve management;
  - b. Education and Research agenda developed and implemented in accordance with corresponding elements of the Plan;
  - c. Activities and programs conducted pursuant to the State's Federally-approved coastal management program authorized under the CZMA, as amended; and
  - d. Enforcement programs regulating water quality, fish and wildlife habitat protection, sport and commercial fisheries, and non-consumptive recreational activities;
2. As the Governor's designee and the recipient State entity in matters concerning all financial assistance awards authorized under the CZMA, DNREC will apply for, budget, and allocate such funds received for acquisition and development, operation and management, and education, research and monitoring;
3. Subject to appropriations, continue the designation of three State positions to serve as Reserve manager, Education coordinator and Research coordinator;

4. Seek State and other funding for acquisition, development, management, and operation of the Reserve;
5. Seek State and other funding for education and research programs at the Reserve;
6. Comply with all of the requirements of Section 106 of the National Historic Preservation Act, as amended, and all regulations and guidelines issued thereunder.
7. Serve as principal negotiator on issues involving proposed boundary changes and/or amendments to the Plan;
8. Submit annual reports to NOAA on the Reserve describing, in accordance with 15 CFR 921.40, program performance in implementing the Plan and a detailed work program for the following year of Reserve operations, including budget projections and research efforts;
9. Respond to NOAA's requests for information and to evaluation findings made pursuant to Section 312 of the CZMA; and
10. In the event that it should become necessary, based on findings of program deficiency, serve as the point-of-contact for the State of Delaware in actions involving the possible withdrawal of Reserve designation, as provided at 15 CFR 921.42.

B. Within NOAA, the Sanctuaries and Reserves Division ("SRD"), of 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 DNREC, consistent with 15 CFR 921 for acquisition, development, management, and operation of the Reserve;
2. Subject to appropriation, provide financial assistance to DNREC and other eligible entities for education, research and monitoring programs for the benefit of the Reserve;

3. Serve as the point-of-contact for NOAA in discussion regarding applications for any financial assistance received by DNREC under Section 315 of the CZMA, including any 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 DNREC'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;
5. Regarding SRD-funded research conducted within the Reserve, maintain communication with DNREC and, in a timely manner, supply the DNREC with copies of all progress reports, final reports, and data sets received by SRD; and
6. Establish an information exchange network cataloging all available research data and educational material developed on each Reserve included within NERRS.

**ARTICLE II: Real Property Acquired for the Purposes of the Reserve**

DNREC agrees that deeds for any real property that it acquires for the Reserve 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 921.40, periodic evaluations of DNREC'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 921.41.

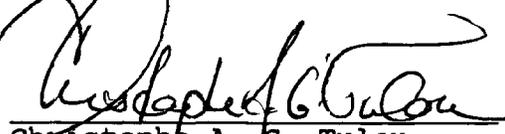
IN WITNESS THEREOF, the parties hereto have caused this MOU to be executed.

NATIONAL OCEANIC AND  
ATMOSPHERIC ADMINISTRATION

  
\_\_\_\_\_  
Frank Maloney  
Acting Director  
Office of Ocean and Coastal  
Resource Management  
National Oceanic and Atmospheric  
Administration  
U.S. Department of Commerce

7/21/93  
Date

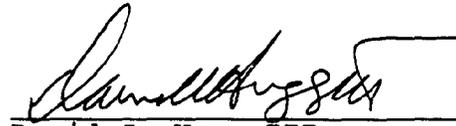
STATE OF DELAWARE

  
\_\_\_\_\_  
Christophe A. G. Tulou  
Secretary  
Delaware Department of Natural  
Resources and Environmental  
Control

5.18.93  
Date

  
\_\_\_\_\_  
CAPT Francesca M. Cava  
Chief  
Sanctuaries and Reserves Division  
Office of Ocean and Coastal  
Resource management  
National Oceanic and Atmospheric  
Administration  
U.S. Department of Commerce

7/6/93  
Date

  
\_\_\_\_\_  
David S. Hugg III  
Director  
Management and Operations  
Office of The Secretary  
Delaware Department of Natural  
Resources and Environmental  
Control

5/13/93  
Date

APPENDIX D

DELAWARE COASTAL MANAGEMENT PROGRAM CONSISTENCY



STATE OF DELAWARE  
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL  
DIVISION OF SOIL AND WATER CONSERVATION  
89 KINGS HIGHWAY  
P.O. BOX 1401  
DOVER, DELAWARE 19903

OFFICE OF THE  
DIRECTOR

TELEPHONE: (302) 739 - 4411

June 2, 1993

Mr. Lee E. Emmons  
DNERR Program Manager  
Office of the Secretary  
Department of Natural Resources  
and Environmental Control  
89 Kings Highway  
P.O. Box 1401  
Dover, DE 19903

**RE: DNERR Final Management Plan - DCMP Consistency**

Dear Mr. Emmons:

The Delaware National Estuarine Research Reserve (DNERR) Final Management Plan was reviewed with regard to its consistency with Delaware's Coastal Management Program. Below is an analysis of the DNERR document as it relates to the management issues of the CMP document.

Wetlands

The DNERR project will be in compliance with the 10 policy statements in the Delaware CMP report. The DNERR project will not destroy any wetlands. A boardwalk has been constructed over a portion of wetland of which a permit from DNREC was obtained.

Beaches and Shorelines

The DNERR project will not effect the 14 policy statements found in the Delaware CMP document. The facility will be set back 200 feet from the nearest tidal wetland. None of the site's beaches will be disturbed. No jetties, piers, groins, breakwaters, seawalls, etc. are planned for this facility.

Coastal Waters

The DNERR program has been reviewed against all 33 policy statements concerning coastal waters found in the Delaware CMP document. The DNERR project will be in compliance with all 33 policies.

*Delaware's good nature depends on you!*

Lee E. Emmons  
June 2, 1993  
page 2

Underwater Lands and the Coastal Strip

The proposed DNERR facility will be located within the "coastal strip" or Coastal Zone as defined in Title 7, Chapter 70 of the Delaware Code. However that State law only regulates heavy industrial uses, manufacturing uses, and bulk product transfer facilities. The proposed DNERR facility is none of the three. It is a public education and research facility. Therefore, it is not regulated by the Delaware Coastal Zone Act and requires no permit. Thus, the DNERR project is completely consistent with that portion of the Delaware CMP.

The DNERR boardwalk included a dock which required a subaqueous lands lease that was obtained from DNREC.

Erosion, and Sediment and Stormwater Management

The DNERR project will require a Sediment and Stormwater Management Plan Approval prior to any construction. The property owner is responsible for acquiring this approval from the Division of Soil and Water Conservation of DNREC. The program manager of the DNERR project will comply with this requirement.

Other Concerns

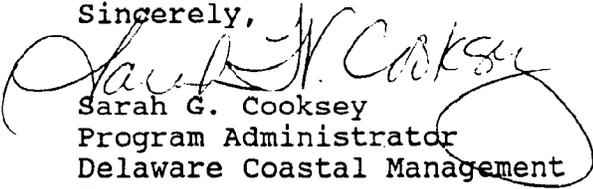
The DNERR project is in compliance with the policy statements found in Sections 5B, 5C, and 5D of the DCMP, including the agricultural lands section.

The facility will require a State permit for an on-site septic tank and drain field. In addition, a State permit will be required for the public drinking water well. These two permits will be acquired as the project approaches the construction phase. Obviously, the facility cannot be constructed without these two permits. Obtaining these two permits will be the responsibility of the contractor.

In summary, The Delaware National Estuarine Research Reserve Final Management Plan is consistent with the Delaware Coastal Management Program.

If you require any further assistance or information concerning this matter please do not hesitate to contact me.

Sincerely,

  
Sarah G. Cooksey  
Program Administrator  
Delaware Coastal Management  
Program

APPENDIX E

NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM PROGRAM  
REGULATIONS 15 CFR Part 921

# Federal Register

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Monday  
July 23, 1990

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Part II

## Department of Commerce

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National Oceanic and Atmospheric  
Administration

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15 CFR Part 921

National Estuarine Reserve Research  
System Program Regulations; Interim  
Final Rule

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

15 CFR Part 921

[Docket No. 70874-0133]

National Estuarine Reserve Research System Program Regulations

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

**ACTION:** Interim final rule.

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

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

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

**ADDRESSES:** Mr. Joseph A. Uravitch, 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 § 921.19. 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 pre-designation

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 \$30,000 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 Reserve Research System, shall receive priority consideration for funding.

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

NOAA received comments from 18 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 28502, June 27, 1984). The deleted paragraph concerned the development and Federal administration of a research and education information exchange network for the System.

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

#### Specific:

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

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

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

which emphasize research and resource protection.

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

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

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

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

*Response:* The mission of the National Estuarine Research System, as stated in § 921.1(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 Research Reserve System. This effort has already been initiated through a memorandum of understanding between the programs at the National level and is being pursued at the local level, where appropriate. Therefore, NOAA believes it does not require restatement in the program regulations. However, NOAA agrees that the management plan should contain the findings of designation and the regulations should show that the Under Secretary is responsible for designation. The regulations have been revised accordingly.

*Section 921.31—Supplemental Acquisition and Development Awards*

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

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

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

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

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

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

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

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

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

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

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

*General*

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

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

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

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

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

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

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

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

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

*Section 921.50—General*

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

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

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

*Section 921.51—Estuarine Research Guidelines*

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

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

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

#### Subpart G—Interpretation and Education

##### Section 921.60—General

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

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

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

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

##### Section 921.71—Allowable Costs

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

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

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

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

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

#### VI. Other Actions Associated With the Rulemaking

(A) *Classification Under Executive Order 12291.* NOAA has concluded that these regulations are not major because they will not result in:

- (1) An annual effect on the economy of \$100 million or more;
- (2) A major increase in costs or prices for consumers; individual industries; Federal, state, or local government agencies; or geographic regions; or
- (3) Significant adverse effects on competition, employment, investment, productivity, innovation or the ability of

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

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

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

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

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

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

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

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

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

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

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

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

Dated: July 10, 1990.

Virginia K. Tippie,

*Assistant Administrator for Ocean Services and Coastal Zone Management.*

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

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

#### Sec.

##### Subpart A—General

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

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

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

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

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

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

- 921.30 Designation of National Estuarine Research Reserves.
- 921.31 Supplemental acquisition and development awards.
- 921.32 Operation and management—Implementation of the management plan.
- 921.33 Boundary changes, amendments to the management plan, and addition of multiple-site components.

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

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

#### Sec.

##### Subpart F—Research

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

##### Subpart G—Monitoring

- 921.60 General.

##### Subpart H—Interpretation and Education

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

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

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

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

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

Authority: Sec. 375, Public Law 92-583, as amended; 36 Stat. 1280 (16 U.S.C. 1481).

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

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

- (1) A draft management plan outline (see § 921.13(a) below); and
- (2) An outline of a draft memorandum of understanding (MOU) between the state and NOAA detailing the Federal-state role in research reserve management during the initial period of Federal funding and expressing the state's long-term commitment to operate and manage the national estuarine research reserve.

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

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

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

- (1) Research reserve goals and objectives, management issues, and strategies or actions for meeting the goals and objectives;
- (2) An administrative section including staff roles in administration, research, education/interpretation, and surveillance and enforcement;
- (3) A research plan, including a monitoring design;
- (4) An education/interpretive plan;
- (5) A plan for public access to the research reserve;
- (6) A construction plan, including a proposed construction schedule, general descriptions of proposed developments and preliminary drawings, if appropriate. Information should be provided for proposed minor construction projects in sufficient detail to allow these projects to begin in the initial phase of acquisition and development. If a visitor center, research center or any other facilities are proposed for construction or renovation at the site, or restorative activities which require significant construction are planned, a detailed construction plan including preliminary cost estimates and architectural drawings must be prepared as a part of the final management plan; and
- (7) An acquisition plan identifying the ecologically key land and water areas of the research reserve, ranking these areas according to their relative importance, and including a strategy for

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

- (i) Determine, with appropriate justification, the minimum level of control(s) required (e.g., management agreement, regulation, less-than-fee simple property interest (e.g., conservation easement), fee simple property acquisition, or a combination of these approaches);
- (ii) Identify the level of existing state control(s);
- (iii) Identify the level of additional state control(s), if any, necessary to meet the minimum requirements identified in (a)(7)(i) of this section;
- (iv) Examine all reasonable alternatives for attaining the level of control identified in (a)(7)(iii) of this section, and perform a cost analysis of each; and
- (v) Rank, in order of cost, the methods (including acquisition) identified in paragraph (a)(7)(iv) of this section. An assessment of the relative cost-effectiveness of control alternatives shall include a reasonable estimate of both short-term costs (e.g., acquisition of property interests, regulatory program development including associated enforcement costs, negotiation, adjudication, etc.) and long-term costs (e.g., monitoring, enforcement, adjudication, management and coordination). In selecting a preferred method(s) for establishing adequate state control over each parcel examined under the process described above, the

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

(8) A resource protection plan detailing applicable authorities, including allowable uses, uses requiring a permit and permit requirements, any restrictions on use of the research reserve, and a strategy for research reserve surveillance and enforcement of such use restrictions, including appropriate government enforcement agencies;

(9) If applicable, a restoration plan describing those portions of the site that may require habitat modification to restore natural conditions; ;

(10) A proposed memorandum of understanding (MOU) between the state and NOAA regarding the 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 percent of the cost of the lands, waters, and interests therein or \$4,000,000 whichever amount is less. In the case of a biogeographic region (see Appendix 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).

**§ 921.23 Boundary changes, amendments to the management plan, and addition of multiple-site components.**

(a) Changes in research reserve boundaries and major changes to the final management plan, including state laws or regulations promulgated specifically for the research reserve, may be made only after written approval by NOAA. If determined to be necessary, NOAA may require public notice, including notice in the Federal Register and an opportunity for public comment. Changes in the boundaries of the research reserve involving the acquisition of properties not listed in the management plan or final EIS require public notice and the opportunity for comment in certain cases, an environmental assessment and possibly, an environmental impact statement, may be required. Where public notice is required, NOAA will place a notice in the Federal Register of any proposed changes in research reserve boundaries or proposed major changes to the final management plan. The state shall be responsible for publishing an equivalent notice in the local media. See also requirements of § 921.4(b) and § 921.13(a)(11).

(b) As discussed in § 921.10(b), a state may choose to develop a multiple-site national estuarine research reserve after the initial acquisition and development award for a single site has been made. Public notice of the proposed addition will be placed by NOAA in the Federal Register. The state shall be responsible for publishing an equivalent notice in the local media. An opportunity for comment, in addition to the preparation of either an environmental assessment or environmental impact statement on the proposal, will also be required. An environmental impact statement, if required, shall be prepared in

accordance with section § 921.13 and shall include an administrative framework for the multiple-site research reserve and a description of the complementary research and educational programs within the research reserve. If NOAA determines, based on the scope of the project and the issues associated with the additional site, that an environmental assessment is sufficient to establish a multiple-site research reserve, then the state shall develop a revised management plan which, concerning the additional component, incorporates each of the elements described in § 921.13(a). The revised management plan shall address goals and objectives for all components of the multi-site research reserve and the additional component's relationship to the original site(s).

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

**§ 921.40 Evaluation of system performance.**

(a) Following designation of a national estuarine research reserve pursuant to § 921.30, periodic performance evaluations shall be conducted concerning the operation and management of each national estuarine research reserve, including the research and monitoring being conducted within the reserve and education and interpretive activities. Evaluations may assess performance in all aspects of research reserve operation and management or may be limited in scope, focusing on selected issues of importance. Performance evaluations in assessing research reserve operation and management may also examine whether a research reserve is in compliance with the requirements of these regulations, particularly whether:

(1) The operation and management of the research reserve is consistent with and furthers the mission and goals of the National Estuarine Reserve Research System (see § 921.1); and

(2) A basis continues to exist to support any one or more of the findings made under § 921.30(a).

(b) Generally, performance will be evaluated at least every three years. More frequent evaluations may be scheduled as determined to be necessary by NOAA.

(c) Performance evaluations will be conducted by Federal officials. When determined to be necessary, Federal and non-Federal experts in natural 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 Reserve Research System the state is required to submit an annual report on operation and management of the research reserve during the immediately preceding state fiscal year. This annual report must be submitted within a ninety day period following the end of the state fiscal year. The report shall detail program successes and accomplishments, referencing the research reserve management plan and, as appropriate, the work plan for the previous year. A work plan, detailing the projects and activities to be undertaken over the coming year to meet the goals and objectives of the research reserve as described in the management plan and the state's role in ongoing research reserve programs, shall also be included.

**§ 921.41 Suspension of eligibility for financial assistance.**

(a) If a performance evaluation under § 921.40 reveals that the operation and management of the research reserve is deficient, or that the research being conducted within the reserve is not consistent with the Estuarine Research Guidelines referenced in subpart F of this part, the eligibility of the research reserve for Federal financial assistance as described in these regulations may be suspended until the deficiency or inconsistency is remedied.

(b) NOAA will provide the state with a written notice of the deficiency or inconsistency. This notice will explain the finding, assess the Federal role in contributing to the problem, propose a solution or solutions, provide a schedule by which the state should remedy the deficiency or inconsistency, and state whether the state's eligibility for Federal financial assistance has been suspended in whole or part. In this notice the state shall also be advised that it may comment on this finding and meet with NOAA officials to discuss the results of the performance evaluation and seek to remedy the deficiency or inconsistency.

(c) Eligibility of a research reserve for financial assistance under these regulations shall be restored upon written notice by NOAA to the state

that the deficiency or inconsistency has been remedied.

(d) If, after a reasonable time, a state does not remedy a deficiency in the operation and management of a national estuarine research reserve which has been identified pursuant to a performance evaluation under § 921.40(a), such outstanding deficiency shall be considered a basis for withdrawal of designation (see § 921.42).

#### § 921.42 Withdrawal of designation.

(a) Designation of an estuarine area as a national estuarine research reserve may be withdrawn if a performance evaluation conducted pursuant to § 921.40 reveals that:

(1) The basis for any one or more of the findings made under § 921.30(a) in designating the research reserve no longer exists;

(2) A substantial portion of the research conducted within the research reserve, over a period of years, has not been consistent with the Estuarine Research Guidelines referenced in subpart F of this part or

(3) A state, after a reasonable time, has not remedied a deficiency in the operation and management of a research reserve identified pursuant to an earlier performance evaluation conducted under § 921.40.

(b) If a basis is found under § 921.42(a) for withdrawal of designation, NOAA will provide the state with a written notice of this finding. This notice will explain the basis for the finding, propose a solution or solutions and provide a schedule by which the state should correct the deficiency. In this notice, the state shall also be advised that it may comment on the finding and meet with NOAA officials to discuss the finding and seek to correct the deficiency.

(c) If, within a reasonable period of time, the deficiency is not corrected in a manner acceptable to NOAA, a notice of intent to withdraw designation, with an opportunity for comment, will be placed in the *Federal Register*.

(d) The state shall be provided the opportunity for an informal hearing before the Under Secretary to consider NOAA's finding of deficiency and intent to withdraw designation, as well as the state's comments on and response to NOAA's written notice pursuant to § 921.42(b) and *Federal Register* notice pursuant to § 921.42(c).

(e) Within 30 days after the informal hearing, the Under Secretary shall issue a written decision regarding the designation status of the national estuarine research reserve. If a decision is made to withdraw research reserve designation, the procedures specified in

§ 921.21(e) regarding the disposition of real property acquired in whole or part with Federal funds shall be followed.

(f) NOAA may not withdraw designation of a national estuarine research reserve if the performance evaluation reveals that the deficiencies in management of the site are a result of inadequate Federal financial support.

#### Subpart F—Research

##### § 921.50 General

(a) To stimulate high quality research within designated national estuarine research reserves, NOAA may provide financial support for research which is consistent with the Estuarine Research Guidelines referenced in § 921.51. Research awards may be awarded under this subpart to only those designated research reserves with approved final management plans with the following exception: NOAA may award research awards under this subpart to reserves without final management plans that have been designated prior to the effective date of these regulations; in the absence of an approved final management plan, however these reserves will be eligible for research awards during only the first two years after the effective date of these regulations. Although this research may be conducted within the immediate watershed of the research reserve, the majority of research activities of any single research project funded under this subpart must be conducted within reserve boundaries. Research funds are primarily used to support management-related research that will enhance scientific understanding of the research reserve ecosystem, provide information needed by reserve managers and coastal management decision-makers, and improve public awareness and understanding of estuarine ecosystems and estuarine management issues. Research projects may be oriented to specific research reserves; however, research projects that would benefit more than one research reserve in the National Estuarine Reserve Research System are encouraged.

(b) Federal research funds under this subpart are not intended as a source of continuous funding for a particular project over time. Research funds may be used to support start-up costs for long-term projects if an applicant can identify an alternative source of long-term research support.

(c) Research funds are available on a competitive basis to any coastal state or qualified public or private person. A notice of available funds will be published in the *Federal Register*. Research funds are provided in addition

to any other funds available to a coastal state under the Act. Federal research funds provided under this subpart must be matched equally by the recipient, consistent with § 921.81(e)(4) ("allowable costs").

##### § 921.51 Estuarine research guidelines.

(a) Research within the National Estuarine Reserve Research System shall be conducted in a manner consistent with Estuarine Research Guidelines developed by NOAA.

(b) A summary of the Estuarine Research Guidelines is published in the *Federal Register* as a part of the notice of available funds discussed in § 921.50(c).

(c) The Estuarine Research Guidelines are reviewed annually by NOAA. This review will include an opportunity for comment by the estuarine research community.

##### § 921.52 Promotion and coordination of estuarine research.

(a) NOAA will promote and coordinate the use of the National Estuarine Reserve Research System for research purposes.

(b) NOAA will, in conducting or supporting estuarine research other than that authorized under section 315 of the Act, give priority consideration to research that uses the National Estuarine Reserve Research System.

(c) NOAA will consult with other Federal and state agencies to promote use of one or more research reserves within the National Estuarine Reserve Research System when such agencies conduct estuarine research.

#### Subpart G—Monitoring

##### § 921.60 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 Reserve Research System, shall receive priority consideration for funding.

(c) Proposals for interpretive and educational projects in national estuarine research reserves will be evaluated in accordance with criteria listed below:

(1) Educational or interpretive merits;

(2) Relevance or importance to reserve management or coastal decisionmaking;

(3) Educational quality (*e.g.*, soundness of approach, experience related to methodologies);

(4) Importance to the National Estuarine Reserve Research System;

(5) Budget and Institutional Capabilities (*e.g.*, reasonableness of budget, sufficiency of logistical support); and

(6) In addition, in the case of long-term projects, the ability of the state or the grant recipient to support the project beyond this initial funding.

#### Subpart I—General Financial Assistance Provisions

##### § 921.80 Application information.

(a) Only a coastal state may apply for Federal financial assistance awards for preacquisition, acquisition and development, operation and management, and education and interpretation. Any coastal state or

public or private person may apply for Federal financial assistance awards for estuarine research or monitoring. The announcement of opportunities to conduct research in the reserve system appears on an annual basis in the Federal Register. If a state is participating in the national Coastal Zone Management Program, the applicant for an award under section 315 of the Act shall notify the state coastal management agency regarding the application.

(b) An original and two copies of the formal application must be submitted at least 120 working days prior to the proposed beginning of the project to the following address: Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration, Universal Building South, 1825 Connecticut Avenue, NW, Suite 714, Washington, DC 20235. The Application for Federal Assistance Standard Form 424 (Non-construction Program) constitutes the formal application for site selection, post-site selection, operation and management, research, and education and interpretive awards. The Application for Federal Financial Assistance Standard Form 424 (Construction Program) constitutes the formal application for land acquisition and development awards. The application must be accompanied by the information required in subpart B (predesignation) of this part, subpart C of this part and § 921.31 (acquisition and development), and § 921.32 (operation and management) as applicable.

Applications for development awards for construction projects, or restorative activities involving construction, must include a preliminary engineering report. All applications must contain back up data for budget estimates (Federal and non-Federal shares), and evidence that the application complies with the Executive Order 12372.

"Intergovernmental Review of Federal Programs." In addition, applications for acquisition and development awards must contain:

(1) State Historic Preservation Office comments;

(2) Written approval from NOAA of the draft management plan for initial acquisition and development award(s); and

(3) A preliminary engineering report for construction projects, or restorative activities involving construction.

##### § 921.81 Allowable costs.

(a) Allowable costs will be determined in accordance with applicable OMB Circulars and guidance

for Federal financial assistance, the financial assistance agreement, these regulations, and other Department of Commerce and NOAA directives. The term "costs" applies to both the Federal and non-Federal shares:

(b) Costs claimed as charges to the award must be reasonable, beneficial and necessary for the proper and efficient administration of the financial assistance award and must be incurred during the award period.

(c) Costs must not be allocable to or included as a cost of any other Federally-financed program in either the current or a prior award period.

(d) General guidelines for the non-Federal share are contained in Department of Commerce Regulations at 15 CFR part 24 and OMB Circular A-110. Copies of Circular A-110 can be obtained from the Marine and Estuarine Management Division, 1825 Connecticut Avenue, NW., Suite 714, Washington, DC 20235. The following may be used in satisfying the matching requirement:

(1) Site Selection and Post Site Selection Awards. Cash and in-kind contributions (value of goods and services directly benefiting and specifically identifiable to this part of the project) are allowable. Land may not be used as match.

(2) Acquisition and Development Awards. Cash and in-kind contributions are allowable. In general, the fair market value of lands to be included within the research reserve boundaries and acquired pursuant to the Act, with other than Federal funds, may be used as match. However, the fair market value of real property allowable as match is limited to the fair market value of a real property interest equivalent to, or required to attain, the level of control over such land(s) identified by the state and approved by the Federal Government as that necessary for the protection and management of the national estuarine research reserve. Appraisals must be performed according to Federal appraisal standards as detailed in Department of Commerce regulations at 15 CFR part 24 and the Uniform Relocation Assistance and Real Property Acquisition for Federal and Federally Assisted Programs in 15 CFR part 11. The fair market value of privately donated land, at the time of donation, as established by an independent appraiser and certified by a responsible official of the state (pursuant to 15 CFR part 24), may also be used as match. Land, including submerged lands already in the state's possession, may be used as match to establish a national estuarine research reserve. The value of match for these state lands will be calculated by

determining the value of the benefits foregone by the state, in the use of the land, as a result of new restrictions that may be imposed by Reserve designation. The appraisal of the benefits foregone must be made by an independent appraiser in accordance with Federal appraisal standards pursuant to 15 CFR part 24 and 15 CFR part 11. A state may initially use as match land valued at greater than the Federal share of the acquisition and development award. The value in excess of the amount required as match for the initial award may be used to match subsequent supplemental acquisition and development awards for the national estuarine research reserve (see also § 921.20). Costs related to land acquisition, such as appraisals, legal fees and surveys, may also be used as match.

(3) Operation and Management Awards. Generally, cash and in-kind contributions (directly benefiting and specifically identifiable to operations and management), except land, are allowable.

(4) Research, Monitoring, Education and Interpretive Awards. Cash and in-kind contributions (directly benefiting and specifically identifiable to the scope of work), except land, are allowable.

**§ 921.22 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, gumbé limbo, and palms.

**B. Coast Shrublands:** This is a transitional area between the coastal grasslands and woodlands and is characterized by woody species with multiple stems a few centimeters to several meters above the ground developing under the influence of salt spray and occasional sand burial. This includes thickets, scrub, scrub savanna, heathlands, and coastal chaparral. There is a great variety of shrubland vegetation exhibiting regional specificity:

1. **Northern Areas:** Characterized by *Hudsonia*, various erinaceous species, and thickets of *Myrica*, *Prunus*, and *Rosa*.
2. **Southeast Areas:** Floral dominants include *Myrica*, *Baccharis*, and *Ilex*.
3. **Western Areas:** *Adenostoma*, *Arctostaphylos*, and *Eucalyptus* are the dominant floral species.

**C. Coastal Grasslands:** This area, which possesses sand dunes and coastal flats, has low rainfall (10 to 30 inches per year) and large amounts of humus in the soil. Ecological succession is slow, resulting in the presence of a number of serial stages of community development. Dominant vegetation includes mid-grasses (2 to 4 feet tall), such as *Ammophila*, *Agropyron*, and *Calamovilfa*, tall grasses (5 to 8 feet tall), such as *Spartina*, and trees such as the willow (*Salix* sp.), cherry (*Prunus* sp.), and cottonwood (*Populus deltoides*). This area is divided into four regions with the following typical strand vegetation:

1. Arctic/Boreal: *Elymus*;
2. Northeast/West: *Ammophila*;
3. Southeast/Gulf: *Uniola*; and
4. Mid-Atlantic/Gulf: *Spartina patens*.

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

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

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

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

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

**E. Coastal Cliffs:** This ecosystem is an important nesting site for many sea and shore birds. It consists of communities of herbaceous, graminoid, or low woody plants (shrubs, heath, etc.) on the top or along rocky faces exposed to salt spray. There is a diversity of plant species including mosses, lichens, liverworts, and "higher" plant representatives.

### Group II—Transition Areas

**A. Coastal Marshes:** These are wetland areas dominated by grasses (Poaceae), sedges (Cyperaceae), rushes (Juncaceae), cattails (Typhaceae), and other graminoid species and is subject to periodic flooding by either salt or freshwater. This ecosystem may be subdivided into: (a) Tidal, which is periodically flooded by either salt or brackish water; (b) non-tidal (freshwater); or (c) tidal freshwater. These are essential habitats for many important estuarine species of fish and invertebrates as well as shorebirds and waterfowl and serves important roles in shore stabilization, flood control, water purification, and nutrient transport and storage.

**B. Coastal Swamps:** These are wet lowland areas that support mosses and shrubs together with large trees such as cypress or gum.

**C. Coastal Mangroves:** This ecosystem experiences regular flooding on either a daily, monthly, or seasonal basis, has low wave action, and is dominated by a variety of salt-tolerant trees, such as the red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia nitida*), and the white mangrove (*Laguncularia racemosa*). It is also an important habitat for large populations of fish, invertebrates, and birds. This type of ecosystem can be found from central Florida to extreme south Texas to the islands of the Western Pacific.

**D. Intertidal Beaches:** This ecosystem has a distinct biota of microscopic animals, bacteria, and unicellular algae along with microscopic crustaceans, mollusks, and worms with a detritus-based nutrient cycle. This area also includes the driftline communities found at high tide levels on the beach. The dominant organisms in this ecosystem include crustaceans such as the mole crab (*Emerita*), amphipods (Gammaridae), ghost crabs (*Ocypode*), and bivalve molluscs such as the coquina (*Donax*) and surf clams (*Spisula* and *Macra*).

**E. Intertidal Mud and Sand Flats:** These areas are composed of unconsolidated, high organic content sediments that function as a short-term storage area for nutrients and organic carbon. Macrophytes are nearly absent in this ecosystem, although it may be heavily colonized by benthic diatoms, dinoflagellates, filamentous blue-green and green algae, and chemosynthetic purple sulfur bacteria. This system may support a considerable population of gastropods, bivalves, and polychaetes, and may serve as a feeding area for a variety of fish and wading birds. In sand, the dominant fauna include the wedge shell *Donax*, the scallop *Pecten*, tellin shells *Tellina*, the heart urchin *Echinocardium*, the lug worm *Arenicola*, and 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 echiuroid 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, *Purra* 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 possess algae consisting mostly of single-celled or filamentous green, blue-green, and red algae, and small thalloid brown algae.

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

### Group III—Submerged Bottoms

**A. Subtidal Hardbottoms:** This system is characterized by a consolidated layer of solid rock or large pieces of rock (whether 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. **Barred 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. cariosus*, 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. It 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. *Eubaline*—40 ppt to 30 ppt.

c. *Mixohaline*—30 ppt to 0.5 ppt.

(1) *Mixoeubaline*—greater than 30 ppt but less than the adjacent eubaline sea.

(2) *Polyhaline*—30 ppt to 15 ppt.

(3) *Mesohaline*—15 ppt to 5 ppt.

(4) *Oligohaline*—5 ppt to 0.5 ppt.

d. *Littoral*—less than 0.5 ppt.

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

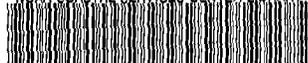
1. *Acid*: Waters with a pH of less than 5.5.

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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