



ERRATA SHEET

After completion of the contractual work by Environmental Services, Inc., it was discovered that much of the information included in the report related to history and the remains of cultural resources are “remarkably similar” to the Master’s thesis prepared by Sami Kay Seeb, “Cape Fear’s Forgotten Fleet: The Eagles Island Ships’ Graveyard, Wilmington, North Carolina.” Master’s thesis, East Carolina University, 2007. Information and quotations from this thesis were used without the author’s notice and without proper credit.

Our apologies go to Ms. Sami [Seeb] Powers, and we express our sincere appreciation for her significant work and interest in Eagles Island.

EAGLES ISLAND: A History of a Landscape



**PREPARED FOR:
NEW HANOVER
SOIL AND WATER CONSERVATION DISTRICT**

**CAPE FEAR
RESOURCE CONSERVATION & DEVELOPMENT, INC.**

**PREPARED BY:
ENVIRONMENTAL SERVICES, INC.**

**EAGLES ISLAND:
A HISTORY OF A LANDSCAPE**

By:

Matthew K. Smith,

Scott Seibel, RPA,

and

Kevin W. Markham

With Technical Support From:

Land Management Group, Inc.

For:

New Hanover Soil and Water Conservation District

and

Cape Fear Resource Conservation & Development, Inc.

ESI Project Number: LEL 09-018.00



July 2011

**Environmental Services, Inc.
P.O. Box 2181
Wilmington, North Carolina 28402**

PREFACE

Eagles Island is, and has always been, part of a dynamic riverine system. What exists today is the result of myriad interactions between natural and human forces that have taken place over time. The flora and fauna of the island continue to evolve as dynamic forces continue to change and to exert change on the island.

In some ways this report has also evolved.

When H. L. “Whitey” Prevatte offered a 52-acre tract of island property to David Green, Chair of the New Hanover Soil and Water Conservation District Board of Supervisors in 2001, only a limited range of values was recognized: wetlands, a man-made pond, and frontage along the busy U.S. 74/76/17 highway corridors. Even so, those values were deemed sufficiently important to warrant acceptance of the gift.

Thereafter, the District’s Supervisors, Community Conservationist Shelly Baird (nee Miller), and Marilyn Meares, then the U.S. Natural Resources Conservation Service’s District Conservationist for New Hanover and Pender Counties, realized that the tract was part of a larger wetland system that contained unique plants and animals. Their judgment was born out by Natural Resource Conservation Service biologists and others, such as Audubon North Carolina, who examined the wetland areas west to Brunswick River and north to the Northwest Cape Fear River. From those examinations, particularly those by the North Carolina Natural Heritage Program staff, there emerged the concept of a “natural area” that would protect unique natural systems and be a green wedge between urbanized Wilmington and the rapidly urbanizing Brunswick County communities to the west.

The concept drove the acquisition of additional land on the island. First, a partnership was formed with an anonymous donor and the Town of Leland to buy a strip of land extending west along the highway corridor from the Prevatte property to the Brunswick River. Second, another landowner donated two parcels immediately south of the highway corridor. Third, assisted by a tactical intervention with the owner by outdoor writer Mike Marsh, the N.C. Natural Heritage Trust Fund provided the money to purchase a property extending north from the Prevatte property to the Cape Fear River (title is held by the N.C. Division of Soil and Water Conservation). Fourth, a grant from the N.C. Clean Water Management Trust Fund has enabled the Soil and Water Conservation District to buy a substantial tract along the Brunswick River. The acquisition of these properties, together with parcels held by the N.C. Department of Transportation (acquired for wetland mitigation purposes) and the USS NORTH CAROLINA Battleship Commission, means that a contiguous block of wetland extending north from the highway corridor to the Cape Fear River is available for ecological research, outdoor recreation (including hunting and fishing), and interpretation of cultural and natural resources.

When the involvement of the wider scientific community revealed that there was already an extensive body of research material that had been accumulated over the years, it seemed logical that these data be located, cataloged, made known, and serve as a basis for future research and management planning.

The Cape Fear Resource Conservation and Development Council, in keeping with its mission of helping public and private entities shape and fund conservation and development activities in the

five-county region it serves, prepared on behalf of the District a proposal to the Harriet Jackson Phelps Charitable Trust to fund the conduct of such an inventory. The Trust awarded a grant to the District to support the work with emphasis on collecting and making available a complete as possible compilation of known research documentation.

Land Management Group, a Wilmington based consulting firm, was awarded the contract to prepare the inventory of research documentation and from those data describe the condition of present day Eagles Island. In addition, the firm's principal, Rob Maul, proposed to link present conditions with cause. The imaginative idea of a report that would deal with the human interventions that over time shaped the current landscape was enthusiastically embraced, and the concept of the proposed report was broadened accordingly.

As work progressed, it became increasingly obvious that the coverage of the report could not be limited to that part of the island north of the U.S. 74/76/17 corridor and west of U.S. 421. Even those parts of the island that have been, and continue to be, subject to the most drastic ecological system changes contain significant natural resource values. An example is the unique migratory bird habitats created and maintained by deposits of dredged material on the southern tip of the island. Other values include the impact of the eastern water front on the City of Wilmington that was recognized in the Cape Fear River Corridor Plan (1997), and the inventoried underwater archeological remains along that waterfront and within the Wilmington Historic District. Once again, in recognition of conditions on the ground, the scope of the report was enlarged to include the entire island.

Further, the sequence of human factors that have influenced the island's several habitats contain the germs of very important historic stories that do much to describe the economic growth and development of Wilmington and the Lower Cape Fear Region. Among the fascinating stories are the development and long standing practice of rice and indigo cultivation, the emergence of the Eagles Island waterfront as the premier producer and shipper of naval stores, and the changing face of ship building that extended from Colonial times to the end of the Second World War.

Land Management Group staff, based on their extensive biological work on the island, completed the inventory of available research material and the description of presently extant ecosystems on the island and began compiling the historic component. Group management and the District amicably agreed that completing this segment of the work was not within the area of Land Management Group expertise. Consequently, a second contract was awarded to Environmental Sciences, Inc. to build upon the excellent natural resource work, complete the linkage between historic events on the island and present conditions, and do the final editing and reproduction. The publication that follows is the work of the two companies.

Clearly, integrating the interests of the various landowners and groups interested in the sustainable management of the island's resources and the remarkable opportunities for longitudinal research into the continuing impacts of external change on currently recognized ecosystems were beyond the ken of a single soil and water conservation district. The result of this recognition was the formation of the Eagles Island Coalition: a loose assemblage of public and private entities committed to an integrated approach to maximizing the public benefits of the island's resources. Many of the individuals associated with the Eagles Island Coalition, either as

individuals or as representatives of organizations, have contributed to the preparation of this report.

Through several extension iterations and changes in scope, the Trustees of the Harriet Jackson Phelps Charitable Trust, supported by the interest and passion for local environmental stewardship of Caroline Butts, were patient and remained steadfast in continuing the funding for what started as an “inventory” project that has become something substantially larger and more complicated.

The Supervisors of the New Hanover Soil and Water Conservation District express deep gratitude to the Trustees and to all the others who have contributed their knowledge of, and interest in, the remarkable entity known as Eagles Island and to the conception and production of *“Eagles Island: A History of a Landscape”*. It is the belief of the members of the Board that the insights contained in the report will support continuing efforts to understand and explain this quietly dynamic landscape for the benefit and enjoyment of present and future generations.

Wilmington, North Carolina
January, 2011

William J. Hart, Vice Chair
Board of Supervisors
New Hanover Soil and Water Conservation District

MANAGEMENT SUMMARY

Eagles Island is an approximately 3,110-acre island located in the lower Cape Fear region of southeastern North Carolina. The island has long been a fixture for the inhabitants of the lower Cape Fear region. In recent years the importance of conserving the cultural and natural history of Eagles Island so that it may be enjoyed by future generations has been recognized. To that end the New Hanover Soil and Water Conservation District (NHSWCD; the District) and the Cape Fear Resource Conservation and Development, Inc. (RC&D) have initiated the formation of the Eagles Island Coalition with the mission to *Lead efforts to conserve and manage the natural and cultural assets of Eagles Island and provide compatible educational and recreational opportunities*. The formation of the Eagles Island Coalition creates the framework for future conservation efforts moving beyond the task of acquiring individual properties and towards working with private and public stakeholders towards the holistic conservation of Eagles Island.

While the citizens of the lower Cape Fear region are generally familiar with Eagles Island, few understand the role that the island has played in the ongoing development of the area. This report seeks to explore the rich natural and cultural history of Eagles Island with an emphasis on how human use of the island through history has reshaped Eagles Island into the landscape that we see today. This report also serves to provide a baseline for the ecological conditions that are seen on Eagles Island. This living document provides the framework for future conservation efforts designed to increase our understanding and appreciation of Eagles Island's past, present, and future role in the lower Cape Fear region.

Moving forward the Eagles Island Coalition are anticipated to focus on the conservation of the existing natural landscape, further explore and document the rich cultural history, and create new opportunities for citizens to learn about and experience Eagles Island. The future of Eagles Island will include several key components such as planning and implementation of restoration/conservation projects, identifying and pursuing future research projects, and developing compatible education/tourism/recreation opportunities.

TABLE OF CONTENTS

	<u>Page</u>
Preface	i
Management Summary	v
List of Figures	ix
List of Tables	x
Acknowledgments	xi
1. Introduction (Conservation Efforts, Status, Goals)	1.1
2. Geological History of Eagles Island	2.1
3. Overview of Human Occupation	3.1
Prehistoric Background	3.1
Historic Background	3.2
Eagles Island	3.5
4. Overview of Environmental Conditions and Change	4.1
Water Quality	4.1
Vegetation	4.2
Wildlife	4.2
5. Significant Events and Activities	5.1
Rice Plantations	5.1
Naval Stores	5.6
Logging/Lumber	5.11
Shipping	5.12
Port and Shipping Facilities	5.12
Shipyards	5.14
Archaeological Remains	5.19
Ecological Effects	5.23
Dredging	5.23
Transportation	5.24
Domestic Occupation	5.30
Fisheries	5.32
Recreation/Tourism	5.32
6. Present Evolving Landscape	6.1
Groundwater and Soils	6.1
Water Resources	6.3
Vegetation	6.11
Habitat Mapping	6.13
Wildlife	6.13

	<u>Page</u>
Mammals	6.13
Birds	6.15
Reptiles	6.16
Fisheries	6.17
North Carolina Natural Heritage Data	6.18
Floral and Faunal Species of Concern	6.18
Significant Natural Heritage Areas	6.20
Lower Cape Fear River Aquatic Habitat	6.21
Brunswick River/Cape Fear River Marshes	6.21
7. Summary of Significant Events and Activities	7.1
8. Future Trends/Use	8.1
Restoration/Conservation Projects	8.1
Research Needs/Opportunities	8.3
Education/Tourism/Recreation Opportunities	8.5
REFERENCES CITED	R.1

LIST OF FIGURES

	<u>Page</u>
Figure 1.1	Project Location
Figure 1.2	Notable Tracts on Eagles Island
Figure 5.1	Rice Field Construction Diagrams
Figure 5.2	Rice Plantations along the Cape Fear River
Figure 5.3	1933 U.S. Coast Map and Geodetic Map showing Eagles Island
Figure 5.4	Aerial of Eagles Island
Figure 5.5	Tar Kiln Construction Diagrams
Figure 5.6	Historical Photo of a Turpentine Still
Figure 5.7	Details of Eagles Island on Sanborn Fire Insurance Maps
Figure 5.8	Eagles Island Warehouses and Wharves
Figure 5.9	Naval Stores Photo and Shipyard Sketch
Figure 5.10	Marine Railways along the Lower Cape Fear River
Figure 5.11	Storage of Liberty Ships along Eagles Island
Figure 5.12	Location of sunken ships along Eagles Island
Figure 5.13	The Tugboat <i>Argonauta</i>
Figure 5.14	Causeway across Eagles Island
Figure 5.15	1948 USGS Map of Wilmington
Figure 5.16	1869 Map of New Hanover County
Figure 5.17	1886 map of New Hanover County
Figure 6.1	NRCS Soils
Figure 6.2	USGS Topography Mapping
Figure 6.3	Lower Cape Fear River Program Sampling Stations
Figure 6.4a	Physical Water Quality Trends
Figure 6.4b	Physical and Biological Water Quality Trends
Figure 6.4c	Chemical Water Quality Trends
Figure 6.4d	Chemical Water Quality Trends
Figure 6.5	Habitat Mapping
Figure 6.6	Rare Species and Natural Communities

LIST OF TABLES

		<u>Page</u>
Table 3.1	Prehistoric Chronology of the Southern Coastal Plain of North Carolina	3.1
Table 6.1	Floral species observed on Eagles Island	6.12
Table 6.2	Mammal species observed on Eagles Island	6.13
Table 6.3	Bird species observed on Eagles Island	6.15
Table 6.4	Reptile species observed on Eagles Island	6.16
Table 6.5	Finfish and shellfish species identified in the vicinity of Eagles Island	6.17
Table 6.6	Threatened and endangered species identified in the vicinity of Eagles Island	6.18

ACKNOWLEDGMENTS

The assistance of many people and institutions have contributed to the on-going conservation efforts for Eagles Island and in the preparation of this document. The Cape Fear Resource Conservation and Development, Inc., and New Hanover Soil and Water Conservation District have provided leadership in the on-going conservation efforts for Eagles Island. We would like to thank Land Management Group for the research and field information that was compiled into the *Chronological Inventory of Eagles Island* that this document is in part based on. In addition a number of individuals have provided information to assist in the development of this document. Their experiences and knowledge of Eagles Island provide a living legacy for the history, land use, changes, and current conditions of Eagles Island. Sam Cooper – Wilmington North Carolina Christmas Bird Count Coordinator and Walker Golder, National Audubon Society provided detailed accounts of the birds observed on and around Eagles Island. Eulis Willis, Mayor of Navassa, provided information on the influence and role of the Gullah or Geechee on the development of Eagles Island. David DuMond provided his insight into the ecological changes that are occurring on Eagles Island and his personal experiences as a naturalist in the Cape Fear region. This document was prepared with the assistance of a grant from the Harriet Jackson Phelps Charitable Trust.

1. Introduction (Conservation Efforts, Status, Goals)

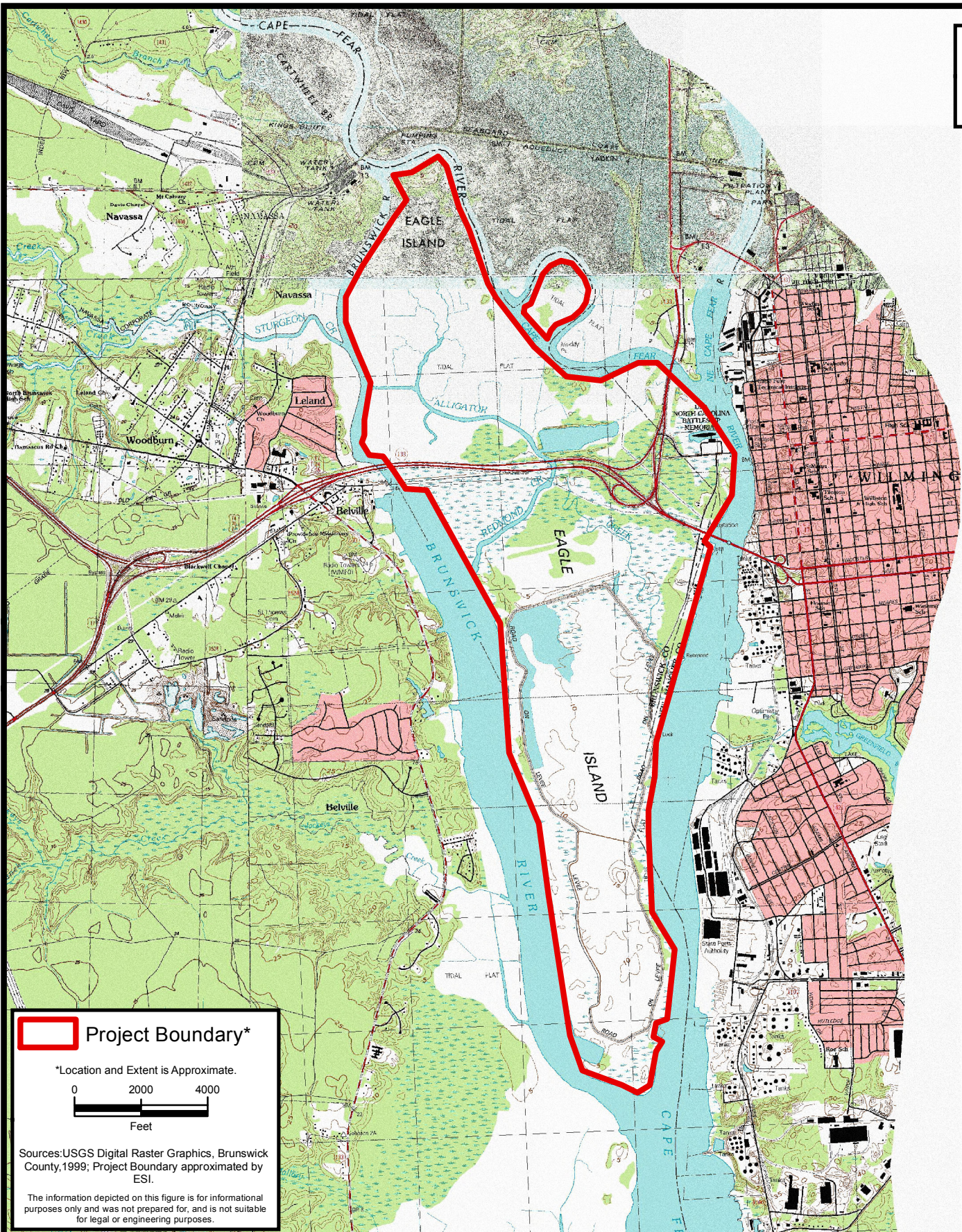
Eagles Island is an approximately 3,110-acre island located in the lower Cape Fear region of southeastern North Carolina (**Figure 1.1**). This island is located about 22 miles upstream from the confluence of the Cape Fear River with the Atlantic Ocean and is bounded by the Brunswick River to the west and the Cape Fear River to the north, east and south. The western and largest part of Eagles Island is in Brunswick County and the smaller eastern portion is in New Hanover County. It is adjacent to the communities of Wilmington, Leland, Belville, and Navassa.

The eastern side, that portion of the island directly across from the City of Wilmington, was developed and modified and, until recently, intensively used for a variety of commercial and industrial activities. The part of the island south of the U.S. 74/76/17 corridor has been modified by the deposition of dredged material; the south end is currently used almost exclusively for dredge spoil disposal by the U.S. Army Corps of Engineers (USACE). The northern end of the island is dominated by successional vegetation following extensive historic use for rice production.

Eagles Island has long been a fixture for the inhabitants of the lower Cape Fear region. In recent years the importance of conserving the cultural and natural history of Eagles Island so that it may be enjoyed by future generations has been recognized. To that end the New Hanover Soil and Water Conservation District (NHSWCD; the District) and the Cape Fear Resource Conservation and Development, Inc., (RC&D) have initiated the formation of the Eagles Island Coalition with the mission to *Lead efforts to conserve and manage the natural and cultural assets of Eagles Island and provide compatible educational and recreational opportunities.*

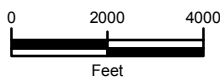
Conservation efforts for Eagles Island began in 2002 with the unsolicited donation of 53 acres to the District from a local business man, Whitey Prevatte. Following this donation, the District began a concerted effort to identify partners and funding with a focus on preserving the northern end of Eagles Island. In March 2003 using a private donation, the District partnered with the Town of Leland to purchase a contiguous tract consisting of approximately 158 acres. Shortly after that, the District was offered and accepted two more tracts with a combined area of approximately 53 acres. In April 2008 the District received a grant from the N.C. Natural Heritage Trust Fund to acquire a 258-acre parcel previously owned by V.A. Creech, located to the north of existing protected lands. Under conditions imposed by the Trust Fund, title to this tract is held by the N.C. Division of Soil and Water Conservation.

To date, the efforts of the District and Cape Fear RC&D have resulted in placing an additional 500 acres on Eagles Island (**Figure 1.2**) into conservation. The District and Cape Fear RC&D are currently seeking grants for the purchase of 239 acres to the southwest of the V.A. Creech Property which is presently owned by Blue Sky Timber, LLC. Acquisition of this property would bring the total area under protection to 746 acres. The recent formation of the Eagles Island Coalition creates the framework for future conservation efforts moving beyond the task of acquiring individual properties and towards working with private and public stakeholders towards the holistic conservation of Eagles Island.



Project Boundary*

*Location and Extent is Approximate.



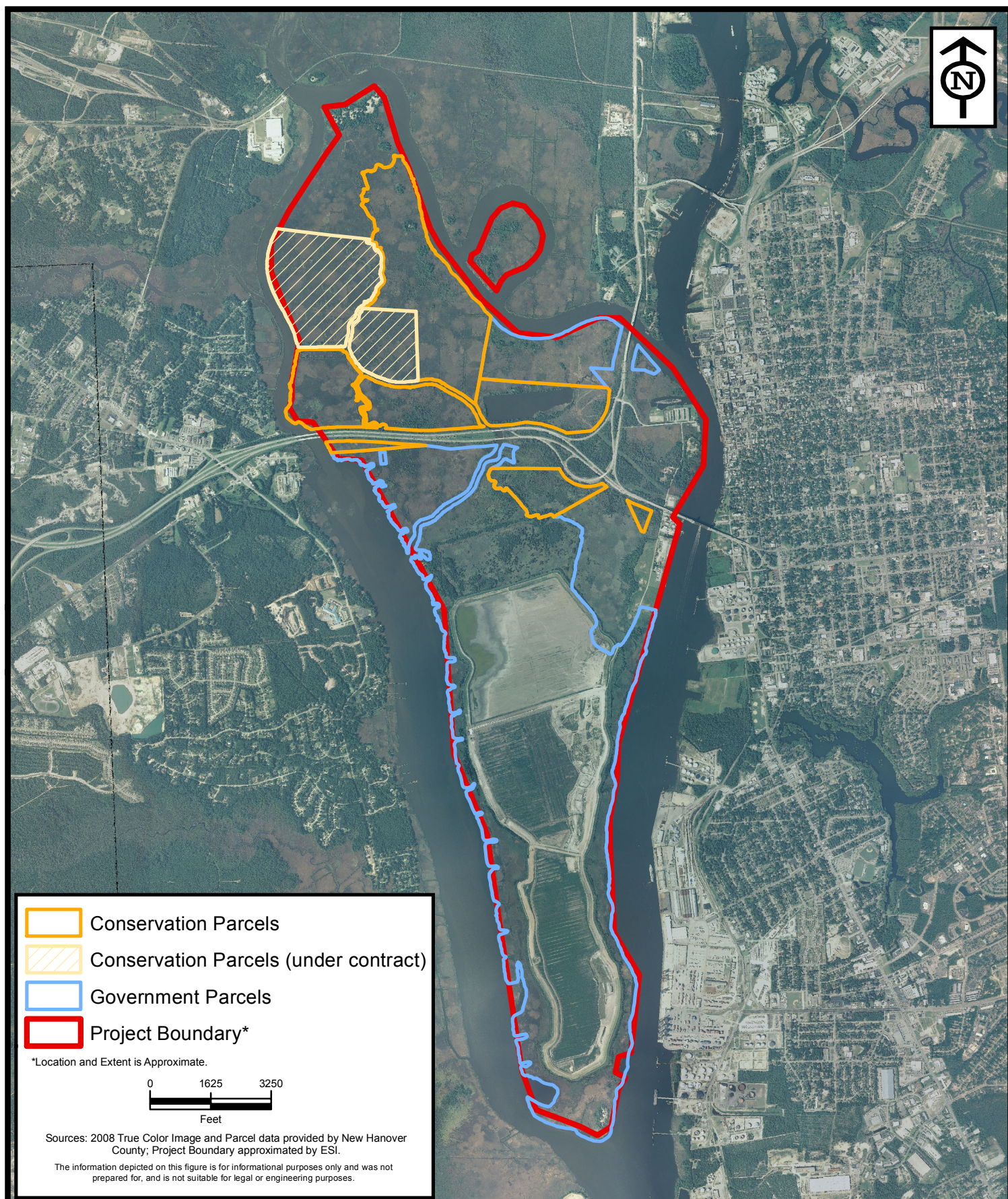
Sources: USGS Digital Raster Graphics, Brunswick County, 1999; Project Boundary approximated by ESI.

The information depicted on this figure is for informational purposes only and was not prepared for, and is not suitable for legal or engineering purposes.



Project Location Map
Eagles Island
New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	KT/MS
Figure:	1.1



Notable Tracts On Eagles Island

Eagles Island

New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	KT/MS
Figure:	1.2

While the citizens of the lower Cape Fear region are generally familiar with Eagles Island, few understand the role that the island has played in the ongoing development of the area. This report seeks to explore the rich natural and cultural history of Eagles Island with an emphasis on how human use of the island through history has reshaped Eagles Island into the landscape that we see today. This report also serves to provide a baseline for the ecological conditions that are seen on Eagles Island. This living document provides the framework for future conservation efforts designed to increase our understanding and appreciation of Eagles Island's past, present, and future role in the lower Cape Fear region.

Moving forward the Eagles Island Coalition are anticipated to focus on the conservation of the existing natural landscape, further explore and document the rich cultural history, and create new opportunities for citizens to learn about and experience Eagles Island.

2. Geomorphology of Eagles Island

Eagles Island is located within a drowned valley of the Cape Fear River and was formed from the accumulation of alluvial sediments deposited by the Cape Fear River as it makes its way to the Atlantic Ocean. Since the land mass is located at the junction of three river systems, the surface formation was shaped by fluvial processes. The tidal fresh water marshes collected and settled out enormous amounts of sediment via sedimentation, siltation and deposition through physical and bio-geochemical processes.

The 1985 Geologic Map of North Carolina (NCGS 1985) describes Eagles Island as being underlain by the Peedee Formation, which consists of sand, clay, clayey sand, greenish clay to olive black, massive glauconite, locally fossilized ferrous and calcareous with patches of sandy molluscan molf limestone (Brant 1998). This rock structure indicates that at one time this location was higher, cooler and drier with mixed hardwoods and drier plant species. The Peedee soft limestone formation occurred during the Cretaceous age but has been uplifted closer to the surface. Sea level changes have influenced how the Cape Fear River and Northeast Cape Fear River flow into the Atlantic Ocean and subsequently formed and shaped Eagles Island.

During the most recent glacial period (Wisconsin), sea level dropped dramatically as much of the available water was trapped as ice. The Cape Fear region saw dramatic rises in sea level, as much as 328 feet, when large sheets of ice melted during the Wisconsin glaciation period, which lasted 20,000 years (Brooks et al. 1989). Evidence from geological borings and paleoclimatological research has put the first evidence of modern man in the region around 12,000 years ago. At that time it was estimated that the ocean shoreline was nearly 75 to 100 miles east of its present location. Even though the upper geologic soil and strata was formed as sedimentary rock, the lower Cape Fear region was uplifted slightly by tectonic forces from old fault lines and is known as the Cape Fear Arch (Sollier 1985; Owens 1991). Sea level has risen approximately 6.6 feet over the last 5,000 years.

As the sea rose and drowned the river, effects of the ocean tide moved upstream. It is reasonable to postulate that as the tidal influence reached the confluence of the rivers, the river flow was slowed and the sediment load was dropped and, in effect, the formation of Eagles Island was deltaic with frequent over washes in the early centuries and the stream systems, including the Brunswick River, probably changed courses frequently in the vicinity of the area that we call Eagles Island today. As elevation on the island increased, vegetation was able to become established. Once established vegetation trapped additional sediment increasing the elevations on portions of the island and allowing the eventual establishment of tree species found along the surrounding river banks.

Eagles Island has been shaped by both erosion scar events during low tide and flooding during extreme flood events. The soils that have formed are composed of a mixture of silt, clay, and sand from up river and organic material both from the decomposition of vegetation on the island and from vegetative material that has washed down from farther up the river system. The existing wetland plants filter out sediment and help build wet flats. Eagles Island has a long

rectangular shape which was formed from the equilibrium of the Cape Fear River and the Northeast Cape Fear River. The surface has a thick black soft mud layer (greater than 5 feet) of “organic soup” caused by the collection and settling of very fine river born silt and organic matter. Peat deposits on Eagles Island were measured at a thickness of 4 to 8 feet as part of a 1987 study (Ingram 1987). It has a strong odoriferous smell caused by hydrogen sulfide gas which seeps out of the heavily detritus laden surface layer. Over time anthropogenic impacts upstream caused by logging, agriculture and development have greatly contributed to this overland flushing of very fine soil particles. The Eagles Island marshes act as a sink for fine sediments and broken down plant debris which also assist in building up the land mass.

3. Overview of Human Occupation

Prehistoric Background

Part of the focus of this document is to explore how human use of the island through history has reshaped the pre-Colonial Eagles Island into the landscape that we see today. As it is very difficult to quantify how prehistoric people affected the modern ecology of Eagles Island, the prehistoric history of the area is not addressed in any detail in this document. Specifically, there has been little in the way of formal archaeological investigations on Eagles Island that focus on prehistoric occupation and use, and there are no prehistoric archaeological sites officially recorded on the island.

The prehistoric cultural chronology of North Carolina was developed based on the excavation of stratified archaeological sites and was first summarized by Coe (1964). Mathis and Crow (1983) and Ward and Davis (1999) summarized further refinements. According to Ward and Davis (1999:22), the project area is located within the Southern Coastal Plain archaeological region. The major prehistoric cultural periods in the Southern Coastal Plain region of North Carolina are the Pre-Clovis, Paleoindian, Archaic, Woodland, and Contact, which are detailed below in **Table 3.1**. At the time of European colonization, native peoples in the region typically lived in semi-permanent villages and practiced horticulture or limited agriculture, but still relied heavily on wild game and seafood for subsistence. (Those who are interested in a more comprehensive discussion of the prehistory of the region can turn to *Time Before History: The Archaeology of North Carolina* by H. Trawick Ward and R.P. Stephen Davis from the University of North Carolina Press.)

Table 3.1: Prehistoric Chronology of the Southern Coastal Plain of North Carolina

Cultural Period	Temporal Placement
<u>Pre-Clovis</u>	???-10000 BC
<u>Paleoindian</u>	10000 – 8000 BC
<u>Archaic</u>	
<i>Early</i>	8000 – 6000 BC
<i>Middle</i>	6000 – 3000 BC
<i>Late</i>	3000 – 1000 BC
<u>Woodland</u>	
<i>Early/Middle</i>	1000 BC – AD 900
<i>Late</i>	AD 900 – 1600
<u>Contact</u>	AD 1600 – 1789

Historic Background

European explorers first investigated the North Carolina coast in the early sixteenth century. Giovanni da Verrazano, an Italian explorer, reached the mouth of the Cape Fear River in 1524. Sailing northward, Verrazano sailed into Onslow Bay and then continued along the Outer Banks, mistaking Pamlico and Albemarle sounds for the Pacific Ocean (Powell 1989:30).

Two years later, a Spanish fleet under the command of Lucas Vasques de Ayllon sailed up the eastern coast of Carolina, stopping for a time near the Cape Fear River. A contingent of ships continued north, possibly reaching Chesapeake Bay (Powell 1989:31). By the late 1550s, it was not uncommon for Spanish ships to be wrecked by storms along the Outer Banks (Powell 1989:32). In 1566, an expedition under Domingo Fernandez passed to the north of Roanoke Island and made landfall on the Currituck Peninsula, where the party erected a large wooden cross and conducted a brief exploration of the area (Powell 1989:32).

English exploration in the area began in earnest the 1580s. On March 25, 1584, Queen Elizabeth granted Walter Raleigh a charter to explore and colonize unknown lands (Powell 1989:38). One month later, a small expedition, organized by Raleigh and led by Philip Amadas and Arthur Barlowe, left Plymouth, England, for America. In July, Amadas and Barlowe reached the Carolina coast and claimed the land in the name of Queen Elizabeth.

The following year, Raleigh organized an attempt to establish a colony on Roanoke Island. At the end of July 1585, a fleet commanded by Sir Richard Grenville and Ralph Lane reached Roanoke Island where Lane set about constructing a fort. A detachment from this expedition followed the Roanoke and Chowan rivers into the interior of the mainland (Powell 1989:40-42). Two years later, a civil settlement was established at Roanoke Island under the governorship of John White (Powell 1989:44), however, international politics kept supplies from reaching the colony. By the time English ships again called at Roanoke Island in 1590, the colonists had disappeared, and repeated attempts to find the colonists failed. After the failure of the “Lost Colony,” English colonial efforts concentrated on the Chesapeake area. In 1607, Jamestown was settled on the James River in Virginia.

Soon after the settlement of Jamestown, the colonists began exploring the surrounding areas. Virginians referred to the Albemarle region as “South Virginia” or the “Southern Plantations,” and many of the earliest settlers in the area came from the Virginia settlements (Watson 1982:2; Anthony and Ash 1980:7).

By the early 1660s, some attempts had been made to colonize the area at the mouth of the Cape Fear River. In 1660, a group from New England purchased land and began exploring the area. At about the same time, a group from Barbados took an interest in establishing a colony in the vicinity. In 1664, the Barbados group established a colony of about 600 people along the banks of the Cape Fear River, but the settlement was abandoned by 1667 (Sharpe 1958:323-324; Lee 1971:5).

Earlier, in 1663, Charles II granted the Carolina Province to eight Lords Proprietors. Albemarle County was established in 1664 and four years later was divided into four precincts. Twenty-

eight years later, in 1696, as settlers moved south to the Pamlico and Cape Fear rivers, Bath County was established. In 1705, Bath was subdivided into the precincts of Beaufort, Hyde, and Craven.

During the early eighteenth century, the populations of Bath County continued to grow. In 1706, John Lawson, the surveyor general of the Carolina province, laid out a town on a bluff overlooking the Pamlico River; two years later that town was incorporated as Bath. In 1710, Baron Christoph von Graffenried, at the head of a group of Swiss and German settlers, established the town of New Bern at the confluence of the Neuse and Trent rivers (Powell 1989:70-73). During the early 1710s, settlers began establishing homes in present-day Onslow County (Onslow County Historical Association 1983:2), and a decade later, permanent settlers began living along the banks of the Cape Fear River and its tributaries (Lee 1971:7). The Carolina Province was split into North Carolina and South Carolina in 1712, and both became royal colonies in 1729.

As a result of the growing population, New Hanover County was created in 1729 from parts of Craven Precinct (Sharpe 1954:327). In turn, New Hanover was partitioned for the creation of Onslow and Bladen counties in 1735, Duplin County in 1750, and Brunswick County in 1764 (Lee 1971:10).

Since the late 1600s, the Cape Fear River had been established as a port of entry for Carolina. In 1726, the town of Brunswick was founded on the west bank of the river to act as a mercantile center for the export of agricultural goods and naval stores from the growing area (Lee 1971:12). By the early 1730s, the land at the juncture of the Northeast Cape Fear and Cape Fear rivers, 15 miles upstream from Brunswick, was being settled and soon formed into a new town named Newtown or Newton (Sharpe 1954:326; Lee 1971:12). In 1740, Newtown was incorporated as Wilmington. With the establishment of Wilmington, Brunswick began a slow decline and was finally abandoned after the Revolutionary War (Powell 1989:84).

Throughout the eighteenth century, most of the residents of the lower Cape Fear region relied on agriculture for their livelihoods. The fertile soils in the area lent themselves to the cultivation of a wide array of produce including wheat, corn, rice, indigo, and tobacco (Powell 1989:132-134). In the colonial economy of Wilmington, rice played an important role as a cash crop. In addition, many people raised hogs and other livestock. The emergence of the cash crop economy led to the development of large plantations throughout the lower Cape Fear region, such as Orton, Rose Hill, Swann Point, Point Pleasant, and The Oaks.

The production of naval stores was a major industry throughout the Coastal Plain during the colonial era. Because of the vast forests of longleaf pine that blanketed the region, the early inhabitants were able to extract the tar, pitch, and turpentine that were so essential in the naval stores industry. At its height, the naval stores industry in the lower Cape Fear region was producing nearly one-third of all the turpentine in the world (Sharpe 1954:312). Not surprisingly, more naval stores were shipped to England from New Hanover County than from any other area in the British Empire (Lee 1971:16). The abundant forests also gave rise to a lumber industry, with mills established throughout the Coastal Plain. The mills produced barrel components, planks, and shingles (Powell 1989:137).

After the Battle of Guilford Courthouse in 1781, Lord Cornwallis, the British commander, led his troops into Wilmington, where he remained for almost three weeks, during which time he decided to march north to Virginia. As the British army moved north along the Duplin Road and through the Coastal Plain, it terrorized the local populace by burning homes and appropriating personal property (Rankin 1959:62; Powell 1989:206). British troops evacuated Wilmington permanently on November 18, 1781, one month after Cornwallis surrendered at Yorktown, Virginia.

During the Antebellum period, Wilmington remained one of the most important shipping centers in the state. Though trade had suffered in the years after the American Revolution, by the 1820s Wilmington had undergone an economic revival. In 1830, the Port of Wilmington handled more freight tonnage than the Port of Richmond (Sharpe 1954:311). Because the economy of the region depended on the Cape Fear River, several projects were undertaken to improve the river through dredging and the construction of jetties (Lee 1971:37). In 1840, the Wilmington and Weldon Railroad, which connected Wilmington to the Roanoke River area and Virginia, was completed (Lee 1971:38-39).

The Civil War had a direct impact on Wilmington and the surrounding areas. In April 1861, Union naval forces began a blockade of Southern ports. The Confederacy responded by utilizing blockade-runners. Wilmington, because of its port facilities, rail connections, and up-river location, quickly became a major blockade-running center (Sharpe 1954:311; Lee 1971:61). The mouth of the Cape Fear River was protected by Fort Fisher, a large earthwork fort that was constructed in 1861-62 (Lee 1971:65).

By August 1864, most of the supplies for the Army of Northern Virginia came through Wilmington (Lee 1971:69). Because of the importance of Wilmington as an entrepôt for supplies for the Confederacy, the city became one of the chief targets of Union strategists. In December 1864, a Union armada bombarded Fort Fisher, and troops were landed, but the fort proved difficult to capture (Lee 1971:71; Powell 1989:376). A second assault on the fort was launched in January 1865. After three days of naval bombardment, Fort Fisher fell to Union troops. With the fall of Fort Fisher, the Confederacy's last open port lay defenseless. By February, Wilmington surrendered to the Federal forces. After the fall of Fort Fisher and Wilmington, Confederate forces attempted to stall the Union advance to Goldsboro by constructing earthworks on the northern bank of the Northeast Cape Fear River. These earthworks guarded the Duplin Road, modern U.S. 117, which led north from New Hanover County. However, the Confederate efforts to contain the Union advance proved to be too little too late, as Goldsboro was taken in March, and the Confederacy collapsed in April 1865.

The end of hostilities in April 1865 brought many changes to the region. Foremost among them was the abolition of the slave system. In its place, a system of tenant farming and sharecropping was installed (Powell 1989:416). The large plantations that had characterized Antebellum agriculture in the Coastal Plain were broken up into smaller farms, so that by 1880, while the number of farms had more than doubled from pre-war numbers, the average acreage of each farm fell by more than 50 percent (Powell 1989:417).

Aside from the dramatic agricultural and social changes wrought by Reconstruction, the era also marked a period of increased modernization. During the 1870s, textile mills began to appear in the Wilmington area (Lee 1971:88). By the 1880s, Wilmington was once again prospering as a seaport. The naval stores trade, though slowly dying, still accounted for much of the cargo passing through Wilmington. Cotton began to be a more important commodity in Wilmington's shipping economy (Sharpe 1954:312; Lee 1971:87). Also, the fertilizer and wood preservation industries began to be established in the region (Sharpe 1954:312).

As the twentieth century dawned, the Coastal Plain remained a largely agricultural area. Though cotton remained an important crop, many farmers began to diversify their crops. Tobacco, which had been grown in the region since the first settlement, began to take on a new importance. For example, by the middle of the twentieth century, tobacco had become the chief crop of many coastal counties (Sharpe 1965). Other extractive industries supplemented the region's agrarian economy. Though the naval stores industry had, by the twentieth century, become an anachronism, the abundance of forested land continued to support an extensive lumber industry (Lee 1971:87).

The proliferation of the automobile in the early twentieth century, combined with the inability of County governments to properly build and maintain roads, caused the state to take over the maintenance and construction of roads. In 1921, the establishment of "The Good Roads System" led to the hard paving of many of the roads in the Coastal Plain. As other roads were built or improved, transportation became easier. Another result of state control of roads was the gradual decline of both the steamship and railroad industries in eastern North Carolina.

(For a more detailed history of the development of the area, there are numerous publications to which one can turn. These include Alan D. Watson's *Wilmington, North Carolina, to 1861*, published in 2003, Lawrence Lee's *The History of Brunswick County* from 1980, or Lee's *New Hanover County: A Brief History* from 1971, among many others.)

Eagles Island

Wilson Angley compiled a document called *A Brief History of the Eagles Plantation and Mill Facility in Brunswick County* in 1989. Most of the information discussed below about the Eagles family is summarized from that document.

Eagles Island gets its name from Richard Eagles, Senior; an English native, merchant, and planter who came to the area from Charleston, (then Charles Town) South Carolina, in 1734. He married Elizabeth Crichton, who was related to William Dry, the customs collector at the Port of Brunswick. He received a grant for 640 acres that was recorded in September 1737 and also acquired landholdings in 1738 that included land on Eagles Island. Over a number of years, he purchased more land on the island and the western side of the Brunswick River, including property from John Watson and Rufus Marsden, and 10 lots in Wilmington, which was known at that time as Newton. Over the eighteenth century, the Eagles family came to own over 900 acres on the island as well as over 6,500 total acres in the region (Hall 1980; Jackson 1996).

Although Richard Eagles came into ownership of the island in the 1730s, it is likely that he, or any other landowners, did not grow any rice on the island until after the 1750s. When he bought

land on the island, rice was grown using a method of upland production, whereby water was impounded along upland streams and then diverted into the rice fields. It was not until the 1750s that rice began to be grown in the region using tidal flow, and this method was not perfected until 1783 by Gideon Dupont in South Carolina (Clifton 1973). Additionally, the lack of extensive longleaf pine forest on the island during the Colonial period would not have been conducive to the large-scale production of raw naval stores. It is most likely that Eagles Island was used for general timbering and as speculative property until the second half of the eighteenth century. The use of the island for the manufacture of naval stores and the transshipment of naval stores and agricultural goods may have begun in the mid-1700s, after Wilmington became established and began to grow into the major port along the Cape Fear River.

The Forks was the most southern Brunswick County plantation situated across the Brunswick River from Eagles Island. According to Waddell (1909), Buchoi was the next plantation north of The Forks, but a map of rice plantations in the area shows that the plantation Aspern was between them (Jackson 1996). Buchoi was originally owned by Judge Alfred Moore, who was married to Susanna Elizabeth Eagles, the daughter of Richard Eagles, Jr. (Anglely 1989). While the name is thought by some to have come from a misspelling of Beauchois, Waddell (1909) suggests that the name was derived from a Native American word recorded in the records of his estate in Goose Creek, South Carolina, as “Boo-Chawee.” Buchoi also had extensive landholdings on Eagles Island (Anglely 1989).

Jackson (1996) shows that the plantation of Glastonbury was north of Buchoi; it had 220 acres of property on the island. Former owners of Glastonbury include Frederick J. Lord and Captain A.W. Rieger. John Waddell, the son of General Hugh Waddell, owned the next plantation, Belville (Waddell 1909). North of that was Belvidere, the plantation originally owned by Colonel William Dry, but which was later owned by Governor Ben Smith (Waddell 1909). Three plantations are known to have been located on the eastern side of Eagles Island Hallett, Osawatomie, and Bleak House (Jackson 1996).

These plantations mainly used Eagles Island for growing rice and extensively developed the island in the late 1700s and early 1800s, covering it with large numbers of ditches and levees constructed to support rice cultivation. While the construction of rice fields was mainly confined to the late eighteenth and early nineteenth century, rice was grown on the island until the early 1900s.

Richard Eagles died in 1758. His will mentioned a “fortune” that had been given earlier to his daughter, Elizabeth Davis, as well as plantation lands and lots in Wilmington given to his son Richard Eagles, Jr. Also included in his will was mention of 73 slaves.

Richard Eagles, Jr., was married to Margaret Henrietta Bugnion and operated The Forks plantation and its related industries through his death in 1769. His will gave the plantation house, mills, large landholdings, and lots in Wilmington to his son James and granted Elizabeth Davis the house in which she lived. His daughter Susanna, who married Judge Alfred Moore, received one-third of her father’s landholdings on Eagles Island as well as other land and Wilmington lots.

James Eagles was only 15 years old when his father died and he gained ownership of The Forks. He later married Sarah Read and had two sons, Richard and Joseph. Based on a journal entry by Janet Schaw in 1775, it is known that operations of The Forks included not only rice fields, but also indigo fields, timber mills, and apparently naval stores manufacturing. James Eagles' landholdings in 1784 totaled 3,060 acres in Brunswick County as well as lots in Wilmington, though records suggest he owned only 13 slaves, a small number to work such a large operation. When James Eagles died in 1791, he had no will, which resulted in a long legal dispute that finally ended in the 1809 North Carolina Supreme Court case *Moore v. Eagles*. The Moores in the case were those of James' sister Susannah Moore, while the Eagles were the heirs of James Eagles.

In 1803, many of the holdings of The Forks were sold at a public auction. A newspaper article from Wilmington in June of 1803 lists that the sale included 30-40 slaves, personal property, Wilmington lots, and 2,000-3,000 acres of land in Brunswick County. It does not appear that either of James Eagles sons owned any of the lands of The Forks or land on Eagles Island.

Sterling B. Everitt, a physician and planter from Brunswick County, acquired most of the former Eagles holdings, including The Forks plantation and mill facilities in 1835, most of which came from Maurice Moore, the son of Judge Alfred Moore. This also included 210 acres on Eagles Island as well as the approximately 700-acre Asperne plantation, which itself had around 100 acres of tidal rice fields on the island. These holdings were subject to the dower of Sarah Read Eagles, James Eagles' wife, who died in 1844. Everitt's rice production in 1850 totaled about 635,500 pounds per year.

Sometime between 1851 and 1857, Everitt no longer owned The Forks and Asperne. Instead, they were owned by Thomas C. McIlhenny, who also had bought Buchoi, which bounded The Forks to the north. McIlhenny was one of the largest rice producers in the area. In 1860, he produced 864,000 pounds of rice and owned around 100 slaves. McIlhenny owned the plantations until 1880, when he put both up for sale. In the advertisement he placed in the *Morning Star* newspaper, it mentioned that The Forks had about 100 acres of rice fields in operation that could be expanded to 200 acres, and that Asperne also had around 100 acres of rice fields that could be increased to 250 acres. Though not mentioned, it is likely that these fields were mainly located on Eagles Island.

Beginning in the late 1700s, and especially during the nineteenth century, the eastern side of Eagles Island, across from Wilmington, became a major part of the area's port and shipping facilities. This area of the island came to house large numbers of warehouses for the transshipment of naval stores and raw and milled lumber as well as turpentine stills and lumber mills. It also was used for shipbuilding and ship repair. The use of Eagles Island for shipping and manufacturing declined during the early 1900s, and by the 1960s, most of these industries had left the island.

4. Overview of Environmental Conditions and Change

Eagles Island is an island in flux, where change is one of the few constants. The Eagles Island that we see today is the result of environmental changes that have their origins in natural succession and human activities. This chapter provides an overview of the key areas where the environmental changes on Eagles Island can be observed. The environmental changes on Eagles Island primarily reflect changes to water quality, vegetation, and wildlife. **Chapter 5** discusses the influence of human activities on the environment of Eagles Island. Detailed descriptions of the existing ecological conditions are presented in **Chapter 6**.

Water Quality

Eagles Island is bordered by the Cape Fear and Brunswick Rivers. The interior of Eagles Island includes the named streams Alligator Creek and Redmond Creek as well as a multitude of unnamed streams and ditches. The unnamed streams and ditches include small natural water bodies, man-made mosquito control ditches, and the remnants of ditches excavated for the cultivation of rice. Some of the water control structures associated with the rice ditches are still present. In addition, the wetlands associated with Eagles Island and the estuaries downstream serve as nursery areas for a variety of fish, crabs, and shrimp.

The waters within and surrounding Eagles Island are currently classified by the State of North Carolina as tidal waters. Tidal waters can include waters that range in salinity from essentially freshwater to salt water. The salinity of the waters surrounding Eagles Island is increasing [University of North Carolina - Wilmington (UNCW) Aquatic Ecology Laboratory (AEL) 2007]. The rise in salinity is the result of a number of different factors including changes in sea level and changes to the depth and shape of the Cape Fear River channel that affect how far up river salt water can flow. The amount of rainfall in the upper portions of the Cape Fear River Basin affects the amount of freshwater coming down the river to mix with the salt water being pushed up the river during incoming tides. In years of heavier rainfall lower salinity can be expected in the waters within and surrounding Eagles Island than in years of drought (UNCW AEL 2007). The relationship between the salinity and the various factors affecting it is part of an on-going study being conducted UNCW Aquatic Ecology Laboratory.

Various other indicators of water quality are being measured in the water surrounding Eagles Island by the State of North Carolina and the UNCW Aquatic Ecology Laboratory to better understand the effect of upstream land use activities on the Lower Cape Fear River Estuary. Upstream land use activities include agriculture, animal feed operations, timber harvesting, and industrial and residential development. The Cape Fear River Basin is one of the most heavily industrialized watersheds in North Carolina and includes over 200 permitted wastewater dischargers. The water quality in the area is frequently impaired by low dissolved oxygen conditions. Much of the information available on water quality in the waters around Eagles Island is the result of an on-going study being conducted by the Lower Cape Fear River Program. The physical and biological parameters being measured include salinity, dissolved oxygen (DO), field turbidity, total suspended solids, chlorophyll a, fecal coliform bacteria,

ammonium, nitrate + nitrite, total nitrogen, orthophosphate, and total phosphate. Dissolved oxygen is typically found to be lower in the summer months when there is a decreased capacity for the water to carry oxygen and the demand for oxygen by aquatic organisms is higher. Low dissolved oxygen conditions are influenced by upstream land use practices and natural processes that fluctuate seasonally. Detailed information on the results of this study can be found in Chapter 6 and is available through the Aquatic Laboratory at UNCW (<http://uncw.edu/cmsr/aquaticcecolgy/laboratory/LCFRP/index.htm>).

Vegetation

The majority of the natural habitats present on Eagles Island today are wetlands including marshes, forests and transitional successional areas between. The majority of the non-wetland areas present on the island occur along the eastern side of the island and adjacent to roadways and spoil areas.

Upland areas represent disturbed habitats that are dominated by a variety of early successional species that readily colonize disturbed areas. These areas are densely vegetated with woody shrub and tree species and generally include little diversity of herbaceous plants. These areas also include a number of non-native species that disperse along roadways and other habitats.

The cypress-gum forested wetlands on Eagles Island occur as scattered pockets primarily adjacent to upland areas and on slightly higher elevations that occur on the interior and along the eastern side of the island dominated by a canopy of bald cypress (*Taxodium distichum*), swamp tupelo (*Nyssa biflora*), and water tupelo (*Nyssa aquatica*). Bald cypress is not tolerant of increased levels of salinity. Evidence of recent mortality of bald cypress can be observed along the fringes of this community where the trees have been stressed. This stress could be attributed to increased levels of salinity in the water. Forested wetlands were more common on Eagles Island historically than what we see today, however, evidence suggests that cypress-gum forest has always been a minor component of Eagles Island.

The tidal marshes of Eagles Island are the dominant habitat across the island. The tidal marshes include areas of diverse tidal freshwater marsh and dense stands of cattails (*Typha angustifolia* and *Typha latifolia*) and giant reed (*Phragmites australis*). The tidal freshwater marshes on Eagles Island are part of the Brunswick River/Cape Fear River Marshes Significant Natural Heritage Area and includes a number of rare plant species that are endemic to the area. This area is unique in that the tidal freshwater marsh is influenced primarily by lunar tides as opposed to wind driven tides that are more common in freshwater marshes in other parts of North Carolina. In recent years brackish and estuarine marsh species have been observed on Eagles Island at scattered localities due to changes in salinity. A number of non-native species have been documented on Eagles Island the most important of which is the invasive giant reed which displaces and outcompetes native marsh vegetation to form dense stands.

Wildlife

Wildlife usage of Eagles Island is directly related to the available habitats and water resources that are present. The majority of the wildlife present includes species adapted to living in aquatic

habitats or those adapted to taking advantage of the disturbed habitats created adjacent to roadways and other areas of human disturbance.

While swamp forests were a component of Eagles Island historically, the freshwater tidal zone of the lower Cape Fear River was considered unique in North Carolina due to the presence of extensive tidal freshwater marshes rather than tidal swamps present elsewhere in North Carolina (Odum *et al.* 1984). This is due in large part to the Cape Fear River's direct connection to the Atlantic Ocean and the presence of tidal influence. Tidal swamps present elsewhere in freshwater tidal zones along other North Carolina rivers result from connections to sounds separated from the Atlantic Ocean by barrier islands, which results in lower tidal amplitude. Eagles Island, located in this tidal freshwater zone, would have supported an assemblage of fish and wildlife adapted to these conditions. Species found in adjacent aquatic systems, both freshwater and higher salinities, would have formed mixed assemblages in this freshwater tidal zone. A good summary of the characteristic fauna of tidal freshwater systems can be found in *The Ecology of Tidal Freshwater Marshes of the United States: A Community Profile* (Odum *et al.* 1984) produced by the U.S. Fish and Wildlife Service. A description of the existing ecological conditions of Eagles Island, including fish and wildlife present, can be found in **Chapter 6**.

In general, within tidal freshwater systems the fish occupying shallow waters and vegetated areas tend to be representatives of freshwater species that occupy slow-flowing aquatic habitats in non-tidal habitats farther upstream, such as various species of minnows, sunfish, and catfish, as well as species of killifish adapted to estuarine conditions. Deeper waters of channels tend to be occupied by estuarine species due to the higher salinities that may be present in a salt wedge beneath the freshwater. Anadromous fish, those that move from marine habitats into freshwater to spawn, are also an important component of the tidal freshwater system, both through the annual movements of some of these species through this zone, and also through the spawning and nursery habitat for juveniles for other species. Important anadromous fish that historically utilized the lower Cape Fear River include several species of herrings and shad, sturgeon, and striped bass.

Alterations on Eagles Island during various periods of occupation and changing land uses would have affected the quality and availability of habitat for fish. Filling of marshes to provide upland areas for construction of structures eliminated habitat, but the overall effect was limited in areal extent. Conversion of extensive areas of tidal freshwater marsh for rice plantations, including construction of dikes and water control structures, may have had a greater effect by alteration of habitat to a monoculture of rice plants and through limiting access to the interior aquatic habitat, degraded as it may have been. As the rice plantations were abandoned and dikes and water control structures fell into disrepair, the tidal freshwater marsh began re-establishing itself and today occupies a large part of what may have been its historic extent. An exception is the southern portion of Eagles Island occupied by a diked dredged material disposal area, which now rises higher in elevation than is conducive for tidal freshwater marsh establishment and has limited access to surrounding waters. This area, however, provides an example of man-induced alterations that although deleterious for some animals, provides habitat for others.

The dredged material disposal area located on the southern end of the island has been shown to provide an important foraging area for migrating shorebirds and other water birds under certain conditions. Unvegetated sand and mud flats along with shallow waters present after dredged material deposition operations have created conditions that can attract over 10,000 shorebirds in a single day during migration (Golder, Cooper, personal communication, 2009). As with the shorebirds, seasonality and availability of suitable habitat conditions influenced the abundance and diversity of other bird species utilizing Eagles Island under past land uses as well as today. The tidal freshwater marsh areas, as well as cattail and sedge-dominated marshy areas of the dredged material disposal area, support species such as rails, herons and egrets, various shorebirds, ducks, wrens, sparrows, and red-winged blackbird. The areas dominated by the invasive giant reed, though, generally provide low quality habitat not utilized by many species. In the past the more common species of rail present in the tidal marshes has been king rail but in recent years more frequent sightings of the more salt tolerant clapper rail have been occurring (Fussell 1994). The dead tree snags on Eagles Island provide habitat that is generally limited by modern forestry practices elsewhere, which provides important nesting habitat for cavity nesters such as woodpeckers, and even resulted in one of the few documented nesting occurrences of tree swallow in North Carolina (Cooper and Markham 1994).

The mosaic of habitats on Eagles Island, combined with its location at the confluence of two rivers near an abrupt change in coastline orientation near the mouth of the Cape Fear, has resulted in a natural migrant trap for individual birds that stray from normal migration routes. Eagles Island is well known among local birdwatchers for attracting species rarely seen in North Carolina, including individuals of species straying from the western U.S. or western migration routes, such as eared grebe, Baird's sandpiper, western kingbird, and mourning warbler; northern U.S., such as rough-legged hawk; Florida, such as roseate spoonbill and gray kingbird; and even Europe, such as curlew sandpiper and ruff (Golder; Cooper, personal communication, 2009). Christmas bird counts performed on Eagles Island as part of the Audubon Society's annual program provide a long record of bird records for the island, and likewise document the presence of a wide diversity of birds utilizing the island in winter, and document some surprising rarities (Cooper, personal communication, 2009).

The mammal fauna of Eagles Island has also experienced changes from man-induced changes over time. The resident historic fauna was likely affected by intensive hunting and trapping pressures exerted over much of the state a century ago, which resulted in local extirpations of such species as beaver, river otter, and black bear, and near extirpation of white-tailed deer. Populations of these species have rebounded, and with the exception of black bear, are resident on Eagles Island again. Another species, the exotic nutria, has become established through expansion of populations established through escapes or releases from captive breeding efforts for the fur trade. Nutria may compete with native species with similar ecological niches, like muskrat, and also can create a nuisance by undermining dikes and levees through their burrowing activities, which could create problems for the dredged material disposal area dikes on Eagles Island.

Overall, the historic diversity and abundance of wildlife using Eagles Island may have been temporally altered by past land use activities, but populations of most species present historically appear to have rebounded within areas that have returned to near historic natural conditions.

Habitats that have been altered by land use activities have provided additional habitats not historically present on Eagles Island, but these too have added to the present-day diversity and abundance of wildlife inhabiting or utilizing the island.

5. Significant Events and Activities

Eagles Island is a landscape that reflects the events and activities that have occurred within its boundaries and along its shores resulting in the landscape that we see today and help us to better understand what the possibilities are for the future. In this chapter we will explore some of the more significant events that have influenced Eagles Island starting with its early use as a base for rice plantations and continuing through its history of modernization starting with its role in North Carolina's naval stores and logging and timber industries and continuing through its role in as a center for shipping and commerce. We will also explore the development of dredging activities and transportation in association with Eagles Island. The direct interaction of people through domestic occupation and use for fisheries, recreation, and tourism will also be explored.

Rice Plantations

The introduction of rice production to Eagles Island brought with it significant changes to the local vegetation and hydrology that ultimately affected landscape level changes to the island. These changes result primarily from the initial clearing of the trees and vegetation bordering the Cape Fear and Brunswick rivers and the construction of canals and ditches.

The introduction of rice production to the lower Cape Fear River was the result of planters moving to the area from along the Cooper River near Charleston, South Carolina, where there had been a large rice industry for many years. They brought with them not only rice production, but also slaves, who served as the main labor force. These slaves were members of the Gullah culture, which is discussed in more detail in the **Domestic Occupation** section later in this chapter. Many of these slaves had their origins along the Gambia River or Sierra Leone, where they had grown rice for generations. They were specifically sought by planters in South Carolina in the 1700s due to their expertise in rice production (Carney 2001). They were then exported up and down the coast to northern Florida and southern North Carolina.

The early, Colonial period rice plantations used the upland production methods. Dams and canals were used to impound fresh water and divert it to fields located in upland swamps for irrigation. This method, though, was subject to the vagaries of rainfall. During this time, rice production was often coupled with the growing and processing of indigo. The indigo season ended in summer, which freed slaves to work the rice harvest and to process rice during the winter (Clifton 1973).

The process of producing rice using tidal flow, though in use to certain degrees since the 1750s, was perfected by Gideon Dupont in South Carolina in 1783. The advent of Dupont's tidal production method after the Revolutionary War moved rice growing to tidal swamps. Indigo production in the area basically ceased at this time (Clifton 1973). Rice plantations along tidally influenced rivers, such as the Cape Fear and Brunswick rivers, would take advantage of high and low tides to flood or drain the fields as needed. The use of tidal rivers for rice production had many benefits over upland rice production. Water supply was constant and predictable. Also, as the tides continually replenished nutrients, a tidal rice field would not have to be abandoned

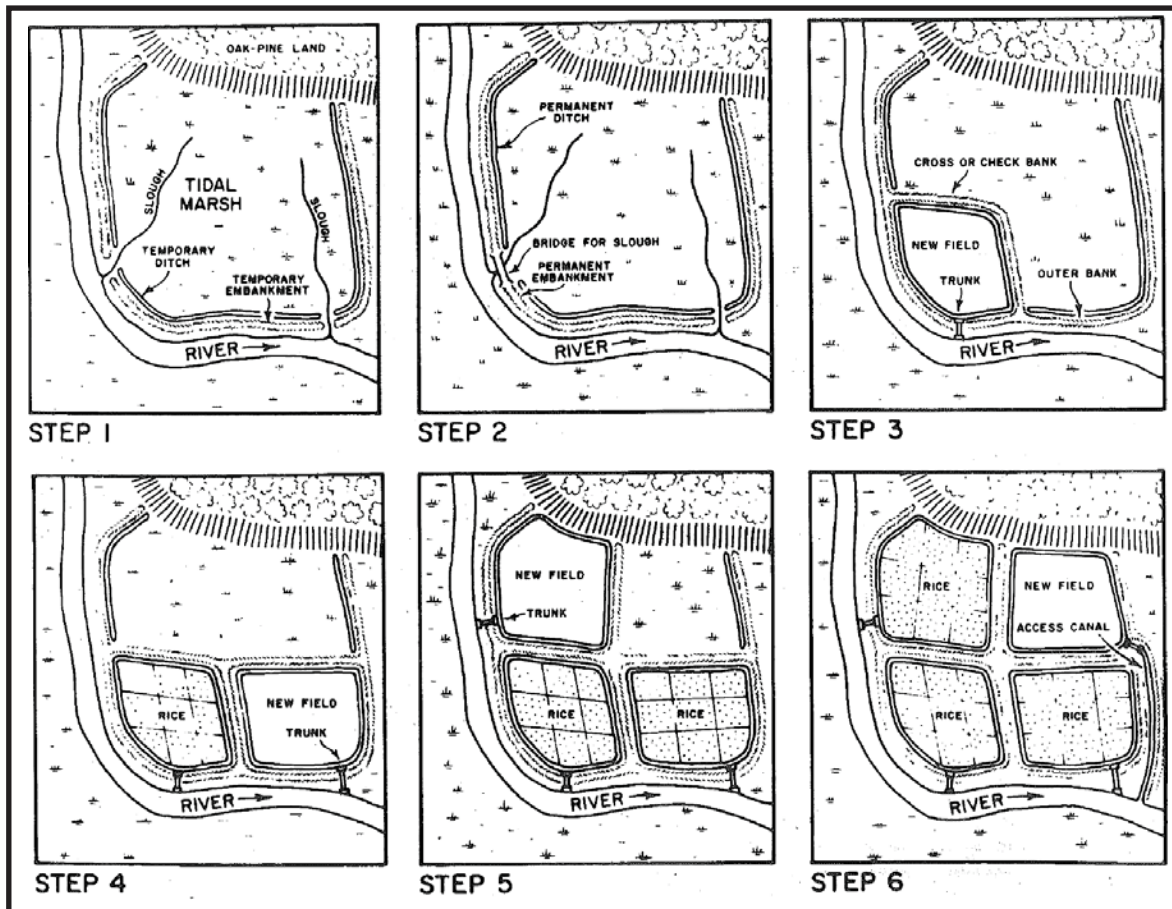
because of soil exhaustion. As such the tidal freshwater forests and extensive tidal freshwater marsh of Eagles Island were considered attractive to early Federal period rice producers.

Converting tidal freshwater swamp for rice production was a multistage process that entailed considerable expense and involved intensive labor to initially clear the land of timber and to construct the network of canals and ditches that would be used to control water levels in the rice fields (**Figure 5.1**). In the case of Eagles Island the tidal cypress and gum forests that may have been present were cleared to open fields. Levees were then built along the river and around each planned field complex prevent the river from uncontrollably flooding the fields at high tide. Each individual field was surrounded by a smaller embankment to contain water. Numerous ditches would be excavated perpendicular to one another to control water flow within the fields, and sluice gates would be placed at points along the levees and along individual fields to raise or lower the water level in the fields (**Figure 5.1**).

Although it yielded large quantities of rice relative to upland rice production, growing rice in tidal fields was very laborious, not just for the initial construction of the fields, but also the maintenance of dikes, canals, and related features and the actual planting, maintaining, and harvesting of the crop (Anderson and Logan 1981; Clifton 1981; Dethloff 1982). The switch to tidal rice production led to a large increase in the use of slave labor. Wood (2004) suggests that a profitable rice plantation would need no fewer than 30 slaves. Due to the intensity of infrastructure maintenance and the actual growing of rice, slaves often lived near the fields, rather than near the plantation house, as is often assumed in popular culture.

The rice grown in the lower Cape Fear region was principally Carolina Gold Rice, which was the main type brought by the initial planters from South Carolina (Clifton 1973). While some Carolina White Rice was also grown, it was not planted to the same degree as its grains had a tendency to shatter during harvest. Production along the river peaked around 1859, when over nine million pounds of rice were grown. After the Civil War, the abolition of slavery caused rice growing to become much less profitable. While rice was still grown in the Carolinas in the late nineteenth century, it all but ceased during the early 1900s as rice production shifted to Louisiana. In 1879, the fields of the lower Cape Fear River produced less than 1.5 million pounds of rice, and the 1909 crop, the last to be officially recorded in the census, yielded only about 350,000 pounds.

Numerous rice plantations were located on Eagles Island during the eighteenth and nineteenth centuries (**Figure 5.2**), and rice production was still occurring on the island in the early twentieth century, as shown on a 1933 U.S. Coast and Geodetic Survey Map, which depicts a number of apparently active rice fields (**Figure 5.3**). Plantations with rice fields on the island included The Forks, Buchoi (Beauchaix), Bleak House, Osawatomie, Glastonbury, and Hallett (Jackson 1996). In addition to The Forks, the plantation of Glastonbury had 220 acres of property on the island (Jackson 1996). Also, three plantations are known to have been located on the eastern side of Eagles Island (Jackson 1996). Hallett Plantation was a small operation owned by B.F. Hallett, which covered approximately 60 acres. South of Hallett was Osawatomie, while Bleak House was located to the north. At one time, it is believed that over 75 percent of Eagles Island was used for growing rice (Hall 1980). Although rice production had dropped significantly by 1900, the Cape Fear Rice Company obtained a charter to grow rice on the island in the early 1900s.



Formation of Tidal Rice Fields (Anderson and Logan 1981).

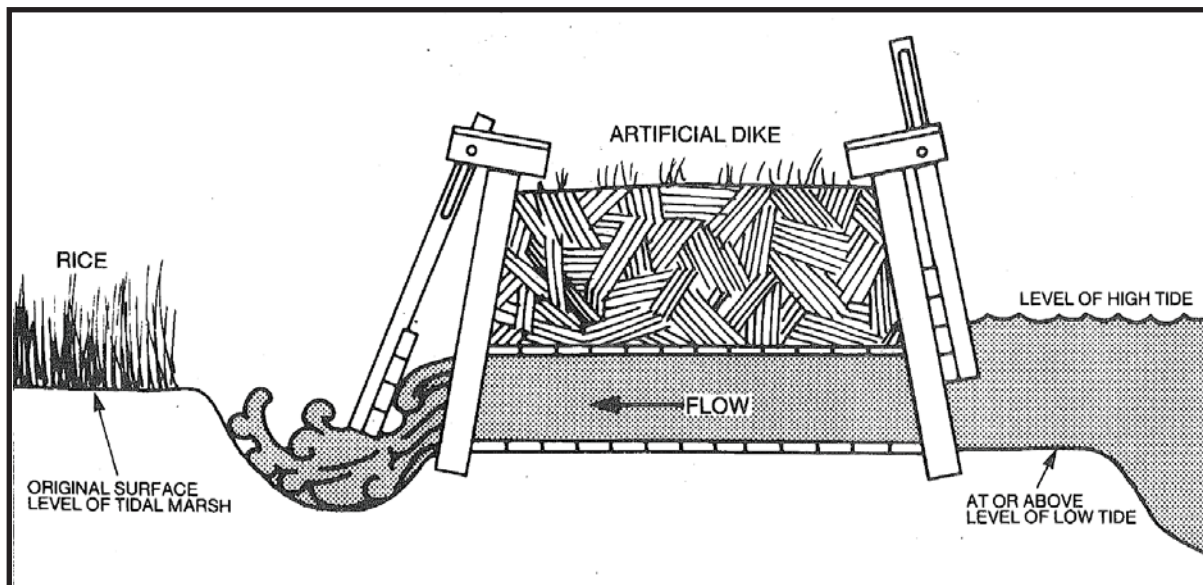
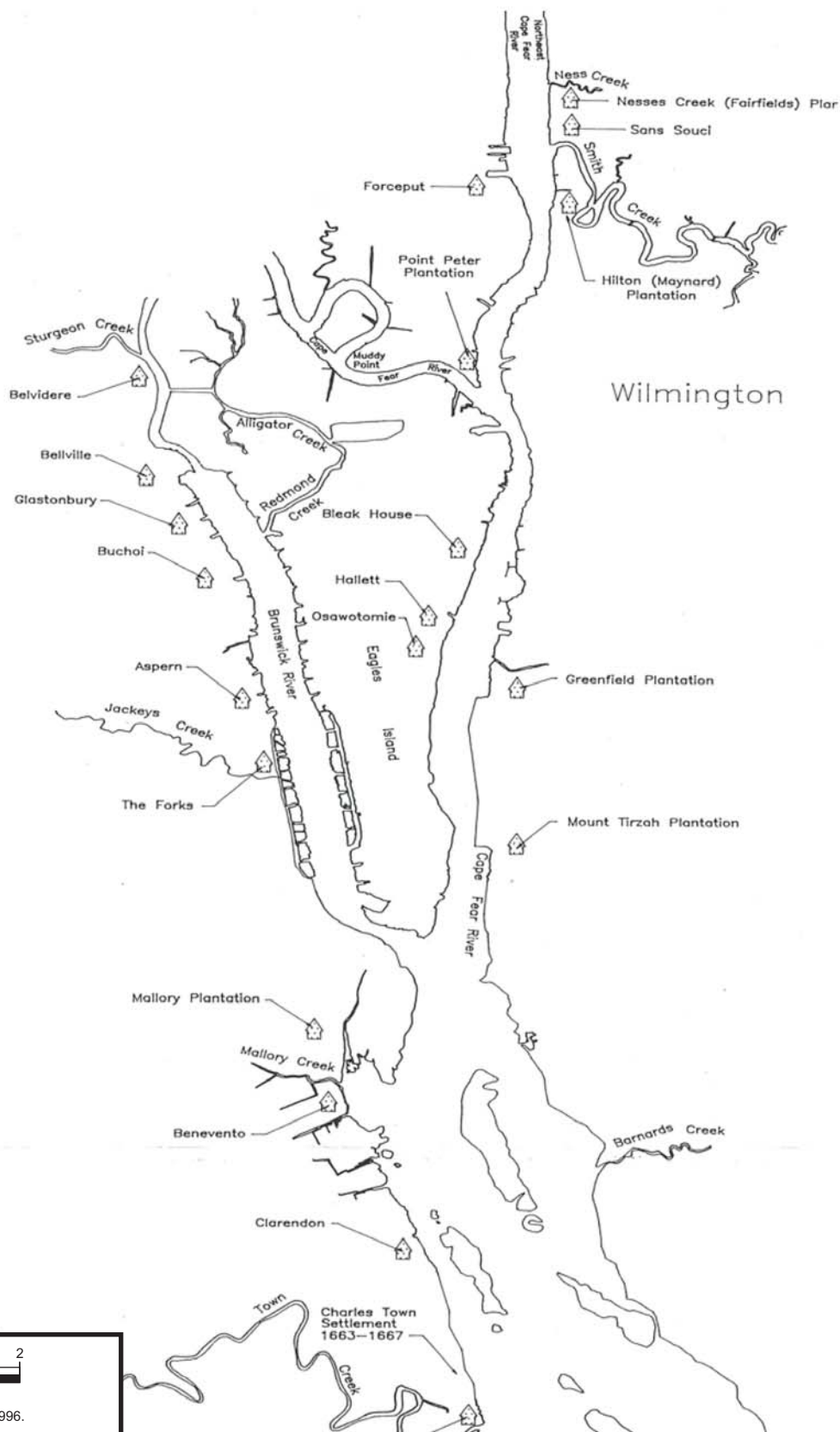


Diagram of a Rice Trunk (Anderson and Logan 1981).



Source: Jackson, 1996.

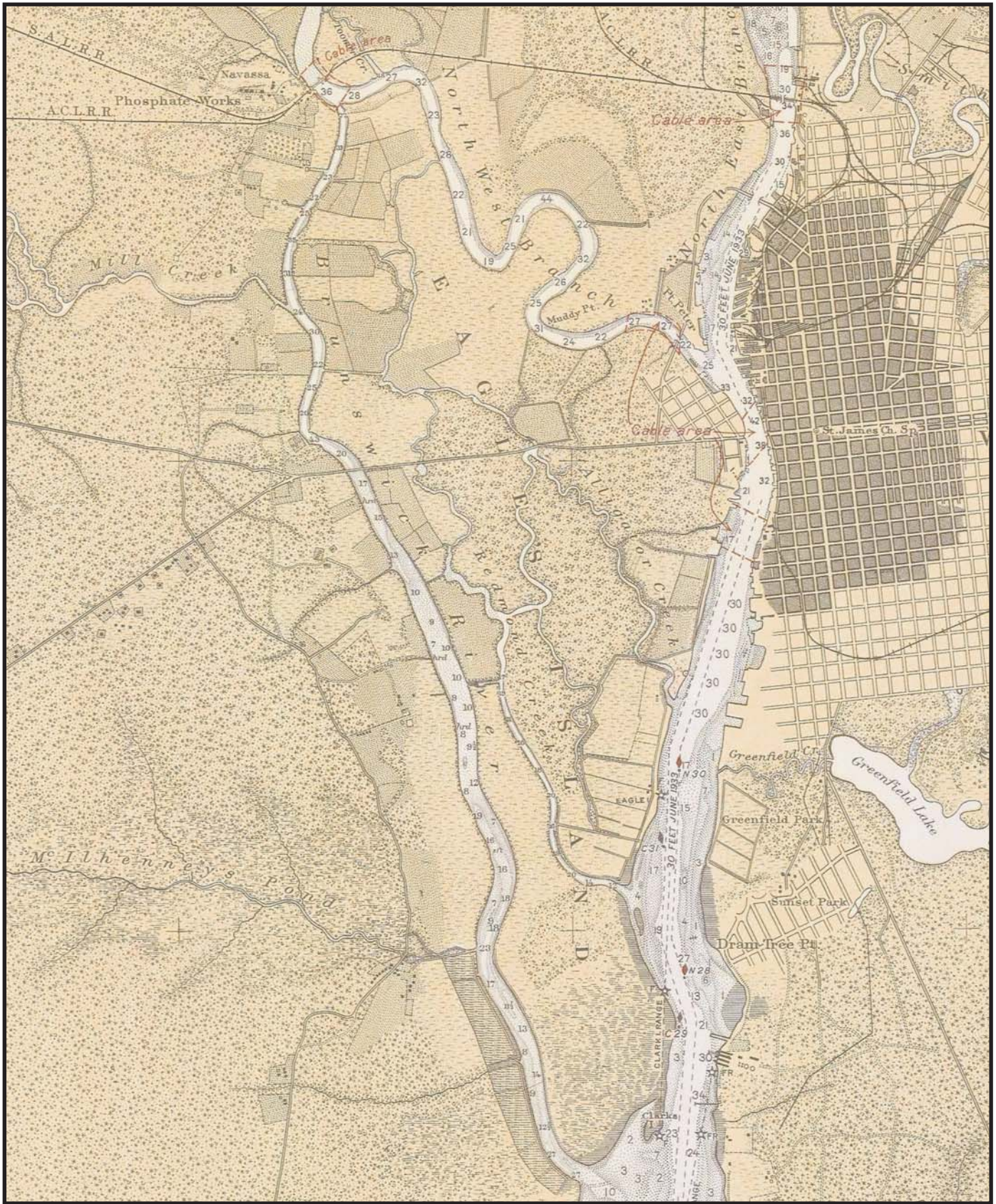
Disclaimer: The information depicted on this figure is for informational purposes only and was not prepared for, and is not suitable for legal or engineering purposes.

Cape Fear Rice Plantations (Jackson 1996).



Rice Plantations along the Cape Fear River
Eagles Island
 New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	MP/SS
Figure:	5.2



1933 U.S. Coast and Geodetic Survey Map showing Eagles Island.



1933 U.S. Coast and Geodetic Map of Eagles Island
Eagles Island
 New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	MP/SS
Figure:	5.3

The effects of rice production are still observable on Eagles Island today. Large canals and remnant embankments are located in the northwestern portion of the island, north and west of U.S. 17/74/76 (**Figure 5.4**). Today, the monoculture of rice has been replaced by the natural regeneration of a much more diverse tidal freshwater wetland plant community. Any evidence of rice fields that were located on the southern half of the island has been obliterated by the dumping of dredge spoil begun during the twentieth century.

A source for more detail on rice production along the lower Cape Fear River can be found in an article in the Volume L, Number 4 of the 1973 *North Carolina Historical Review*. The article by James M. Clifton is called *Golden Grains of White: Rice Planting on the Lower Cape Fear*. It contains a wealth of information on how rice fields were prepared, how rice was grown and harvested, the hierarchy and culture of rice plantations, and the decline of the rice industry in the area.

Naval Stores

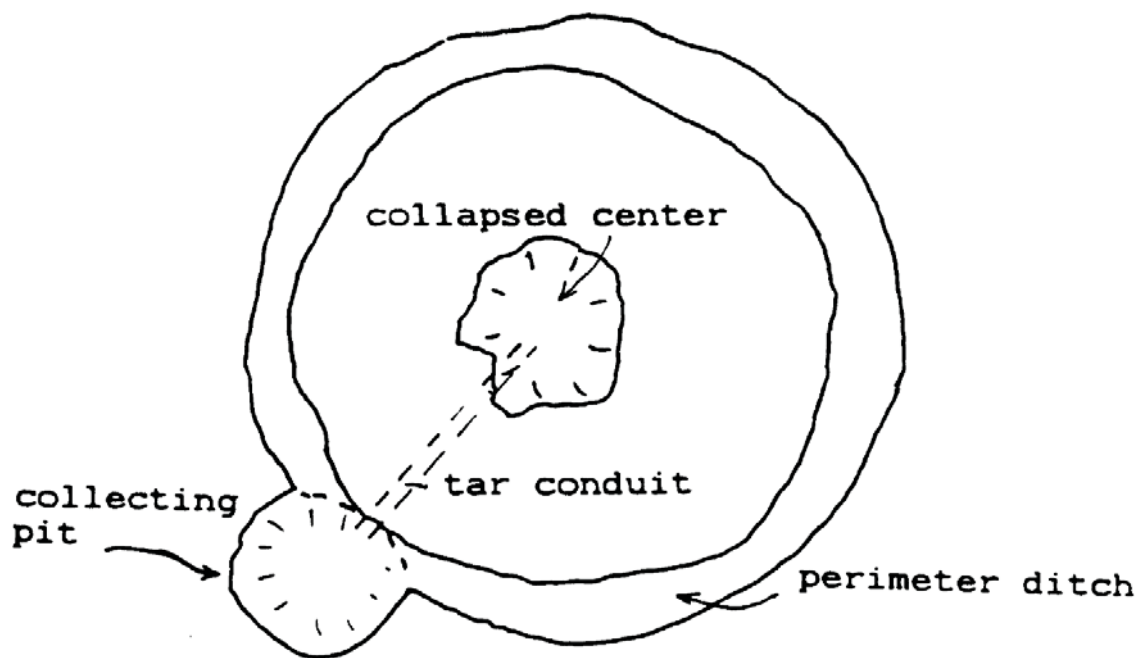
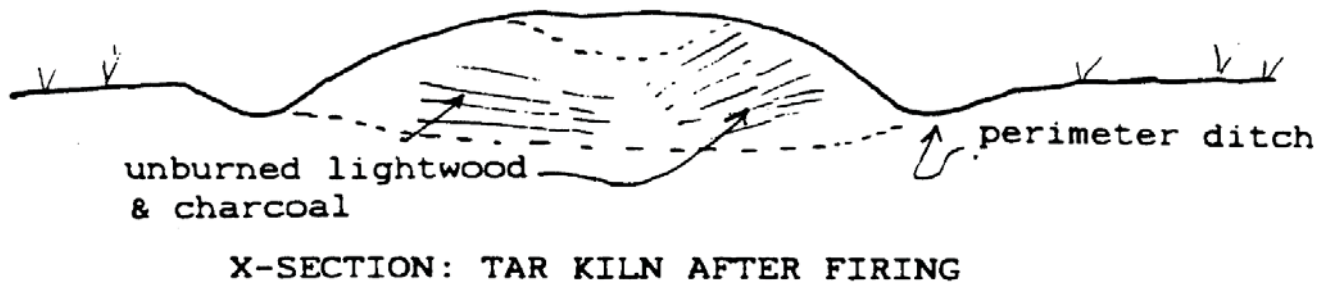
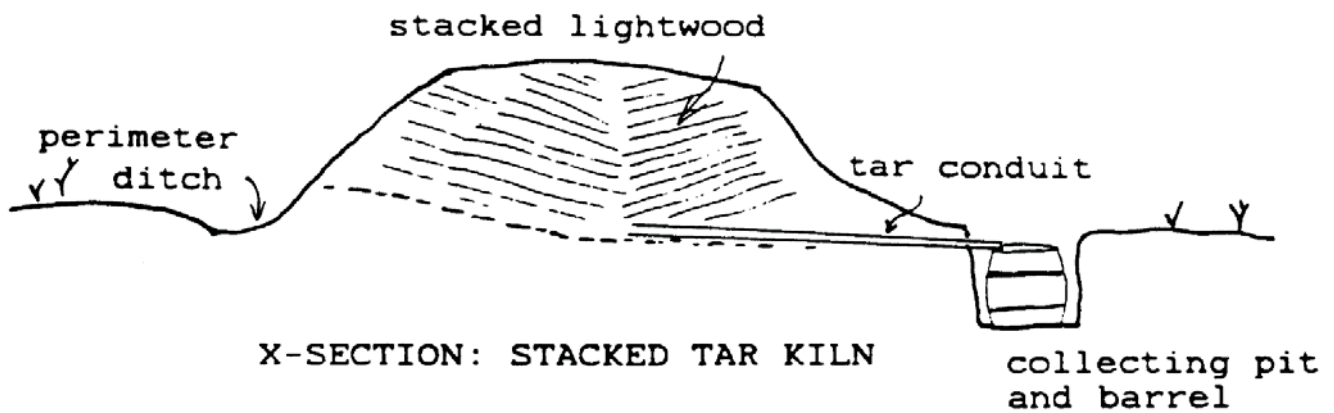
Generally speaking, the term “naval stores” is used to describe the products produced for the marine and shipbuilding industries from the gum of coniferous trees. The main products of the naval stores industry were gum, tar, pitch, spirits of turpentine, and rosin. These were used to help waterproof naval vessels as well as roofs and other items. Refined products such as turpentine were used in solvents, paints, soaps, medicine, and even for fuel. Although many different types of conifers can be used for naval stores production, the main tree used in North Carolina was the longleaf pine (*Pinus palustris*).

Gum is also known as raw turpentine or resin and is the basic material of naval stores products (Brown 1919). Heart pine has high concentrations of gum, so much in fact that the wood is highly flammable. Gum would be obtained through the scraping, scoring, or cutting of the trunk of a pine tree. As the gum ran down the wounds cut into the tree, it would collect in containers hung on the side of the tree or in cavities that had been cut into the tree. Although it could be used as a crude waterproofing material, it was generally used to produce tar, rosin, or sprits of turpentine. Gum production during the eighteenth and early to mid-nineteenth centuries was conducted by crews made up mainly of slaves. A crew would set up a camp in the forest and work until the gum had been depleted, which in the case of heart pine would be about five to seven years (Robinson 1997:52, 55).

Tar was made by heating or burning pine wood rich in gum, and the heat of the fire would drive out the gum for collection. A tar kiln would be made by stacking up lengths of lightwood (e.g. pine rich in gum), often collected from dead trees but sometimes consisting of cut trees, in large circular piles typically 20 to 30 feet in diameter, and which could reach upwards of 50 feet in diameter in some instances (**Figure 5.5**). The pile of wood would be covered by pine needles, leaves, and dirt and then set on fire with as little flame as possible. Hot tar would run out of the kiln through a pipe or other conduit that had been built underneath the bottom of the kiln. The pipe opened up into a pit, into which barrels would be placed to collect the tar runnings. A standard barrel of gum was 31.5 gallons (Harmon and Snedeker 1993). During the colonial and antebellum period, tar kilns were constructed and operated by slaves. Kilns were often fired



Remains of Rice Fields in Northwestern Third of Eagles Island (Google 2009).



Tar Kiln Construction (Robinson 1991).

during the winter when gum was not running or the slaves were not engaged in agricultural activities (Robinson 1997:55-56).

Pitch was produced by the burning of tar in pitch pots, typical in the eighteenth century, or boiling tar in iron pots. A pitch pot was a hole 2-5 feet in diameter, several feet deep, and lined with clay. The burning or boiling of the tar evaporated off the volatile fractions, leaving behind a thicker substance that was used for sealing cracks between boards on ships and for general waterproofing (Robinson 1997:57).

Gum could also be processed into spirits of turpentine and rosin. The process was not common in North Carolina until after 1800. Using the techniques of distillation, gum would be distilled into various grades of turpentine spirits, which were used as solvents and in medicine (**Figure 5.6**). Rosin was the by-product of the distillation. A sticky substance, it was also often used for waterproofing, but has many other uses as well (Robinson 1997:57).

During Colonial times, longleaf pine forests stretched from the Chesapeake region south along the Atlantic coast and west along the Gulf Coast (Robinson 1997:52). When Britain reestablished bounties on naval stores in 1729 to encourage their production in the Colonies, plantations in the Charleston area had begun switching to producing rice and other more profitable products (Crittenden 1936). This pushed low-value production of naval stores to the margins, which at that time included the lower Cape Fear River region. Naval stores quickly became a leading export of this rapidly growing area, which at the time was anchored by Port Brunswick. By the 1760s, the lower Cape Fear region had become the largest supplier of naval stores in the British Empire (Lee 1965). Over the period of time spanning January 1768 to January 1773, Port Brunswick had shipped out over 41 percent of the total amount of naval stores produced in all of the American Colonies (Lee 1951:65).

The predominance of the region in the production of naval stores continued into the nineteenth century. Although the Civil War greatly affected the naval stores industry, the island and the region as a whole saw a great recovery after 1865, placing Wilmington back into the lead as a naval stores exporter. By the early 1900s, however, the naval stores industry in North Carolina, and the Southeastern United States as a whole, was in significant decline. The exhaustion of the longleaf pine forests in North Carolina was a major cause. Production moved south into South Carolina and Georgia, then west along the Gulf Coast. The other major factor was the shift from wood to iron and steel in ship construction. While vital to wooden boats, naval stores were not necessary for the metal boats. The book *Looking for Longleaf: The Fall and Rise of an American Forest* by Lawrence S. Earley published in 2004 by the University of North Carolina Press gives an extensive history of the exploitation of longleaf pine forests in the southeastern and southern United States for the naval stores and timber industries.

The lower Cape Fear region once held extensive forests of longleaf pine, which were harvested extensively for the raw materials used in the naval stores industry. Although Eagles Island did not contain suitable habitat conditions for longleaf pine, the use of Eagles Island as a manufacturing and processing center for naval stores was predicated on a number of factors, including its location along a deep water channel, its proximity to Wilmington, the availability of cheap slave labor, and the lack of dense development, meaning that there was plenty of room to



View of a Turpentine Still in North Carolina (Littleton View Company n.d.).

expand and the flammable manufacturing process and products were not a danger to the houses and commercial buildings of Wilmington. Naval stores operations on Eagles Island focused on the production of processed products such as turpentine and the transshipment of raw gum and processed tar, pitch, rosin, and turpentine

Tar kilns are found throughout the Coastal Plain of North Carolina, though none are formally recorded at the North Carolina Office of State Archaeology on Eagles Island. Given the lack of longleaf pine habitat on Eagles Island, there was likely little to no gum and tar production on the island. As such, there are likely no remains of the camps of naval stores workers, either slaves or wage laborers, on the island.

However, there were a number of distilleries built on the island to process raw pine sap or resin into turpentine and rosin. These raw materials were brought to the island down the Cape Fear and Northeast Cape Fear rivers on boats and rafts. At one time, at least 13 different turpentine distilleries were in operation on the island (Isaacs 1912). During the late 1800s, there were so many distilleries on the eastern side of Eagles Island that the Eagle [sic] Island Fire Company was established in 1871, which included locating a fire engine on Eagles Island, as there had been numerous fires that had destroyed not only distilleries, but had also affected warehouses and other facilities on the island (Wilmington Star 26 July 1871).

Sanborn maps from 1884, 1889, and 1915 show a number of distilleries and distributors of naval stores on the island around the Cape Fear River Ferry, which ran from Market Street. Two of the major companies to have naval store operations on the island were the American Naval Stores Company and the George L. Morton Company (Isaacs 1912).

The naval stores industry took advantage of Eagles Island's ready access to the Cape Fear River, its location in the lower Cape Fear regions pine lands, and its close proximity but physical isolation from Wilmington. The distilleries, warehouses, and wharfs that developed primarily along the eastern side of Eagles Island resulted in the loss of the forests and marshes that occupied those areas as they were developed through clearing and filling to make room for development. This transformation continued and intensified as Eagles Island became important in the lumber industry and as a center for shipping in the lower Cape Fear region making way for the landscape that we see today along much of the eastern side of the island.

Logging/Lumber

While Eagles Island was best known as a production and transshipment point for naval stores, the island also contained a significant lumber industry. The importance of this industry is evidenced by the fact that over 50 sawmills could be found along the Cape Fear River and its tributaries by 1767 (Lee 1951). The main products of sawmills in the region were shingles, barrel staves, and lumber for both the construction of sailing vessels and buildings.

The cutting of timber on Eagles Island was most likely conducted primarily to accommodate other land uses; first to make way for rice plantations and later to accommodate the development of wharfs, warehouses, distilleries, and sawmills used in the manufacture and shipping of forest products. The location of Eagles Island created a natural convergence point where the raw

materials from forests further up the Cape Fear and Black Rivers and from the nearby portions of New Hanover and Brunswick Counties could be refined and packaged to be shipped overseas.

On Eagles Island proper, logs were brought down the Cape Fear and Northeast Cape Fear rivers specifically for lumber or were part of rafts used to bring naval stores products to the island. Often, trees were cut for lumber after they had been exhausted of gum. The production of staves, which were used for making barrels and casks, was a complimentary industry to naval stores production. During the 1700s, hundreds of thousands of such containers had been made solely for shipping naval stores products (Robinson 1997:60).

The use of Eagles Island for the manufacture of lumber increased steadily in the nineteenth century and especially after the Civil War. Mills along the eastern side of the island produced lumber from loblolly pine, white cedar, and cypress. The 1889, 1893, 1898, and 1904 Sanborn Fire Insurance Maps show the locations of some lumber mills on the eastern side of Eagles Island (**Figure 5.7**). During the twentieth century, production shifted towards specialty hardwoods and materials for furniture manufacturing. The last vestiges of the timber industry on the island disappeared in the late 1980s at the sale of the International Paper pulpwood barge landing.

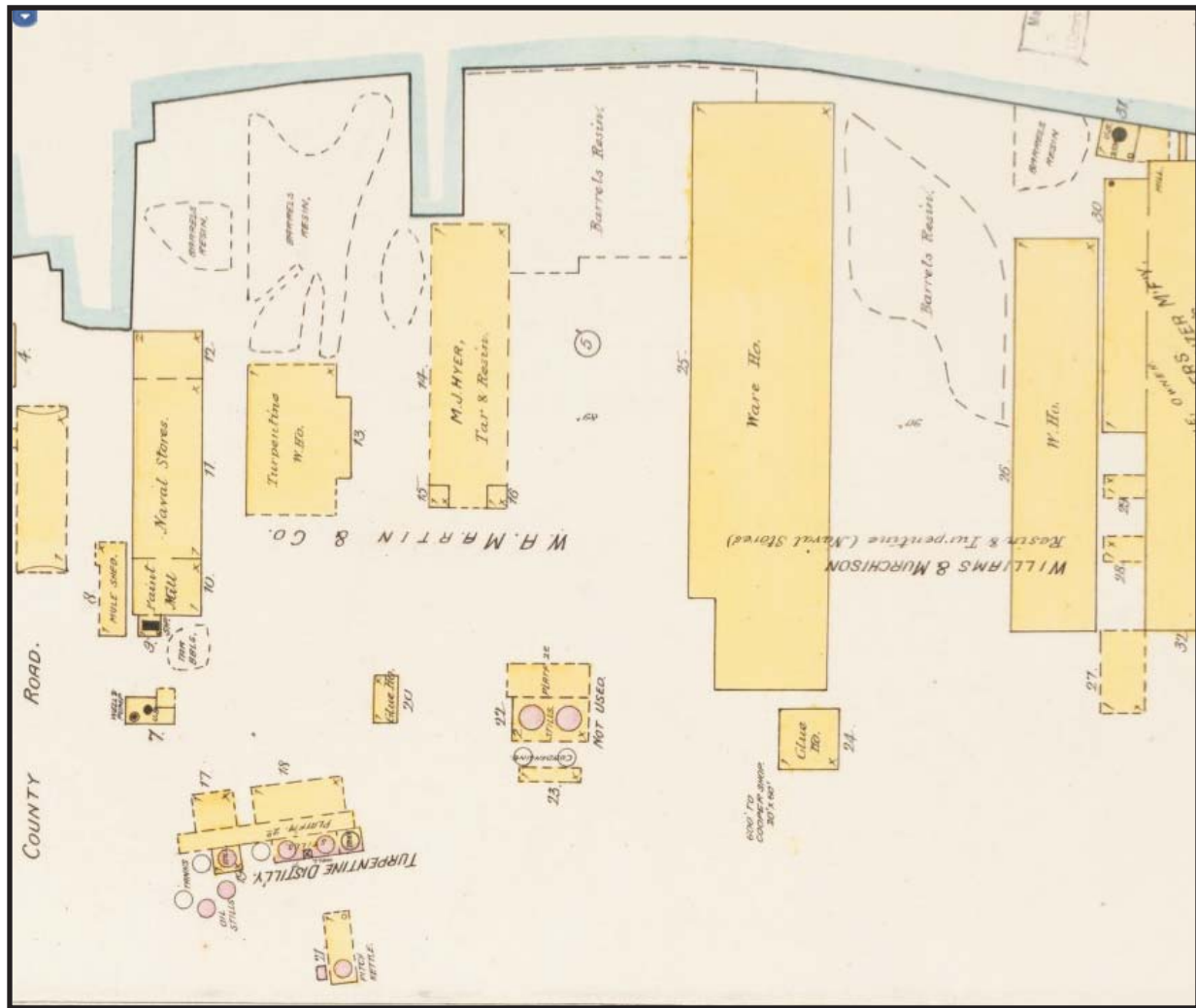
Shipping

Port and Shipping Facilities

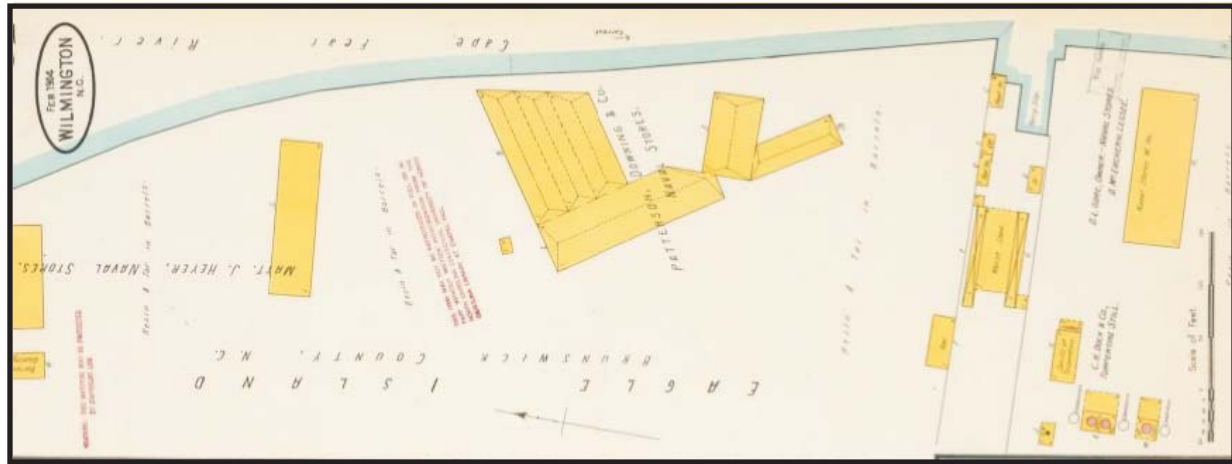
Not too long after its founding in the 1730s, Wilmington became a major port. Its location along the Cape Fear River, navigable up to Fayetteville, and the vast forests in the region that were the source of the raw materials for the naval stores industry and general timbering quickly led to Wilmington becoming the largest port in North Carolina in the 1700s. The tidal flats at the mouth of the Cape Fear River prevented large ships from entering the river. Sloops and other boats smaller than around 100 tons could run up the river to Wilmington, though for a while larger boats continued to dock downstream at Brunswick (Hartzer 1984; Watson 1992).

Being situated along the Cape Fear River right across from Wilmington made Eagles Island a perfect choice as a transshipment point for goods brought down the Cape Fear and Northeast Cape Fear Rivers, the processing of raw materials for export, and for the construction of warehouses to store goods for merchants based in Wilmington proper. While the most significant port facilities in the area were across the river in Wilmington, Eagles Island hosted a range of docks, wharves, warehouses, etc. used for the storage and transshipment of naval stores, rice, and other agricultural products out of North Carolina. By 1800, Eagles Island was shipping around 77,000 barrels of turpentine, rosin, and pine tar, the most of any port in the United States (Isaacs 1912, Ashe 1894).

In addition to the naval stores and timber industries with production and shipping facilities on Eagles Island, there were also warehouses for cotton companies. Cotton was the main export of Wilmington in the 1880s, comprising over two-thirds of the total (Watson 1992). In 1864, the Confederate States Cotton Compress was built abutting the landing of the Cape Fear River Ferry on Eagles Island with the purpose of supplying cotton for export by blockade runners, who used



1889 Sanborn Map (Page 14).



1904 Sanborn Map (Page 31).

shallow draft vessels to cross the shoals at the mouth of the Cape Fear River. The compress was burnt in February of 1865 by local residents to keep it from falling into Union hands (Seeb 2007).

Evidence of the use of Eagles Island for warehouses for Wilmington merchants exists in many newspaper articles from the 1870s. Northrop and Cummings lost corn, turnips, and other goods from its warehouse during an 1874 flood (Wilmington Star 1 October 1874), while salt and molasses at the warehouse of Mr. Williams and Mr. Murchison were threatened by an unusually high tide in 1878 (Wilmington Star 5 January 1878).

The primacy of Wilmington as a port began to decline at the nineteenth century drew to a close. Reasons for this included a shift of naval stores production south to South Carolina and Georgia, a general depletion of timber resources in the region, and the growth of ports and shipping companies outside of North Carolina such as in Norfolk, Virginia, and Charleston, South Carolina (Watson 1992; Randall 1965). During the mid-twentieth century, the shipping industry in Wilmington began to grow again, partly due to the construction of the Intracoastal Waterway in the 1930s (Hartzer 1984). For Eagles Island, however, by the 1960s, the area had been more or less abandoned for warehousing and transshipment activities, though International Paper maintained a pulpwood barge landing just to the south of the current U.S. 17/74/76 bridge over the Cape Fear River into the late 1900s.

Figures 5.8 and 5.9, top show drawings and photographs of docks, wharves, warehouses, lumber, and naval stores on Eagles Island in the 1800s and early 1900s. Although it does not show individual structures, the 1933 U.S. Coast and Geodetic Survey map (**Figure 5.3**) shows the area where the port and warehouse facilities on Eagles Island were concentrated, basically just downstream of the confluence of the Cape Fear River (labeled as “North West Branch” on the map) and the Northeast Cape Fear River.

Shipyards

In addition to port facilities, Eagles Island was host to a number of shipyards. The hey day of shipbuilding in the Wilmington area was during the nineteenth century.

The shipbuilding industry began to decline significantly at the beginning of the twentieth century. The main cause was the city’s failure to shift from wooden construction to that of iron and steel. World War I did help create a temporary increase in shipbuilding in the area, evidenced by the increase statewide in shipbuilding employment from 66 in 1910 to over 7,000 in 1919, but this quickly disappeared (Still 1981). Shipbuilding increased again during World War II, specifically related to the construction of Liberty and Victory ships by the North Carolina Shipbuilding Company, a subsidiary of the Newport News Shipbuilding Company, which leased a yard from the Maritime Commission (Watson 1992). Again, however, the industry died after the end of the war.

The first recorded shipyard on the island was Beery’s Shipyard, opened by Samuel Berry and his two sons on property purchased on 20 June 1848 (Seeb 2007; **Figure 5.9, bottom**). When Benjamin Beery bought out his father’s shares in 1852, the business included a steam sawmill, a



Cape Fear River Ferry in 1800s with Warehouse and Wharves on Eagles Island in Background (On file, Fales Collection).



View of Wharves and Warehouses on Eagles Island in 1920 (Block 1989)

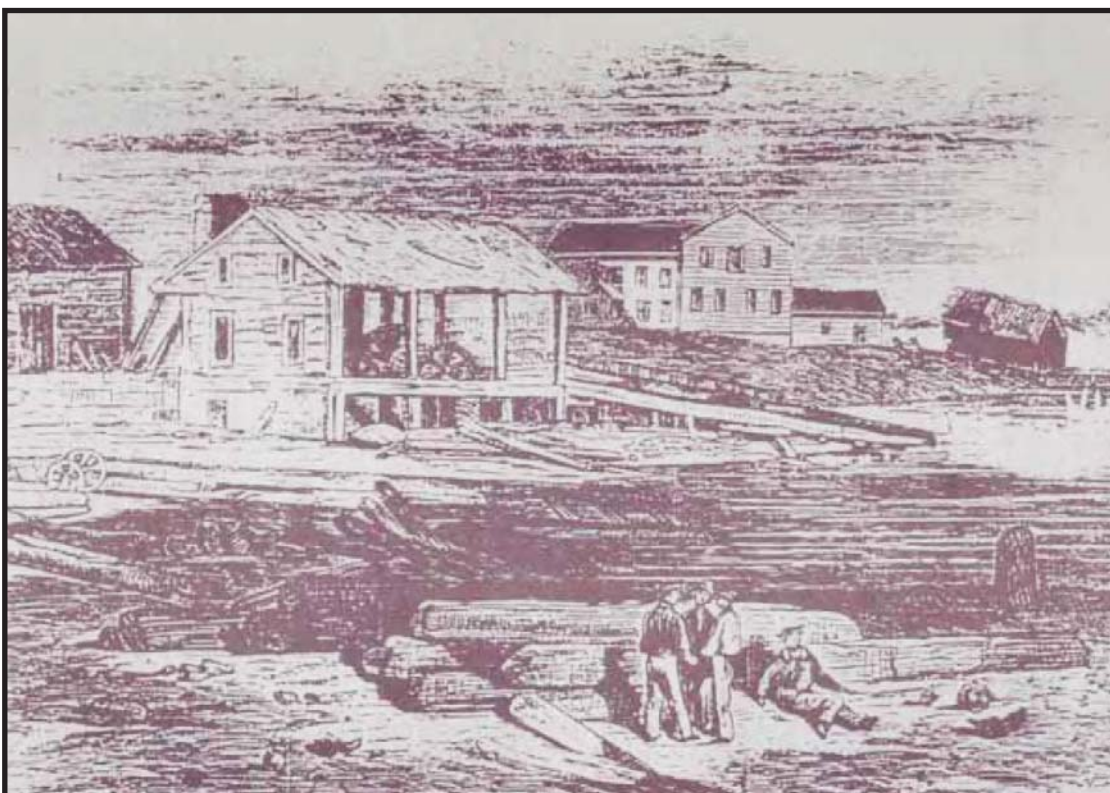


Eagles Island Warehouses and Wharves
Eagles Island
 New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	MP/SS
Figure:	5.8



Barrels of Naval Stores on Eagles Island in 1900 with Wilmington in Background (On file, Fales Collection).



Drawing of Beery's Shipyard (Jackson 1996).



Naval Stores Photo and Shipyard Sketch
Eagles Island
 New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	MP/SS
Figure:	5.9

shipyard, a railway, a blacksmith shop, and a rigging loft, all located on Eagles Island (Jackson 1996). Also known as the Commercial Mill and Shipyard and the Confederate Navy Yard, it produced commercial vessels until the Civil War, when it focused on building ships solely for the Confederate Navy. The most famous vessel to come out of the yard was the CSS *North Carolina*, an ironclad steamship. The shipyard was burned to prevent it from falling into the hands of Federal forces. William Beery rebuilt the facilities by 1872. When the brothers closed their larger location, though, the shipbuilding plant was located on the east side of the Cape Fear River (Jackson 1996).

The Wilmington Iron Works bought the location in 1911 and built a large wharf (Jackson 1996). The plan for the company was to also build dry docks, warehouses, machine and repair shops, and foundries (Wilmington Dispatch 23 September 1911). At the site of the old Beery works, the company built a marine railway known as the Wilmington Marine Railway Company, which began operation in 1912 (Seeb 2007; **Figure 5.10, top**).

Adjacent to the north was the Diamond Steamboat and Wrecking Company. It was jointly administered by Arthur P. Naul and became known as the Naul Shipyard in 1917 and 1918 (Jackson 1996).

The Stone Towing Company (**Figure 5.10, bottom**), which had been formed in 1895 as a towing business and grocer, bought the Wilmington Marine Railway Company and the Naul Shipyard in 1924 (Seeb 2007; Jackson 1996). The company was focused on docking vessels in the Wilmington Port and general towing. A major fire swept through the facilities in 1946 (Wilmington Post 13 June 1946). Use of the marine railway declined during the mid-century, and it was only rarely used during the 1950s and early 1960s, when the company abandoned its facilities on Eagles Island, save to dump materials. The company went out of operation in 1982 (Personal communication of Richard Womack in 2006 cited in Seeb 2007).

Just to the north of the Wilmington Iron Works was the Diamond Steamboat & Wrecking Company. It operated in the early 1900s, and was sold in 1924 to R.R. Stone. The remains of this shipyard can still be found on the island, including the tugboat *Iscoe* (Jackson 1996).

South of the Wilmington Marine Railway was the Hamme Marine Railway, which was built in 1915 on land purchased by R.F. Hamme in 1910 (Wilmington Dispatch 7 Sept 1910, 23 July 1915). It also encompassed land bought from the Suburban Land and Development Company in 1915 (Jackson 1996). The small railway was used to haul small vessels up for repair. Hamme built a larger railway in 1919 (Seeb 2007). In 1946, Hamme sold the company to J.P. Pretlow, who soon thereafter had to rebuild it following damage from the same fire that affected the Wilmington Marine Railway Company. The yard was closed in the 1960s (Jackson 1996). Eagles Island has not been completely abandoned by industrial concerns. Specialty Boatworks and Moran Towing both operate from locations along Battleship Road.

The USACE began constructing the Government Shipyard and Marine Railway on Eagles Island in 1910 across the Cape Fear River from Castle Street in Wilmington. Dredging of the river for the construction of wharves and docks was completed in September of 1910, and the USACE moved machinery and buildings from their old location at the end of Queen Street to the new



Wilmington Marine Railway (On file, Underwater Archaeology Branch).



Stone Marine Railway(1924; On file, Underwater Archaeology Branch).

yard in 1910 and 1911 (Jackson 1996; United States Army Corps of Engineers 1911). This yard is still in operation today and is known as the U.S. Engineer Yard (Jackson 1996).

After World War II, the U.S. Maritime Commission Reserve Fleet used the Brunswick River to store surplus cargo ships. Both sides of the river, including the Eagles Island side, were cleared and the channel of the river dredged to accommodate the ships (**Figure 5.11**). The first vessels were docked in 1946, and the peak number of mothballed vessels was 649 in 1958. The last ship was removed in 1970. The ships were stored from a point south of U.S. 17/74/76 down river to the confluence with the Cape Fear River (Watson 1992; Hall 1980). These alterations to the river channel and subsequent disposal of dredge material marked a significant change in the shoreline of Eagles Island.

Archaeological Remains

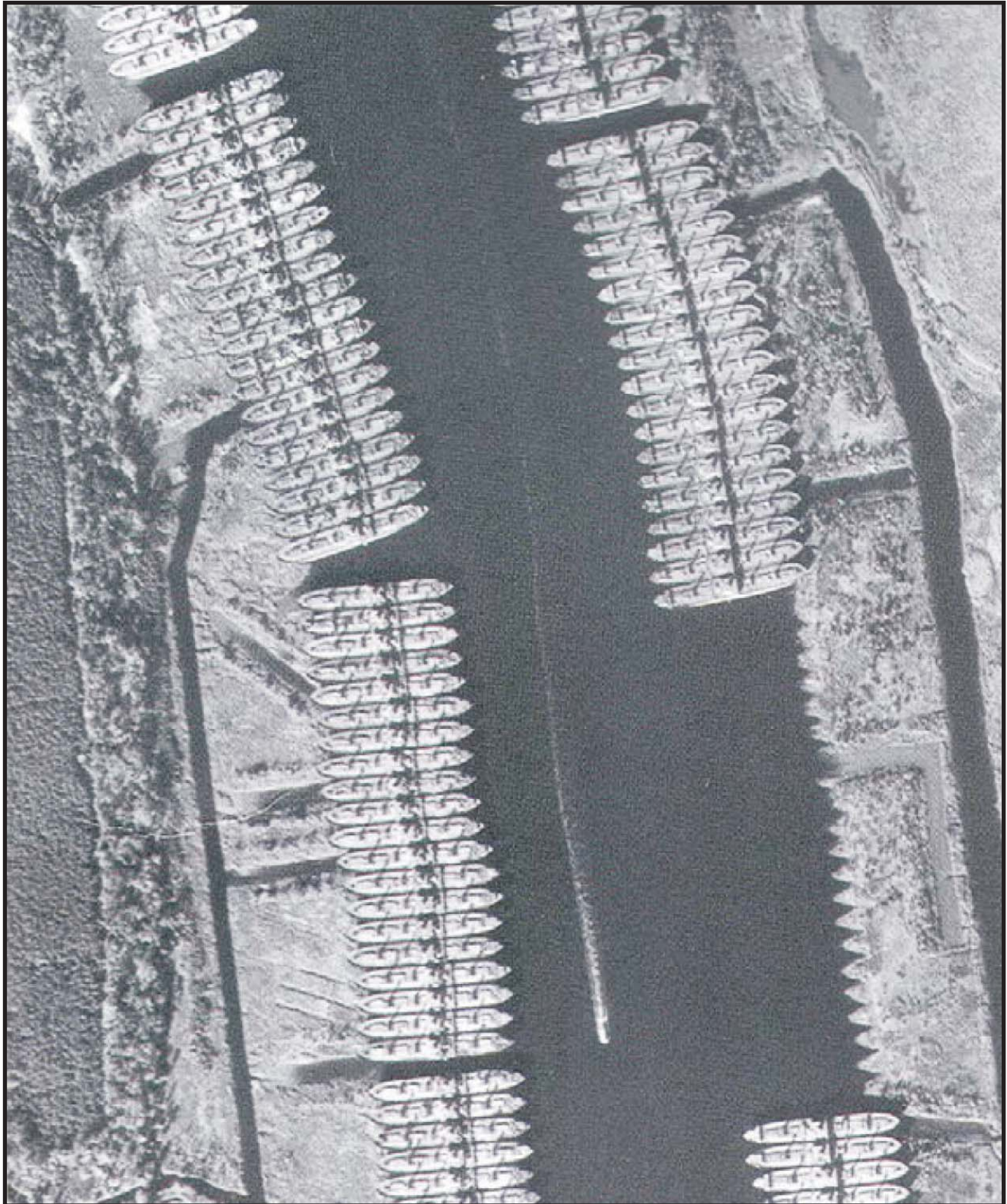
Dozens of recorded shipwrecks (**Figure 5.12**) and likely many other unknown shipwrecks can be found along the shores of Eagles Island, especially along the Cape Fear River. These wrecks include barges, tugboats, and wooden sailing ships. The remains of historical dockyards also line the shores of the island. The largest concentration of these wrecks and remains are between the Battleship North Carolina and the Cape Fear Memorial Bridge.

The first archaeological work on the island was a field school held by the Underwater Archaeology Branch (UAB) of the North Carolina Office of State Archaeology (N.C. OSA). This led to a series of other archaeological investigations in the Cape Fear River from 1983 to 1985 that resulted in the documentation of the remains of 37 vessels, 34 on Eagles Island, that had been included in the Wilmington Historic and Archaeological District, which was originally listed in the *National Register of Historic Places* in 1974 (Wilde-Ramsing 1986; Lawrence 1985). The UAB maintains the official state files on the remains of these vessels at their office at Fort Fisher.

Additional work was conducted in 1993 and 1994 by the UAB and the USACE as part of a comprehensive study of the Cape Fear and Northeast Cape Fear rivers (Overton and Lawrence 1996). Studies conducted by private companies contracted by the USACE have also occurred on or adjacent to the island (Hall 2004; Watts 2000, 1988). Work conducted by Sami Seeb for her 2007 thesis has also added much to our knowledge of abandoned ships and naval facilities on Eagles Island.

The wrecks include the *Argonauta*, a nineteenth century metal-hulled boat (**Figure 5.13**), the remains of the tugboat *Minnesota*, the 120-foot long steamer *Waccamaw*, the ferry *John Knox*, and the stern-paddle wheeler *H.G. Wright*, the machinery of which is on display at the Cape Fear Museum (Star News Online 10 June 2009). Other documented remains include those of the Stone Towing Company dry dock, the carpentry shop, and other features of the marine railway, pilings associated with the turpentine distillery and tar distributors wharf, located north of the Stone Towing Company, and remains associated with the Hamme Marine Railway (Seeb 2007).

These abandoned vessels and marine facilities are physical reminders of Eagles Island's historically important role in the commerce along the lower Cape Fear River. Although they



View of Mothballed Ships on Brunswick River (Fonvielle). Eagles Island is on



Storage of Liberty Ships along Eagles Island
Eagles Island
 New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	MP/SS
Figure:	5.11



Eagles Island "Ships Graveyard" (Seeb 2007).



Tugboat *Argonauta* in Use (On file, Underwater Archaeology Branch).



Remains of Tugboat *Argonauta* on Eagles Island (Seeb 2007).

are succumbing to the elements, slowly and inexorably decaying and rusting away, they are still easily visible from the river and from downtown Wilmington.

Ecological Effects

The shipping efforts on Eagles Island have always been focused on the eastern shore adjacent to the City of Wilmington. At the height of the shipping industry in Wilmington, the upland areas across from the city were basically fully developed. In addition, much of the marsh fringe along the eastern shore was converted to make way for docking for commercial ships. Prior to development, this area would have included freshwater marshes at lower elevations along the river front backed by cypress forest at slighter higher elevations along the river banks. Today we can see remnants of the cypress forest and tidal marshes in areas where the wharfs and adjoining warehouses have been abandoned, and due to low elevations, native vegetation has been able to recolonize these areas.

Dredging

Although perhaps not formally dredging, the construction of rice fields in the eighteenth and nineteenth century required the removal of large amounts of soil to construct canals. As discussed above, the remains of many of these canals can be seen in the northern third of the island. The spoil from the digging of the canals would have been used to build dikes and levees around the rice fields.

The U.S. Congress appropriated 100,000 dollars for improvements to the Cape Fear River in 1870, which included closing New Inlet, removing natural and Confederate obstructions, and dredging part of the shipping channel to a depth of 12 feet (Hartzer 1984). Beginning in 1881 as part of the *Rivers and Harbors Act*, the USACE started work on dredging the Cape Fear River from its mouth 30 miles up to Wilmington to a depth of 16 feet, which was increased to 20 feet in 1890. Since that time, the Cape Fear and Brunswick rivers have been dredged numerous times to keep shipping lanes open for deepwater vessels.

The southern half of the island has been used for decades for the placement of spoil from USACE dredging projects. The extensive dredge spoil disposal area that covers approximately 880 acres of Eagles Island is normally referred to as Disposal Area No. 15. It is managed by the USACE and owned by the U.S. Maritime Commission.

Dredging has also impacted the shoreline of the island along both the Brunswick and Cape Fear rivers. Along the Brunswick River, dredging was conducted to allow for the storage of ships after World War II. The shoreline along the Cape Fear River was subject to minor dredging operations related to the shipping and shipbuilding industries from the eighteenth century through the mid-twentieth century, specifically for the construction of wharves and docks, among other features.

Dredging has been an ongoing activity in the lower Cape Fear River with modern dredging activities to accommodate ever larger ships increasing the depth of the river channel to as much as 40 feet in places. Much discussion and research has focused on the potential effects of

dredging on the Cape Fear River and the marshes and forests within the Cape Fear River, with specific attention on the effects of salt water intrusion.

Hackney and Yelverton performed a study in 1990 near Eagles Island, which demonstrated that major changes in the salinity regime have occurred due to a rising sea level and to navigation improvements in the Cape Fear River. These factors have allowed ocean derived salts to encroach further upstream due to increased tidal amplitude.

In 1987, the State of North Carolina performed a study of tree mortality in the swamps of the lower Northeast Cape Fear River estuary (USACE 1996). That study concluded that tree death in the affected areas was attributable to high levels of salinity in the river. Site inspections by the USACE in 1988 found that tree mortality was evident throughout the lower Northeast Cape Fear River estuary (USACE 1996). Salinity stress was noted in Smith Creek to a point approximately 1.5 miles upstream of the Southern Coastline Railroad Bridge. On the Northeast Cape Fear River, the upstream limit was a point approximately 4 miles above the bridge. All tributary streams between Smith Creek and the upstream limit on the Northeast Cape Fear River were similarly affected.

Changes in the native flora community as a result of salinity changes are evident. Stands of bald cypress (*Taxodium distichum*) and swamp tupelo (*Nyssa biflora*) that used to dominate the area are now found dead, scattered throughout the marsh. The remaining live individuals are mainly present on remnant high bluffs. Herbaceous species that are adapted to brackish conditions have migrated into the area and are beginning to out-compete the freshwater ecosystems.

Tree species most affected by salt water intrusion are bald cypress, tupelo gum (*Nyssa aquatica*), sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), ash (*Fraxinus* spp.) and oaks (*Quercus* spp.). The salinity tolerances of these species and other species occurring in the swamp forests of the area are not well documented but are assumed to be quite low. Some work on salinity tolerances of freshwater wetland species of plants has been done. Pezeshki et al. (1987a) found that stomatal conductance and net photosynthesis of bald cypress seedlings declined significantly at salinities as low as 2 parts per thousand (ppt). Similarly, significant reductions in stomatal conductance and net photosynthesis have also been reported for green ash (*Fraxinus pennsylvatica*) and other freshwater swamp seedlings with salinities at approximately 1.95 ppt (Pezeshki and Chambers 1986).

Transportation

In the earliest days of European colonization, the only way to and from Eagles Island was by boat. Ferries operated across both the Cape Fear River and the Brunswick River from the mid-1700s through the mid-1900s. The ferries were typically flatboats that were towed across the river by rowboats. The USACE built modern ferry slips at either end of the causeway crossing the island in the early 1900s. The Cape Fear River Ferry ran from the foot of Market Street in Wilmington, and the Brunswick River Ferry ran from near the Town of Belville. The ferries were only abandoned when the tolls for bridges across the Cape Fear and Brunswick rivers were abolished (Jackson 1996).

As the King's Road, which connected the northern and southern colonies, became established during the eighteenth century, better means of crossing the Cape Fear River were desired. With the intent of facilitating travel, a contract was given to Colonel William Dry in 1764 to build a causeway across the island, which would connect with the Cape Fear River Ferry at one end and the Brunswick River Ferry at the other (Jackson 1996). The causeway was built, in part, using ballast stones brought by ships sailing to the port at Wilmington. Local reports were that the causeway was horribly inadequate (Hall 1980).

The son-in-law of Colonel Dry, Benjamin Smith, received a contract from the General Assembly in 1789 for the construction of a road across the island. Built by slave labor, the road was reported to be approximately 16 feet in width and 2 feet above the high tide line and was finished in 1791 (Hall 1980; Jackson 1996). A picture of the causeway in the early 1900s can be seen as **Figure 5.14**. It is not known how either of the causeways crossed creeks on the island; if it was by bridging or the placement of fill.

Until the mid-1900s, the road built by Benjamin Smith was the only road to cross the island (see **Figures 5.3 and 5.15**). The North Carolina Division of Highways constructed two toll bridges, one between Wilmington and Eagles Island and one across the Brunswick River (Hall 1980; Jackson 1996). In 1969, the Cape Fear Memorial Bridge opened, carrying U.S. 17/74/76 from Eagles Island into Wilmington (Star News Online 15 December 2009). The construction of the bridge occurred prior to the implementation of many modern environmental regulations, such as the *National Environmental Policy Act*, which was passed in that same year. As such, many acres of wetlands were dredged or filled. A 27-acre borrow pit that is located in the center of the island, right next to the highway, is related to the construction of the connection from the bridge to the interchange with U.S. 17 (Star News Online 29 March 2003).

The Wilmington and Manchester Railroad (W&MRR) built the first rail line across the island. Chartered in 1846, it opened in 1853, running from Wilmington across Eagles Island and west to Camden Crossing in South Carolina. The route of the railroad can be seen on **Figure 5.16**. The terminal for the W&MRR was located on Eagles Island opposite Chestnut Street in Wilmington. In 1870, it reorganized as the Wilmington, Columbia, and Augusta Railroad (WC&ARR), and when it began advertising as the Atlantic Coast Line in 1872, leased the Wilmington and Weldon Railroad. While the lease was canceled in 1878 due to the bankruptcy of the WC&ARR, it was sold and reorganized under the same name in 1880. By 1889, the line was part of the Atlantic Coast Line Company, which served as a holding company for a large railroad system stretching from Georgia to Virginia, and the Atlantic Coast Line Railroad was formed in 1900 (Newber 2001; Kernan 1988; Howell 1979).

The line across Eagles Island was abandoned in the late 1800s, and it is not depicted on an 1886 map of New Hanover County (**Figure 5.17**). Remnants of the rail line are located on the island, including the remains of the bridge across the Brunswick River, which are visible at low tide. The former location of the W&MRR depot is now occupied by the *U.S.S. North Carolina Battleship Memorial*.

The development of transportation facilities across Eagles Island to provide greater connection between Wilmington and Brunswick County provided for greater and greater access to the

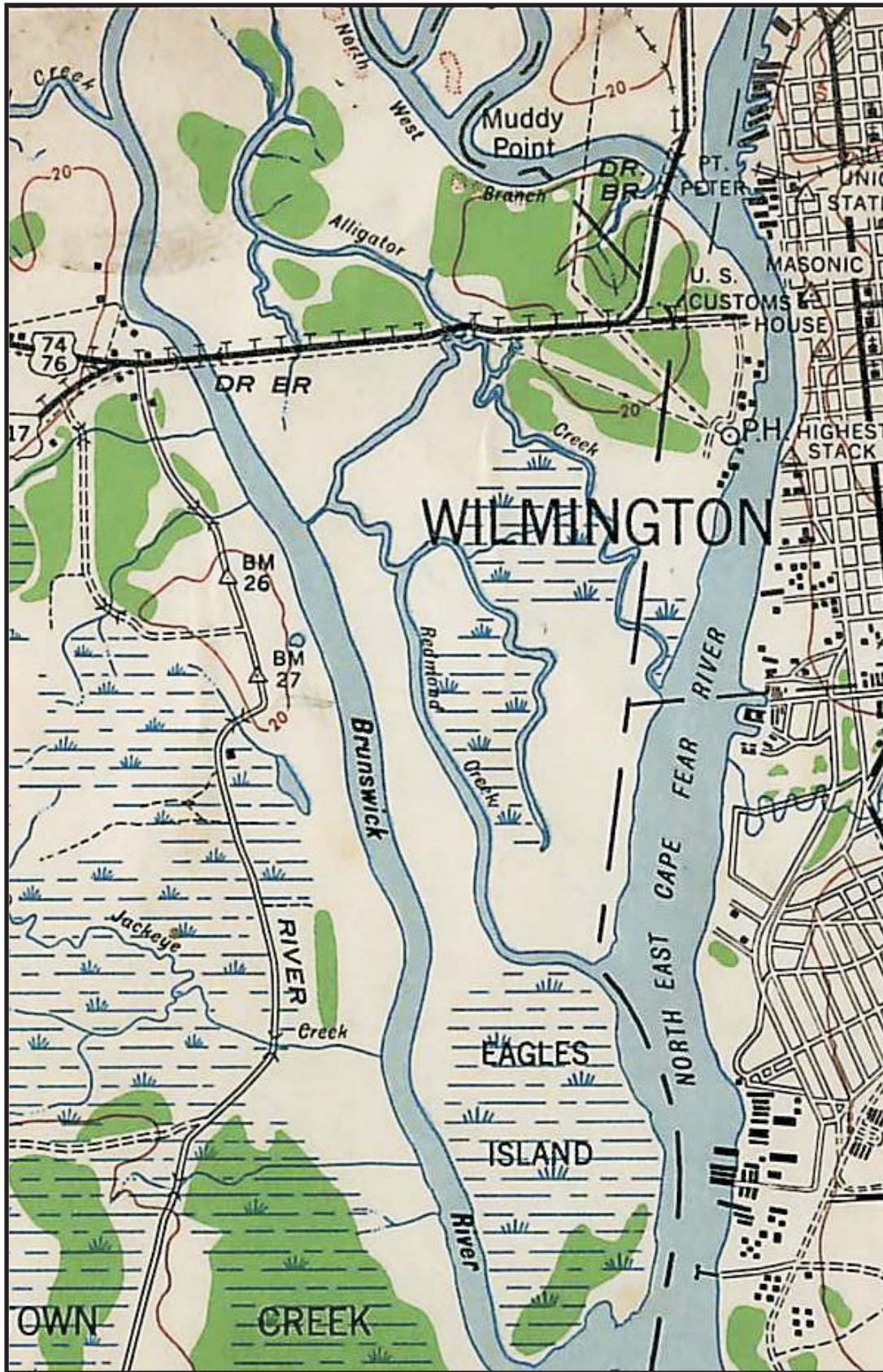


Causeway across Eagles Island in 1900s (Fales Collection).



Causeway across Eagles Island
Eagles Island
 New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	MP/SS
Figure:	5.14

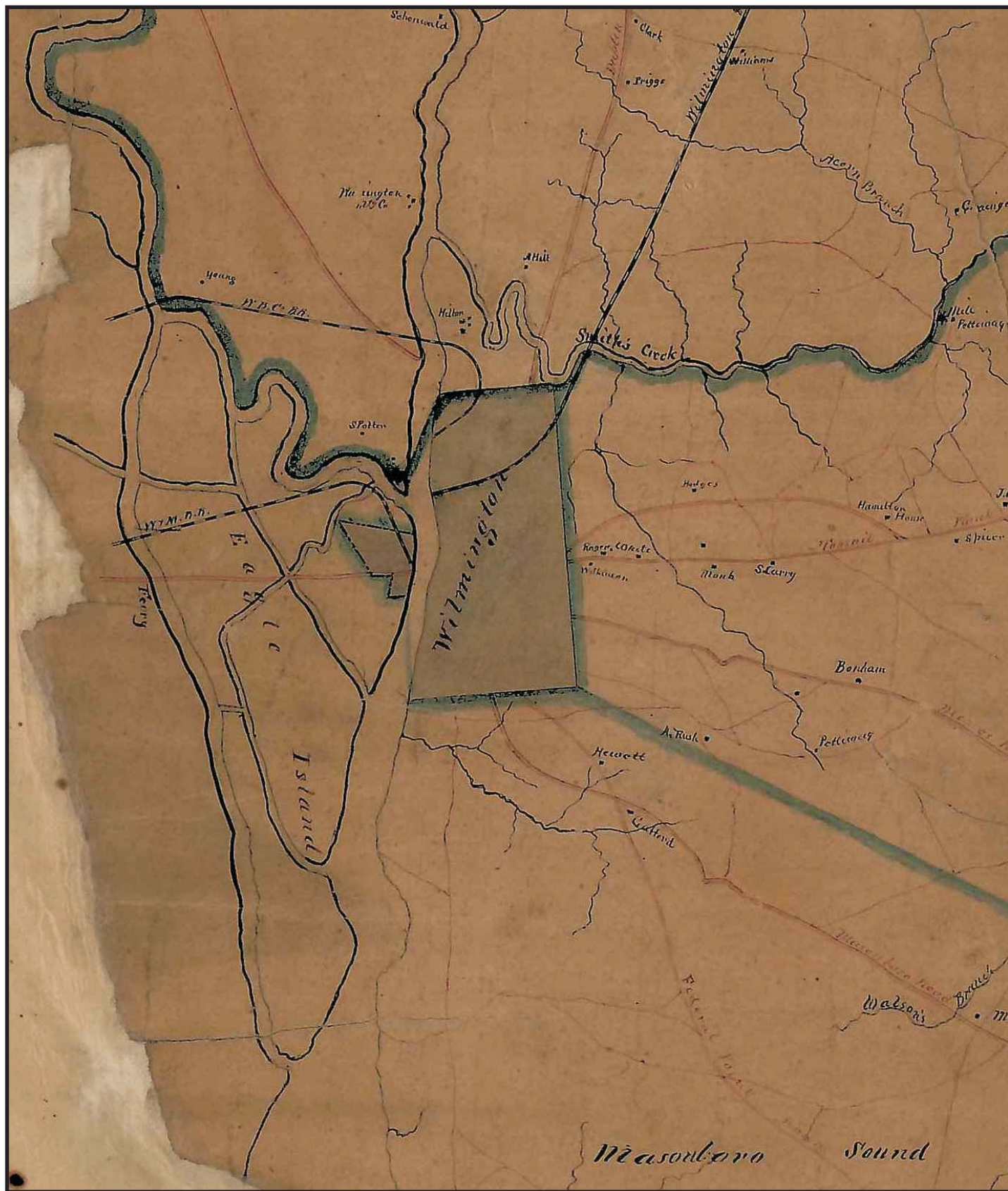


1948 Wilmington USGS Quadrangle Map.



1948 USGS Map of Wilmington
Eagles Island
 New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	MP/SS
Figure:	5.15

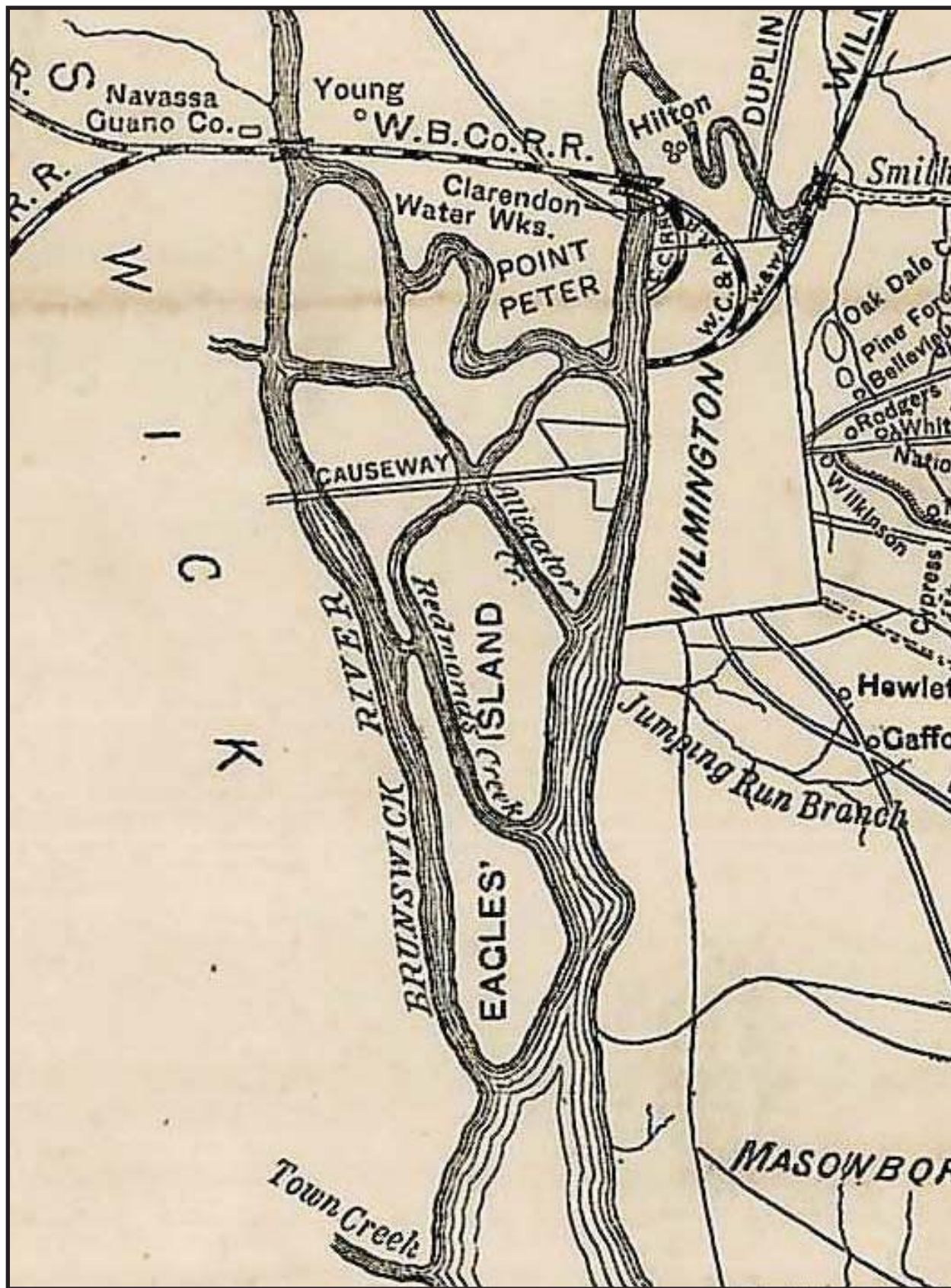


1869 Map of New Hanover County (Brown 1869).



1869 Map of New Hanover County
Eagles Island
 New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	MP/SS
Figure:	5.16



1886 Map of New Hanover County (Moss Engraving Co. 1886).



1886 Map of New Hanover County
Eagles Island
 New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	MP/SS
Figure:	5.17

interior of Eagles Island as well as creating new areas of high ground that could be colonized by a variety of upland plants and animals that previously were not found in the interior of Eagles Island. Much of the vegetation that colonized the newly formed high ground on Eagles Island includes undesirable weedy nuisance species such as Chinese privet (*Ligustrum sinense*) as well as opportunistic native species including sumac (*Rhus copallina*), sourwood (*Oxydendrum arboretum*), beech (*Fagus grandifolia*), ironwood (*Carpinus caroliniana*), redbud (*Cercis canadensis*), and horsesugar (*Symplocos tinctoria*)

Domestic Occupation

A number of plantations were located on Eagles Island (see **Figure 5.2**), while others had landholdings on the island. Colonel William Dry is said to have had the first brick home on the island, which was built near the landing of the Cape Fear River Ferry across from Wilmington. Colonel Dry was related by marriage to the Eagles family (Hall 1980; Jackson 1996).

During Colonial, Federal, and Antebellum times, slave labor was used to operate and maintain the plantation rice fields. The slaves would have lived adjacent to the fields they worked and maintained. The same would have been true for any naval stores activities on the island, which would most likely have been related to the processing of gum (resin) rather than its collection. It is likely that there were numerous slave houses or small slave communities scattered across Eagles Island.

The descendants of the former slaves of the area are known as Gullah or Geechee, a culture that spanned an area running from around Jacksonville, Florida, north to around Jacksonville, North Carolina, but which was strongest in Georgia and South Carolina. The presence of Gullah culture in southeastern North Carolina is a result of slaves from the Charleston area being brought up to work on new rice plantations in North Carolina. Gullah were originally brought to Charleston due to their experience working in rice cultivation in West Africa and the West Indies. The Geechee were West Africans brought from coastal Georgia to work in the naval stores industry.

As discussed above, slaves working in the rice fields or in naval stores production typically lived in the vicinity of the areas in which they worked and often had little supervision. This separation allowed the Gullah to develop their own culture and communities and to retain many aspects of their original West African and later West Indian heritage. After the end of slavery, many Gullah remained in their homes and their communities, entering the tenancy and sharecropping system that arose after the Civil War.

The history of Gullah culture in North Carolina is not well documented, certainly relative to areas such as Mount Pleasant and Charleston in South Carolina and Savannah in Georgia. As the intensity of rice cultivation was much less along the Cape Fear River than it was in South Carolina and Georgia, the local Gullah culture did not develop as deep of roots in North Carolina as it did to the south (Star News Online 2 September 2007).

In the vicinity of Eagles Island, the Town of Navassa exists due to the presence of the Brunswick County plantations during the eighteenth and nineteenth centuries. The abolition of slavery

eventually led to the formation of communities of former slaves in the areas surrounding the former plantations (Star News Online 16 August 2008). According to Mayor Eulis A. Willis, about 80 percent of the residents of Navassa are descendants of the former slaves of local rice plantations and have ties to Gullah culture, even if they are not aware of them (Star News Online 27 May 2009).

In 2006, the U.S. Congress established the Gullah/Geechee Cultural Heritage Corridor, which is managed by the National Park Service. The corridor stretches from Pender and New Hanover counties in North Carolina south to Duval County in Florida and extends from the coast about 30 miles inland. Mayor Eulis Willis of the Town of Navassa is one of the commissioners. More information on the Gullah/Geechee Cultural Heritage Corridor, as well as links to other information on Gullah/Geechee culture in the Southeast can be found at <http://www.nps.gov/guge/index.htm> and http://www.nps.gov/sero/planning/gg_srs/gg_res.htm.

As there was little to no habitat for longleaf pine on Eagles Island, there were likely no camps on the island occupied by either slaves or wage laborers associated with the slashing of pines for gum or kilns for producing tar. Domestic occupation related to the naval stores industry would have been associated with turpentine production and the shipping of naval stores products. These activities were concentrated in the eastern part of the island, and this is where evidence of domestic occupations associated with this industry would be found.

R.F. Hamme reportedly built the first “modern” home on Eagles Island in 1923 adjacent to the Hamme Marine Railway (Wilmington Star 30 August 1923). It was located on a 150-x-300 foot parcel across the Cape Fear River from Church Street in Wilmington and was known as Edgewater (Jackson 1996). The 1933 U.S. Coast and Geodetic Survey map (**Figure 5.3**) shows few structures on Eagles Island. The ones it does depict are located in the southeastern portion of the island on Alligator Creek and the Cape Fear River. The map also shows a complex of roads at the eastern edge of the island where port and industrial facilities were concentrated. While this area was mostly used for commercial and industrial activities, there were no doubt people who lived here, too. Residential occupation of this area could be researched using U.S. Census records.

The picture of the causeway in the early 1900s also shows two houses along the causeway (**Figure 5.14**). Interestingly, it has been noted by some that the design of these houses resembles that of slave quarters. While there is no evidence that these houses had been slave quarters, the picture does show that people were living on the island away from the center of industrial and commercial activity along the eastern side of the island.

Domestic occupation likely primarily occurred along existing access points associated with transportation facilities or other shipping activities. Many of the structures that were once in place on Eagles Island have been reclaimed back into the marshes and forests with little evidence that can be seen today other than the traces of the fill on which these structures once existed.

The ornamental and agriculturally important plants that were used in the landscapes surrounding homes and home sites last long after other evidence of domestic occupation is gone. Species such as English ivy (*Hedera helix*), periwinkle (*Vinca* sp.), mulberry (*Morus* sp.), mimosa

(*Mimosa* sp.) and wisteria (*Wisteria* sp.) may still be observed on Eagles Island in areas formerly used for domestic occupation. Other species including daffodils, tulips, crocus, and iris may also be observed in scattered localities across the island.

Fisheries

Historical documentation of commercial fisheries that pertain to Eagles Island and the surrounding areas of the Cape Fear and Brunswick Rivers is somewhat lacking. There is ample anecdotal evidence that various commercially important species and recreational game species have been fished for in the waters surrounding the island. In addition the waterways and marshes on Eagles Island serve as nursery areas for many species that remain commercially important today. Commercially and recreationally important species documented on Eagles Island and its surrounding waterways are included in **Table 6.5** (see **Chapter 6**, below).

The loss of swamp forest habitat to facilitate the cultivation of rice on Eagles Island decreased the available habitat for anadromous species that may have included Atlantic sturgeon (*Acipenser oxyrinchus*) and shortnose sturgeon (*Acipenser brevirostrum*). The shallow marshes that developed across much of Eagles Island after rice cultivation was phased out provide spawning and nursery habitat for a variety of commercial species including flounder, shrimp, and blue crabs.

Recreation/Tourism

The main tourist attraction on Eagles Island is the battleship *U.S.S. North Carolina*. Located between the U.S. 17 and the U.S. 74/76 bridges, the 36-acre *U.S.S. North Carolina* Battleship Memorial contains a large basin holding the 729-foot long ship, parking, and tourist facilities. The battleship was decommissioned following World War II, and in 1958, residents of Wilmington found out that their namesake ship was to be scrapped. A campaign initiated by area schoolchildren raised sufficient funds to purchase the ship and bring it to Wilmington as a memorial to North Carolinians who had lost their lives during the war. The area selected, a portion of Eagles Island that had been the site of the Wilmington and Manchester Railroad depot as well as an area that likely historically contained other commercial and possibly residential properties, was dredged to accommodate the ship. Spoil from the dredging may have been placed in low spots in the surrounding area and/or for the construction of the parking lot.

Although there are currently no recreational activities organized around the shipwrecks and other archaeological remains of the shipping industry along the eastern shore of Eagles Island, there is work in that direction. Dr. Nathan Richards of East Carolina University (ECU) has been working on the Eagles Island Ships' Graveyard Project and Trail, which proposed as an iPod® playable video tour that can be viewed from the Wilmington side of the river as well as from a possible paddle trail that would run along the eastern side of Eagles Island.

The Cape Fear Museum in Wilmington offers a variety of exhibits on the history of the area that are applicable to activities that occurred on Eagles Island. It opened an exhibit titled *Land of the Longleaf Pine* on 2 April 2010. This exhibit explores the naval stores industry and life in Colonial-era Wilmington. The museum also offers a pavilion that displays a range of different

types of boats that have been used along the Cape Fear River and other rivers and creeks in the area. Some of these types of vessels likely landed on Eagles Island over the past 300 years.

Eagles Island has long been a destination for hunters, fishermen, and other outdoor recreation enthusiasts. These activities have typically focused on the northern and western portions of the island, as much of the eastern and southern portions are used for the deposition of spoil and for a variety of commercial and government marine facilities. Outdoor recreation is anticipated to become more important in the future as the residential population of the lower Cape Fear region grows and access to the island and its interior waterways improves. Currently publicly accessible sites to launch boats and/or canoes and kayaks can be found on the Brunswick River, Mill Creek, Cape Fear River, and Davis Creek in close proximity to Eagles Island.

6. Present Evolving Landscape

The following description of the existing ecological conditions of Eagles Island including soils, groundwater, surface water resources, vegetation, wildlife, and rare and endangered species and significant natural communities was prepared by Land Management Group (LMG; 2009) on behalf of the District and Cape Fear RC&D.

Groundwater and Soils

Groundwater within the vicinity of Eagles Island is derived from three geologic formations including the Pee Dee Formation, the Castle Hayne Formation and surficial sands (USDA 1977). These aquifers are recharged primarily through precipitation, lateral inflow from adjacent areas and interaquifer leakage (USACE 1989).

According to the Brunswick County Soil Survey (USDA 1986) and the New Hanover County Soil Survey (USDA 1977), mapped soils on the island are Chowan silt loam (CH), Dorovan (DO), Newhan fine sand, dredged (NhE), Urban (Ur) and Yaupon silty clay loam (YaB) (**Figure 6.1**).

- Chowan silt loam is common along the flood plains of the Cape Fear River and its tributaries. The soil is nearly level, poorly drained and often flooded for six months of the year on average. Due to excess flooding and wetness, chowan soil is not typically used for development (USDA 1986, 1977).
- Dorovan soil is common along the floodplains of freshwater streams and is nearly level and very poorly drained. The water table is generally at or near the surface during dry months. This soil is not well suited for development due to wetness and flooding (USDA 1977).
- Newhan fine sand, when dredged, is characterized by excessively drained sandy dredge spoil with fine sands and shell fragments. The soil is common along the edges of the mainland and near the Cape Fear River. Due to the nature of deposition, this soil is poorly suited for development (USDA 1986, 1977). It should be noted that Newhan fine sand is often mixed with dredge spoil and is found on small spoil islands along the perimeter of Eagles Island. Newhan fine sand constitutes most of the non-wetland acreage found on Eagles Island.
- Urban land includes areas that are more than 85 percent covered by urban development. The natural soil in these areas has been drastically altered over time and runoff is high due to elevated impervious surface coverage (USDA 1977), particularly on the eastern side of the island.
- Yaupon silty clay loam is frequently found along the edges of the mainland and along the Cape Fear River. This clayey soil has poor to moderate drainage. Large disposal areas, like those on Eagles Island, are generally surrounded by dikes. Approximately 1,000 acres on Eagles Island are classified as Yaupon soil. The soil has high shrink-swell potential and does



NRCS Soils
Eagles Island
 New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	SS/MS
Figure:	6.1

not have potential for forestry, agriculture or urban development (USDA 1986).

Sediment in the Cape Fear River channel in the vicinity of Wilmington Harbor is characterized as 10 percent gravel, 55 percent sand and 35 percent silt and clay (USACE 1996). As mentioned previously, much of Eagles Island has been manipulated from years of ditching and use as a dredge disposal area by the USACE. Federal construction and maintenance of the Cape Fear River and Brunswick River have altered the soil composition of a considerable part of the island over time.

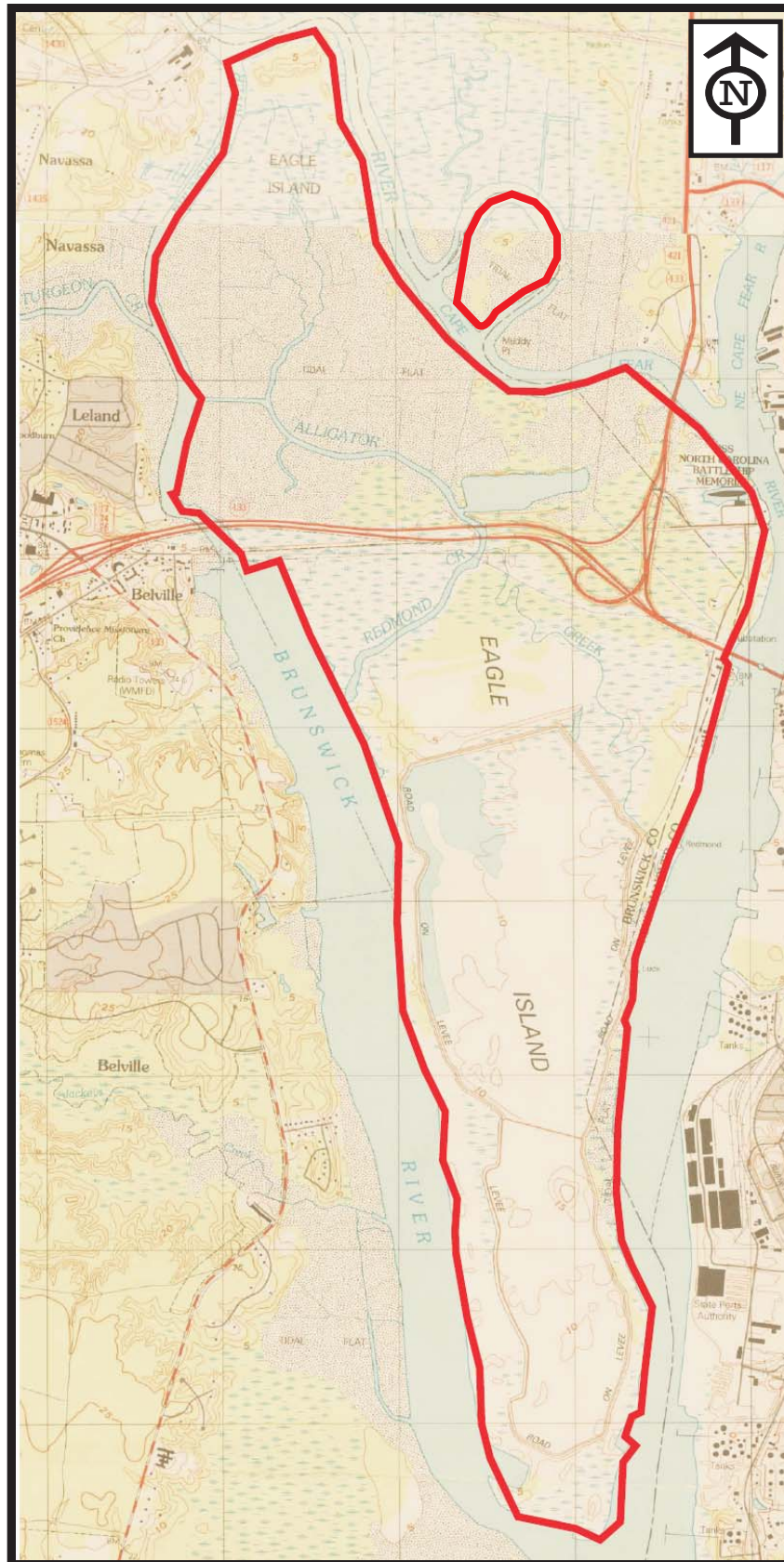
According to the United States Geological Survey (USGS) *Wilmington 7.5-Minute* topographic quadrangle map, elevations on the island range from 0 feet to 10 feet above mean sea level (AMSL; **Figure 6.2**). The northern half of the island consists mainly of tidal flats with scattered upland knobs created from dredging activities and fill used to create the embankment on which U.S. 17/74/76 is built. Rice cultivation within this area required the creation of numerous ditches, many of which can still be observed today. The southern half of the site has a slightly higher elevation of 10 feet AMSL due to regular deposition of dredge spoil. The current height limit for dikes utilized by the USACE on Eagles Island is 42 feet. The north-eastern side of the island was also raised for a variety of commercial operations seeking close proximity to Wilmington Harbor.

Water Resources

The Cape Fear River is formed in the North Carolina Piedmont by the merging of the Haw and Deep Rivers in Chatham County. As the Cape Fear River enters the Coastal Plain, it is joined by two blackwater systems, the Black River and the Northeast Cape Fear River. After the junction of the Cape Fear and the Northeast Cape Fear rivers, at Eagles Island, the estuary travels approximately 30 miles before discharging directly into the Atlantic Ocean. It is the largest coastal river in North Carolina that empties directly into the Atlantic Ocean and is not impeded by barrier islands or shallow sand topography. Much of the land draining into the Cape Fear River consists of swamp forests laden with organic material which leaches into the river producing a dark-stained “blackwater” system.

The Cape Fear River at Wilmington Harbor has an average width of 700 feet and an average tidal variation of approximately 4.0 feet. The eastern banks of the river in Wilmington Harbor are almost entirely bulkheaded and, according to USACE hydrographic surveys, the river bottom drops sharply to the channel with a depth of -40 feet to -45 feet mean low water (MLW) in the vicinity of the Cape Fear Memorial Bridge. The western side of the river along Eagles Island now has a heavily vegetated shoreline and the bottom is thick mud which gradually drops from shore to a bottom depth of -5 feet MLW.

There are two named water bodies that flow through the interior of Eagles Island and originate at the Brunswick River: Alligator Creek and Redmond Creek. The first known map to have documented Alligator Creek with its present name was an 1827 USACE map. Alligator Creek crosses Eagles Island in a northwest to southeast direction, eventually flowing into the Cape Fear



Source: Land Management Group, Inc. Image reproduced, not to scale.
Castle Hayne and Wilmington USGS 7.5-minute quadrangles (1990)



USGS Topography Mapping
Eagles Island
New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	SS/MS
Figure:	6.2

River opposite Wilmington. Redmond Creek is found on the western side of the island and flows northeast during a flood tide into Alligator Creek (Jackson 1996).

As an estuary, the Cape Fear River at Eagles Island is comprised of fresh water from upstream flow and tidal salt water from the Atlantic Ocean. Rising ocean levels and human induced changes in the depth and configuration of the river have contributed to an increase in salinity to the point that water, once considered largely fresh at Wilmington, now has a salinity of 2.0 – 3.5 ppt near the surface and 12.0 – 17.0 ppt in bottom currents (UNCW Aquatic Ecology Laboratory). There is a dynamic mixing of salinity between the ebb and flood tidal cycles.

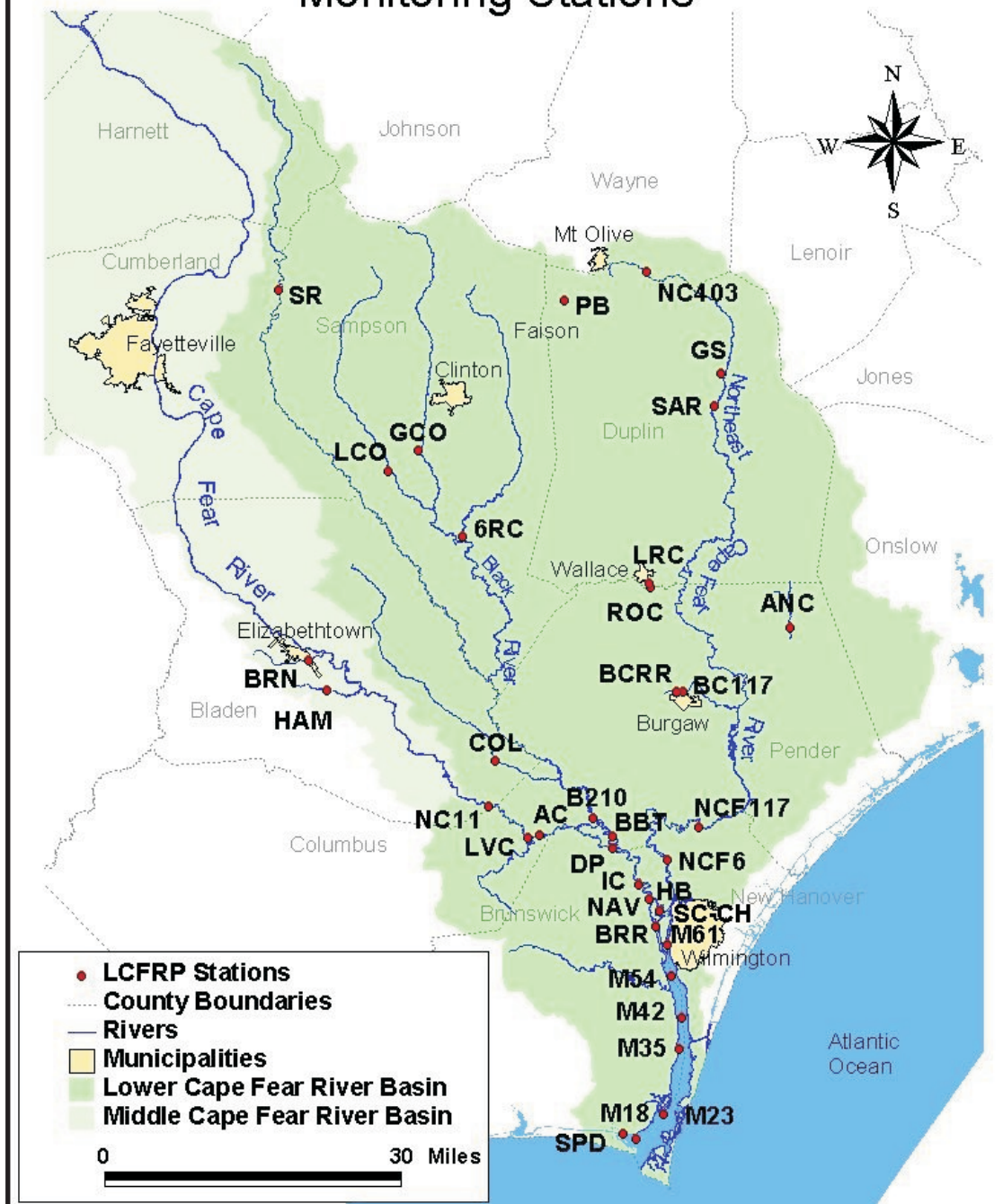
The North Carolina Division of Water Quality (DWQ; 2005) classifies both the Cape Fear River at the Wilmington Harbor and the Brunswick River as SC; “tidal waters protected for secondary recreation such as fishing, boating and other activities involving minimal skin contact; aquatic life propagation and survival; and wildlife.” These waters are also designated as impaired for aquatic life due to low dissolved oxygen, low pH and occasional high turbidity, usually following heavy rain events upstream. In addition, the Cape Fear River watershed is one of the most heavily industrialized watersheds in the State of North Carolina. There are over 200 permitted wastewater dischargers. This watershed is also host to a large number of concentrated animal feed operations (CAFOs). Thus, there is potential for significant pollutant loading from both point and non-point sources.

A long term multi-parameter water monitoring effort has been ongoing through the Lower Cape Fear River Program (LCFRP) since June 1995. The LCFRP encompasses a number of sampling sites throughout the Cape Fear River, Northeast Cape Fear River and Black River watersheds, including four sites in the vicinity of Eagles Island (**Figure 6.3**). Yearly trends of the selected physical, chemical and biological data have been included as **Figure 6.4a** through **Figure 6.4d**. All parameters were collected monthly and the average mean is included in the graphical interpretation of the data.

Overall water quality trends in the Cape Fear River Basin are closely tied to both anthropogenic land uses in the upland watershed and climatologic events, such as hurricanes, floods, and seasonal drought. Given the tidal nature of the system, poor timber harvesting and agriculture practices upstream of Eagles Island adversely impact downstream waters in the vicinity of Eagles Island resulting in increased turbidity, depressed dissolved oxygen levels and increased fecal coliform bacteria. These impacts are further exacerbated during climatic events resulting in heavy rainfall and runoff. Salinity for 2007 (**Figure 6.4a**) was considerable higher than in previous years due to drought-induced low runoff and discharge conditions (UNCW AEL 2007)

A more detailed analysis of the Cape Fear River watershed, including monthly physical, chemical and biological water quality parameters is available through the Aquatic Ecology Laboratory at UNCW.

Lower Cape Fear River Program Monitoring Stations



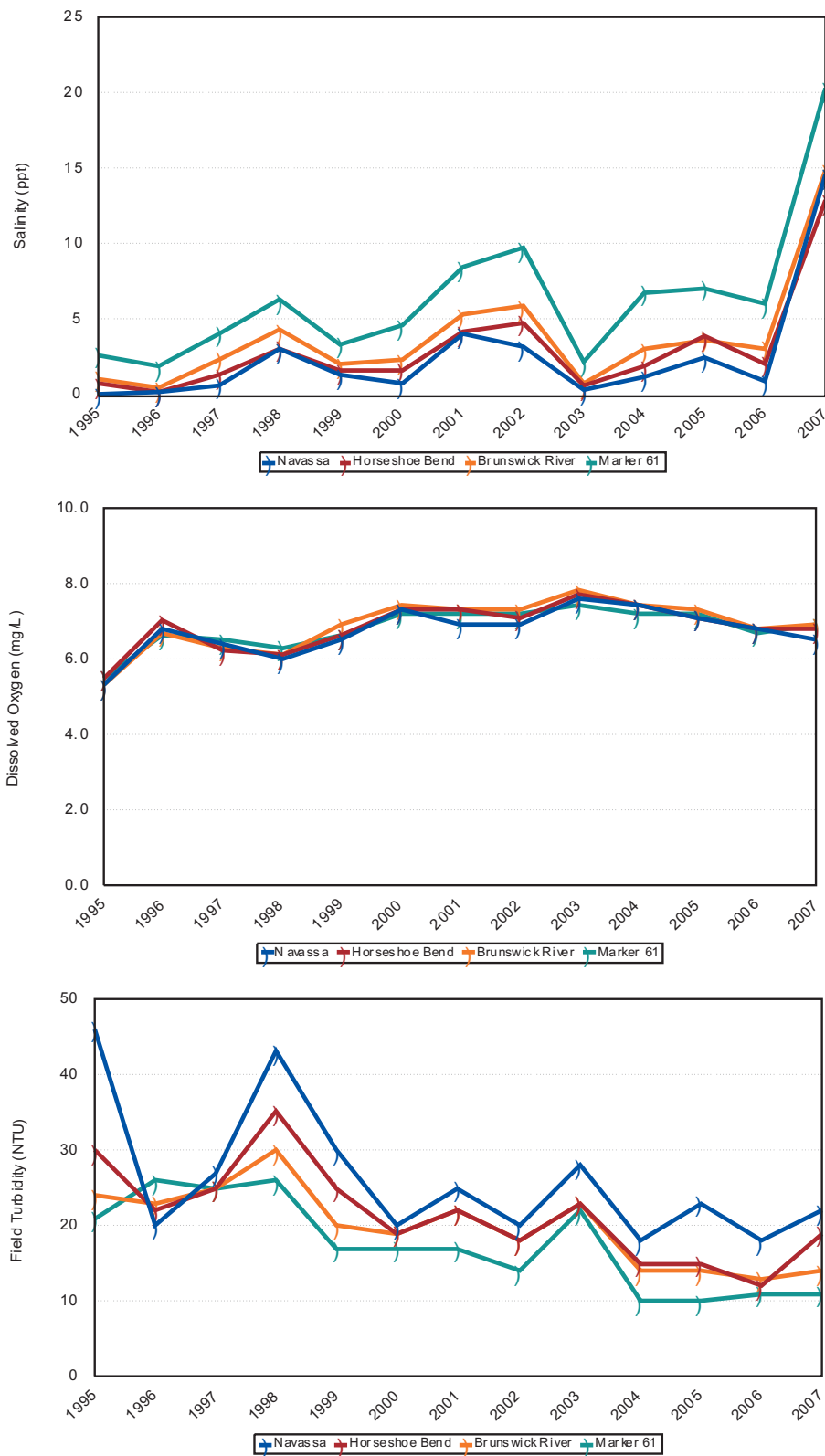
Source: UNCW Aquatic Ecology Laboratory. Image reproduced, not to scale.

Lower Cape Fear River Program Sampling Stations. Sites in the immediate vicinity of Eagles Island include, Navassa (NAV), Horseshoe Bend (HB), Brunswick River (BRR) and Channel Marker 61 (M61).



Lower Cape Fear River Program Sampling Stations
Eagles Island
New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	MP/MS
Figure:	6.3

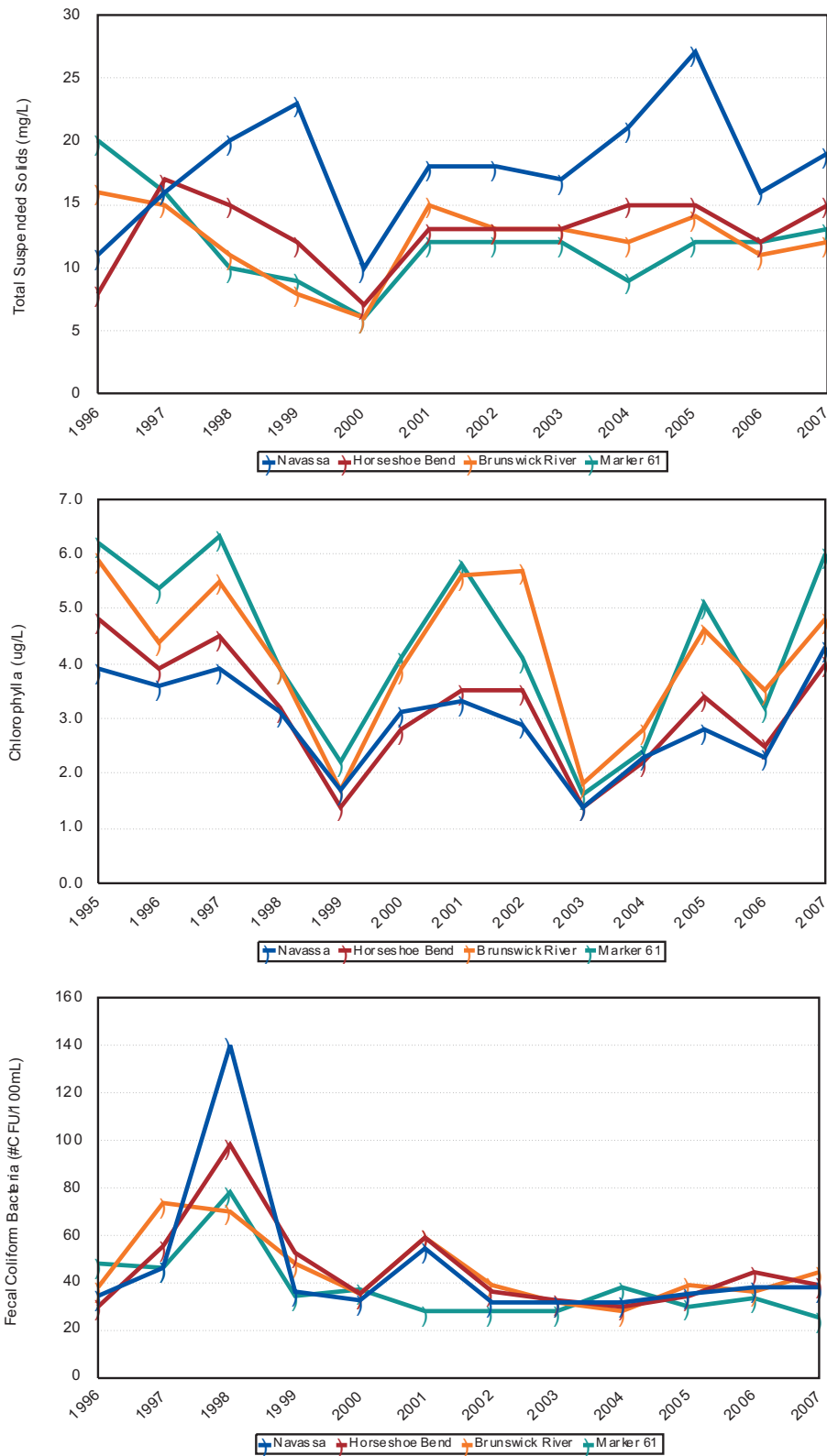


Physical water quality trends, Cape Fear River near Eagles Island, data presented as yearly mean.

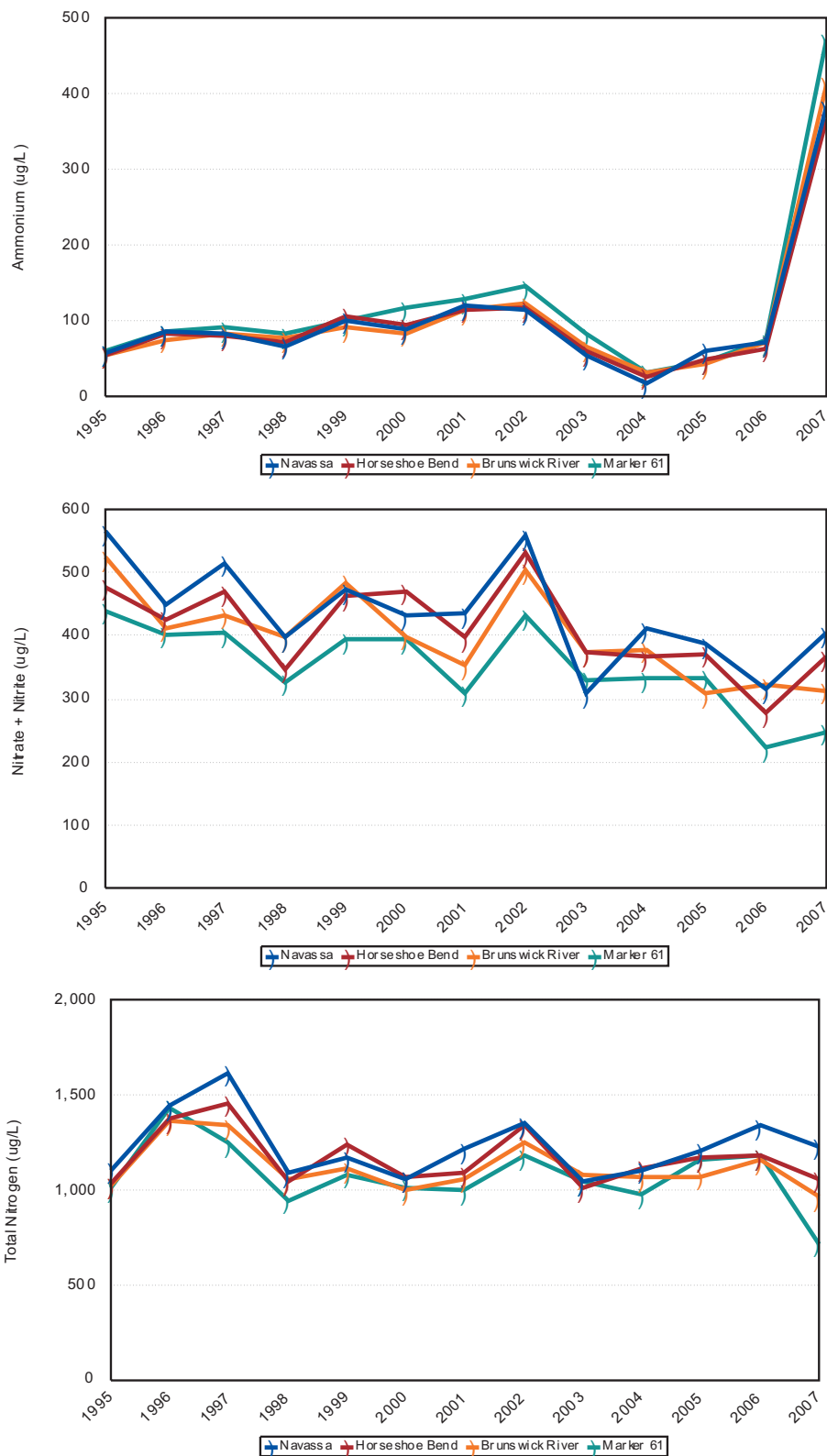


Physical Water Quality Trends
Eagles Island
 New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	MP/MS
Figure:	6.4a



Physical and biological water quality trends, Cape Fear River near Eagles Island, data presented as yearly mean.

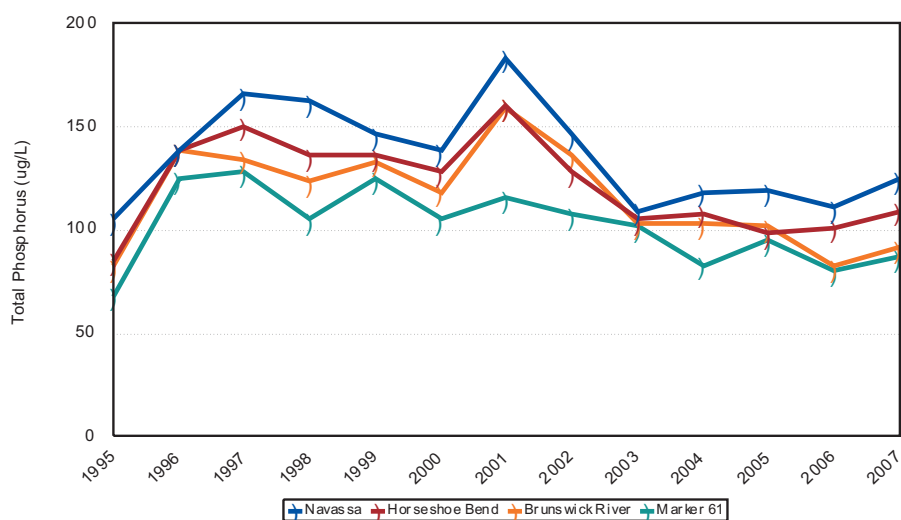
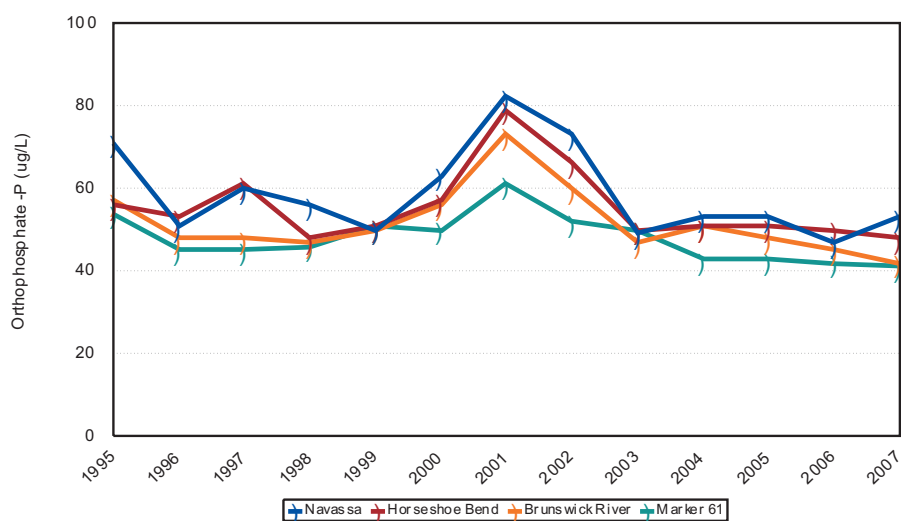


Chemical water quality trends, Cape Fear River near Eagles Island, data presented as yearly mean.



Chemical Water Quality Trends
Eagles Island
 New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	MP/MS
Figure:	6.4c



Chemical water quality trends, Cape Fear River near Eagles Island, data presented as yearly mean.

Vegetation

Eagles Island consists mostly of tidal freshwater wetlands, dredge spoil piles and developed areas. Wetlands on the island can be divided into several categories including, but not limited to, tidal freshwater marsh, cypress-gum swamp as well as areas of disturbed wetland habitat.

Tidal freshwater marsh exists along the fringes of the island and interior creeks and ditches. These wetlands are situated at a low elevation and experience regular tidal inundation. They can support dense herbaceous vegetation such as giant cordgrass (*Spartina cynosuroides*), smooth cordgrass (*S. alterniflora*), sawgrass (*Cladium jamaicense*) and several species of rush including *Juncus* and *Scirpus* spp. (Schafale and Weakley 1990). Other notable species include hibiscus (*Hibiscus moscheutos*), yellow spikerush (*Eleocharis flavescens*), southern blueflag (*Iris virginica*), rosy camphorweed (*Pluchea foetida*), sedges (*Carex* spp.), and water hemp (*Amaranthus cannabinus*). Scattered shrubs and trees often include wax myrtle (*Morella cerifera*) and bald cypress (*Taxodium distichum*) (Schafale and Weakley 1990; LMG site assessments).

There are small pockets of cypress-gum swamp habitat located throughout the island. Tidal cypress-gum swamps are palustrine and are regularly to irregularly flooded with freshwater from lunar and wind tides (Schafale and Weakley 1990). This wetland community is common along blackwater rivers like the Cape Fear River and the Brunswick River. The canopy species are dominated by bald cypress (*Taxodium distichum*), swamp tupelo (*Nyssa biflora*), and water tupelo (*Nyssa aquatica*). Loblolly pine (*Pinus taeda*) and red maple (*Acer rubrum*) are also common. The understory community in cypress-gum swamp habitat generally includes swamp red bay (*Persea palustris*), sweet bay (*Magnolia virginiana*), Carolina ash (*Fraxinus caroliniana*), and Virginia red-cedar (*Juniperus virginiana*). The shrub layer ranges from open to dense and includes wax myrtle (*Morella cerifera*), ti-ti (*Cyrilla racemiflora*), blueberry (*Vaccinium corymbosum*), swamp rose (*Rosa palustris*), and dwarf palmetto (*Sabal minor*). The herbaceous layer is generally only dense in areas with a large canopy opening. Typical herbaceous species include royal fern (*Osmunda regalis* var. *spectabilis*), cinnamon fern (*O. cinnamomea*), netted chainfern (*Woodwardia areolata*), lizard's tail (*Saururus cernuus*), sedges (*Carex* spp.), and arrow arum (*Peltandra virginica*) (Schafale and Weakley 1990). It should be noted that cypress-gum stands along the Cape Fear River and Brunswick River have experienced recent mortality. Research suggests that the rise in mortality could be attributed to salinity increases in the region (USACE 1996; Hackney and Yelverton 1990).

Eagles Island supports large monotypic stands of cattails (*Typha angustifolia* and *T. latifolia*) with scattered sawgrass (*Cladium jamaicense*), common three-square (*Schoenoplectus pungens*) and other varieties of bulrush (*Scirpus* spp.; LMG site assessments).

There are a number of natural and manmade upland islands scattered throughout the site that have been created by side casting of dredge spoil. Many of these islands are heavily vegetated with woody species such as wax myrtle (*Morella cerifera*), eastern baccharis (*Baccharis halimifolia*) and tallow (*Sapium sebiferum*). A comprehensive table of floral species is shown in **Table 6.1**.

**Table 6.1: Floral species observed on Eagles Island
(LMG 2009; Schafale and Weakley 1990).**

Name	Genus species	Wetland Indicator Status ^a
Trees		
Bald cypress	<i>Taxodium distichum</i>	OBL
Carolina ash	<i>Fraxinus caroliniana</i>	OBL
Loblolly pine	<i>Pinus taeda</i>	FAC
Red maple	<i>Acer rubrum</i>	FACW-
Swamp red bay	<i>Persea palustris</i>	FACW
Swamp tupelo	<i>Nyssa biflora</i>	FACW+
Sweetbay	<i>Magnolia virginiana</i>	FACW+
Tallow	<i>Sapium sebiferum</i>	FAC
Virginia red-cedar	<i>Juniperus virginiana</i>	FAC
Water tupelo	<i>Nyssa aquatica</i>	OBL
Shrubs		
Blueberry	<i>Vaccinium corymbosum</i>	FACW
Dwarf palmetto	<i>Sabal minor</i>	FACW
Eastern baccharis	<i>Baccharis halimifolia</i>	FAC
Swamp rose	<i>Rosa palustris</i>	OBL
Sweet pepperbush	<i>Clethra alnifolia</i>	FACW
Ti-ti	<i>Cyrilla racemiflora</i>	FACW
Wax myrtle	<i>Morella cerifera</i>	FAC+
Herbs		
Arrow arum	<i>Peltandra virginica</i>	OBL
Cattail	<i>Typha</i> spp.	OBL
Cinnamon fern	<i>Osmunda cinnamomea</i>	FACW+
Lizard's tail	<i>Saururus cernuus</i>	OBL
Netted chainfern	<i>Woodwardia areolata</i>	OBL
Rose/Marsh mallow	<i>Hibiscus moscheutos</i>	OBL
Rosy camphorweed	<i>Pluchea camphorata</i>	FACW
Royal fern	<i>Osmunda regalis</i> var. <i>spectabilis</i>	OBL
Southern/Virginia blueflag	<i>Iris virginica</i>	OBL
Water hemp	<i>Amaranthus cannabinus</i>	OBL
Grasses		
Bulrush	<i>Scirpus</i> spp.	OBL
Common three-square	<i>Schoenoplectus pungens</i>	OBL
Giant cordgrass	<i>Spartina cynosuroides</i>	OBL
Giant reed	<i>Phragmites australis</i>	FAC
Sawgrass	<i>Cladium jamaciense</i>	OBL
Smooth cordgrass	<i>Spartina alterniflora</i>	OBL
Sedges		
Sedge	<i>Carex</i> spp.	FAC-OBL
Yellow spikerush	<i>Eleocharis flavescens</i>	OBL

Name	Genus species	Wetland Indicator Status ^a
Rushes		
Rush	<i>Juncus</i> spp.	FACW-OBL

^a Key to Wetland Indicator Status:

OBL – Obligate Wetland – plants that occur in wetland habitat approx. 99 percent of the time

FACW – Facultative Wetland – plants that occur in wetland habitat approx. 67 percent to 99 percent of the time

FAC – Facultative – plants that are just as likely to occur in wetland or non-wetland habitat (approx. 34 percent to 66 percent probability of occurring in wetlands)

FACU – Facultative Upland – plants that occur in wetland habitat approx. 1 percent to 33 percent of the time

UPL – Upland – plants that occur in uplands approx. 99 percent of the time

(-) – Indicates strong tendency toward wetland conditions

(+) – Indicates less of an association with wetlands

Habitat Mapping

LMG developed a generalized habitat map to aid in both the environmental resource assessment as well as an analysis of land cover changes over time. The habitat map is based on a combination of field surveys and digital image analysis. The dominant vegetative groups were digitally delineated from 2004 ortho-rectified aerial photography. Habitat features were identified and enumerated using Geographic Information Systems (GIS) software. The aerial photographs assisted in distinguishing wetland versus upland communities and, in some cases, distinguishing leaf morphologies of different plant species. Habitat on the island was classified into one of the following dominant habitat groups; tidal freshwater marsh, cypress-gum swamp, cattail dominated wetland, Phragmites/invasive community or urban/dredge spoil (**Figure 6.5**).

Wildlife

Mammals

A number of animals have been observed within the region, either through observation of a live specimen, roadkill, scat, or tracks (Marsh, personal communication). **Table 6.2** lists mammalian species known to inhabit Eagles Island.

Table 6.2: Mammal species observed on Eagles Island (LMG 2009).

Common Name	Scientific Name	Notes
Beaver	<i>Castor canadensis</i>	Resident population
Black bear	<i>Ursus americanus</i>	Occasional visitor
Gray fox	<i>Urocyon cinereoargenteus</i>	Resident population
Marsh rabbit	<i>Sylvilagus palustris</i>	Resident population
Mink	<i>Neovison vison</i>	Occasional visitor
Muskrat	<i>Ondatra zibethicus</i>	Resident population
N. American river otter	<i>Lontra canadensis</i>	Resident population
Nutria	<i>Myocastor coypus</i>	Resident population
Opossum	<i>Didelphis virginiana</i>	Resident population
Raccoon	<i>Procyon lotor</i>	Resident population
White-tailed deer	<i>Odocoileus virginianus</i>	Resident population



Source: Land Management Group, Inc. Image reproduced, not to scale.



Habitat Mapping
Eagles Island
 New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	SS/MS
Figure:	6.5

Birds

Eagles Island is host to a variety of birds including waterfowl, shorebirds, raptors, seedeaters and rare migrant species (**Table 6.3**).

The southern part of Eagles Island has been used for many years as a disposal site by the USACE for materials dredged from the Wilmington Harbor area. Dredge islands provide suitable nesting habitat for shorebirds (Parnell and Soots 1975). This is because dredge islands are relatively stable, extend well above the high-tide line, and support appropriate vegetation. Additionally, many of these islands are surrounded by open water and are relatively inaccessible to mammalian predators. While dredge islands are not important for nesting land birds, they may be important resting and feeding areas for them during migration (Soots and Parnell 1975).

There has been documentation of over 1,000 shorebirds per day at Eagles Island during the spring and fall migrations (Golder; Cooper, personal communication). Un-vegetated raised mudflats are created during periods of dredge deposition behind modern dikes, providing suitable and attractive habitat for many bird species. When the dredging cycles are timed to coincide with the peak of waterbird migration, the island has attracted over 10,000 shorebirds in a single day (Golder; Cooper, personal communication).

**Table 6.3: Bird species observed on Eagles Island
(NHP 1995; LMG 2009)**

Common Name	Scientific Name
<i>Waterfowl</i>	
Blue-winged teal	<i>Anas discors</i>
Clapper rail/Marsh hen	<i>Rallus crepitans</i>
Great blue heron	<i>Ardea herodias</i>
Great egret	<i>Casmerodius albus</i>
Green heron	<i>Butorides striatus</i>
Green-winged teal	<i>Anas crecca</i>
Little blue heron	<i>Egretta caerulea</i>
Snowy egret	<i>Egretta thula</i>
Tri-colored heron	<i>Egretta tricolor</i>
Wood duck	<i>Aix sponsa</i>
<i>Raptors</i>	
Bald eagle	<i>Haliaeetus leucocephalus</i>
Barn owl	<i>Pandion haliaetus</i>
Peregrine falcon	<i>Falco peregrinus</i>
Rough-legged hawk	<i>Buteo lagopus</i>
Short-eared owl	<i>Asio flammeus</i>
<i>Shorebirds</i>	
American golden plover	<i>Pluvialis dominica</i>
Baird's sandpiper	<i>Calidris bairdii</i>
Black-necked stilt	<i>Himantopus mexicanus</i>

Common Name	Scientific Name
Curlew sandpiper	<i>Calidris ferruginea</i>
Greater yellowlegs	<i>Tringa melanoleuca</i>
Least sandpiper	<i>Calidris minutilla</i>
Lesser yellowlegs	<i>Tringa flavipes</i>
Northern phalarope	<i>Phalaropus lobatus</i>
Red phalarope	<i>Phalaropus fulicarius</i>
Ruff	<i>Philomachus pugnax</i>
Semipalmated sandpiper	<i>Calidris pusilla</i>
Short-billed dowitcher	<i>Limnodromus griseus</i>
Western sandpiper	<i>Calidris mauri</i>
White-rumped sandpiper	<i>Calidris fuscicollis</i>
Wilson's phalarope	<i>Phalaropus tricolor</i>
Miscellaneous, including vagrants	
Bobolink	<i>Dolichonyx oryzivorus</i>
Cerulean warbler	<i>Dendroica cerulea</i>
Common grackle	<i>Quiscalus quiscula</i>
Eared grebe	<i>Podiceps nigricollis</i>
Eastern kingbird	<i>Tyrannus tyrannus</i>
Gray kingbird	<i>Tyrannus dominicensis</i>
Mourning warbler	<i>Oporornis philadelphia</i>
Painted bunting	<i>Passerina ciris</i>
Red-winged blackbird	<i>Agelaius phoeniceus</i>
Roseate spoonbill	<i>Ajaia ajaja</i>
Western kingbird	<i>Tyrannus verticalis</i>

Reptiles

Many reptiles are known to occur with some frequency on Eagles Island, taking advantage of the wetland and upland habitats. See **Table 6.4** for a list of species.

**Table 6.4: Reptile species observed on Eagles Island
(NHP 1995; LMG 2009).**

Common Name	Scientific Name	Notes
American alligator	<i>Alligator mississippiensis</i>	Resident
Brown water snake	<i>Nerodia taxispilota</i>	Resident
Common snapping turtle	<i>Chelydra s. serpentina</i>	Resident
Corn snake	<i>Elaphe guttata guttata</i>	Resident
Eastern cottonmouth	<i>Agkistrodon piscivorus piscivorus</i>	Resident
Eastern diamondback terrapin	<i>Malaclemys terrapin terrapin</i>	Sightings
Eastern mud turtle	<i>Kinosternon subrubrum subrubrum</i>	Resident
Green ribbon snake	<i>Thamnophis sauritus</i>	Resident
Garter snake	<i>Thamnophis sirtalis</i>	Resident
Northern water snake	<i>Nerodia sipedon sipedon</i>	Resident
Redbelly water snake	<i>Nerodia erythrogaster erythrogaster</i>	Resident
Yellowbelly slider	<i>Trachemys scripta scripta</i>	Resident

Fisheries

The waters surrounding Eagles Island are listed as Primary Nursery Area (PNA). PNAs, as defined by the Marine Fisheries Commission, are those areas in the estuarine system where initial post-larval development takes place. These areas are usually located in the uppermost sections of a system where populations are uniformly very early juveniles. Much of the nekton identified either utilize the river as a refuge during larval and juvenile stages of life or as a transportation route for spawning. Eagles Island also represents a major navigational landmark for anadromous fish migrating upriver to their historical spawning grounds. The confluence of the Brunswick and Cape Fear rivers is located at the southern end of Eagles Island and many shoreline oriented fish such as striped bass, alewife and blueback herring tend to follow the Brunswick River to its upstream confluence with the Cape Fear River on their way to their traditional spawning grounds. However, there are a number of species that are permanent residents of the system. A comprehensive list of fish species is included in **Table 6.5**.

Table 6.5: Finfish and shellfish species identified in the vicinity of Eagles Island (N.C. Division of Marine Fisheries).

Common Name	Scientific Name	Notes
<i>Finfish</i>		
Alewife	<i>Alosa pseudoharengus</i>	
American eel	<i>Anguilla rostrata</i>	Catadromous
American shad	<i>Alosa sapidissima</i>	Anadromous
Atlantic croaker	<i>Micropogonias undulatus</i>	
Atlantic menhaden	<i>Brevoortia tyrannus</i>	
Atlantic needlefish	<i>Strongylura marina</i>	
Atlantic sturgeon	<i>Acipenser oxyrinchus</i>	
Atlantic thread herring	<i>Opisthonema oglinum</i>	
Bay anchovy	<i>Anchoa mitchilli</i>	
Bay whiff	<i>Citharichthys spilopterus</i>	
Blackcheek tonguefish	<i>Symphurus plagiatus</i>	
Blue catfish	<i>Ictalurus furcatus</i>	
Blueback herring	<i>Alosa aestivalis</i>	Anadromous
Bluefish	<i>Pomatomus saltatrix</i>	
Channel catfish	<i>Ictalurus punctatus</i>	
Common carp	<i>Cyprinus carpio</i>	
Crevalle jack	<i>Caranx hippos</i>	
Flathead catfish	<i>Pylodictis olivaris</i>	
Freshwater goby	<i>Gobionellus shufeldti</i>	
Gizzard shad	<i>Dorosoma cepedianum</i>	
Gray snapper	<i>Lutjanus griseus</i>	
Hickory shad	<i>Alosa mediocris</i>	Anadromous
Hogchoker	<i>Trinectes maculatus</i>	
Inland silverside	<i>Menidia beryllina</i>	
Ladyfish	<i>Elops saurus</i>	
Largemouth bass	<i>Micropterus salmoides</i>	
Longnose gar	<i>Lepisosteus osseus</i>	
Mummichog	<i>Fundulus heteroclitus</i>	

Common Name	Scientific Name	Notes
Pinfish	<i>Lagodon rhomboides</i>	
Red drum	<i>Sciaenops ocellata</i>	
Sharptail goby	<i>Gobionellus hastatus</i>	
Shortnose sturgeon	<i>Acipenser brevirostrum</i>	
Silver jenny	<i>Eucinostomus gula</i>	
Silver perch	<i>Bairdiella chrysura</i>	
Southern flounder	<i>Paralichthys lethostigma</i>	
Spot	<i>Leiostomus xanthurus</i>	
Spotfin mojarra	<i>Eucinostomus argenteus</i>	
Spotted seatrout	<i>Cynoscion nebulosus</i>	
Striped bass	<i>Morone saxatilis</i>	Anadromous
Striped mullet	<i>Mugil cephalus</i>	Catadromous
Summer flounder	<i>Paralichthys dentatus</i>	
Threadfin shad	<i>Dorosoma petenense</i>	Anadromous
Weakfish	<i>Cynoscion regalis</i>	
White perch	<i>Morone americana</i>	Anadromous
Windowpane	<i>Scophthalmus aquosus</i>	
Shellfish		
Blue crab	<i>Callinectes sapidus</i>	
Brown shrimp	<i>Farfantepenaeus aztecus</i>	
Grass shrimp	<i>Palaemonetes</i> spp.	
Pink shrimp	<i>Farfantepenaeus duorarum</i>	
White shrimp	<i>Penaeus setiferus</i>	

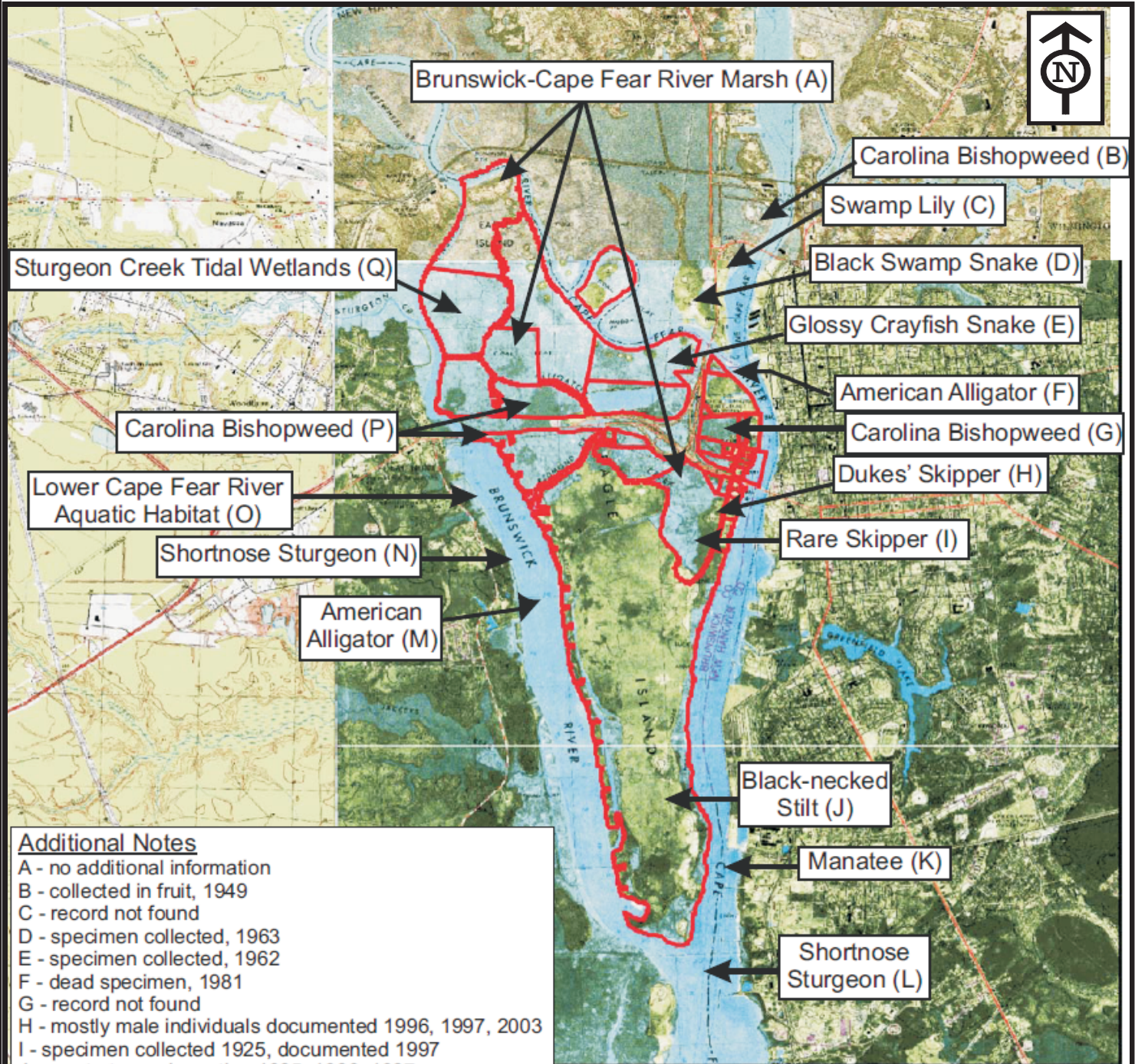
North Carolina Natural Heritage Data

Floral and Faunal Species of Concern

In addition to the plant and animal species listed above, Eagles Island provides habitat to a number of rare species. **Table 6.6** and **Figure 6.6** provide an inventory of rare species identified in the vicinity of Eagles Island.

Table 6.6: Threatened and endangered species identified in the vicinity of Eagles Island (LeGrand et al. 2006; Franklin and Finnegan 2006; NHP 1995).

Common Name	Scientific Name	US Status	NC Status
Fauna			
American alligator	<i>Alligator mississippiensis</i>	T(S/A)	T
Atlantic sturgeon	<i>Acipenser oxyrinchus</i>	SC	C
Bald eagle	<i>Haliaeetus leucocephalus</i>	BGEPA	T
Black-necked stilt	<i>Himantopus mexicanus</i>	-	SR
Black swamp snake	<i>Seminatrix pygaea</i>	-	SR
Carolina diamondback terrapin	<i>Malaclemys terrapin centrata</i>	-	SC
Dukes' skipper	<i>Euphyes dukesi dukesi</i>	-	SR
Eastern painted bunting	<i>Passerina ciris ciris</i>	FSC	SR
Glossy crayfish snake	<i>Regina rigida</i>	-	SR



Source: Land Management Group, Inc. Image reproduced, not to scale
(North Carolina Natural Heritage Program 2009)



Rare Species and Natural Communities
Eagles Island
New Hanover County, North Carolina

Project:	LEL09018.00
Date:	July 2011
Drwn/Chkd:	SS/MS
Figure:	6.6

Common Name	Scientific Name	US Status	NC Status
Rare skipper	<i>Problema bulenta</i>	FSC	SR
Shortnose sturgeon	<i>Acipenser brevirostrum</i>	E	E
West Indian manatee	<i>Trichechus manatus</i>	E	E
Flora			
Carolina bishop-weed	<i>Ptilimnium ahlesii</i>	FSC	SR
Ribbed bishop-weed	<i>Ptilimnium costatum</i>	-	SR
Swamp lily	<i>Crinum americanum</i>	-	SR

KEY to Table 6.6:

BGEPA-Bald and Golden Eagle Protection Act - In the July 9, 2007 the bald eagle was declared recovered, and removed (de-listed) from the Federal List of Threatened and Endangered wildlife. This delisting took effect August 8, 2007. After delisting, the Bald and Golden Eagle Protection Act (Eagle Act) (16 U.S.C. 668-668d) becomes the primary law protecting bald eagles. The Eagle Act prohibits take of bald and golden eagles and provides a statutory definition of "take" that includes "disturb."

E-Endangered - A taxon "in danger of extinction throughout all or a significant portion of its range."

T-Threatened - A taxon "likely to become endangered within the foreseeable future throughout all or a significant portion of its range."

C-Candidate - A taxon under consideration for official listing for which there is sufficient information to support listing.

FSC-Federal Species of Concern - A species under construction for listing, for which there is insufficient information to support listing at this time.

T(S/A)-Threatened Due to Similarity of Appearance - A species that is threatened due to similarity of appearance with other rare species and is listed for its protection. These species are not biologically endangered or threatened and are not subject to section 7 consultation.

SC-Special Concern - Any species of wild animal native or once native to North Carolina which is determined by the N.C. Wildlife Resources Commission to require monitoring. Any species of plant in North Carolina which requires monitoring but which may be collected and sold under regulations adopted under the provisions of the Plant Protection and Conservation Act.

SR-Significantly Rare - Any species of animal which has not been listed by the N.C. Wildlife Resources Commission as an Endangered, Threatened, or Special Concern species, but which exists in the State of North Carolina in small numbers and has been determined by the N.C. Natural Heritage Program to need monitoring. Any species of plant not listed by the N.C. Plant Conservation Program as Endangered, Threatened, or Candidate, which is rare in North Carolina, generally with 1-100 populations in the state, frequently substantially reduced in numbers by habitat destruction (and sometimes also by direct exploitation or disease).

Significant Natural Heritage Areas

The North Carolina Natural Heritage Program (NHP) has identified over 2,000 Significant Natural Heritage Areas (SNHA) across the state of North Carolina. SNHAs are areas of land or water that have been identified by the NHP as being 'important for conservation of the State's biodiversity' and include high quality or rare natural communities, rare species, and/or special animal habitats. It is important that conservation efforts are addressed for SNHAs that are not permanently managed for protection and enhancement. Two SNHAs are located within Eagles Island; the Lower Cape Fear River Aquatic Habitat and Brunswick River/Cape Fear River Marshes.

Lower Cape Fear River Aquatic Habitat

The Lower Cape Fear River Aquatic Habitat has been recognized by the NHP as an SNHA. This habitat includes approximately 20,426 acres along the Cape Fear River and the Brunswick River from Eagles Island downstream to the mouth of the river near Bald Head Island (**Figure 6.6**). This extensive area had been recognized as a critical corridor linking a number of natural areas in both Brunswick and New Hanover counties. The Lower Cape Fear River Aquatic Habitat surrounds Eagles Island and supports populations of three federally and state protected species, including the West Indian manatee (*Trichechus manatus*), shortnose sturgeon (*Acipenser brevirostrum*), and the American alligator (*Alligator mississippiensis*). This area also provides important habitat for the Atlantic sturgeon (*Acipenser oxyrinchus*) and the Carolina diamondback terrapin (*Malaclemys terrapin centrata*) (Cranston ICON Planning Collaborative 1997).

Brunswick River/Cape Fear River Marshes

The Brunswick River/Cape Fear River Marshes have been recognized by the NHP as an SNHA that includes approximately 3,873 acres of oligohaline and freshwater marsh. The northern boundaries of Eagles Island are recognized as part of this habitat. The Brunswick River/Cape Fear River Marsh contains the largest area of tidal freshwater marsh habitat in the State of North Carolina and supports shortnose sturgeon, a federally and state recognized endangered species. Other rare and important species supported by this heritage area include the American alligator, rare skipper (*Problema bulenta*), rare Duke's skipper (*Euphyes dukesi*), glossy crayfish snake (*Regina rigida*) and black swamp snake (*Seminatrix pygaea*).

Both of the only known North Carolina occurrences of ribbed bishopweed (*Ptilimnium costatum*) and two out of four known North Carolina occurrences of Carolina bishopweed (*Ptilimnium ahlesii*) are located within this heritage area. Small marshes in the interior of the 3,873 acres support patches of bald cypress (*Taxodium distichum*), softstem bullrush (*Schoenoplectus tabernaemontani*), shoreline sedge (*Carex hyalinolepis*), narrowleaf cattail (*Typha angustifolia*) and giant cordgrass (*Spartina cynosuroides*). It is also possible that this area previously supported a Tidal Cypress-Gum swamp community. Wildflowers documented in the freshwater marshes include lanceleaf arrowhead (*Sagittaria lancifolia* var. *media*), arrow arum (*Peltandra virginica*), pickerelweed (*Pontederia cordata*), and eastern doll's daisy (*Boltonia asteroides*) (Cranston ICON Planning Collaborative 1997).

This site has been impacted by a number of developmental activities, including roadbed construction, dredge and fill projects and powerline corridors. Tidal salt advancement due to sea level rise and river dredging poses a threat to this habitat. It should also be noted that the non-native common reed (*Phragmites australis*) has replaced large areas of native marsh within this heritage area (Cranston ICON Planning Collaborative 1997). (See further descriptive material on pages 8.2 and 8.3.)

7. Summary of Significant Events and Activities

The history of Eagles Island is one that shows the relationship between the natural and cultural history of the Lower Cape Fear region of North Carolina. Starting with the arrival of the earliest explorers, the natural resources of the island have been an attraction, and their exploitation has changed the natural environment of Eagles Island to what we see today. By understanding the various elements of Eagles Island that attracted people to the island and the activities that they undertook, we can better understand how the ecology and physical structure of the island have also changed through time. In addition, through an understanding of past use and its influence on the natural world we can better balance the preservation of important cultural resources associated with Eagles Island with our desire to preserve and enjoy the natural resources that we see today and desire to protect for future generations.

There are three broad cultural activities that have influenced the ecology and natural environment of Eagles Island over the past 250 or so years: Agriculture, Industry, and Twentieth Century Development. Each of these broad categories resulted in significant impacts to the natural environment of the island, both individually and collectively. In addition, a number of natural changes are on-going that further influence Eagles Island including salinity changes due to upstream freshwater inputs that are influenced by drought, land use, and rainfall and sea level rise and changes to the Cape Fear River channel that affect tidal amplitude and extent.

Agricultural activities on the island consisted almost exclusively of rice production. While rice was grown on the island into the twentieth century, the most intensive use of the island for rice production occurred from the mid-eighteenth to the mid-nineteenth centuries. Rice fields were found all over the island. Their construction involved the cutting of canals, the building of levees, and the operation of water control devices. These activities resulted in significant changes to the ecology of Eagles Island including changes to the diversity and distribution of plants and wildlife across the island. The previous monoculture of rice has transitioned back into large expanses of freshwater marsh but the ditches and canals are still present today creating open water habitats that were not part of the original landscape of Eagles Island.

Industrial activities on the island were concentrated along the Cape Fear River across from Wilmington. The major industries found on the island from the late eighteenth century to the mid-twentieth century included the processing of naval stores; warehousing and transshipment of naval stores, timber, rice, other products via both ship and railroad; and shipbuilding and ship repair. While, areas of natural high ground were present along the eastern side of Eagles Island additional tidal marsh areas were converted to uplands to facilitate the industrial activities on the island.

Twentieth century development on Eagles Island, especially after World War II, has significantly affected the island's environment. Perhaps the most influential activity in is the use of the southern half of the island for the deposition of dredge spoil. Other notable activities include the dredging of the Brunswick River for the storage of surplus military vessels following World War II and the marshes on the eastern side of the island for the permanent mooring of the U.S.S.

North Carolina and the construction of modern infrastructure (roads, transmission lines, etc.). In addition to the loss of tidal marsh habitat, the transshipment of products led the way to the transportation infrastructure that we see on Eagles Island today. With the creation of transportation corridors additional changes to flow of surface water and groundwater across the island occurred and the causeways created a natural dispersion corridor for a variety of native and non-native plant and animal species that had not previously been a part of the ecology of Eagles Island.

As this report has hopefully shown, the cultural environment and the natural environment of Eagles Island are irrevocably intertwined. Environmental conditions attract people seeking to make use of natural resources, and people alter the environment during the use of those natural resources, which in turns changes ecological conditions and the resource base that is available for human use. Additionally, general cultural changes affect how people view the environment and the different types of natural resources that are of value to them. Understanding these systemic processes makes it possible to create more broad-based conservation and restoration programs for the island. Ongoing and possible future efforts towards these ends are discussed in **Chapter 8**, below.

8. Future Trends/Use

Eagles Island is rich in both ecological and cultural resources. In addition, it is an important component of water quality protection for the lower Cape Fear River. Since Eagles Island is made up of a combination of privately and publicly held parcels, long term management will require cooperative agreements with all stakeholders, which can be accomplished through the Eagles Island Coalition.

The future of Eagles Island will most likely be driven by the efforts of the Eagles Island Coalition, which is made up of leaders from local municipal governments, conservation organizations, and concerned private citizens. The mission of the Eagles Island Coalition is to *Lead efforts to conserve and manage the natural and cultural assets of Eagles Island and provide compatible educational and recreational opportunities.* This mission will guide future conservation and land use for Eagles Island in the future. The future of Eagles Island will include several key components including planning and implementation of restoration/conservation projects, identifying and pursuing future research projects, and developing compatible education/tourism/recreation opportunities.

Restoration/Conservation Projects

Restoration and conservation of both cultural and ecological resources on Eagles Island is expected to be an important part of the coalition's activities. Conservation efforts will likely focus on collaborative efforts with various state, federal, and private agencies. Options for collaborative efforts with the N.C. Wildlife Resources Commission, N.C. Estuarine Research Reserve Program, N.C. Coastal Land Trust, and NHP have been ongoing.

The most likely State protection may be through a Natural Heritage dedication. Land that qualifies for this type of dedication will be protected by a perpetual conservation easement enforced by the Attorney General's office. The program focuses on rare species and habitats that were once endemic to the region. As it is widely known, Eagles Island is part of the Brunswick River/Cape Fear River Marshes SNHA. The NHP has been contacted in hopes of placing this land in a dedication. State dedications do not preclude most of the uses that are envisioned for the land including, education, research and low impact recreation such as hunting and fishing.

Recent restoration projects such as the McIntyre Mitigation Project show that habitat restoration is still possible on Eagles Island. As part of the mitigation plan for unavoidable wetland impacts associated with the construction of the Wilmington Bypass, the North Carolina Department of Transportation (NCDOT), hired a private mitigation banking firm, ECOBANK, to restore 12.3 acres of tidal cypress-gum swamp, 23.1 acres of tidal marsh/shrub scrub habitat, and 25.2 acres of tidal freshwater marsh located on the north-eastern side of Eagles Island. This parcel became known as the McIntyre Tract. In addition, ECOBANK's mitigation efforts enhanced 79.6 acres of tidal marsh/shrub scrub habitat. The following summary of the McIntyre Mitigation Project was provided by LMG.

The 143-acre McIntyre Tract site is located at the confluence of the Cape Fear River and the Northeast Cape Fear River and had been manipulated as a result of previous river transportation projects. Spoil material generated from dredging sections of the river had been placed on this tract over time, creating four upland islands throughout the site. In addition, an old railroad bed and an old roadbed were located on the tract. This fill material altered tidal amplitudes and disrupted the natural riverine flushing throughout portions of the site. Therefore, the mitigation work at this site consisted primarily of re-contouring spoil islands, the railroad bed and the old roadbed to the natural grade of adjacent wetlands and establishing meandering tidal sloughs within the tract, thereby reestablishing tidal flushing and nutrient exchange. In addition, flooding breaks were established through an earthen berm on the southern end of the property, which assisted the flushing and water exchange of tidal freshwater marsh and tidal marsh/shrub scrub behind the berm. All graded areas were planted with vegetation native to the area. Trees were planted in the tidal cypress-gum swamp habitat and woody shrubs and herbaceous plants were planted in the marsh/shrub scrub and tidal freshwater marsh areas.

Hydrological and vegetation monitoring occurred annually for five years and was successfully completed in 2006. LMG was contracted to perform the annual biological monitoring, monthly tide gauge monitoring and salinity sampling. During this five year period LMG documented the dynamic water exchange and gradual species transitions that occurred. This study was concluded and the NCDOT has transferred ownership to the North Carolina State Ecosystem Enhancement Program with a permanent conservation easement.

This five year mitigation study has revealed the succession and plant zonation patterns within the tidal fresh marsh community. Overall abundance and diversity of plant species decreased with increasing water depth and salinity. Typically, the greatest changes in plant diversity and survival were found on sloped elevation gradients and in zones on the island that had less inundation. Smooth cordgrass (*Spartina alterniflora*) had particularly high survivability when planted. Water hemp (*Amaranthus cannabinus*) was a prolific volunteer seeder the 2nd and 3rd years while the planted saw grass (*Cladium jamaciense*) and rushes (*Scirpus robustus* and *americanus*) did not grow dramatically until the 4th and 5th year of the study at which time the water hemp nearly died out.

Tidal fresh water marsh habitat is different from other tidal salt marsh and non-tidal fresh water marsh habitat due to subtle micro-gradients brought in with tidal flushing and flooding cycles. The flooding and salinity regimes were found to be very irregular and subject to change based on rainfall amounts upstream which may cause flooding/overland flow events with fresh water. This is contrasted to periodic inundation with lunar spring high tides with brackish water approaching 5 to 7 ppt. The predominant plant species that can with stand this variation are giant cordgrass (*Spartina cynosuroides*), cattail (*Typha* spp.) and giant reed (*Phragmites australis*) and therefore became the dominant herbaceous species. These grasses tend to be tall, dominant monocultures due to their strong ability to grow very densely by rhizomes and stolons and shade out competing shorter stature plants. This study found that an effective way to jump start young planted herbaceous seedlings was to temporarily knock down or flatten the previous years marsh plant stems once a season by mechanical means in the early spring. In particular the rushes and saw grass responded to this technique by gaining more sunlight.

The bald cypress (*Taxodium distichum*) and water tupelo (*Nyssa aquatica*) that once were the dominant species on Eagles Island did not survive in the lower landscape positions where they were planted. The tupelo was eaten by deer populations on the island and was an obstacle that was not overcome even with animal shield protection.

The mitigation study also indicated that the old rice fields or cattail flats had monthly inundation events of 2 to 8 inches in height and salinities that averaged around 2 ppt. The substrate soils in many areas consisted of floating organic mats of plant detritus intertwined with living roots and rhizomes of the predominant marsh species. When placing tide gauges in this substrate the compacted swamp soils were often located 2 to 3 feet below the matted marsh surface. Hydrogen sulfide gas was released through the broken plant surface veneer indicating anaerobic conditions.

These tidal fresh water marshes had few natural predators but provided habitat to a mixture of fauna adapted to low salinities. The created and restored meandering creeks and sloughs became functional nursery areas for juvenile fish and coastal birds in less than two years. The once white spoil sand became darker from the daily filtering of tidal waters through it and within four years the vegetation and soils looked naturalized.

Near the center of the island, inundation appears to be gradually rising approximately 0.75 to 1.0 inch every decade and salinity is rising 1 to 2 ppt every 10-year period. With these conditions, the fresh water sections of the island will become saltier and the habitats will gradually change from a mixture of fresh water plants and high tidal marsh to low tidal marsh. Eventually all of the woody plants except those on the highest landscapes will disappear. As the flora changes so does its fauna. Management options must adapt accordingly.

Research Needs/Opportunities

Evaluate the impacts of salinity changes and changes to average tidal amplitude. Evidence suggests that the salinity in the waters surrounding Eagles Island is increasing. This is likely due to a combination of factors including changes in sea level, changes to the Cape Fear River channel, and recent periods of reduced rainfall. This will affect habitat and ecosystems over time but it makes a great visual educational resource to teach about the effects of sea level rise. The island's value to preservation and education for the District's conservation program will not be diminished. Eco-tourism will not be hindered but hunting and fishing resources will be altered by more brackish water inhabitants. The site will still be an important primary nursery area and a great wildlife and bird sanctuary. Research to better understand how the changes in salinity are affecting the aquatic and terrestrial flora and fauna of Eagles Island should continue.

Conduct a terrestrial cultural resource inventory. To date no formal terrestrial cultural resource survey has not been conducted on Eagles Island. There are likely dozens, if not hundreds, of cultural resource sites across Eagles Island that are yet to be discovered. Cultural resource sites could include water control features associated with rice fields, domestic sites including slave quarters, commercial and industrial sites along the eastern side of the island, and old transportation networks such as the former W&M Railroad line and ferry landings. Jim Kapetsky is reportedly recording the locations of water control features in the northwestern

portion of the island with GPS, and Robert Minford, a graduate student at East Carolina University, is planning on conducting archaeological investigations on the island as part of his Master's degree research. These efforts, and other as of yet unplanned investigations, should be coordinated through the development of a cultural resources management plan for the island.

Continue habitat and bird studies. The habitat study could be evaluated every five years to see how the ecosystem is transitioning from various habitat types due to the physiological stresses noted above. Aerial photographs will need to be ground-truthed and have habitat and pixel values assigned to each. New GIS software has recently been developed that can then be used to perform a low cost assessment to prepare habitat locations and general size differences from earlier work.

Continue water quality studies. Water quality parameters have only changed slightly over the last ten years. This condition may be due to the river's large watershed that mixes fresh runoff water from the piedmont with brackish water in the lower Cape Fear estuary. Dissolved oxygen, Total Suspended Solids, turbidity, fecal coliform bacteria, ammonia, phosphate and nitrogen have been very similar year to year except after major rainfall events when the readings spike and exacerbate their relationships to runoff input. There are no management tools the District can use to change these variables. The District should encourage the continued baseline sampling of these water quality parameters by UNCW for the Lower Cape Fear River program and periodically incorporate the information into their education programs.

Collect anadromous fish catch and release data. The herring, shad, alewife populations have dropped dramatically. The current mud flats and shallow creeks scattered across the island were increased through the land conversion that occurred during the years the island was used for rice production making them great shallow estuarine species nursery sites. However, this resulted in the demise of freshwater forested swamp forest habitat which was used by anadromous fish. Gill netting in the Brunswick River currently has caused the snagging and loss of some of these fish resources and quite possibly impacted shortnose sturgeon. It would be worth evaluating the practicality of limiting the use of gill nets in the Brunswick River during the spawning season. The lock and dams upstream have caused the greatest impact to these species and there will be some changes to the locks and dams to help these species migrate during spawning times which should elevate their populations in Eagles Island's creeks. Catch and release events could be timed yearly after alterations are made on the nearest two lock and dams to determine if populations are increasing.

Create cypress and hardwood forest demonstration plantings. These forest resources are gradually being eliminated by the brackish water increases. The District may sponsor programs to plant more hardwoods and cypress on the island. Sites that are over 1 foot in elevation above the normal high water should be chosen for hardwoods and cypress. These areas exist around the perimeter of the spoil islands, old causeways, railroad beds, rice culture dams, tidal lake, dredge spoil dike features and on old building sites along the river. These new planted areas would make good demonstration plots to show how plant habitat zonation adapts to salinity and tidal amplitude changes.

Education/Tourism/Recreation Opportunities

Creating education opportunities for the citizens of the lower Cape Fear region to learn about the resources that compose Eagles Island along with the creation of compatible tourism and recreational opportunities will lead to a greater understanding and appreciation of the unique resources of the lower Cape Fear region.

Emphasize the Battleship North Carolina Memorial. The battleship is a memorial to the men and women of North Carolina who sacrificed their lives during World War II and is located directly across the Cape Fear River from downtown Wilmington. A passenger ferry also operates connecting the battleship memorial to downtown Wilmington. This memorial could be used as a focal point and anchor for other education, tourism, and recreational opportunities.

Create a naval stores production demonstration project. The naval store industries and lumbering have caused the massive loss of longleaf pine in the region. The importance of this tree species to the region's economy should be emphasized since Eagles Island was a principal destination for cutting, refining, storing, packing and shipping longleaf pine products. Obtaining pine resin and tar from box cutting trees and bleeding out pine tar has weakened many long leaf pines. Regeneration of the long leaf pine is slow and fire control is suppressed to the point that other species out-compete the long leaf pine. Populations of longleaf pine have decreased dramatically over the last 25 years. A tar kiln/distillery demonstration project could help explain why being from the "Tar Heel State" has importance. This task could be with cooperation with the forestry museum in Whiteville and the Cape Fear Museum on property near the Battleship and be part of the eco-tourism destination.

Create a rice culture demonstration project. Since the rice fields and ditches on the Creech tract are still intact, the District could demonstrate how the early wooden gates worked to contain and release water. A replica of a wooden gate and narrative description of how the rice workers matched its use with the ebb and flood of the daily tides may be informative. A lecture stand about rice culture could be placed on the most western McIntyre spoil island which is raised approximately 20 feet in height and overlooks most of the Creech rice fields.

Create a historic-ecological walking tour. A historic walking tour from the *U.S.S. Wilmington* utilizing the former W&M railroad bed would be informative. Historic markers and habitat signs along the way could highlight information from this baseline study. It is also possible that the former rail bed of the W&M Railroad could also be used as the basis for walking trails originating near the battleship.

Add new historic markers along the Leland to Wilmington causeway. Since the District owns land on both sides of the highway it may be appropriate to educate the public about the history of the island by placing historic markers or signs that explain some of the historical events. Traffic slows through this area when the bridge is raised and during rush hour so it should not be difficult to read these informational markers.

Create a ecotourism map and paddle routes. This particular program element could be implemented in conjunction with complementary paddle facilities in the Towns of Leland and

Navassa. A map of the creeks and rice ditches on Eagles Island could be prepared with approximate water depths based on mean low water conditions and the tidal lag predicted so the time frame of inundation and safe navigation could be estimated. Eventually kayak/canoe races could be sponsored by the District in order to attract attention to the beauty and unique resource we have in our back yard.

Designation as a local Wildlife Sanctuary of portions of Eagles Island and developing infrastructure for viewing wildlife. Eagles Island could be developed as a link in the North Carolina Birding Trail program developed by the N.C. Wildlife Resources Commission (www.ncbirdingtrail.org). The southern portion of Eagles Island that is currently being used as a dredge disposal site by the USACE for materials dredged from the Wilmington Harbor could also be incorporated into a consolidated plan for wildlife viewing opportunities. The dredge disposal area creates foraging habitat for a variety of shorebirds. There has been documentation of over 1,000 shorebirds per day at Eagles Island during the spring and fall migrations, and that number can increase to over 10,000 when dredging cycles are timed to coincide with the peak waterbird migration. The USACE is a signatory to a Memorandum of Understanding that provides a framework for cooperative activities necessary to develop, implement, maintain, and enhance a Watchable Wildlife Program on federal and state lands and to assist private landowners (www.watchablewildlife.org). These two programs are compatible and provides an opportunity to unify the northern and southern portions of Eagles Island for a common purpose. Development of a bird checklist for Eagles Island, access points for viewing, and interpretive signs at access points would only enhance this opportunity.

Create an elevated walkway to access the maritime archaeological sites. The largest concentration of these wrecks and remains are between the Battleship North Carolina and the Cape Fear Memorial Bridge. Dozens of recorded shipwrecks and likely many other unknown shipwrecks can be found along the shores of Eagles Island, especially along the Cape Fear River. These wrecks include barges, tugboats, and wooden sailing ships. The remains of historical dockyards also line the shores of the island. An elevated walkway with interpretive displays would allow visitors to view and appreciate these cultural resource sites without the need of a boat.

Create a linear park on the eastern bank of Eagles Island. A major recommendation of the Cape Fear River Corridor Plan is for the Eagles Island shoreline to remain in a natural condition. The creation of a linear park would help facilitate this recommendation. In order for this to occur acquisition of an easement on properties between the Cape Fear Memorial bridge and the Battleship North Carolina Memorial would be needed. This park could be extended to all of the remaining undeveloped areas of Eagles Island to create an expansive green zone between urban Wilmington and the rapidly urbanizing areas of Belville, Leland, and Navassa.

REFERENCES CITED

- Anderson, David G., and Patricia A. Logan
1981 *Francis Marion National Forest: Cultural Resources Overview*. United States Department of Agriculture, Columbia, South Carolina.
- Angle, W.
1989 *A Brief History of the Eagles Plantation and Mill Facility in Brunswick County. Raleigh, NC: North Carolina Department of Cultural Resources*. North Carolina Division of Archives and History, Research Branch, Raleigh.
- Ashe, W.W.
1894 *Forest Products of Eastern North Carolina; Forest Investigations Commissioned by the General Assembly, Bulletin #5*.
- Brant, R.D.
1998 *Depositional history of the Waccamaw River between Old Dock and the NC-SC state line*. Unpublished Masters of Science Thesis, East Carolina University, Greenville, North Carolina.
- Brooks, M. P.S. Stone, D.J. Colquhoun and J.G. Brown
1989 *Sea Level Change, Estuarine Development & Temporal Variability in Woodland Period*. South Carolina Institute of Archaeology and Anthropology Anthropological Studies 9, Columbia.
- Brown, James
1869 *Map of New Hanover County*. On file, North Carolina State Archives, Raleigh.
- Clifton, James
1981 *The Rice Industry in Colonial America*. *Agricultural History* 55:266-283.
1973 *Golden Grains of White: Rice Planting on the Lower Cape Fear*. *North Carolina Historical Review* 50(4):365-393.
- Cranston ICON Planning Collaborative
1997. *Cape Fear River Corridor Plan Prepared for Brunswick County, New Hanover County, City of Wilmington*. Cranston ICON Planning Collaborative, Augusta, Georgia.
- Crittenden, Charles C.
1936 *The Commerce of North Carolina: 1763-1789*. Yale University Press, New Haven, Connecticut.
- Dethloff, Henry
1982 *The Colonial Rice Trade*. *Agricultural History* 56:231-243.

Fonvielle, Chris E.

- 2007 *Historic Wilmington & the Lower Cape Fear: An Illustrated History*. Lower Cape Fear Historical Society, Inc., Wilmington, North Carolina.

Fussell, John O., III

- 1994 *A Birder's Guide to Coastal North Carolina*. University of North Carolina Press, Chapel Hill.

Google

- 2009 <http://maps.google.com> Accessed December 2009.

Hackney, C.T., and Yelverton, G.F.

1990. Effects of human activities and sea level rise on wetland ecosystems in the Cape Fear River Estuary, North Carolina, USA. In D.F. Whigham, R.F. Good and Y. Kvet (Editors) *Wetland Ecology and Management: Case Studies*. Kluwer Academic. Amsterdam. Pp. 55-61.

Hall, L.P.

- 1980 *Land of the Golden River. Historical Events and Stories of Southeastern North Carolina and the Lower Cape Fear. Volumes II and III*. Wilmington Print Company, Wilmington, North Carolina.

Hall, Wes

- 2004 *Archaeological Remote Sensing and Diver Survey of Navigation Channel Improvement Areas, Wilmington Harbor Waterfront and Northeast Cape Fear River, North Carolina*. Mid-Atlantic Technology and Environmental Research, Inc., Castle Hayne, North Carolina.

Harmon, Michael A., and Rodney J. Snedeker

- 1993 The Archaeological Record of Tar and Pitch Production in Coastal Carolina. In Linda F. Stine, Lesley M. Drucker, Martha Zierden, and Christopher Judge (Editors) *Historic Landscapes in South Carolina: Historical Archaeological Perspectives of the Land and its People*. Council of South Carolina Professional Archaeologists in conjunction with the University of South Carolina, South Carolina Institute of Archaeology and Anthropology, Savannah River Archaeological Research Program, Columbia.

Hartzer, R.B.

- 1984 *To Great and Useful Purpose: A History of the Wilmington District U.S. Army Corp of Engineers*. U.S. Army Corp of Engineers, Wilmington District, Wilmington, North Carolina.

Howell, A.J.

- 1979 *The Book of Wilmington*. Wilmington Print Company, Wilmington, North Carolina.

- Ingram, Roy L.
1987 Peat Deposits of North Carolina. *North Carolina Geological Survey Section Bulletin* 88.
- Isaacs, I.J.
1912 *The City of Wilmington: The Metropolis and Port of North Carolina*. Wilmington Chamber of Commerce, Wilmington, North Carolina.
- Jackson, C.V.
1996 *The Cape Fear – Northeast Cape Fear Rivers Comprehensive Study. A Maritime History and Survey of the Cape Fear and Northeast Cape Fear Rivers, Wilmington Harbor, NC, Volume I*. Maritime History. Kure Beach, North Carolina: Underwater Archaeology Unit, State Historic Preservation Office, Division of Archives and History and U.S. Army Corps of Engineers, Wilmington District, Wilmington, North Carolina.
- Kernan, C.R.
1988 *Rails to Weeds. Searching out the Ghost Railroads around Wilmington*. Wilmington Railroad Museum, Wilmington, North Carolina.
- Land Management Group (LMG)
2009 *Chronological Inventory of Eagles Island, Brunswick and New Hanover Counties, NC*. Draft Report. Land Management Group, Wilmington, North Carolina.
- Lawrence, Richard
1985 *Underwater Archaeological Sites in the Wilmington Historic District*. Nomination addendum for the National Register of Historic Places Inventory, Wilmington District. On file, North Carolina Office of State Archaeology, Underwater Archaeology Branch, Kure Beach.
- Lee, Enoch Lawrence, Jr.
1980 *The History of Brunswick County, North Carolina*. Brunswick County American Revolution Bicentennial Committee, Southport, North Carolina.
1971 *New Hanover County: A Brief History*. Division of Archives and History, North Carolina Department of Cultural Resources, Raleigh.
1965 *The Lower Cape Fear in Colonial Days*. University of North Carolina Press, Chapel Hill.
1951 *The History of Brunswick, North Carolina: The Political and Economic Development of a Colonial Town*. Unpublished Master's thesis, Department of History, University of North Carolina, Chapel Hill.
- Littleton View Company
n.d. *A turpentine still, N.C.* Littleton View Company, Littleton, New Hampshire.
- Moss Engraving Company
1886 *Map of New Hanover County*. On file, North Carolina State Archives, Raleigh.

- Newber, J.F.
2001 *A Report of Railroad Structures in the Environs of Wilmington, NC.* Newber J.F., Wilmington, North Carolina. Pp. 21-30.
- North Carolina Division of Water Quality (DWQ)
2005 *Cape Fear River Basinwide Water Quality Plan.* North Carolina Division of Water Quality, Raleigh.
- North Carolina Geological Society (NCGS)
1985 *Geologic Map of North Carolina.* North Carolina Geological Society, Raleigh.
- LeGrand, Harry E., Stephen P. Hall, Sarah E. McRae, and John T. Finnegan (Editors)
2006 *List of Rare Animal Species of North Carolina.* North Carolina Natural Heritage Program, Raleigh.
- Misty A. Franklin and John T. Finnegan (Editors)
2006 *List of Rare Plant Species of North Carolina.* North Carolina Natural Heritage Program, Raleigh.
- North Carolina Natural Heritage Program (NHP)
1995 *An Inventory of the Significant Natural Areas of Brunswick County, North Carolina.* North Carolina Natural Heritage Program, Raleigh.
- Overton, Glenn C., and Richard W. Lawrence
1996 *The Cape Fear-Northeast Cape Fear Rivers comprehensive Study: A Maritime History and Survey of the Cape Fear and Northeast Cape Fear Rivers, Wilmington Harbor, North Carolina. Volume 2.* On file, North Carolina Office of State Archaeology, Underwater Archaeology Branch, Kure Beach.
- Owens, J.P.
1991 *Geology of the Cape Fear Arch Region, North Carolina.* United States Geological Survey, Map 1-1948A, Washington, D.C.
- Parnell, J.F. and R.F. Soots
1978 The Use of Dredge Islands by Wading Birds. *Wading Birds Research Report* 7:105-111.
- Parnell, J.F. and R.F. Soots
1975 Dredging and Birds in the North Carolina Estuary; Coastal Development and Areas of Environmental Concern. Proceedings of Symposium held in Greenville, North Carolina on March 5, 1975. *UNC Sea Grant Report No. UNC-SG-75-18.* Pp. 48-53.
- Pezeshki, S.R. and J.L. Chambers
1986 Effect of soil salinity on stomatal conductance and photosynthesis of green ash (*Fraxinus pennsylvanica*). *Canadian Journal of Forest Resources* 15:371.

- Pezeshki, S.R., R.D. Delaune and W.H. Patrick, Jr.
1987 Response of bald cypress (*Taxodium distichum* L. var. *distichum*) to increases in flooding salinity in Louisiana's Mississippi River deltaic plain. *Wetlands* 7(1):1-10.
- Pope, M.
2006 *Tales of the Silver Coast: A Secret History of North Carolina's Brunswick County*. Wiwoca Press, Wilmington, North Carolina.
- Powell, W.
1989 *North Carolina through Four Centuries*. University of North Carolina Press, Chapel Hill.
- Robinson, Kenneth W.
1997 Port Brunswick and the Colonial Naval Stores Industry: Historical and Archaeological Observations. *North Carolina Archaeology* 46:51-68.
- Sanborn Map Company
1904 *Sanborn Fire Insurance Maps of Wilmington, N.C.* Sanborn Map Company, Colorado Springs, Colorado.
1889 *Sanborn Fire Insurance Maps of Wilmington, N.C.* Sanborn Map Company, Colorado Springs, Colorado.
- Schafale, M.P., and A.S. Weakley
1990 *Classification of the Natural Communities of North Carolina, Third Approximation*. North Carolina Department of Environment and Natural Resources, North Carolina Natural Heritage Program, Division of Parks and Recreation, Raleigh.
- Seeb, Sami
2007 *Cape Fear's Forgotten Fleet: The Eagles Island Ships' Graveyard, Wilmington, North Carolina*. Unpublished Masters thesis, on file, East Carolina University, Greenville, North Carolina.
- Sollier, David R.
1985 *Geology and Tectonic History of the Cape Fear River Valley, Southeastern, North Carolina*. United States Geologic Survey Paper 1466-A, Washington, D.C.
- Soots R.F., and J.F. Parnell.
1975 Introduction to the Nature of Dredge Islands and their Wildlife in North Carolina and Recommendations for Management. In J.F. Parnell and R.F. Soots (Editors) *Proceedings of a Conference on Management of Dredge Islands in North Carolina Estuaries*. University of North Carolina Sea Grant Program Publication UNC-SG-75-01, Raleigh.

Sprunt, J.

- 2005 *Chronicles of the Cape Fear River, 1660 – 1916*. Reprint of the 1916 addition. Dram Tree Publishing, Wilmington, North Carolina.

Star News Online

- 2009a After 40 years, Cape Fear Memorial Bridge remains a vital access point. *Star News Online* 15 December 2009.
- 2009b Gullah/Geechee Preservation Hopes. *Star News Online* 27 May 2009.
- 2008 Gullah Culture in N.C. gets some recognition. *Star News Online* 16 August 2008.
- 2007 Historians look to preserve the nearly extinct Gullah culture. *Star News Online* 2 September 2007.

University of North Carolina Wilmington Aquatic Ecology Laboratory (UNCW AEL)

2007. *Environmental Assessment of the Lower Cape Fear River System, 2007*. CMS Report No. 08-03, University of North Carolina-Wilmington Center for Marine Science, Wilmington.

United States Army Corps of Engineers (USACE)

- 1996 *Wilmington Harbor Record of Decision and Final Environmental Impact Statement*. United States Army Corps of Engineers Wilmington District, Wilmington, North Carolina.
- 1989 *Final Environmental Impact Statement, Long Term Maintenance of Wilmington Harbor*. United States Army Corps of Engineers Wilmington District, Wilmington, North Carolina.

United States Coast and Geodetic Survey

- 1933 *Cape Fear River from Reeves Point to Wilmington, North Carolina*. United States National Geodetic Survey, Washington, D.C.

United States Department of Agriculture (USDA)

- 1986 *Soil survey of Brunswick County, North Carolina*. United States Department of Agriculture, Washington, D.C.
- 1977 *Soil survey of New Hanover County, North Carolina*. United States Department of Agriculture, Washington, D.C.

United States Geological Survey (USGS)

- 1948 *Wilmington, North Carolina, 15-minute quadrangle map*. United States Geological Survey, Washington, D.C.

Waddell, Alfred M. (Alfred Moore),

- 1909 *A history of New Hanover County and the lower Cape Fear region*. Unknown Publisher, Wilmington, North Carolina.

Watson, A.D.

- 1992 *Wilmington Port of North Carolina*. University of South Carolina Press, Columbia.

Watts, Gordon P.

- 2000 *Underwater Archaeological Excavation and Data Recovery at the A.P. Hurt, John Knox, and Blanchard Wreck Sites on the Cape Fear River at Wilmington, North Carolina*. Tidewater Atlantic Research, Washington, North Carolina.
- 1988 *Archaeological Reconnaissance of the Wilmington Harbor/Northeast Cape Fear River, North Carolina*. Tidewater Atlantic Research, Washington, North Carolina.

Wilde-Ramsing, Mark

- 1986 *Vessel Remains in Wilmington Harbor: Urban Eyesores of the Richest Kind*. Paper presented at the 1986 Conference on Underwater Archaeology, Sacramento, California.

Wood, B. J.

- 2004 *This Remote Part of the World. Regional Formation in Lower Cape Fear, North Carolina 1725-1775*. University of South Carolina Press, Columbia.

Additional Sources of Information

Golder, Walker – National Audubon Society; N.C. Chapter
Lawrence, Richard – N.C. State Historic Preservation Office, Underwater Archeology
Marsh, Mike – Local Biologist, Writer, Hunter
Owens, Jenny – U.S. Army Corps of Engineers
Rehder, Stanley – Amateur Biologist
Rhode, Fritz – N.C. Division of Marine Fisheries
Varnum, Howard – U.S. Army Corps of Engineers
Warren, Harry – N.C. Forestry Museum Director, Whiteville, North Carolina

Websites of Interest

Water Resources

UNCW Aquatic Ecology Laboratory – www.uncw.edu/aquaticceology/laboratory
N.C. Division of Water Quality – <http://h2o.enr.state.nc.us>

Floral and Faunal Resources

National Audubon Society – <http://www.ncaudubon.org>
N.C. Division of Coastal Management – <http://dcm2.enr.state.nc.us>
N.C. Division of Marine Fisheries – <http://www.ncfisheries.net>
N.C. Natural Heritage Program – <http://www.ncnhp.org>
N.C. Wildlife Resources Commission – <http://www.ncwildlife.org>
U.S. Fish and Wildlife Service – www.fws.gov

Cape Fear River Dredging Projects

U.S. Army Corps of Engineers, Wilmington Branch –
<http://www.saw.usace.army.mil/wilmington-harbor/main.htm>



ENVIRONMENTAL SERVICES, INC.

www.environmentalservicesinc.com

Providing Superior Solutions to Environmental, Natural, and Cultural Resource Needs