



www.coastaldynamicsdesignlab.com

EAGLES ISLAND NATURE PARK VISIONING STUDY

EAGLES ISLAND NATURE PARK

A VISION FOR CONSERVATION, EDUCATION, AND RECREATION
CELEBRATING THE NATURAL AND CULTURAL RESOURCES OF EAGLES ISLAND

COASTAL DYNAMICS DESIGN LAB
NC STATE UNIVERSITY | 2021

COLLEGE OF DESIGN
DEPARTMENT OF LANDSCAPE ARCHITECTURE & ENVIRONMENTAL PLANNING

NC STATE
Design

BRUNSWICK & NEW HANOVER COUNTIES, NORTH CAROLINA

EAGLES ISLAND NATURE PARK

A VISION FOR CONSERVATION, EDUCATION, AND RECREATION CELEBRATING THE NATURAL AND CULTURAL RESOURCES OF EAGLES ISLAND

BRUNSWICK & NEW HANOVER COUNTIES, NORTH CAROLINA

This study was funded by the Edward M. Gore, Sr. Southeastern CES Environmental Education Endowment and was completed in collaboration with faculty and students from the NC State University Department of Landscape Architecture and Environmental Planning.



2021 COASTAL DYNAMICS DESIGN LAB
www.coastaldynamicsdesignlab.com

NC STATE Design

PURPOSE OF THE STUDY

The following document was produced by the NC State University Coastal Dynamics Design Lab (CDDL) in collaboration with the Eagles Island Central Park Task Force. The project was completed during an intensive engagement that spanned from January 2021 to August 2021.

The purpose of the study, inclusive of all processes and products described herein, was manifold, including but not limited to:

- + Contribute expertise in land and water resource management to advance conservation and sustainable development practices in and around Eagles Island.
- + Draw on current research to inform the creation and application of best practices capable of protecting Eagles Island's natural resources and leveraging its ecological and societal assets.
- + Explore planning, design, and management strategies that promote the highest and best uses of Eagles Island.
- + Develop transferable lessons and recommendations related to responsible and resilient land management and programming strategies in southeastern North Carolina.
- + Highlight the importance of research, planning, and design in protecting the health, safety, and well-being of people, places, and the planet.

The study's research and engagement efforts endeavored to: (i) identify, align, and illustrate relevant conservation, educational, and recreational purposes; and (ii) align respective programmatic recommendations for Eagles Island Nature Park with existing and anticipated national, state, and local conservation, planning, and/or recreation plans and policies.

The research, engagement, and documentation efforts involved in generating this document were made possible through a generous grant from the Edward M. Gore, Sr. Southeastern CES Environmental Education Endowment, as administered by the CALS Foundation and the North Carolina Cooperative Extension offices in Brunswick, New Hanover, and Pender Counties. NC State Cooperative Extension is the largest outreach program at NC State University. Based in the College of Agriculture and Life Sciences (CALS), the program reaches millions of North Carolina citizens each year through local centers in the state's 100 counties and with the Eastern Band of Cherokee Indians. Cooperative Extension is a partnership that began in 1914 when county, state, and federal governments agreed that by joining together they could provide all citizens with access to the wealth of knowledge generated by public universities.

PROJECT TEAM

NC STATE UNIVERSITY COASTAL DYNAMICS DESIGN LAB (CDDL)

The CDDL is a team of architects, landscape architects, and environmental planners with the mission of leading trans-disciplinary research and design teams to address critical ecological and community development challenges facing vulnerable coastal regions.

Andrew Fox, FASLA, PLA
Professor: Department of Landscape Architecture and Environmental Planning
Co-Director: Coastal Dynamics Design Lab

Travis Klondike, Associate ASLA
Assistant Research Professor: Coastal Dynamics Design Lab
Department of Landscape Architecture and Environmental Planning

Madalyn Baldwin, Associate ASLA
Research Associate: Coastal Dynamics Design Lab
Department of Landscape Architecture and Environmental Planning

Katarina King, Student ASLA
Graduate Student Research Assistant: Coastal Dynamics Design Lab
Department of Landscape Architecture and Environmental Planning

PROJECT ADVISORS

A group of members and leadership of the Eagles Island Central Park Task Force met with the CDDL team twice a month to discuss project direction and advise on report content. Many thanks to this group for their ongoing feedback, support, and expertise.

Evan Folds
New Hanover Soil & Water Conservation District

Lloyd Singleton
NC Cooperative Extension, New Hanover County Center

Amy Mead
NC Cooperative Extension, Brunswick County Center

Roger Shew
UNC Wilmington

Brayton Willis
Brunswick County NAACP & NC Gullah Geechee Greenway/Blueway Heritage Trail

TABLE OF CONTENTS

8 PROJECT BACKGROUND

16 SECTION ONE
VISION

60 SECTION TWO
LOCAL & REGIONAL ALIGNMENT

74 SECTION THREE
CONTEXT

84 SECTION FOUR
ECOLOGY

102 SECTION FIVE
HISTORY & CULTURE

122 CALL TO ACTION

124 APPENDICES



PROJECT BACKGROUND

PROJECT BACKGROUND

The effort to preserve Eagles Island has been ongoing since 2001 and has taken many forms over the years. Conservation efforts were first sparked with a private donation of a 52-acre tract to the New Hanover Soil & Water Conservation District. After an environmental assessment identified the numerous ecological values present within the island's vast wetlands, momentum grew around the idea of conserving Eagles Island as a natural area and drove acquisition of additional land through private donations and funding sources. In an effort to describe the existing conditions on the island, Land Management Group and Environmental Sciences, Inc. collaborated to compile existing ecological and historical research and conduct biological surveys. The resulting report, *Eagles Island: A History of a Landscape*, was published in 2011 and remains the most comprehensive source of information on Eagles Island. To further the conservation goals for the Island, the Eagles Island Coalition, a group of public and private entities committed to an integrated approach to maximize the public benefits of the island's resources, was formed. In 2015, the Coalition produced the *Eagles Island Conservation Management Plan* that explored the future of the island's natural and cultural resources, identified goals, threats, opportunities, and potential partners.

The Eagles Island Central Park Task Force (EICPTF), co-chaired by Evan Folds (elected supervisor of the New Hanover Soil & Water Conservation District) and Lloyd Singleton (director of the N.C. Cooperative Extension, New Hanover County Center), is currently composed of members representing diverse backgrounds and interests with the common goal of establishing Eagles Island Nature Park as a world-class recreational destination with a focus on conservation and education. This group envisions a park that brings joy to all people, where the past informs the present, meets the future, and people can learn to thrive with nature. Eagles Island Nature Park invites the world to our region, and unites the counties, cities, and communities of Southeastern North Carolina through conservation, education, and recreation.

EAGLES ISLAND CENTRAL PARK TASK FORCE

GARY ANDERSON
Eagles Island Community Rowing

OSKU BACKSTROM
UNC Wilmington

TOM BOLAND
New Hanover Soil & Water

RANDALL BRAY
Wilmington Harbor Enhancement Trust

NIEL BROOKS
Town of Leland

KEMP BURDETTE
Cape Fear River Watch

STEPHEN BURNETT
Koolbridge Solar

MATT COLLOGAN
New Hanover Soil & Water

DANIELLE DARKANGELO
Cape Fear Resource Conservation & Development

AUDREY DUNN
Cape Fear River Watch

AMBER ELLIS
NC State University Stormwater Engineering Group

EVAN FOLDS
New Hanover Soil & Water

TRAVIS GILBERT
Historic Wilmington Foundation

BILL GRAHAM
Renaissance Wilmington Foundation

ADRIENNE HARRINGTON
Smart Moves Consulting

KAY LYNN HERNANDEZ
Wilmington Outdoor Adventures

VIRGINIA HOLMAN
Island Wildlife - Cape Fear Region

GORDON JOHNSON
Cape Fear River Watch

JAMES KAPETSKY
Eagles Island Coalition

MORGAN KING
NC Cooperative Extension (Brunswick County)

JEANNIE LENNON
Community activist

AMY MEAD
NC Cooperative Extension (Brunswick County)

ROB MOUL
Eagles Island Coalition

BILL NEVILL
Community Activist

PAUL PASCAROSA
Headwater Environmental, Inc.

ANGIE PEARSALL
NC Cooperative Extension (New Hanover County)

MARK SEITZ
NC Cooperative Extension (Pender County)

SAM SHORES
Plastic Ocean Project

LLOYD SINGLETON
NC Cooperative Extension (New Hanover County)

ROGER SHEW
UNC Wilmington

DOUG SPRINGER
Wilmington Water Tours

PEYTON THOMAS
UNC Wilmington

MARK WILDE-RAMSING
Archaeologist

ATHINA WILLIAMS
Town of Belville

BRAYTON WILLIS
NC Gullah Geechee Greenway Blueway Heritage Trail

EULIS WILLIS
Mayor, Town of Navassa

DAWN YORK
Moffat & Nichol

REPRESENTATION FROM
North Carolina Coastal Land Trust

REPRESENTATION FROM
Cape Fear Audubon Society



HOW TO USE THIS DOCUMENT

The contents within this report are intended to: i) communicate the vision for Eagles Island Nature Park; ii) illustrate potential future conditions and user experiences; and iii) celebrate the unique ecological and cultural values that support the vision of Eagles Island Nature Park. The exhibits provided in the following pages are intended to build support for the vision from the general public, local government officials, private interests, and programmatically aligned organizations.

Section One of this report articulates the vision for Eagles Island Nature Park and identifies a number of potential projects that support the vision. Subsequent sections of the document illustrate the 'why' behind the vision, provide examples of the site's regional context and its natural and cultural resources, and illustrate Eagles Island's unique potential as a recreational and educational destination that provides wide-ranging public benefits. Sections Two and Three expand the area of study to describe alignments with local and regional recreational networks, physiographic context, and land-planning opportunities stemming from potential enhancements to Eagles Island. Following these broader analyses, sections Four and Five highlight a few of the island's most significant ecological, cultural, and historic conditions that can be leveraged in support of programmatic goals. These recommendations collectively aim to celebrate place-based

educational and recreational opportunities most pertinent to the study area and its surroundings, while highlighting the need and value of ongoing conservation efforts. Lastly, the appendices include a catalog of additional reports and resources that are referenced in this report, were informative in the creation of graphic content, or can provide additional in-depth information for interested parties.

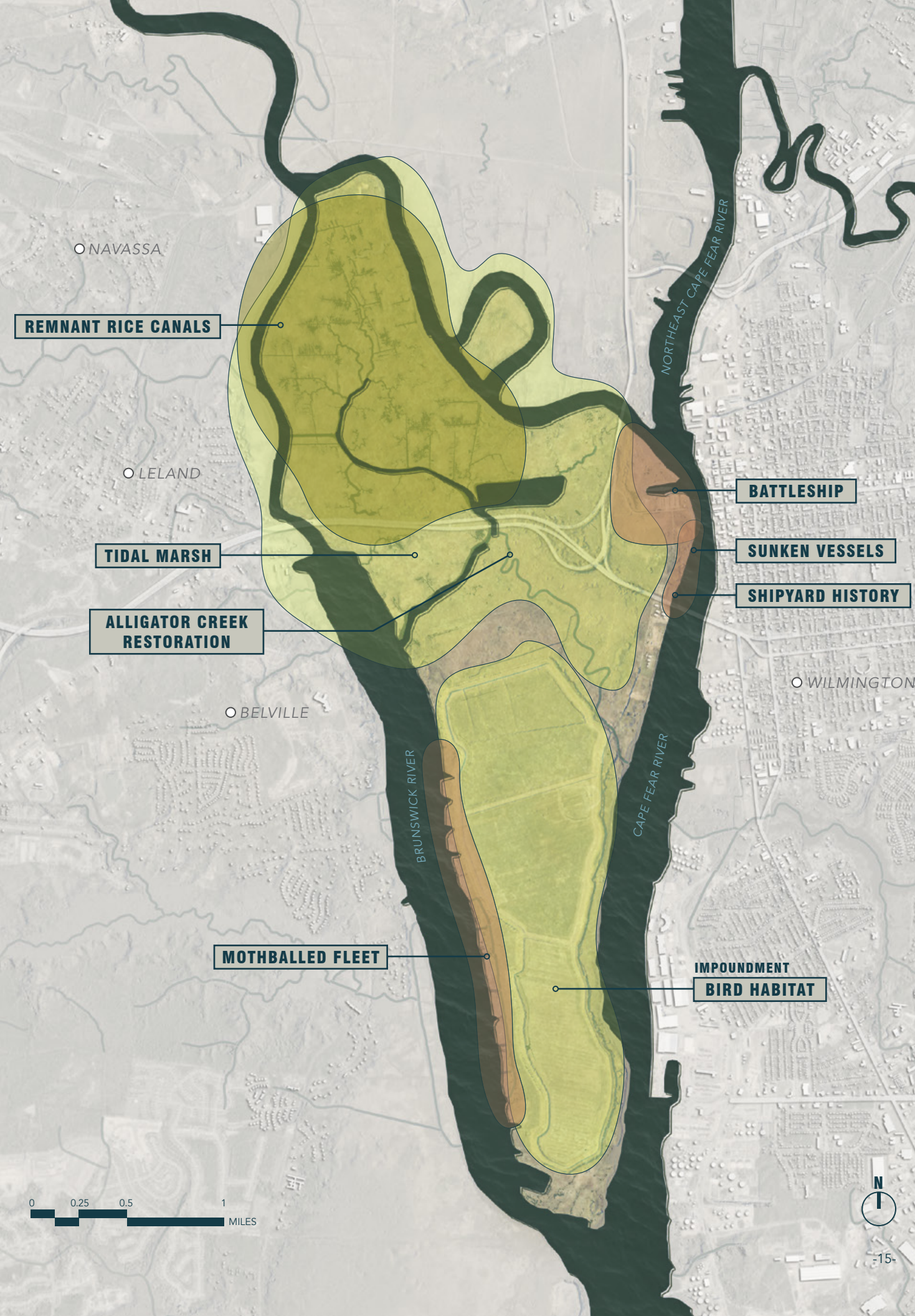
As a whole, the report is structured to provide a comprehensive description of the opportunities and public benefits associated with the vision. It is also intended that individual sections or exhibits can be selected and shared in future presentations and as promotional material to generate interest and excitement in the project. Furthermore, exhibits from sections Three, Four, and Five can be used as graphic precedent and/or to inform content development for future educational material and interpretive exhibits.



OVERVIEW

Located between the Brunswick and Cape Fear Rivers, Eagles Island has a rich natural and cultural history, and has played an integral role in the ecological significance, commercial development, and industrial activities of the Lower Cape Fear Region. The approximately 3,110 acre island is located roughly 22 miles upriver from the mouth of the Cape Fear. On the eastern side of the island, downtown Wilmington lies just across the Cape Fear River. On the western side, Belville, Leland, and Navassa are located just across the Brunswick River. Over the years, Eagles Island has supported surrounding populations through the provision of natural resources (hunting, fishing, and timbering) and has seen agricultural (rice) and industrial (naval stores and shipping) uses. Currently, almost 1,500 acres in the southern area of the island are managed by the US Army Corps of Engineers as a disposal site for dredge spoils, and this area is also used as habitat by myriad shorebirds. To the north, where portions of the island are in conservation, the tidal freshwater marsh habitat is designated as a Natural Heritage Program Natural Area, and remnants of hand dug ditches and canals reveal the island's history as a significant agricultural site for rice cultivation. Sunken and abandoned vessels along the eastern shore of the island tell the story of Wilmington's economic growth and industrial past.

While the environmental conditions, artifacts, and historical records speak to the critical role Eagles Island historically played in the ecological and cultural development of the Lower Cape Fear Region, they also highlight the resources and opportunities for Eagles Island to provide ongoing public benefits for local populations and the region as a whole.





SECTION ONE

VISION



“EAGLES ISLAND NATURE PARK INVITES THE WORLD TO OUR REGION, AND UNITES THE COUNTIES, CITIES, AND COMMUNITIES OF SOUTHEASTERN NORTH CAROLINA THROUGH CONSERVATION, EDUCATION, AND RECREATION.”



VISION STATEMENT

Eagles Island first appeared on North Carolina maps in 1671 - known then as Cranes Island. Located at the confluence of the Cape Fear and Brunswick Rivers, Eagles Island has been a vital ecological asset for our riverine system and a centerpiece of the dynamic cultural history of our region.

Eagles Island Nature Park is a once-in-a-generation opportunity to create a world-class park. The timing could hardly be better: the region boasts two of the most rapidly growing populations in the United States with growing appreciation and needs for outdoor experiences.

Establishing Eagles Island Nature Park amplifies the area's brand as a coastal destination that also holds valuable historical significance. Regional residents can access it easily, and it's also an area that families will travel to experience. Walking paths, marsh boardwalks, bike trails, birdwatching, kayaking, a harbor loop, and an exhibition and education center will commemorate the people and the stories that have shaped a nation.

VISION

Eagles Island Nature Park is the heart of Southeastern North Carolina, connecting its communities and the region through education, recreation, and conservation.

MISSION

We care for the well-being of all at Eagles Island Nature Park. Park amenities, nature trails, and programs will amplify the region's value, livability, and appeal at a crucial moment in our history.

PROGRAMS & ACTIVITIES

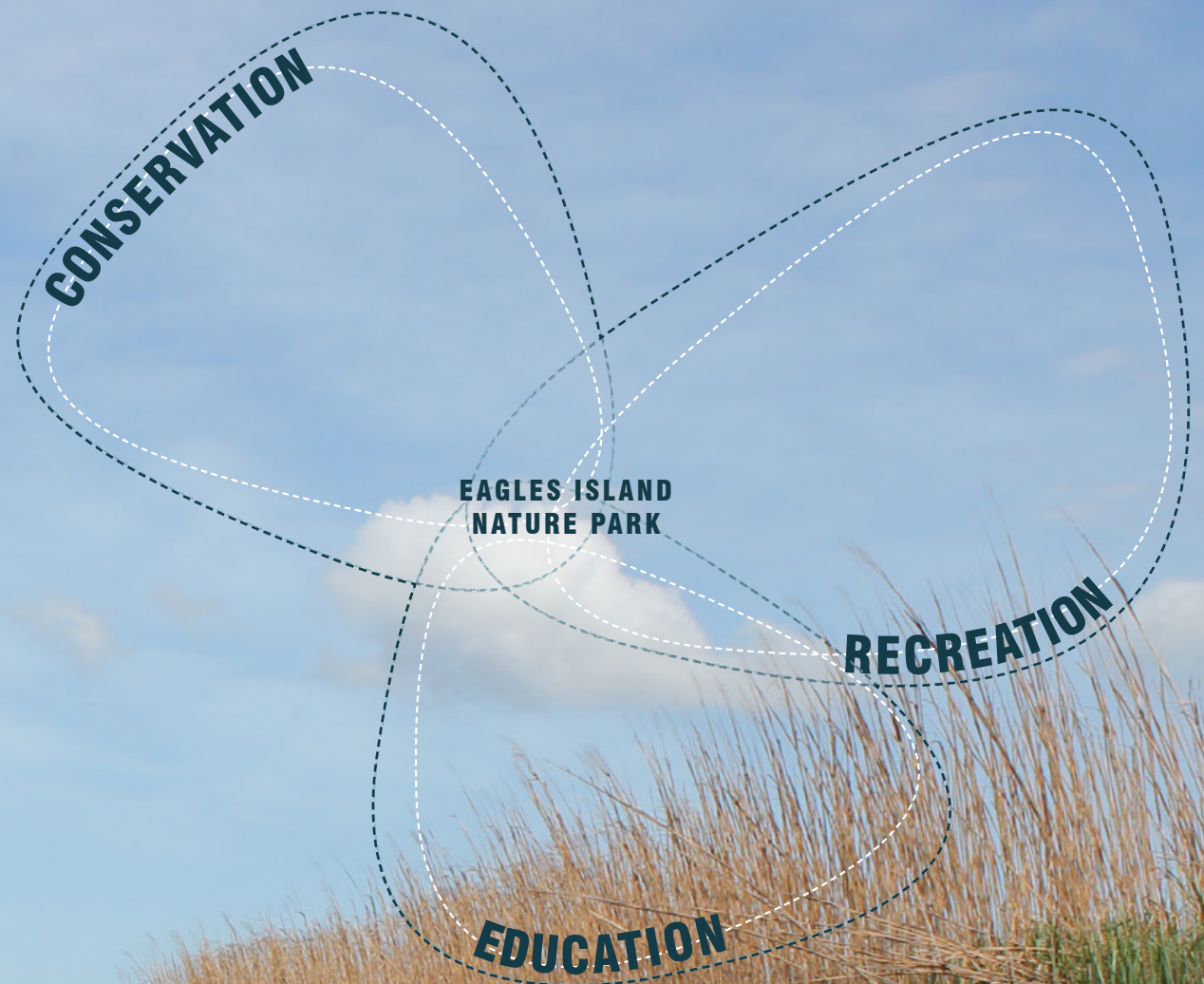
SITE INTERPRETATION & EDUCATION
ECOLOGY / CULTURE / HISTORY
WALKING, HIKING & PADDLING
BIRDWATCHING
GUIDED TOURS

FEATURES

BOARDWALKS
HIKING & NATURE TRAILS
PADDLE TRAILS
EDUCATIONAL CENTER
WILDLIFE OBSERVATION AREAS
INTERPRETIVE SIGNAGE

VALUES

LOW-IMPACT & SUSTAINABLE
PUBLIC ACCESS & CONNECTIVITY
TOURISM DRIVER
COMMUNITY BENEFIT



DEVELOPING A SHARED VISION

In order to better understand various interests, refine the scope of this report, and develop a shared vision for the future of Eagles Island, in March 2021, the project team distributed a 'Visions and Values' survey to members of the Eagles Island Central Park Task Force. The survey included questions about respondents' overall vision for Eagles Island as well as any ideas they had regarding priorities, programming, and design for three categories: conservation, education, and recreation. Aggregated results from the 29 responses highlighted specific assets and opportunities on Eagles Island, prioritized programming and design goals, and characterized the overall values at the core of the effort to establish Eagles Island Nature Park. The list at left highlights the highest priority programs, design interventions, and values identified through the survey results. Building on some of the goals and projects identified by the Eagles Island Coalition, the vision and recommendations discussed throughout this report reflect current conditions on Eagles Island and relate to new and ongoing local and regional planning efforts.

FEATURES AND AMENITIES

EAGLES ISLAND NATURE PARK

By prioritizing conservation and responsible development of park infrastructure and amenities, Eagles Island Nature Park can provide a transformational enhancement to the educational and recreational resources serving the surrounding communities and the Lower Cape Fear region. Directly adjacent to Wilmington (2020 population: 126,000), as well as northern Brunswick County, one of the fastest growing areas in North Carolina, public access to a natural area of this size will serve local residents as an invaluable amenity and promote cultural and eco-tourism. Prioritizing community access upholds the goal "to work with other interested parties and agencies to ensure the **continued preservation of and recreational access to Eagles Island**" (Wilmington Parks & Recreation Master Plan: Goal 6, Objective B).

CONSERVATION

Conservation of privately owned land is critical to preserving and enhancing the environmental qualities of Eagles Island. While much of the island's acreage is not physically accessible, the scenery and wildlife habitat can be experienced from the water.

BIKE/PED CONNECTOR

An off-road bike and pedestrian route connects Brunswick and New Hanover County communities to Eagles Island and ties into regional and national greenway systems.

WILDLIFE VIEWING

Viewing decks and observation towers accessible by walking and/or paddle trails can provide unique vantage points across the Island for spotting and photographing birds and other wildlife.

EDUCATIONAL CENTER

An educational center and riverfront park area welcomes visitors to Eagles Island Nature Park and can host a multitude of interpretive and informational exhibits most pertinent to the island and the broader Cape Fear region.

PADDLE TRAILS

Miles of paddle trails surrounding Eagles Island and the maze of interior creeks and canals afford immersive access to the site's natural landscape and history while also connecting to existing local and regional blueway networks.

NATURE TRAILS

Where conditions allow, natural surface trails and boardwalks can provide miles of hiking and walking opportunities throughout the island's marsh ecosystems. Interpretive signage and exhibits supplementing trails can also help educate visitors about ecological and cultural histories.

BOARDWALKS

Boardwalks along the eastern shore of Eagles Island enable visitors to interact with the Cape Fear River's many sunken vessels and provide an opportunity to learn about local maritime history and shipbuilding.

ECOLOGICAL RESTORATION

For areas of the island that have been heavily modified by historic land uses, ecological restoration can improve wildlife habitat and water quality, demonstrate emerging restoration techniques, and augment conservation efforts across the island.

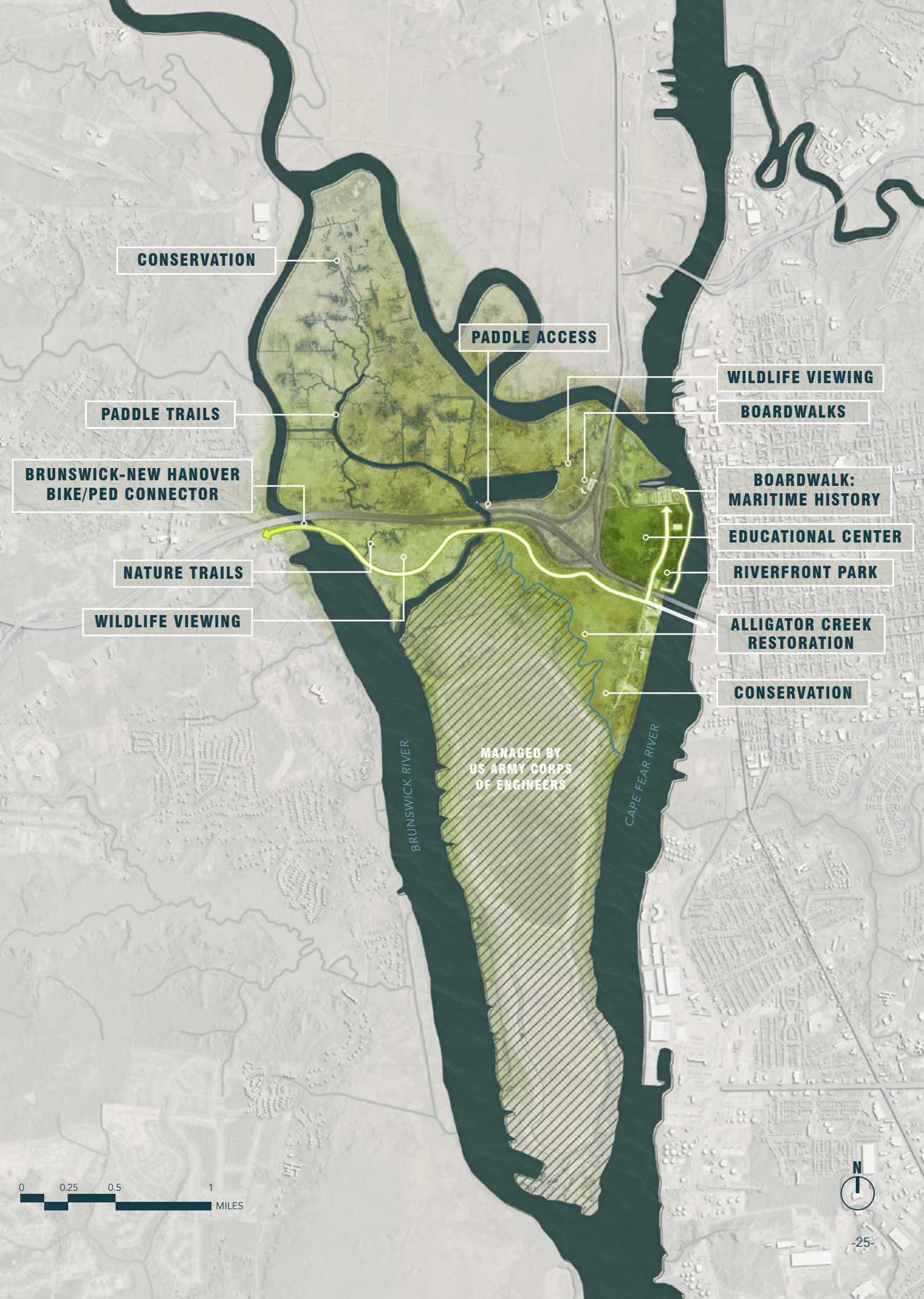
PAGE 30

PAGE 40

PAGE 38

PAGE 46

PAGE 26



IMMERSIVE SITE INTERPRETATION



**UNDERWATER ARCHAEOLOGY
EDUCATIONAL EXHIBITS**

PUBLIC PADDLE ACCESS

SUBMERGED VESSEL REMAINS

WHARF REMAINS

CONSTRAINTS

PATCHWORK OF PRIVATE OWNERSHIP
DEVELOPMENT INTEREST NEAR BATTLESHIP
EXISTING SHORELINE DEVELOPMENT
RIGHT-OF-WAY & EXISTING TRAFFIC PATTERNS

OPPORTUNITIES

PARTNERSHIP WITH STATE LAND OWNERS
PARTNERSHIP WITH BATTLESHIP
MULTIPLE PARCELS IN CONSERVATION
ALLIGATOR CREEK RESTORATION

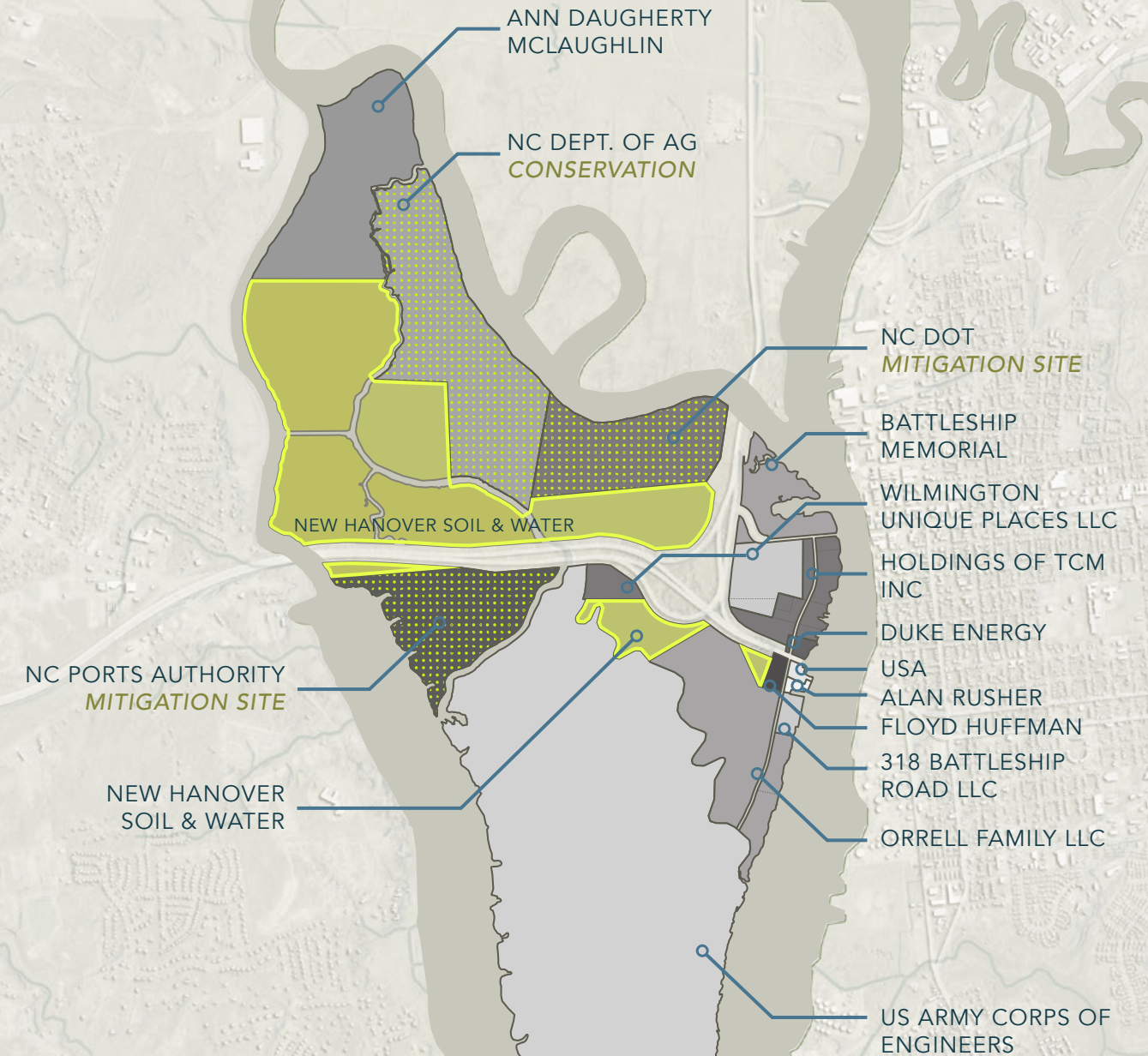
ACTION ITEMS

PRIVATE LAND OWNER OUTREACH
EXPLORE SHARED USE AGREEMENTS
COORDINATION WITH NC DOT

CONSERVATION STATUS CURRENT LAND OWNERSHIP

The patchwork of ownership on Eagles Island is a significant constraint concerning the establishment of Eagles Island Nature Park. The division of parcels on the Island represents a vast array of public and private ownership conditions and varying degrees of land use and management. Six parcels, representing approximately 520 acres, are owned and/or held in conservation easements by the New Hanover Soil & Water Conservation District. These parcels can currently support programming and public access as part of Eagles Island Nature Park, but are limited in accessibility due to isolation from existing infrastructure and the prevalence of wetland conditions. Separately, several of the larger parcels on the island, totaling about 485 acres, are owned and/or held in conservation easements by state agencies including the North Carolina Department of Transportation, the North Carolina Department of Agriculture, and the North Carolina Ports Authority. These areas may support the Eagles Island Nature Park programming vision, therefore conversations with these state agencies should be initiated to pursue shared-use agreements for public access, if desired. The largest single parcel on Eagles Island is under the jurisdiction of the United States Army Corps of Engineers, and while most of the area is actively used as a dredge spoil storage and disposal area, a shared-use agreement for public access could also be pursued within the northern portion of this parcel.

Lastly, the series of smaller parcels along the eastern shore of Eagles Island is predominantly in private ownership, with some of the land in industrial use. This area has been extensively modified by past and present land uses, and is essentially the only part of the island with soils and elevation suitable for development. As such, there has been ongoing interest in private residential or mixed-use development in the area directly south of the USS North Carolina Battleship Museum.



RECOMMENDATION ONE

ESTABLISH BLUEWAY NETWORK

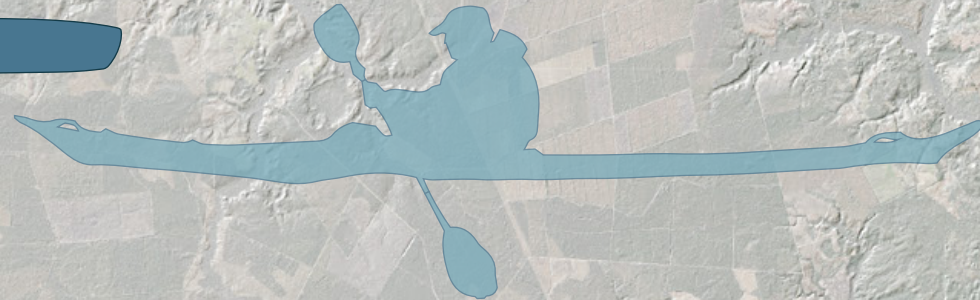
Formalize and promote Eagles Island Nature Park paddle trails with route names, maps, and wayfinding signage.



18mi
PADDLING IN/AROUND
EAGLES ISLAND

73mi
CONNECTING LOCAL
PADDLE ROUTES

187mi
CAPE FEAR RIVER
PADDLE TRAIL



LOCAL BLUEWAY NETWORK

Located between the Brunswick and Cape Fear Rivers, Eagles Island is currently most easily explored by boat. With a 13-mile perimeter, five miles of navigable interior creeks, and countless remnant rice canals, paddling through the Eagles Island marshes provides unparalleled access to this unique ecosystem and the island's historic artifacts. Many local outdoor adventure outfitters lead guided paddling tours around Eagles Island; the boat launches at Dram Tree Park and the Brunswick Riverwalk provide easy access for self-guided excursions. With nine additional paddle access points in the area, the island is centrally located to the surrounding communities through 73 miles of blueway trails and local tributaries. In addition, public access points along the Cape Fear River between Wilmington and Moncure, NC, afford paddle access to 187 miles of river with varying degrees of flat and whitewater conditions.

Formalizing the island's existing blueway network with route names, maps, wayfinding signs, interpretive signage, and promotional material will help establish the public presence and identity of Eagles Island Nature Park. These interventions are relatively low cost and can be installed on creek-adjacent land presently owned by the New Hanover Soil & Water Conservation District or on privately owned land with a shared-use agreement. Additional improvements could include a public-access paddle launch and boat rental facility on Eagles Island (established through an agreement or partnership with a private landowner) and kayak-accessible platforms along paddle routes to provide destinations for resting, picnicking, camping, and exploring the island on foot.

RIEGELWOOD CLUB
BOAT LAUNCH

RIVERSIDE PARK
BOAT LAUNCH

DAVIS CREEK BOAT LAUNCH

CYPRESS COVE PARK
BOAT LAUNCH

BRUNSWICK RIVERWALK
BOAT LAUNCH

ARCHIE BLUE PARK
BOAT LAUNCH

DRAM TREE PARK
BOAT LAUNCH

BOAT LAUNCH
BRUNSWICK NATURE PARK

RICE CREEK BOAT RAMP

BOAT LAUNCH
RIVER ROAD PARK



LOCAL BLUEWAY NETWORK
EXPLORING HISTORIC RICE CANALS

**PADDLE TRAIL WAYFINDING
& INTERPRETIVE SIGNAGE**

ALLIGATOR CREEK
PADDLE TRAIL

MILE 2 

**GUIDED TOURS
& EXPEDITIONS**

PUBLIC ACCESS

BOARDWALK & TRAIL

The goal of pedestrian access to Eagles Island can be realized through development of boardwalks, trails, and shelters in the 79-acre parcel currently owned by the New Hanover Soil & Water Conservation District, located directly across Highway 74 from the USS North Carolina Battleship Museum. This recommendation connects to the paddle trail system described in Project One, and provides the first pedestrian public access to Eagles Island Nature Park's recreational facilities. Construction of a small- to mid-sized parking lot in the existing disturbed areas and higher ground within the highway right-of-way can provide easy public access while minimizing visual and ecological disturbance in the marsh. The right-of-way can also accommodate an access road to a kayak launch and rental facility with access to Alligator Creek and the property's human-made pond. Observation decks located at either end of the pond provide expansive views across the island and opportunities for site interpretation, wildlife viewing and photography. While boardwalks are required for access to the marsh and pond, a natural-surface trail constructed on the higher ground of dredge spoils lets visitors experience the forested conditions along the water's edge.

Upgrades to the intersection of Highway 74 and USS North Carolina Road are necessary to facilitate safe vehicular access and pedestrian travel between the nature park and the Battleship Museum. Discussions with Battleship stakeholders and NCDOT should include: i) installation of traffic lights (including left-turn signals) at the intersection; ii) turn-lane improvements; iii) pedestrian crosswalk; iv) visibility enhancement; and v) sidewalk or off-road pedestrian path along USS North Carolina Road. These enhancements will greatly improve safety at a challenging intersection.

RECOMMENDATION TWO

CREATE PARK DESTINATIONS

Construct low-impact park infrastructure such as boardwalks, trails, and open-air shelters to establish Eagles Island Nature Park as a publicly accessible recreational destination.



EXAMPLES & INSPIRATION

PATHS AND ACCESS



Surface Treatment: Natural Surface

Materials: bare earth, crushed stone, native materials

Relative Cost: Less expensive (\$150k - \$350k/mile)

Maintenance: More frequent (ECG, 2021)



Surface Treatment: Asphalt

Relative Cost: Moderately Expensive (\$350k - \$750k/mile)

Lifespan: 7-15 years on average

Maintenance: More frequent; permeable asphalt requires additional maintenance (ECG, 2021)



Wildlife Viewing Platform

Tipperne Bird Sanctuary, Johansen Skovsted Arkitekter

Observation platforms and towers provide an opportunity for thoughtful and striking architectural design and can act as park landmarks.



Boardwalk Seating & Amenities

Above: Crosby Arboretum, E. Fay Jones & Andropogon Associates

Below: Brooklyn Navy Yard, Nelson Byrd Woltz



Surface Treatment: Boardwalk

Materials: timber, composite, concrete

Relative Cost: More expensive (\$750k - 1.5 million/ mile)

Lifespan: 15 years on average for timber

Maintenance: Less frequent (ECG, 2021)



Surface Treatment: Concrete

Relative Cost: More Expensive (\$750k - 1.5 million/ mile)

Lifespan: 25+ years on average

Maintenance: Less frequent (ECG, 2021)



Low-Impact Parking Strategies

As part of a sensitive site design, strategies to manage and reduce the negative impacts of stormwater runoff on receiving water bodies should be considered. This can be achieved through the use of permeable or porous paving materials and the siting of various native-planted bioretention areas to filter, store, and infiltrate stormwater.



PUBLIC ACCESS: BOARDWALKS & TRAILS

WILDLIFE VIEWING

GUIDED BIRDWATCHING
& NATURE WALKS

MARSH ECOLOGY
EDUCATIONAL EXHIBITS

GULLAH GEECHEE HERITAGE
EDUCATIONAL EXHIBITS

WILDLIFE VIEWING



RECOMMENDATION THREE

CREATE PEDESTRIAN CONNECTIONS

Establish an off-road bike and pedestrian route connecting Belville and Wilmington to increase access to Eagles Island Nature Park.

BRUNSWICK - NEW HANOVER PEDESTRIAN CONNECTION

Pedestrian access and community connectivity is a top priority of the Eagles Island Nature Park vision. Establishing an off-road pedestrian route across Eagles Island will provide immersive access to the island from the nearest population centers on both sides of the rivers. Since access opportunities are limited elsewhere on the island, site interpretation and educational goals can be integrated along this route. Additional walking trails or boardwalks and amenities such as observational decks or towers can also be expanded from this route, where appropriate.

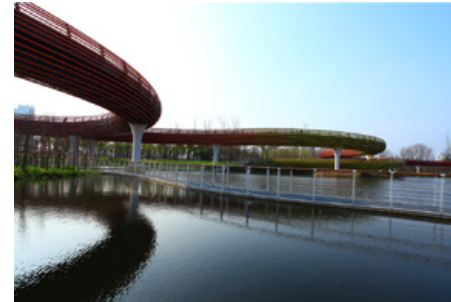
The Eagles Island connection between Belville and neighboring Brunswick County communities with downtown Wilmington also serves as the missing link of an extensive multi-county park system with connections to regional and national recreational networks. The proposed route would establish a physical connection with the USS North Carolina Battleship that is mutually beneficial to the mission and visitorship of both the Battleship and Nature Park. Furthermore, the Eagles Island connection would link with the planned Alligator Creek Restoration project and associated nature trail. This route is identified in the Belville 2030 Vision Plan as connecting to an expanded Brunswick Riverwalk and is also a critical segment of the proposed Gullah Geechee Cultural Heritage Corridor Multi-Use Greenway/Blueway Trail, a multi-modal pedestrian network that connects to the East Coast Greenway in Southport and Wilmington.

This project heavily relies on extensive infrastructure improvements including the establishment of a new pedestrian bridge across the Brunswick River or improvements to the existing vehicular bridge to accommodate pedestrian use. Access across the Cape Fear would require construction of the Cape Fear Memorial Bridge replacement to include bike and pedestrian accommodations. Ideally, a dedicated bike and pedestrian route would be established, but a pedestrian ferry service between Wilmington and Eagles Island could also facilitate easy public access. These projects come with a lengthy timeline, but fundraising, planning, and design development of sections of the Eagles Island route can begin immediately. With NCDOT coordination, the majority of the route could be located within the US 17/US 74 and Battleship Road rights-of-way. However, the pedestrian experience would be significantly enhanced by routing the greenway away from the busy highway corridor. The preferred route would require establishing partnerships and shared-use agreements with the North Carolina Ports Authority and the US Army Corps of Engineers who manage the land south of the highways.



EXAMPLES & INSPIRATION

PATHS AND ACCESS



Pedestrian Bridge: Iconic

Location: Yanweizhou Park, Jinhua City, China
 Features: 2,300-foot long steel structure with fiberglass handrails and bamboo paving. Bridge is elevated above 200-year flood level with ramps that can be submerged during 20-year and larger floods, serving as water-resilient infrastructure.
 Landscape Architect: Turenscape



Pedestrian Bridge: Greenway Road Crossing

Location: American Tobacco Trail over I-40, Durham, NC
 Features: At 210 feet long, this structure is the largest stressed ribbon bridge of its kind in North America. It opened in 2014 as part of the 22-mile long rails-to-trails pathway.
 Design: WSP USA



Pedestrian Bridge: Adaptive Reuse

Location: Walnut Street Bridge, Chattanooga, TN
 Features: 2,376-foot long historic wrought-iron and steel through-truss. The original bridge was erected in 1890, closed to motor vehicles in 1978, and was repurposed and opened as a pedestrian walkway and linear park in 1993.



Pedestrian Access: Traffic Calming & Complete Streets

Complete Streets strategies such as separated bike and pedestrian walkways, road diets to calm traffic, and pedestrian refuge islands facilitate multi-modal accessibility and are designed to balance safety and convenience for everyone using the road.

PEDESTRIAN ACCESS GREENWAY CONNECTIONS

**BIKE/PED CONNECTION USING
EXISTING SERVICE ROAD**

WAYFINDING

WILMINGTON WATERFRONT VIEWS

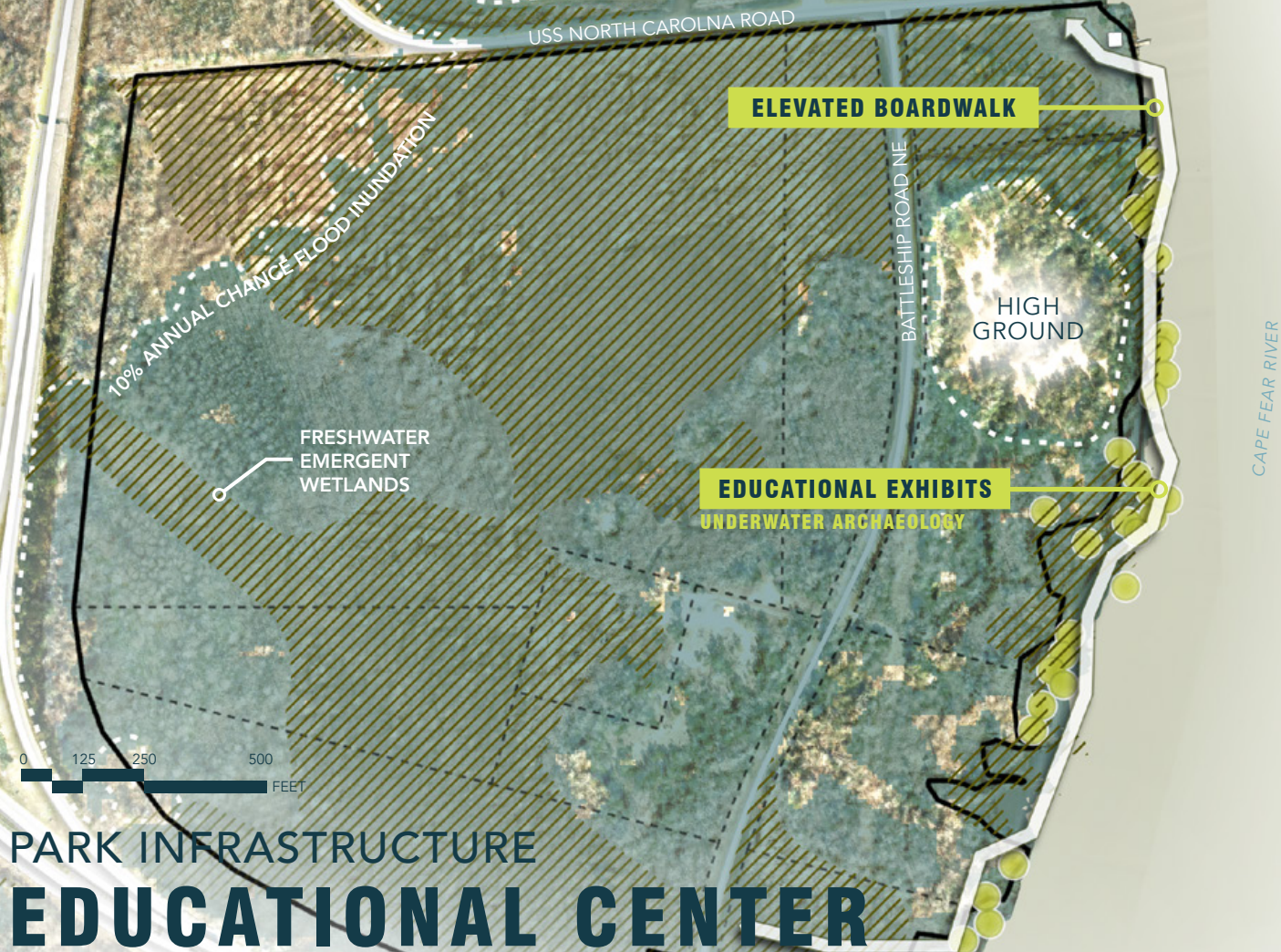
**EAGLES ISLAND
GREENWAY TRAIL**

- ↑ Battleship Memorial
0.5 MI
- ↑ East Coast Greenway
Connection
2 MI
- ← Belville
2.3 MI
- ← Navassa
4 MI

RECOMMENDATION FOUR

ESTABLISH EDUCATIONAL CENTER

Pursue partnerships with landowners or explore feasibility of acquiring developable land south of the Battleship to build an educational center and riverfront park.



PARK INFRASTRUCTURE EDUCATIONAL CENTER

Establishing an educational center has remained essential to the Eagles Island Nature Park vision throughout the evolution of Eagles Island preservation efforts, and would complement the Battleship Memorial's popular educational programming. While this type of facility would undoubtedly provide an exceptional local and regional amenity, development opportunities are limited due to the island's sensitive environmental conditions, wetland soils, and persistent flood risk. The only location in the study area suitable for development lies within several privately owned parcels south of the USS North Carolina Battleship. This area has been extensively modified over time, contains predominantly urban/modified soils, and is the highest elevation on the island. Importantly, the surrounding soils are all wetland soil types. While elevation across most of the island ranges from 0-10 feet above sea level, the high point in this area has an elevation approximately 15 feet above sea level and is one of the few shoreline areas that will not be inundated by a 10-year flood event (10% probability of annual occurrence). Given the lower environmental impact, reduced flood risk, and proximity to existing infrastructure, this high ground (approximately four acres) is the most suitable location for an educational center on the island. This location also provides the best access to the section of Eagles Island shoreline that contains

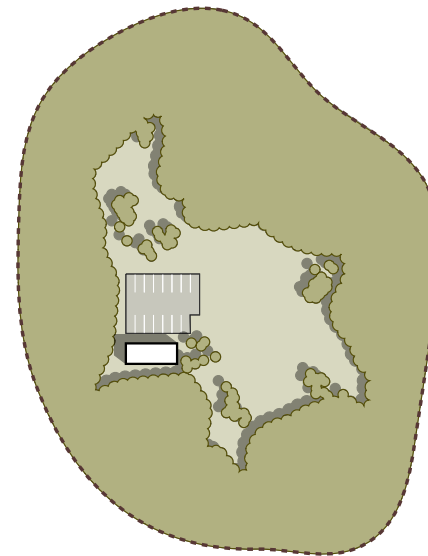


EAGLES ISLAND

CAPE FEAR RIVER

BUILDING SIZING & PARKING REQUIREMENTS

The diagrams below illustrate a range of building sizes and the associated parking requirements within the 4-acre high ground, with suitable building uses based on size.



1,000 FT²

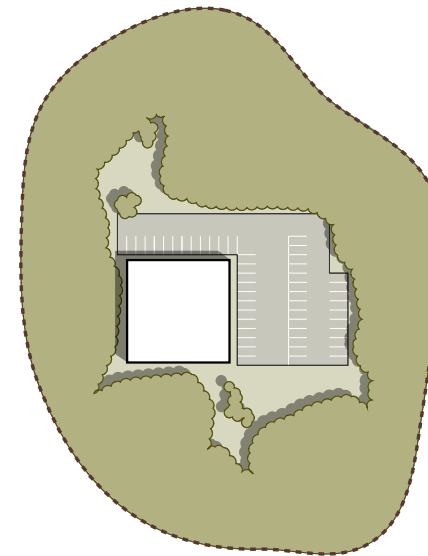
OPEN AIR PAVILION

Capacity: 50 people
Parking: 4 stalls minimum
15 stalls recommended
Amenities: Covered gathering area, space for classes, 8 picnic tables

OR

VISITOR KIOSK

Capacity: 24 people
Parking: 3 stalls minimum
15 stalls recommended
Amenities: Small exhibit space, small office space, park restroom facilities



10,000 FT²

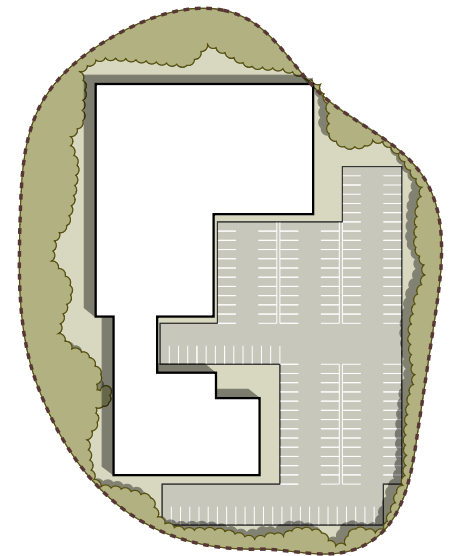
MUSEUM SPACE

Capacity: 240 people
Parking: 25 stalls minimum
Amenities: 5 exhibit spaces, small office space, reception & visitor information, classroom facilities

OR

THEATER SPACE

Capacity: 240 people
Parking: 48 stalls minimum
Amenities: 2 small theaters or 1 large theater space, reception & visitor information



50,000 FT²

EDUCATIONAL COMPLEX

Capacity: 1,200 people
Parking: 162 stalls minimum
Amenities: 10+ exhibit spaces, 384-seat theater, event space, classroom facilities, visitor information, park headquarters office space

dozens of sunken vessels. These artifacts present a unique opportunity to establish a boardwalk and interpretive material for an immersive experience highlighting shipbuilding and maritime history while preserving state-recognized historic artifacts. Because this area is privately owned, initiating conversations with the current landowner to gauge interest in the potential sale or lease of the land, lease of future building space, and/or partnership to develop mutually beneficial programming is recommended. If development of an educational center at this site is feasible, the diagram above illustrates various building sizes, their potential programs, and the required parking areas for each.

An additional consideration for development is that much of the land in this area is registered as a brownfield site with the North Carolina Department of Environmental Quality due to environmental contamination. Initial remediation efforts have been undertaken, but additional remediation activities may be required. Based on the type of contamination, NCDEQ has restricted use on these parcels to single-family residential, high density residential, short-term rental home, office, retail, restaurant, hotel, recreation, marina, open space, and associated parking.



WILMINGTON

FLOOD HAZARD MITIGATION

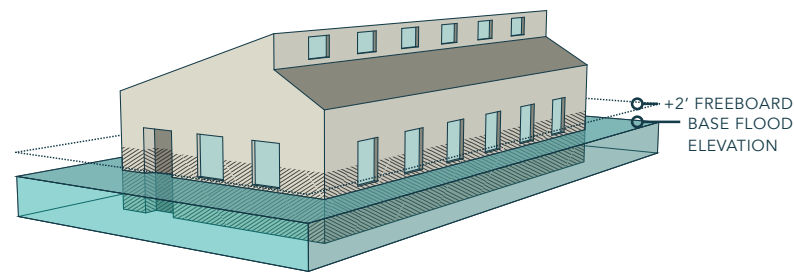
PARK INFRASTRUCTURE

Due to the increased likelihood of flooding from sea level rise, any development of park infrastructure should be designed to mitigate the impacts of floodwaters. For non-residential buildings in New Hanover and Brunswick Counties, this involves floodproofing or elevating to the Regulatory Flood Protection Elevation, or the Base Flood Elevation (BFE) plus two feet of freeboard. The BFE across Eagles Island is nine feet, meaning non-residential structures need to be floodproofed or elevated to a height of eleven feet above sea level. Because the average elevation of the ground surface on Eagles Island is around three feet above sea level, most structures would require flood protection of approximately eight feet, at a minimum.

FLOODPROOF

For non-residential structures, floodproofing is a viable way to protect building contents. There are two categories of floodproofing: wet and dry. Wet floodproofing allows floodwaters to enter a building, whereas dry floodproofing attempts to prevent the entry of floodwaters altogether.

Wet floodproofing uses water-resistant construction materials and techniques that are capable of withstanding inundation. Allowing floodwater to enter and move through a building lessens the likelihood of structural damage by equalizing the pressure (i.e., weight of water) on both sides of load-bearing structures (FEMA, 2014). Wet floodproofing neither guards buildings from the impacts and deposition of debris nor protects the contents of buildings from saturation, mold, and damage that result from exposure to water.

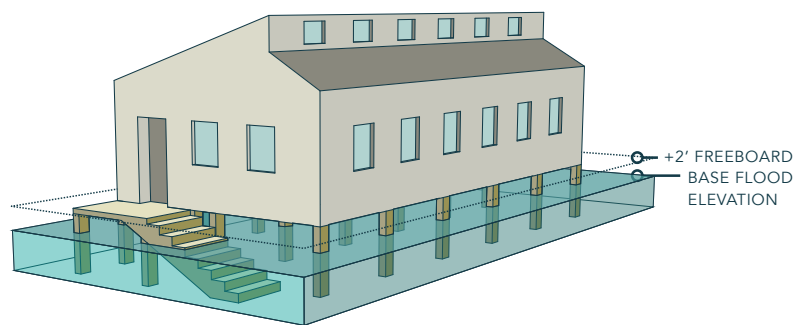


FLOODPROOF

Dry floodproofing requires completely sealing the exterior of a building to prevent the entry of floodwaters (FEMA). This system relies on: i) fortified walls to resist the external forces exerted by floodwaters; and ii) integrated backup drainage devices, like sump pumps, to minimize internal exposure to water intrusion. Because the pressure of water on structures is so great, this method is only suitable for structures where maximum flood depths are less than three feet (FEMA, 2014).

ELEVATE

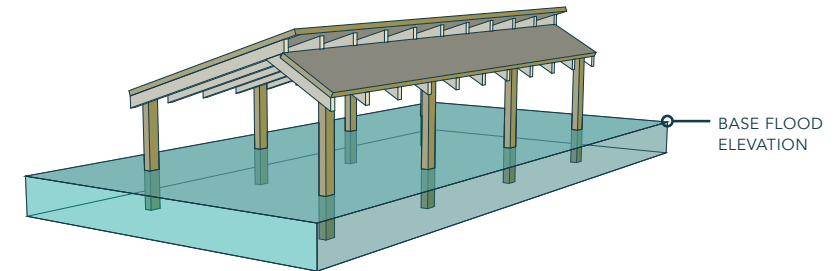
Another option is to elevate the building above regulated flood levels. The most common methods for raising a building include: elevation using a concrete or masonry foundation, or elevation using concrete, masonry or treated-lumber piers. Elevating with a foundation is considered a viable option for buildings if the new finished floor elevation (FFE) does not exceed four feet (48") above the surrounding ground level. Once elevation needs exceed four feet, it is recommended to elevate with piers. Elevating can protect building contents from floodwaters, but requires additional access accommodations to maintain ADA compliance and universal accessibility.



ELEVATE

OPEN-AIR STRUCTURE

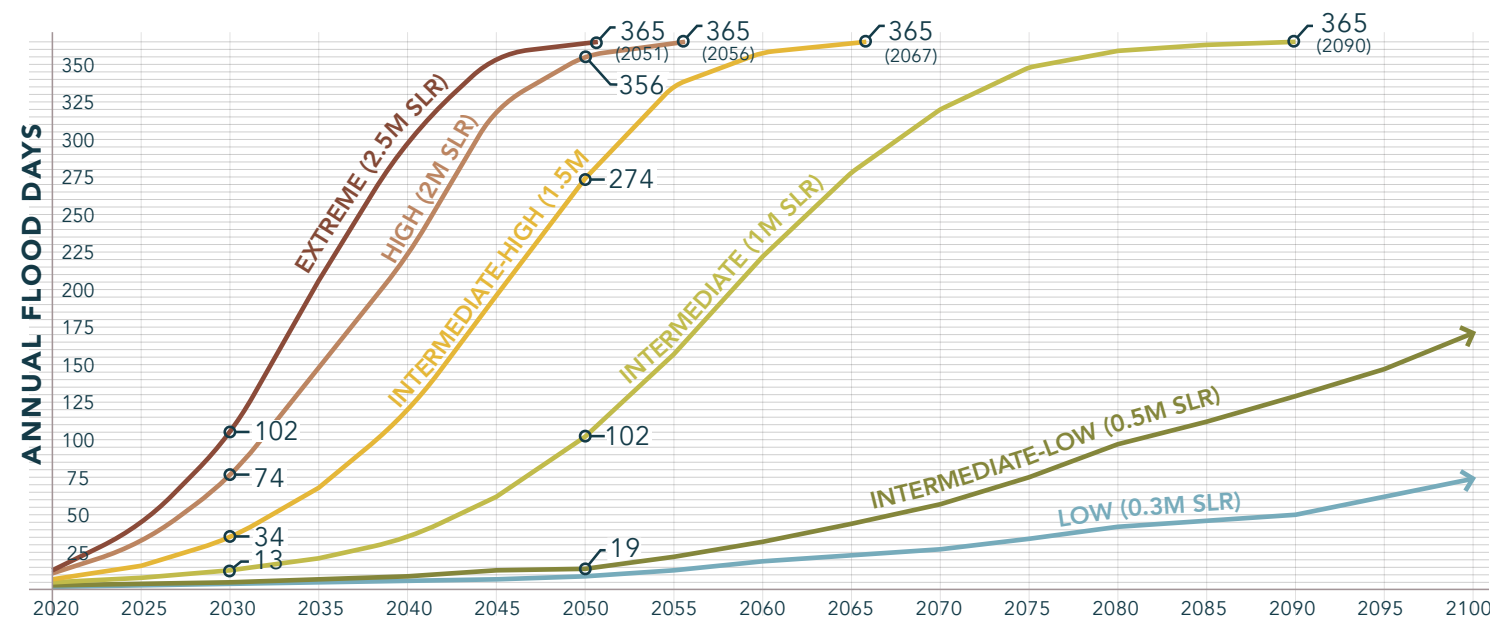
An open-air structure constructed at-grade is a cost-effective solution to offering basic infrastructural amenities without requiring costly floodproofing enhancements. This type of structure is appropriate for small shelters, large pavilions, kiosks for visitor information, modest office or booth space for rangers or volunteers, equipment rentals, and exhibits. Contents would not be protected from flooding, so exhibits featuring digital or electronic elements are not appropriate.



OPEN-AIR STRUCTURE

INCREASING SUNNY-DAY FLOODING

In addition to flood risks associated with larger storm events, the Wilmington area and Eagles Island already experience regular nuisance flooding in low-lying areas, also called sunny day flooding or high-tide flooding, due to winds, tidal fluctuations, and King Tides. One of the projected impacts of sea level rise is an increase in the frequency of sunny day flooding in coastal areas. The chart below illustrates the modeled annual number of nuisance flood days in Wilmington, NC for different SLR projections. In Wilmington's most extreme scenario, sunny day flooding is projected to occur every day of the year by 2051. Although the exact impacts are still unknown, it's imperative to factor in regular nuisance flooding to planning and design efforts, from considering parking lot locations and public road access, to the elevation of trails and boardwalks.



HIGH-TIDE FLOODING PROBABILITY SCENARIOS: WILMINGTON, NC

Information from NOAA Technical Report NOS CO-OPS 086: Patterns and Projections of High Tide Flooding Along the U.S. Coastline Using a Common Impact Threshold

EXAMPLES & INSPIRATION

PARK FACILITIES



Marine Education Center at the Gulf Coast Research Laboratory

Location: Ocean Springs, MS

Function: Educational Complex, with outdoor classrooms, laboratories, exhibition space, etc.

Size & Features: 29,700 sq. feet across six pine structures. Buildings are constructed with low-impact materials, and sited within the least sensitive ecological zone three feet above the 500-year floodplain.

Architect: Lake Flato Architects



Gulf State Park Interpretive Center

Location: Gulf Shores, AL

Function: Interpretive Center serving the 6,150 acre Gulf State Park

Size & Features: 7,500 sq. feet. Built using locally sourced lumber and recycled materials. Features solar panels, natural ventilation, rainwater harvesting, and UV water treatment.

Architect: ArchitectureWorks



Walnut Creek Urban Wetlands Education Center

Location: Raleigh, NC

Function: Visitor Education Center for the 49-acre Walnut Creek Urban Wetlands Educational Park

Size & Features: 7,000 sq. feet building with classrooms, a laboratory, small library, and conference room. The structure sits six feet above the wetland floodplain, with cisterns to collect rainwater and windows that provide natural ventilation.

Architect: Frank Harmon, FAIA



Tillamook Forest Interpretive Center

Location: Tillamook, OR

Function: Interpretive and Educational Center for Tillamook State Forest

Size & Features: 13,500 sq. feet. Built using locally milled timber and heated by the burning of wood pellets made of leftover sawdust. Windows provide natural daylight and ventilation, and rainwater is collected and treated for use.

Architect: Miller Hull Partnership

EXAMPLES & INSPIRATION

PARK FACILITIES



Westwood Hills Nature Center

Location: St. Louis Park, MN

Function: Educational Center for a 160-acre nature park, with classrooms, multi-purpose rooms, and exhibition space
 Size & Features: 13,300 sq. feet. Constructed to achieve zero energy consumption and featuring solar panels, a geothermal heating system, and bird-friendly glass.

Architect: HGA



Potomac Science Center

Location: Woodbridge, VA

Function: Tidal Freshwater Research Lab Facility for George Mason University
 Size & Features: 50,000 sq. feet. Building and landscape designed to meet LEED Silver certification standards and showcase a suite of low-impact development techniques

Architect: HKS, Inc.



Shangri-La Nature Center

Location: Orange, TX

Function: Interpretive Center for the 252-acre Shangri La Botanical Gardens

Size & Features: 17,600 sq. feet. Includes an exhibition space, outdoor classroom pavilions, research facilities and bird-viewing blinds, and utilizes geothermal heating, cooling, and solar energy collection.

Architect: Lake Flato Architects



Black Rock Sanctuary

Location: Phoenixville, PA

Function: Park and Nature Preserve on a former coal silt decanting basin

Size & Features: 0 sq. feet. Extensive remediation restoration improved habitat for migratory birds and enhanced quality of runoff entering the Schuylkill River. A 0.8 mile ADA accessible trail provides site interpretation.

Landscape Architect: KMS Design Group, LLC

PARK INFRASTRUCTURE PARK & EDUCATION CENTER



NATURE TRAIL

EDUCATIONAL PAVILION

BATTLESHIP CONNECTION

PEDESTRIAN FERRY

ELEVATED BOARDWALK

SUBMERGED VESSEL REMAINS

WHARF REMAINS

**EDUCATIONAL EXHIBITS
UNDERWATER ARCHAEOLOGY**

UNITED STATES, 2017 (NRPA, 2020)

\$166 BILLION	1.1 MILLION	\$51 BILLION
----------------------	--------------------	---------------------

NORTH CAROLINA, 2017 (NRPA, 2020)

\$3.2 BILLION	27.5 THOUSAND	\$951.5 MILLION
Economic Activity Generated	Jobs Supported	Salaries, Wages, Benefits Generated

MECKLENBERG COUNTY, 2009 (Trust for Public Land, 2009)

\$8.3 MILLION	\$29 MILLION	\$922 MILLION	\$25 MILLION
County Revenue from Increased Tourism and Property Value	Resident Wealth Increase from Tourism and Park Proximity	Resident Savings from Direct Use and Health Value Factors	Municipal Savings Related to Clean Water, Air, and Community Cohesion

CASE STUDIES & METRICS

ECONOMIC IMPACTS OF PARKS

While parks and open space support myriad community benefits that can be difficult to quantify - such as their contribution towards quality of life as public amenities - a number of studies have been conducted that enumerate the distinct economic impacts that park systems have at a variety of scales. For example, a generalized study conducted by The National Recreation and Park Association (NRPA) reports on the nationwide and state-level impacts of local parks and recreation operations. This study assesses the impact of park-related direct, indirect, and induced spending on economic activity, and reports \$3.2 billion generated in North Carolina in 2017.

Additional variables can be quantified at the county scale. The Center for City Park Excellence has identified seven measurable attributes that provide economic benefits, a framework that informed a 2009 study of the Charlotte/Mecklenburg county parks and recreation system by the Trust for Public Land. These attributes include i) property value and tourism value, both of which provide the county with direct income through taxation and increase the collective wealth of residents; ii) direct use value and health value, which provide direct savings to residents through free recreational opportunities and supported health benefits; and iii) savings provided to the county government through the influence that open space has on social cohesion as well as the ecosystem services it provides.



Case Study: Timucuan Ecological and Historic Preserve

Location: Jacksonville, FL

Description: 46,000 acres of wetland and other habitat, plus historic sites

Economic Impact: A NPS study from 2018 found that 1.1 million park visitors spent an estimated \$67 million in local gateway regions while visting Timucuan. These expenditures supported a total of 1,020 jobs, \$31.5 million in labor income, \$54.3 million in value added, and \$93.9 million in economic output in local gateway communities surrounding the preserve (NPS, 2019).

Managed by: National Park Service; part of the Gullah Geechee Cultural Heritage Corridor

EAGLES ISLAND NATURE PARK RECOMMENDATION SUMMARIES

RECOMMENDATION ONE

Formalize and promote Eagles Island Nature Park paddle trails with route names, maps, and wayfinding signage.

OPPORTUNITIES

- Low-cost
- Relies on branding and marketing more than infrastructure
- Many waterways are within parcels already owned by allied organizations

CONSTRAINTS

- Signage or access improvements along waterways intersecting privately owned parcels will require shared-use agreement
- No public boat launch on Eagles Island

ACTION ITEMS

- Private landowner outreach
- Approach paddle-tour companies about partnership opportunities
- Coordinate production of signage and promotional materials with graphic designer

RECOMMENDATION TWO

Construct low-impact park infrastructure such as boardwalks, trails, and open-air shelters to establish Eagles Island Nature Park as a publicly accessible recreational destination.

OPPORTUNITIES

- Parcel owned by allied organizations
- Accessible through existing intersection
- Physical connection to project one paddle trails

CONSTRAINTS

- Challenging intersection
- Rail realignment

ACTION ITEMS

- Coordinate with Battleship stakeholders and NC DOT
- Fundraising for design and construction of infrastructure

RECOMMENDATION THREE

Establish an off-road bike and pedestrian route connecting Belville and Wilmington and providing access to Eagles Island Nature Park.

OPPORTUNITIES

- Alignment with multiple existing plans and proposed projects (East Coast Greenway, expanded Brunswick Riverwalk / Belville 2030 Vision Plan, Gullah Geechee Heritage Trail)
- Dedicated bike / pedestrian route connecting Eagles Island and Wilmington

CONSTRAINTS

- Requires considerable infrastructure such as elevated walkways and multiple bridges
- Limited access to land south of highway
- Impacted by larger projects such as the Memorial Bridge replacement project and rail realignment

ACTION ITEMS

- Coordinate with NC DOT
- Continue conversations with Gullah Geechee Trail stakeholders
- Assess pedestrian bridge feasibility
- Private landowner outreach

RECOMMENDATION FOUR

Pursue partnerships with landowners or explore feasibility of acquiring developable land south of the Battleship to build an educational center and riverfront park.

OPPORTUNITIES

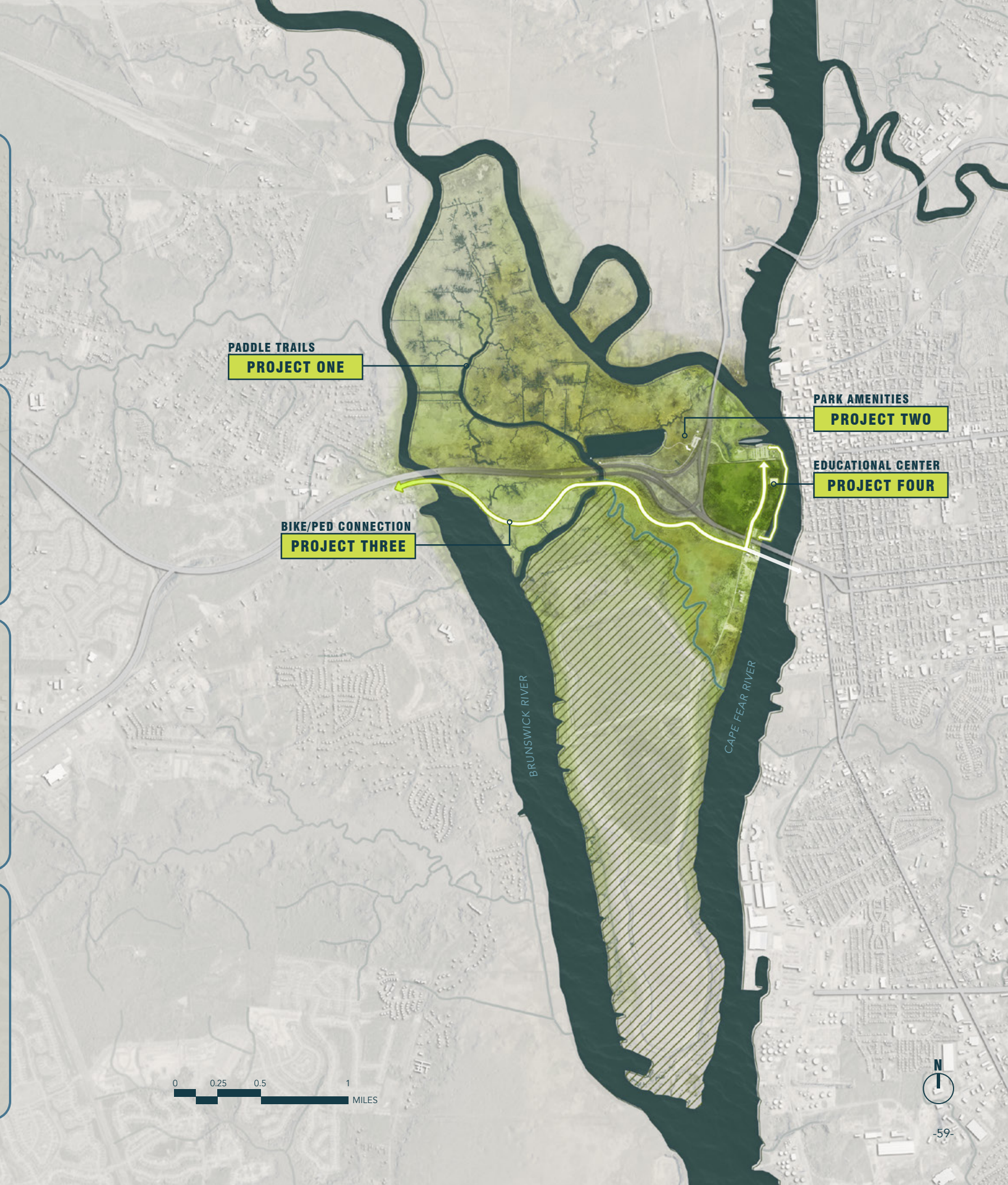
- High-elevation and prior disturbance create suitable conditions for park infrastructure
- Proximity to Battleship / complementary programming
- Access to shoreline with vessel artifacts

CONSTRAINTS

- Private ownership
- Proposed development

ACTION ITEMS

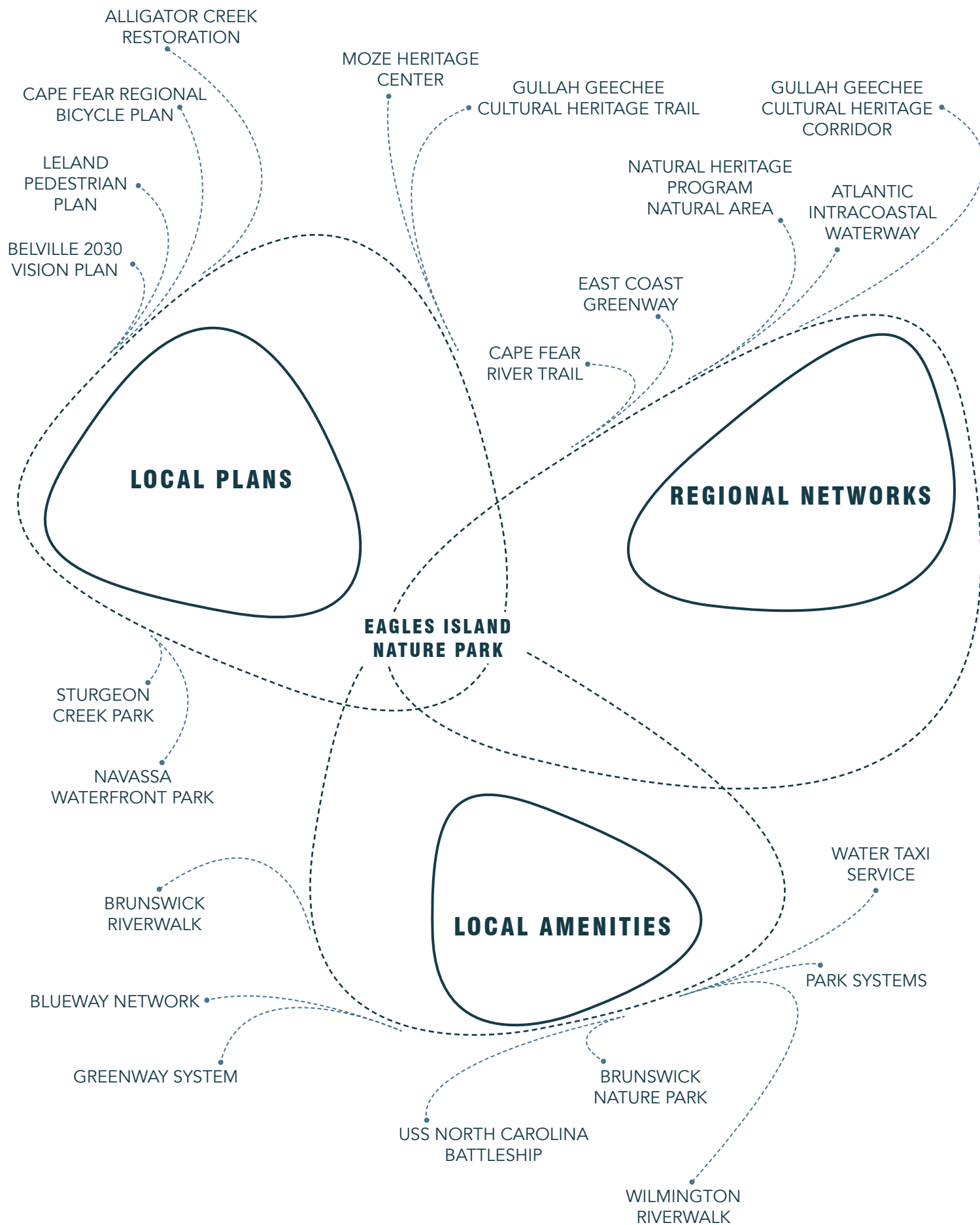
- Private landowner outreach





SECTION TWO

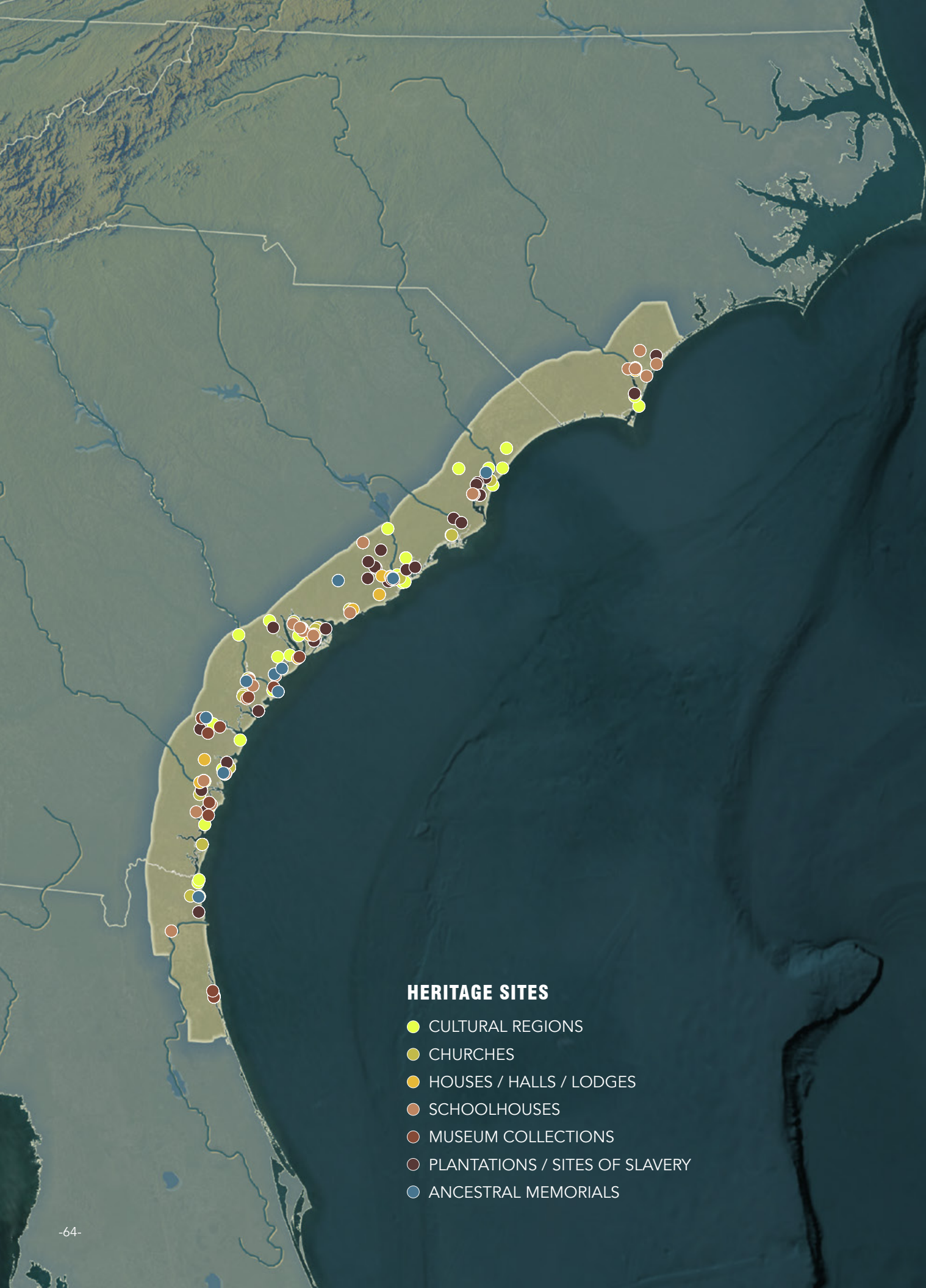
LOCAL & REGIONAL ALIGNMENT



LOCAL & REGIONAL ALIGNMENT

The establishment of a nature park on Eagles Island allows for residents of Wilmington, Belville, Leland, Navassa, and the entire Cape Fear region (approximate population: 450,000) more broadly, to share and enjoy the island's natural and cultural resources. This type of recreational opportunity will connect to and enhance existing **local amenities** such as the Wilmington and Brunswick Riverwalks, Battleship Museum, and greenway and blueway systems. This vision also aligns with the **planning goals** of municipal and county governments and creates physical and programmatic connections to planned future projects with opportunities to develop regional trail and recreational alliances.

Eagles Island Nature Park is the missing link that can connect complementary amenities in Brunswick and New Hanover Counties with regional and national recreational networks.



HERITAGE SITES

- CULTURAL REGIONS
- CHURCHES
- HOUSES / HALLS / LODGES
- SCHOOLHOUSES
- MUSEUM COLLECTIONS
- PLANTATIONS / SITES OF SLAVERY
- ANCESTRAL MEMORIALS



GULLAH GEECHEE CULTURAL HERITAGE CORRIDOR

The Gullah Geechee Cultural Heritage Corridor, stretching from St. Johns County, Florida to Pender County, North Carolina, is an approximately 12,000 square mile National Heritage Area dedicated to recognizing the unique culture of the Gullah Geechee people who have historically resided in the coastal areas and the sea islands of North Carolina, South Carolina, Georgia, and Florida (Cultural Heritage Corridor Commission, 2021). The corridor comprises many historical and cultural places of significance to the Gullah Geechee people. These include churches, houses, schoolhouses, museum collections and exhibits, former plantations and other sites of slavery, and ancestral memorials.

Eagles Island Nature Park can serve as an important location within this regional corridor by providing site interpretation and educational programming that reveal its history as a site with plantations and extensive rice cultivation. As a critical segment of the proposed Gullah Geechee Cultural Heritage Corridor Multi-Use Greenway/Blueway Trail, park programming on the island is well-suited to complement the many local heritage sites in celebration of Gullah Geechee culture and history.



REGIONAL RECREATIONAL CONNECTIVITY

Wilmington and Eagles Island reside at the nexus of three regionally and nationally significant recreation and transportation networks: the East Coast Greenway, the Cape Fear River, and the Atlantic Intracoastal Waterway. In addition to the myriad recreational opportunities Eagles Island Nature Park will create for the surrounding communities, its central location within these broader networks positions the park as a significant cultural and eco-tourism driver for the region. Recreational access to unique natural and cultural resources directly adjacent to Wilmington's thriving urban center and Brunswick County's rapidly growing communities offers a diverse suite of amenities and attractions for visitors traveling on these recreational networks and tourists visiting the area through more traditional means.

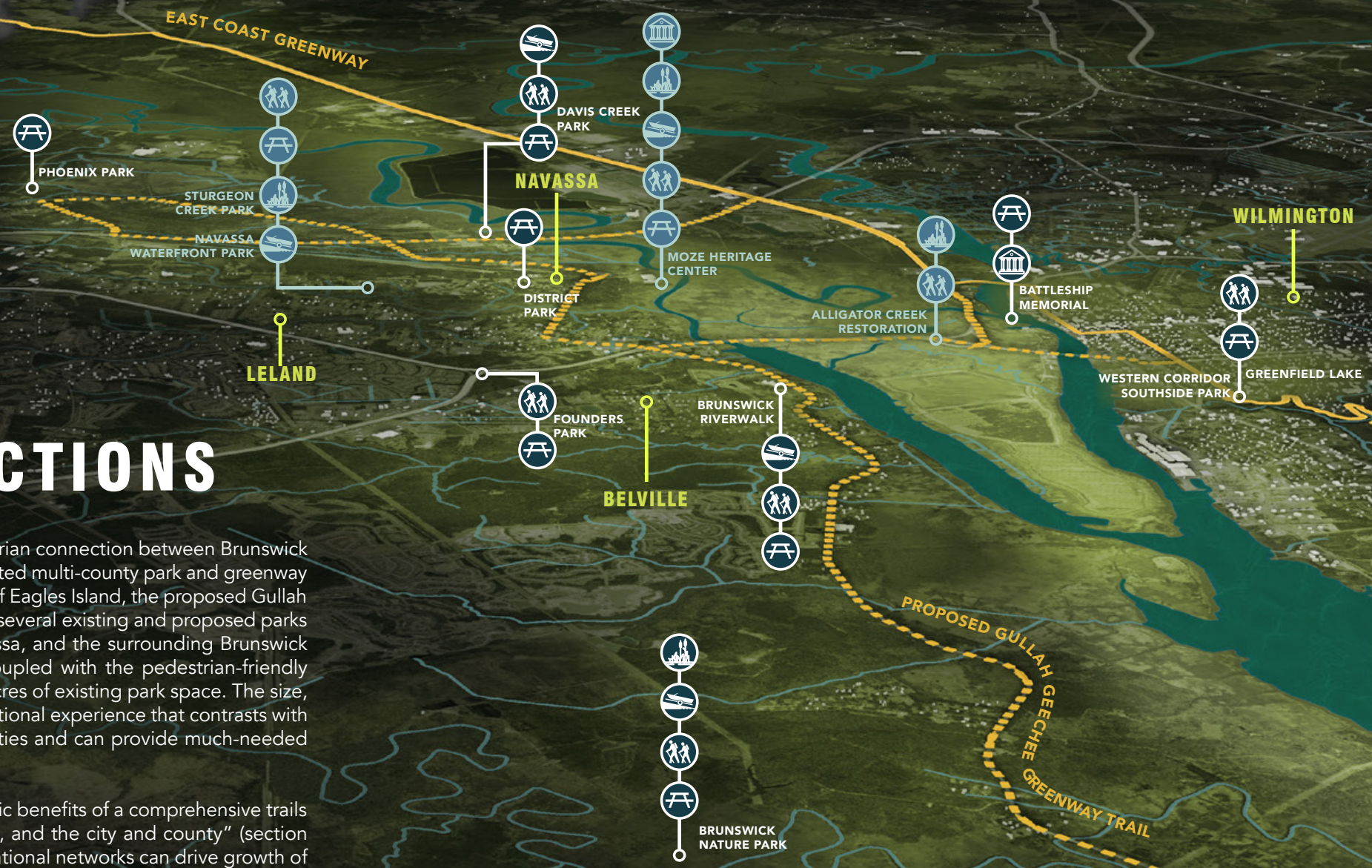


- EAST COAST GREENWAY
- CAPE FEAR RIVER
- ATLANTIC INTRACOASTAL WATERWAY

LOCAL RECREATIONAL CONNECTIONS

As previously described, Eagles Island Nature Park, including the proposed pedestrian connection between Brunswick County and New Hanover County communities, can serve as a catalyst for an integrated multi-county park and greenway system with connections to regional and national recreational networks. To the west of Eagles Island, the proposed Gullah Geechee Cultural Heritage Corridor Multi-Use Greenway/Blueway Trail connects to several existing and proposed parks to facilitate multi-modal recreation and improve access for Belville, Leland, Navassa, and the surrounding Brunswick County communities. To the east of Eagles Island, the East Coast Greenway, coupled with the pedestrian-friendly character of downtown Wilmington, can connect Eagles Island with the city's 743 acres of existing park space. The size, natural character, and focus on natural resource conservation affords a unique recreational experience that contrasts with and complements the existing recreational infrastructure in surrounding communities and can provide much-needed respite from an increasingly urbanizing landscape.

Wilmington's Comprehensive Plan, published in 2016, recognizes that "the economic benefits of a comprehensive trails system are many, and may accrue for many users, including residents, businesses, and the city and county" (section 4.2). The vision of a nature park on Eagles Island with integrated multi-modal recreational networks can drive growth of recreation-based businesses including the outdoor adventure and eco-tourism sector, as well as promote a community character that attracts residents who prioritize recreation and walkability in their communities.



- 
 PARK FACILITIES
- 
 WALKING TRAILS
- 
 BOAT LAUNCH
- 
 CONSERVATION
- 
 CULTURAL EXHIBITS
- 
 FUTURE FACILITIES

CONSERVATION

- NORTH CAROLINA COASTAL LAND TRUST
WILMINGTON, NC
- CONSERVATION TRUST FOR NORTH CAROLINA
RALEIGH, NC
- NORTH CAROLINA COASTAL FEDERATION
WRIGHTSVILLE BEACH, NC
- THE NATURE CONSERVANCY
DURHAM, NC
- AUDUBON NORTH CAROLINA
DURHAM, NC
- CAPE FEAR AUDUBON CHAPTER
WILMINGTON NC
- NORTH CAROLINA WILDLIFE FEDERATION
RALEIGH, NC
- CAPE FEAR RIVER WATCH
WILMINGTON, NC
- ISLAND WILDLIFE - CAPE FEAR REGION
WILMINGTON, NC

RECREATION & TOURISM

- PARKS AND RECREATION DEPARTMENT
COUNTIES & LOCAL MUNICIPALITIES
- COUNTY TOURISM DEVELOPMENT AUTHORITIES
BRUNSWICK, NEW HANOVER, PENDER COUNTIES
- GULLAH GEECHEE CULTURAL HERITAGE
CORRIDOR COMMISSION
JOHN'S ISLAND, SC
- VISITORS BUREAU
LOCAL MUNICIPALITIES
- EAST COAST GREENWAY ALLIANCE
DURHAM, NC
- GULLAH GEECHEE HERITAGE TRAIL
BRUNSWICK COUNTY
- LOCAL TOUR & GUIDE COMPANIES
- OUTDOOR RECREATION & GEAR BUSINESSES

RESEARCH & EDUCATION

- PUBLIC SCHOOL SYSTEMS
BRUNSWICK, NEW HANOVER, PENDER COUNTIES
- CAPE FEAR COMMUNITY COLLEGE
WILMINGTON, NC
- UNC WILMINGTON
WILMINGTON, NC
- EAST CAROLINA UNIVERSITY
GREENVILLE, NC
- COASTAL STUDIES INSTITUTE
WANCHESE, NC
- NORTH CAROLINA
WILDLIFE RESOURCES COMMISSION
RALEIGH, NC
- NC SEA GRANT
RALEIGH, NC
- NEW HANOVER COUNTY LIBRARY
WILMINGTON, NC
- NORTH CAROLINA COOPERATIVE EXTENSION
RALEIGH, NC

HISTORY

- CAPE FEAR MUSEUM
WILMINGTON, NC
- FRIENDS OF THE BATTLESHIP, NC
WILMINGTON, NC
- HISTORIC WILMINGTON FOUNDATION
WILMINGTON, NC
- LOWER CAPE FEAR HISTORICAL SOCIETY
WILMINGTON, NC
- HISTORIC PRESERVATION COMMISSION
WILMINGTON, NC
- STATE HISTORIC PRESERVATION OFFICE
RALEIGH, NC

ARTS & CULTURE

- THE ARTS COUNCIL OF WILMINGTON & NHC
WILMINGTON, NC
- THE CHILDRENS MUSEUM OF WILMINGTON
WILMINGTON, NC
- DREAMS CENTER FOR ARTS EDUCATION
WILMINGTON, NC
- LELAND CULTURAL ARTS CENTER
LELAND, NC
- THALIAN ASSOCIATION
WILMINGTON, NC
- CAMERON ART MUSEUM
WILMINGTON, NC

OPPORTUNITIES FOR PROGRAMMATIC PARTNERSHIPS

Proposed recreation- and nature-based programs offered at Eagles Island Nature Park provide opportunities to partner with a diverse coalition of educational and cultural institutions. These include museums, land trusts, universities, historical societies, theater and arts organizations, school systems, and non-profit organizations with educational missions. Collaboration on programmatic offerings can include a range of events and activities such as theater/art in the park events, community cleanup volunteer days, citizen science surveys, historical and ecological guided tours, paddle races, and many more. Partnerships or sponsorship contracts with local businesses can also help spread the word about Eagles Island Nature Park and garner public support and interest in the project before establishment of any physical park infrastructure. Organizations and institutions listed above represent only a few of the local and regional entities whose missions align with the vision of Eagles Island Nature Park and may be considered for potential partnerships.

PARTNERSHIP OPPORTUNITIES RESEARCH & EDUCATION

RESEARCH OPPORTUNITIES
LOCAL UNIVERSITIES

K-12 CURRICULUM ALIGNMENT
FIELD-TRIP OPPORTUNITIES

K-12 CURRICULUM ALIGNMENT
AFTER SCHOOL PROGRAMMING



SECTION THREE

CONTEXT



GLOBAL BIODIVERSITY HOTSPOT

In 2016, the North American Coastal Plain of the eastern United States that stretches from Cape Cod to Northern Mexico was designated as a Global Biodiversity Hotspot. This designation means that the region meets the Critical Ecosystem Partnership Fund's (CEPF) criteria of i) containing at least 1,500 endemic vascular plant species (this region supports 1816 endemic species), and ii) having lost over 70% of its historic vegetation (the Coastal Plain has experienced 85.5% habitat loss). In other words, this region is highly biologically diverse, but threatened.

Conversion to agricultural land has contributed significantly to the loss of the region's historic vegetation, but human development continues to pose a significant risk to the remaining natural landscapes and connective landcover that sustain diverse and healthy ecosystems. Between 1960 and 2008, the population of Atlantic coastal counties grew by 56% (US Census Bureau, 2010), spurring the growth of urban centers and expanded rural and suburban development. Brunswick County was the fastest growing county in the state from 2010-2020. In addition, Eastern North Carolina is expected to see annual population growth of 0.35% through at least 2029 (NC East Alliance, 2020). A consequence of this type of growth is a fragmented, degraded system of habitats within the broader ecoregion.

Furthermore, the Wildlife Action Plan developed by the N.C. Wildlife Resources Commission identifies human development as a top threat to native wildlife. The plan concludes with recommendations to acquire and conserve water-edge buffer lands to promote water quality, prevent harmful erosion and sedimentation, and maintain critical habitat. The floodplains, wetlands, agricultural lands, and forestal tracts that make up much of the coastal plain have long provided critical habitat for hundreds of species, but the protected spaces that support wildlife have become increasingly scarce as these habitats succumb to development pressures. The CEPF identifies the following conservation priorities for this North American Coastal Plain Biodiversity Hotspot: i) reducing urban sprawl from population growth; ii) identifying climatic refugia and biodiversity hotspots at a finer scale across the region; iii) protecting these key areas in new reserves; iv) maintaining and restoring movement corridors; and v) restoring or mimicking natural disturbance (especially fire) and hydrological regimes (NECP, 2016).



CAPE FEAR WATERSHED

With an area exceeding 9,000 square miles, the Cape Fear River Basin is North Carolina’s largest watershed (Cape Fear River Partnership, 2021). The headwaters originate northwest of Greensboro, North Carolina, and include the Haw and Deep Rivers that merge to form the Cape Fear, which eventually drains directly into the Atlantic at Bald Head Island. The Cape Fear River Watershed is home to more than one-third of North Carolina’s population and is one of the most heavily industrialized watersheds in the state (Smith et al., 2011). This heavily developed basin contains 200+ permitted wastewater dischargers, several large metropolitan areas and urban centers, and a significant amount of agricultural lands, including concentrated animal feed operations (CAFOs).

Originating in the Piedmont and traveling through the Sandhills, the mainstem of the Cape Fear River contains significant amounts of sediment and nutrients. The Black and Northeast Cape Fear Rivers and their tributaries are blackwater river systems that drain the flat, swamp areas of southeastern North Carolina. Eagles Island is located at the confluence of the Cape Fear and Northeast Cape Fear Rivers, where the waters from these two unique river systems mix with dynamically visible sediment plumes. These waters also mix with tidal saltwater from the Atlantic, creating an important fish nursery area and habitat conditions for many organisms.

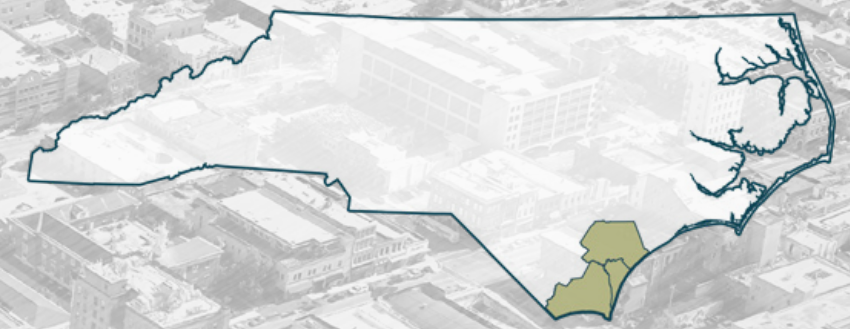
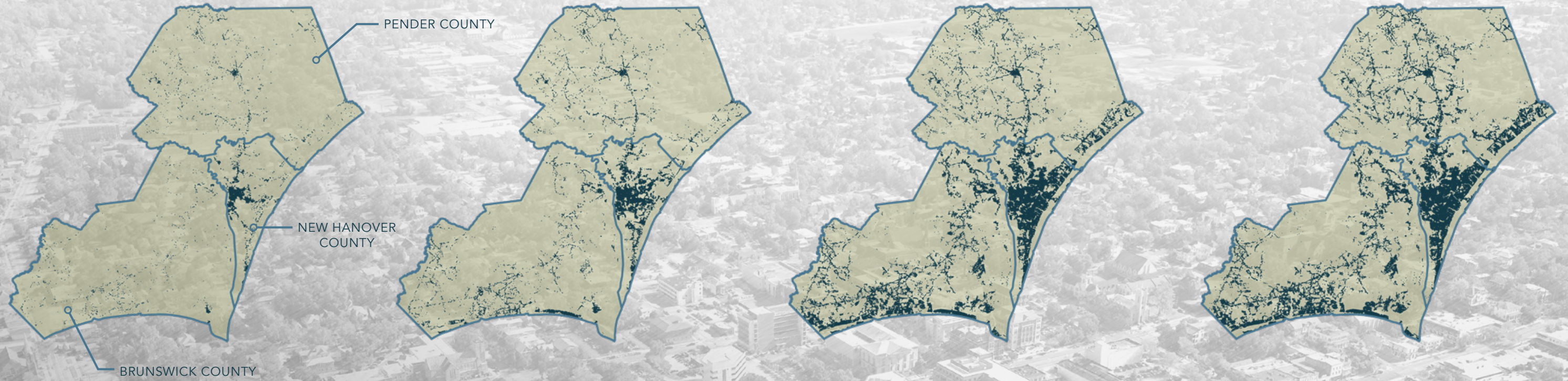


1950
COMBINED POPULATION: 100,933

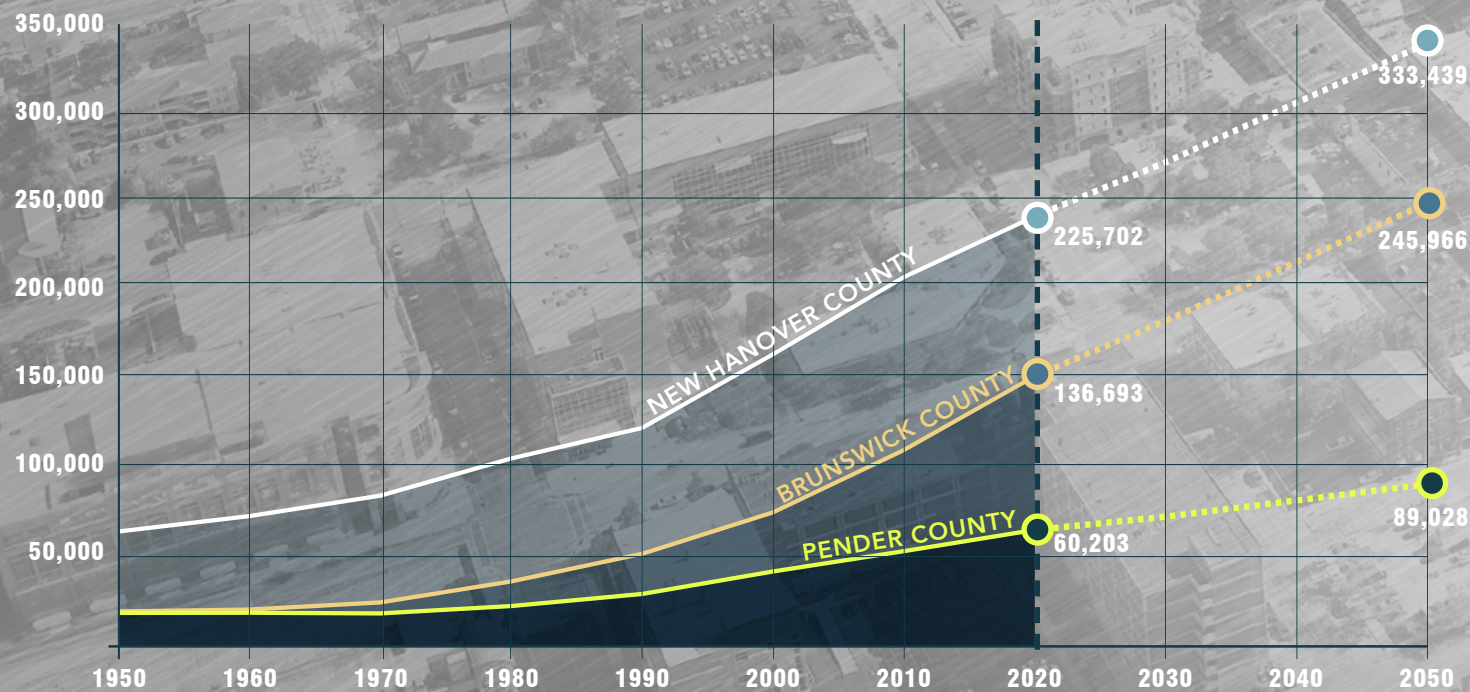
1975
COMBINED POPULATION: 152,700

2000
COMBINED POPULATION: 275,822

2020
COMBINED POPULATION: 422,598

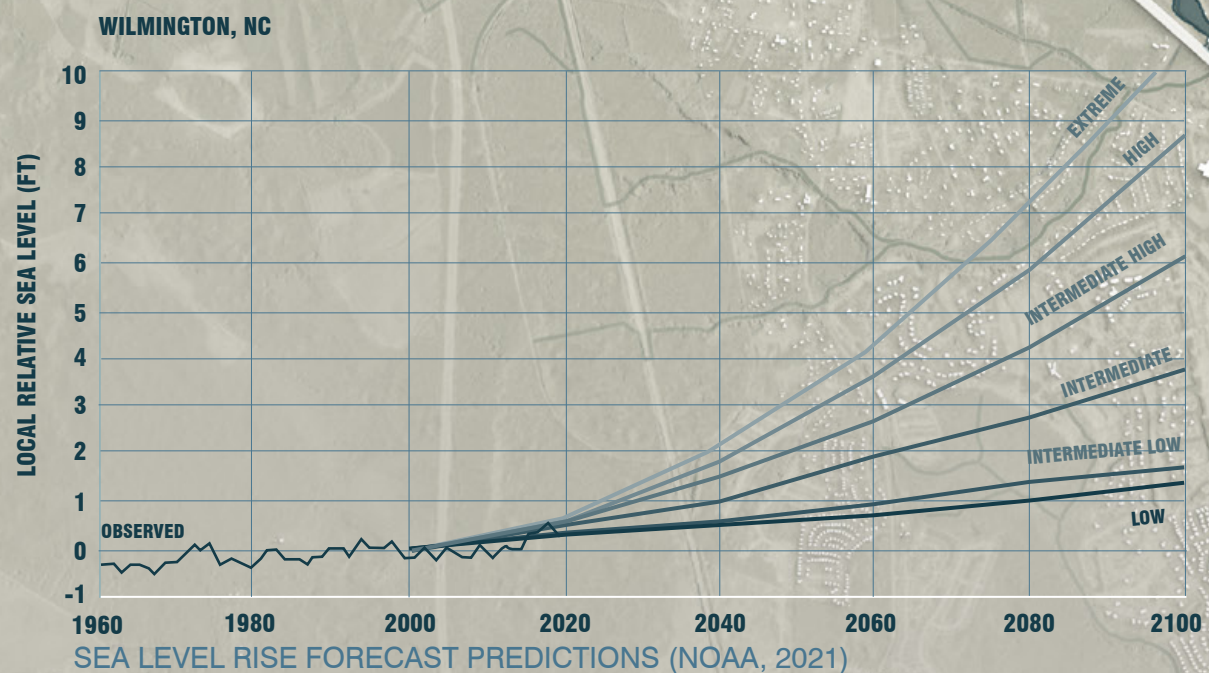


REGIONAL DEVELOPMENT PATTERNS & TRENDS



Consistent with patterns of growth across North Carolina and the mid-Atlantic seaboard, Brunswick, Pender, and New Hanover Counties have experienced steadily increasing populations for decades, and are expected to continue growing for the foreseeable future. Since 2010, the population of Brunswick County has grown by +43%, New Hanover by +18%, and Pender by +24% (World Population Review, 2021). As illustrated in the figures above, this rapid growth has been accompanied by expanding developed areas and urbanization around Wilmington, in oceanfront communities, and the growth of suburban and rural-residential developments throughout each county.

Coinciding with local population growth and development, the area has also seen a steady increase in tourism spending and visitation, with coastal areas drawing approximately 12-million visitors annually (Visit NC, 2019). In 2019, visitors spent a combined \$1.4 billion in Brunswick, New Hanover, and Pender Counties (Visit NC, 2019). This sustained growth has made conservation of natural resources critical to maintaining the region's connected habitat and high levels of biodiversity. Prioritizing conservation and public access on Eagles Island will not only help create a unique, centrally located recreational amenity for surrounding communities, but will also support the booming tourism industry centered around the region's natural resources.



SEA LEVEL RISE SCENARIOS

In coastal North Carolina, the effects of sea level rise (SLR) have been extensively documented and are expected to continue at an accelerated rate. Based on tidal gauge records collected since 1935, the Wilmington area is experiencing SLR at a rate of approximately 2.5 millimeters each year. Sea level rise is contributing to increasingly frequent nuisance flooding within the Cape Fear River Estuary, Eagles Island, and populated areas along the river. Coupled with increasingly strong storm events, flooding is anticipated to continue occurring more frequently and with greater severity.

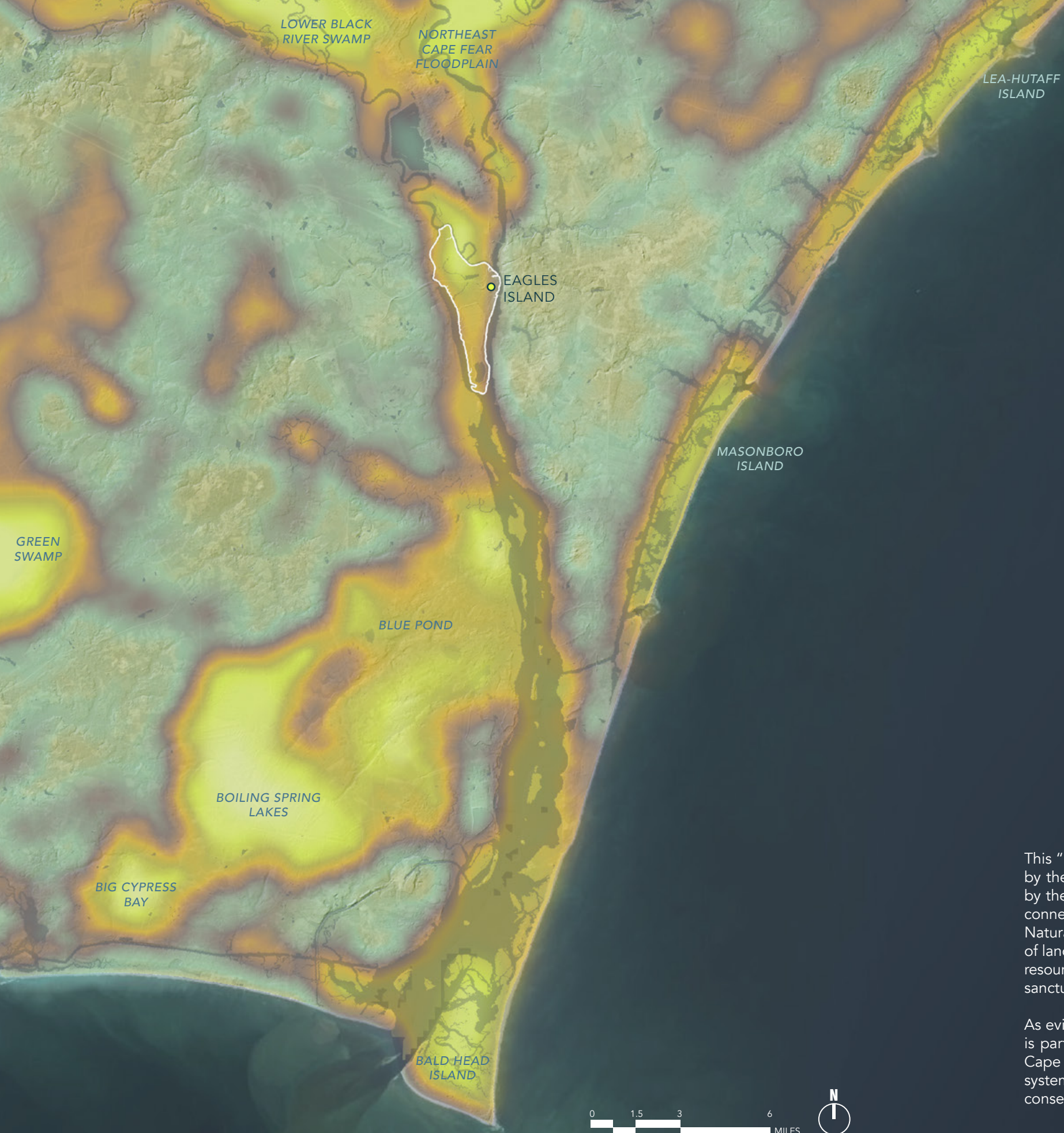
Factoring SLR projections into any coastal planning effort is paramount. As illustrated in the map at right, almost all of low-lying Eagles Island is vulnerable to SLR inundation for scenarios ranging from a one to nine feet increase, with darker shades of blue indicating the highest-risk areas. Residential and commercial development, even located on the island's highest ground, would be exceptionally vulnerable to the effects of sea level rise, especially when compared to higher-elevation areas in and around Wilmington. Considerations should also be taken regarding the flood vulnerability of any planned park infrastructure including a visitor center and educational center, boardwalks, access roads, and parking lots. In addition to SLR impacts on development and existing infrastructure, rising sea levels are expected to have broad ecological impacts that include increased soil and water salinization and changes to marsh species composition and associated food webs.





SECTION FOUR

ECOLOGY



SPECIES RICHNESS

This “heat map” indicates the relative hotspot rankings of species richness and important habitat areas as determined by the Biodiversity and Wildlife Habitat Assessment (BWHA). The BWHA is a conservation planning tool developed by the North Carolina Natural Heritage Program focused on terrestrial and aquatic habitats, landscape function, and connectivity. This dataset is a composite of spatially explicit indicators of ecosystem health including: ranked Significant Natural Heritage Areas; occurrences of rare species and natural communities; Important Bird Areas; indicator species of landscape integrity; wetlands; aquatic areas classified as high-quality waters; aquatic areas classified as outstanding resource waters; stream bioclassification; stream buffers; wild brook trout waters; anadromous fish spawning areas; oyster sanctuaries; hard bottom areas; shellfish growing areas; fish nursery areas; and submerged aquatic vegetation beds.

As evidenced from the BWHA results, Eagles Island represents one of the highest ranking landscapes in the state and is part of a connected network of additional high-quality and exceptionally biodiverse landscapes along the Lower Cape Fear River corridor and surrounding coastal wetlands. The following pages highlight just a few of the dynamic systems, conditions, and species that contribute to this ranking and situate Eagles Island as a natural resource of critical conservation importance with unmatched opportunities for education and recreation.

NATURAL HERITAGE PROGRAM NATURAL AREAS

Much of Eagles Island is located within the 'Brunswick and Cape Fear River Marshes' Natural Area, a Registered Natural Area designated by the North Carolina Natural Heritage Program (NC NHP) with a top ranking of 'Exceptional'. Out of almost 2,500 Natural Areas in the state, only 17% achieve this highest rating. These areas are critically important for the conservation of North Carolina's natural biodiversity and contain some of the best populations of rare species, their habitat, and natural communities in the state (NC NHP, 2020). Additionally, the Cape Fear and Brunswick Rivers surrounding and south of Eagles Island are designated by the NC NHP as the 'Lower Cape Fear River Aquatic Habitat' Natural Area with a top ranking of 'Very High'. Across the Brunswick River, the 'Sturgeon Creek Tidal Wetlands' Natural Area is recognized by the NC NHP with a 'Moderate' ranking. These three Natural Areas converge at Eagles Island and, along with the myriad upstream and nearby Natural Areas, help create a connected, biologically rich corridor along the Cape Fear River.

Brunswick River and Cape Fear River Marshes

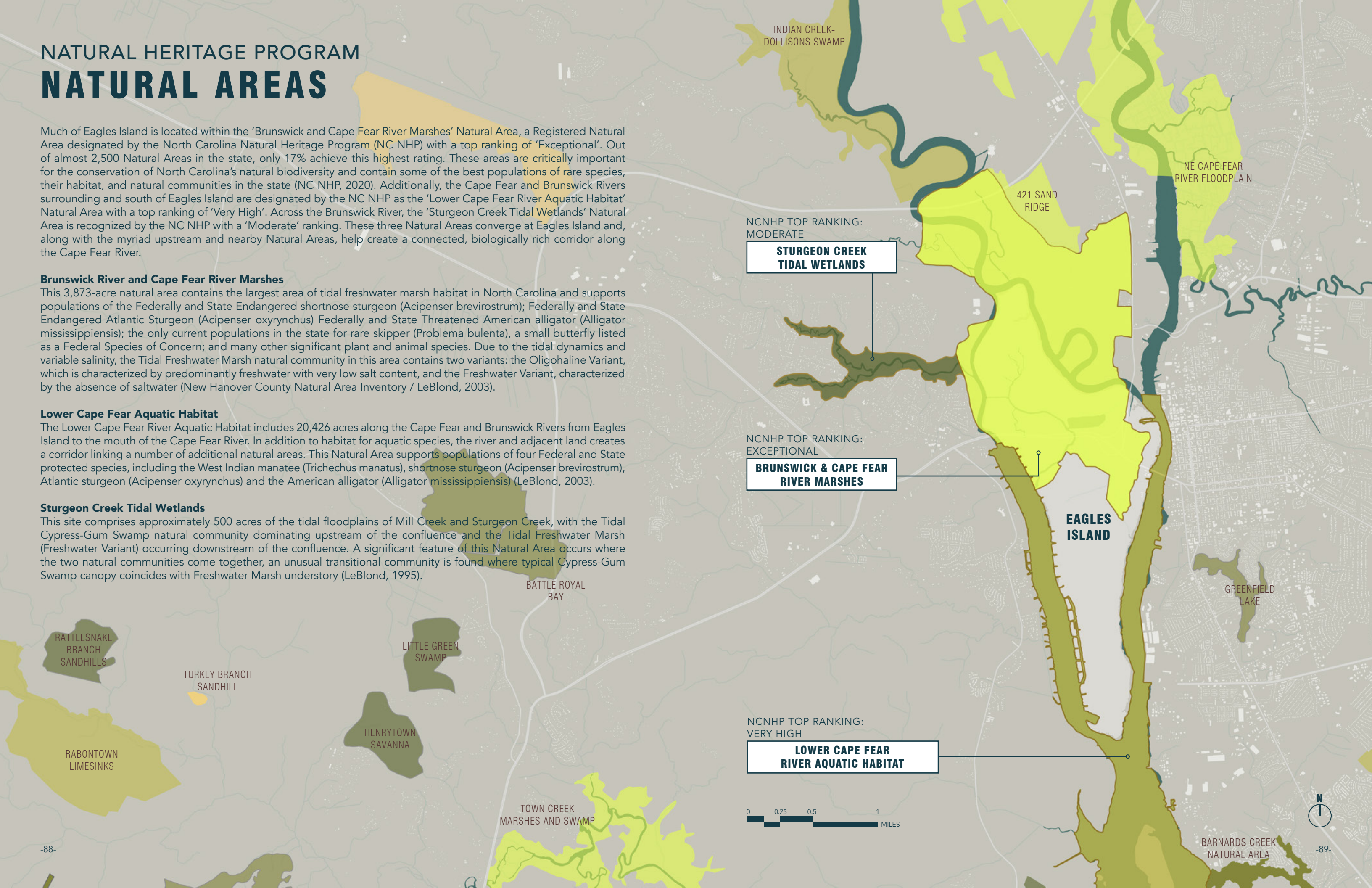
This 3,873-acre natural area contains the largest area of tidal freshwater marsh habitat in North Carolina and supports populations of the Federally and State Endangered shortnose sturgeon (*Acipenser brevirostrum*); Federally and State Endangered Atlantic Sturgeon (*Acipenser oxyrinchus*) Federally and State Threatened American alligator (*Alligator mississippiensis*); the only current populations in the state for rare skipper (*Problema bulenta*), a small butterfly listed as a Federal Species of Concern; and many other significant plant and animal species. Due to the tidal dynamics and variable salinity, the Tidal Freshwater Marsh natural community in this area contains two variants: the Oligohaline Variant, which is characterized by predominantly freshwater with very low salt content, and the Freshwater Variant, characterized by the absence of saltwater (New Hanover County Natural Area Inventory / LeBlond, 2003).

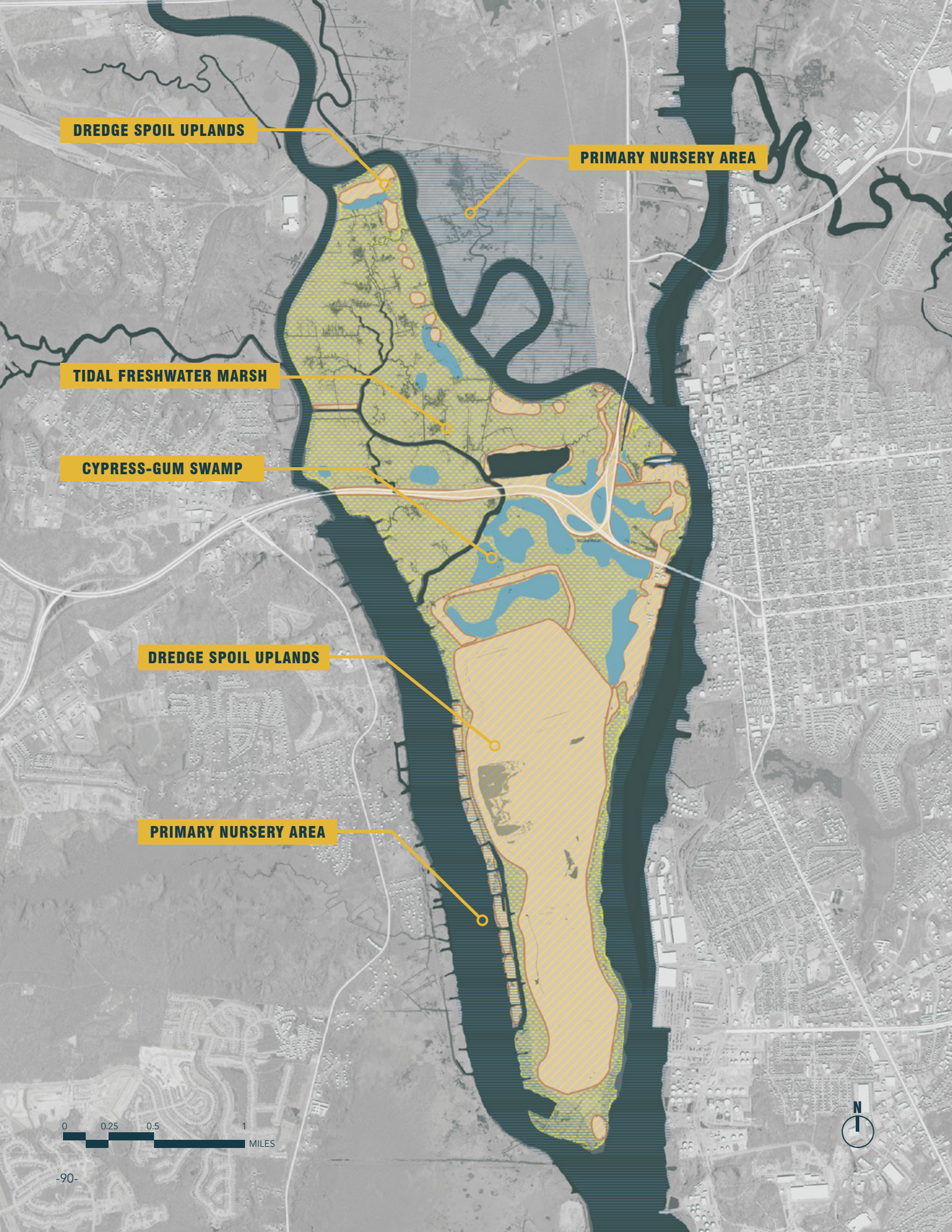
Lower Cape Fear Aquatic Habitat

The Lower Cape Fear River Aquatic Habitat includes 20,426 acres along the Cape Fear and Brunswick Rivers from Eagles Island to the mouth of the Cape Fear River. In addition to habitat for aquatic species, the river and adjacent land creates a corridor linking a number of additional natural areas. This Natural Area supports populations of four Federal and State protected species, including the West Indian manatee (*Trichechus manatus*), shortnose sturgeon (*Acipenser brevirostrum*), Atlantic sturgeon (*Acipenser oxyrinchus*) and the American alligator (*Alligator mississippiensis*) (LeBlond, 2003).

Sturgeon Creek Tidal Wetlands

This site comprises approximately 500 acres of the tidal floodplains of Mill Creek and Sturgeon Creek, with the Tidal Cypress-Gum Swamp natural community dominating upstream of the confluence and the Tidal Freshwater Marsh (Freshwater Variant) occurring downstream of the confluence. A significant feature of this Natural Area occurs where the two natural communities come together, an unusual transitional community is found where typical Cypress-Gum Swamp canopy coincides with Freshwater Marsh understory (LeBlond, 1995).





PRIMARY NURSERY AREA	TIDAL FRESHWATER MARSH	CYPRESS-GUM FORESTED WETLANDS	DREDGE SPOILS & URBAN FILL
<p>Area designated by the Marine Fisheries Commission to protect initial post-larval development.</p> <p>The estuarine system is used as a refuge during larval and juvenile stages and as a transportation route by anadromous fish migrating to spawning grounds (Markham et al, 2011).</p>	<p>Experiences regular lunar tidal flooding.</p> <p>Salinity ranges from oligohaline to fully fresh, with occasional brackish water intrusion driven by storm surge and drought.</p> <p>Consists of dense herbaceous vegetation that occurs in zones or patches, either as diverse mixtures or as single dominant species that spread clonally (NCNHP).</p>	<p>Dominated by bald cypress (<i>Taxodium distichum</i>), swamp tupelo (<i>Nyssa biflora</i>), and water tupelo (<i>Nyssa aquatica</i>).</p> <p>Bald cypress is not tolerant of increases in salinity, and evidence of stress from sea level rise includes mortality and crown thinning (NCNHP).</p>	<p>Represent disturbed environments and fill areas that consist of early successional species, woody shrub and tree species, non-natives, and barren land.</p> <p>Dredged material disposal areas can provide important foraging habitat for migrating birds (Markham et al).</p>

LANDCOVER AND HABITAT

Eagles Island is dominated by two distinct landcover types representing the extremes of a spectrum that ranges from natural to heavily disturbed. The majority of the southern half of the island, along with extensive areas along the eastern shore, are predominantly dredge spoils and urban fill. While the dredge spoil storage area operated by the US Army Corps of Engineers is still actively used and contains little vegetative cover, vegetation on other urban fill areas and smaller dredge spoil islands consists of early-successional species, woody shrub and tree species, and non-native and/or invasive species, with some barren areas as well. The water bodies surrounding and within the island are designated as Primary Nursery Areas supporting larval and juvenile anadromous fish species. The northern part of the island is dominated by freshwater marshes with a mix of monotypic stands of cattails and Tidal Freshwater Marsh natural communities. Scattered throughout the island are stands of remnant Cypress-Gum wetlands. These forested wetlands likely covered a significant part of Eagles Island, but the history of human disturbance coupled with environmental changes has decreased suitable areas for this habitat. Large numbers of Bald Cypress skeletons (often referred to as ghost trees) can be seen across the island, providing visible evidence of ongoing increases in salinity.

The map at left was developed by cross-referencing the National Land Cover Database (2016), the GAP/LANDFIRE National Terrestrial Ecosystems dataset (2011), the generalized habitat map of Eagles Island produced by Land Management Group (2011), and recent satellite orthoimagery. Primary Nursery Area delineations are based on data generated by the NC DENR, Division of Marine Fisheries (2015).

MARSH ECOLOGY

The dynamic conditions representative of tidal freshwater marshes and estuarine aquatic habitats on Eagles Island create important habitat for myriad species of plants and animals. Characterized by regular lunar and wind tidal flooding coupled with more severe flooding from storms and the associated changes in salinity, the species adapted to life in the marsh experience fluctuating daily conditions as well as long-term shifting dynamics.

Tidal Freshwater Marshes are typically more fertile and productive than non-tidal wetlands, in part because of the daily influx of nutrients that accompanies tidal fluctuations. Like many natural communities dominated by herbaceous cover, regular patterns of disturbance events play an important role in maintaining a balanced ecosystem. While natural fires are a well-known disturbance factor across the coastal plain and sandhills (and may have also historically been important in coastal wetlands), intrusion of brackish water due to strong storm events creates the ecological disturbance critical to Tidal Freshwater Marshes. Although some of the plant species found in these marshes are tolerant of brackish water, many are better adapted to freshwater ecosystems and can experience stress, damage, and/or death when concentrations of salt water increase. Adverse affects of increasing salinity facilitates various stages of succession, a mosaic of species compositions, and zonation among these communities (NC NHP, 2020).

In addition to the daily fluctuations and dynamics of periodic disturbances, ongoing sea level rise results in a long-term, slow shift in environmental conditions. An overview of this community published by the NC Natural Heritage Program states, "all Freshwater Tidal Wetlands should be regarded as in transition to wetter and saltier communities." Tidal ranges are also affected by human-made disturbances and interventions, such as efforts to deepen the Cape Fear River shipping channel, which leads to increases in salinity further upstream (Hackney, 1990). Evidence of these long-term environmental shifts are apparent on Eagles Island in the skeleton stands of Bald Cypress that have not survived the slow but steady increase in salinity and subsidence.

The charts shown on these pages indicate species found on Eagles Island with State and/or Federal conservation status indicated (Smith et al., 2011, NC Wildlife, 2017).

MAMMALS

COMMON NAME	SCIENTIFIC NAME	NC STATUS	US STATUS
BEAVER	<i>Castor canadensis</i>		
OPOSSUM	<i>Didelphis virginiana</i>		
N. AMERICAN RIVER OTTER	<i>Lontra canadensis</i>		
NUTRIA	<i>Myocastor coypus</i>		
MINK	<i>Neovison vison</i>		
WHITE-TAILED DEER	<i>Odocoileus virginianus</i>		
MUSKRAT	<i>Ondatra zibethicus</i>		
RACCOON	<i>Procyon lotor</i>		
MARSH RABBIT	<i>Sylvilagus palustris</i>		
WEST INDIAN MANATEE	<i>Trichechus manatus</i>	ENDANGERED	
GRAY FOX	<i>Urocyon cinereoargenteus</i>		
BLACK BEAR	<i>Ursus americanus</i>		

REPTILES

COMMON NAME	SCIENTIFIC NAME	NC STATUS	US STATUS
EASTERN COTTONMOUTH	<i>Agkistrodon piscivorus piscivorus</i>		
AMERICAN ALLIGATOR	<i>Alligator mississippiensis</i>	THREATENED	THREATENED
COMMON SNAPPING TURTLE	<i>Chelydra s. serpentina</i>		
CORN SNAKE	<i>Elaphe guttata guttata</i>		
EASTERN MUD TURTLE	<i>Kinosternon subrubrum subrubrum</i>		
CAROLINA DIAMONDBACK TERRAPIN	<i>Malaclemys terrapin centrata</i>	SPECIAL CONCERN	
EASTERN DIAMONDBACK TERRAPIN	<i>Malaclemys terrapin terrapin</i>	SPECIAL CONCERN	
REDBELLY WATER SNAKE	<i>Nerodia erythrogaster erythrogaster</i>		
NORTHERN WATER SNAKE	<i>Nerodia sipedon sipedon</i>		
BROWN WATER SNAKE	<i>Nerodia taxispilota</i>		
GLOSSY CRAYFISH SNAKE	<i>Regina Rigida</i>	SIGNIFICANTLY RARE	
BLACK SWAMP SNAKE	<i>Seminatrix pygaea</i>	SIGNIFICANTLY RARE	
GREEN RIBBON SNAKE	<i>Thamnophis sauritus</i>		
GARTER SNAKE	<i>Thamnophis sirtalis</i>		
YELLOWBELLY SLIDER	<i>Trachemys scripta scripta</i>		

FISH

COMMON NAME	SCIENTIFIC NAME	NC STATUS	US STATUS
SHORTNOSE STURGEON	<i>Acipenser brevirostrum</i>	ENDANGERED	ENDANGERED
ATLANTIC STURGEON	<i>Acipenser oxyrhynchus</i>	ENDANGERED	ENDANGERED
BLUEBACK HERRING	<i>Alosa aestivalis</i>		
HICKORY SHAD	<i>Alosa mediocris</i>		
ALEWIFE	<i>Alosa pseudoharengus</i>		
AMERICAN SHAD	<i>Alosa sapidissima</i>		
BAY ANCHOVY	<i>Anchoa mitchilli</i>		
AMERICAN EEL	<i>Anguilla rostrata</i>		
SILVER PERCH	<i>Bairdiella chrysura</i>		
ATLANTIC MENHADEN	<i>Brevoortia tyrannus</i>		
CREVALLE JACK	<i>Caranx hippos</i>		
BAY WHIFF	<i>Citharichthys spilopterus</i>		
SPOTTED SEATROUT	<i>Cynoscion nebulosus</i>		
WEAKFISH	<i>Cynoscion regalis</i>		
COMMON CARP	<i>Cyprinus carpio</i>		
GIZZARD SHAD	<i>Dorosoma cepedianum</i>		
THREADFIN SHAD	<i>Dorosoma petenense</i>		
LADYFISH	<i>Elops saurus</i>		
SPOTFIN MOJARRA	<i>Eucinostomus argenteus</i>		
SILVER JENNY	<i>Eucinostomus gula</i>		
MUMMICHOG	<i>Fundulus heteroclitus</i>		
SHARPTAIL GOBY	<i>Gobionellus hastatus</i>		
FRESHWATER GOBY	<i>Gobionellus shufeldti</i>		
BLUE CATFISH	<i>Ictalurus furcatus</i>		
CHANNEL CATFISH	<i>Ictalurus punctatus</i>		
PINFISH	<i>Lagodon rhomboides</i>		
SPOT	<i>Leiostomus xanthurus</i>		
LONGNOSE GAR	<i>Lepisosteus osseus</i>		
GRAY SNAPPER	<i>Lutjanus griseus</i>		
INLAND SILVERSIDE	<i>Menidia beryllina</i>		
ATLANTIC CROAKER	<i>Micropogonias undulatus</i>		
LARGEMOUTH BASS	<i>Micropterus salmoides</i>		
WHITE PERCH	<i>Morone americana</i>		
STRIPED BASS	<i>Morone saxatilis</i>		
STRIPED MULLET	<i>Mugil cephalus</i>		
ATLANTIC THREAD HERRING	<i>Opisthonema oglinum</i>		
SUMMER FLOUNDER	<i>Paralichthys dentatus</i>		
SOUTHERN FLOUNDER	<i>Paralichthys lethostigma</i>		
BLUEFISH	<i>Pomatomus saltatrix</i>		
FLATHEAD CATFISH	<i>Pylodictis olivaris</i>		
RED DRUM	<i>Sciaenops ocellata</i>		
WINDOWPANE	<i>Scophthalmus aquosus</i>		
ATLANTIC NEEDLEFISH	<i>Strongylura marina</i>		
BLACKCHEEK TONGUEFISH	<i>Symphurus plagiusa</i>		
HOGCHOKER	<i>Trinectes maculatus</i>		

SHELLFISH

COMMON NAME	SCIENTIFIC NAME	NC STATUS	US STATUS
BLUE CRAB	<i>Callinectes sapidus</i>		
BROWN SHRIMP	<i>Farfantepenaeus aztecus</i>		
PINK SHRIMP	<i>Farfantepenaeus duorarum</i>		
GRASS SHRIMP	<i>Palaemonetes spp.</i>		
WHITE SHRIMP	<i>Penaeus setiferus</i>		

MARSH ECOLOGY



+ BIRDS OF PREY



+ MIGRATORY &
NON-MIGRATORY BIRDS

+ DEAD TREE SNAGS



+ HERBACEOUS VEGETATION

+ WATERFOWL &
SHOREBIRDS



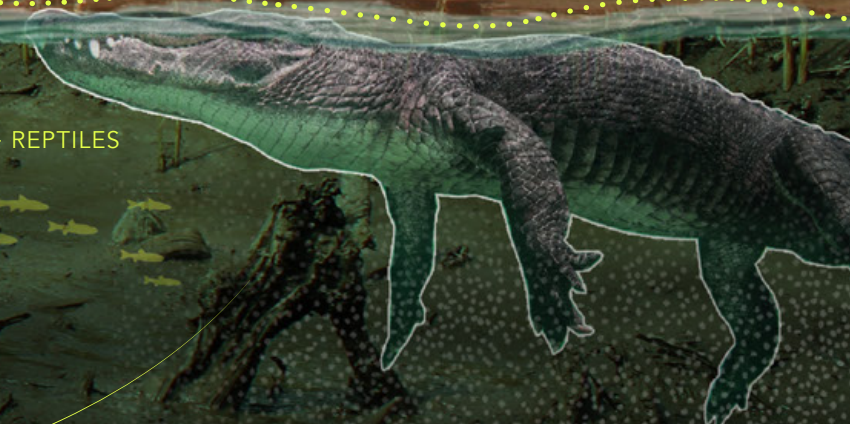
+ MACROINVERTEBRATES



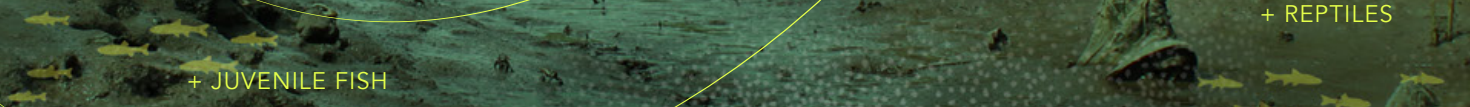
+ RESIDENT &
MIGRATORY FISH



+ REPTILES



+ JUVENILE FISH



+ SHELLFISH



+ BENTHOS



IMPORTANT BIRD HABITAT

The combination of Freshwater Tidal Marsh habitat to the north of Eagles Island and the dredge spoil impoundments to the south provide critical breeding, migratory, and all-season habitat for numerous bird species. These conditions have led to the designation of much of the island (and some of the marsh area north of the island) as a global-priority Audubon Important Bird Area (IBA). The Audubon Society describes the IBA program as "a conservation blueprint that helps Audubon, its partners, and landowners identify and safeguard the natural areas and landscapes that are most critical for maintaining bird populations, diversity, and habitats" (Audubon, 2021). The Eagles Island IBA supports a high diversity of birds during migration, with all regionally observed shorebird species, including many rare species, seen on the island. The most numerous shorebirds observed on Eagles Island include the semipalmated sandpiper (*Calidris pusilla*), least sandpiper (*Calidris minutilla*), short-billed dowitcher (*Limnodromus griseus*), greater yellowlegs (*Tringa melanoleuca*) and lesser yellowlegs (*Tringa flavipes*) (Audubon, 2021).

AUDUBON IMPORTANT BIRD AREA BOUNDARY



LEAST TERN
STERNULA ANTILLARUM



GREATER YELLOWLEGS
TRINGA MELANOLEUCA



ANHINGA
ANHINGA ANHINGA

SALTMARSH SPARROW
AMMOSPIZA CAUDACUTA

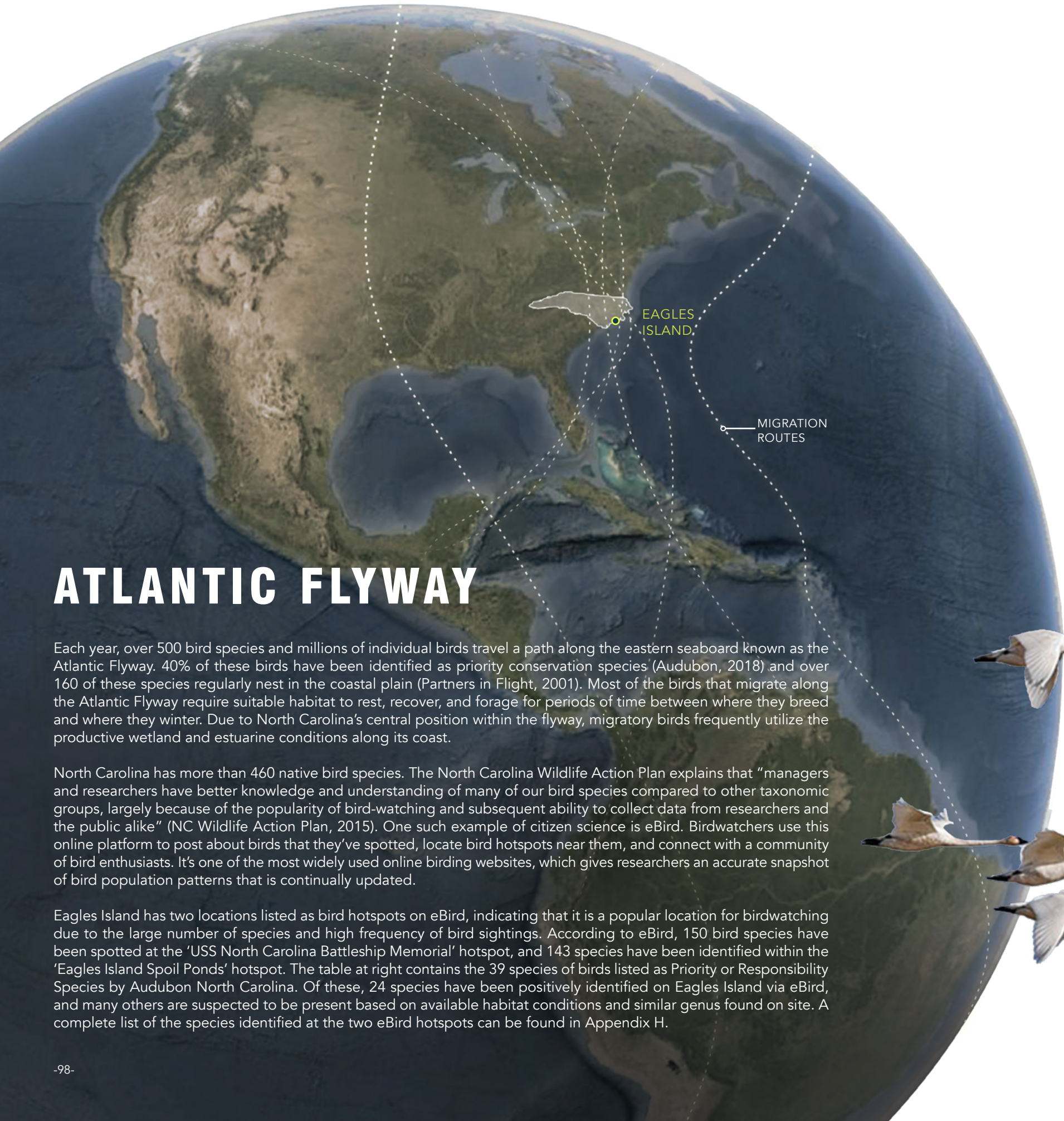


WESTERN SANDPIPER
CALIDRIS MAURI



BLACK-NECKED STILT
HIMANTOPUS MEXICANUS





ATLANTIC FLYWAY

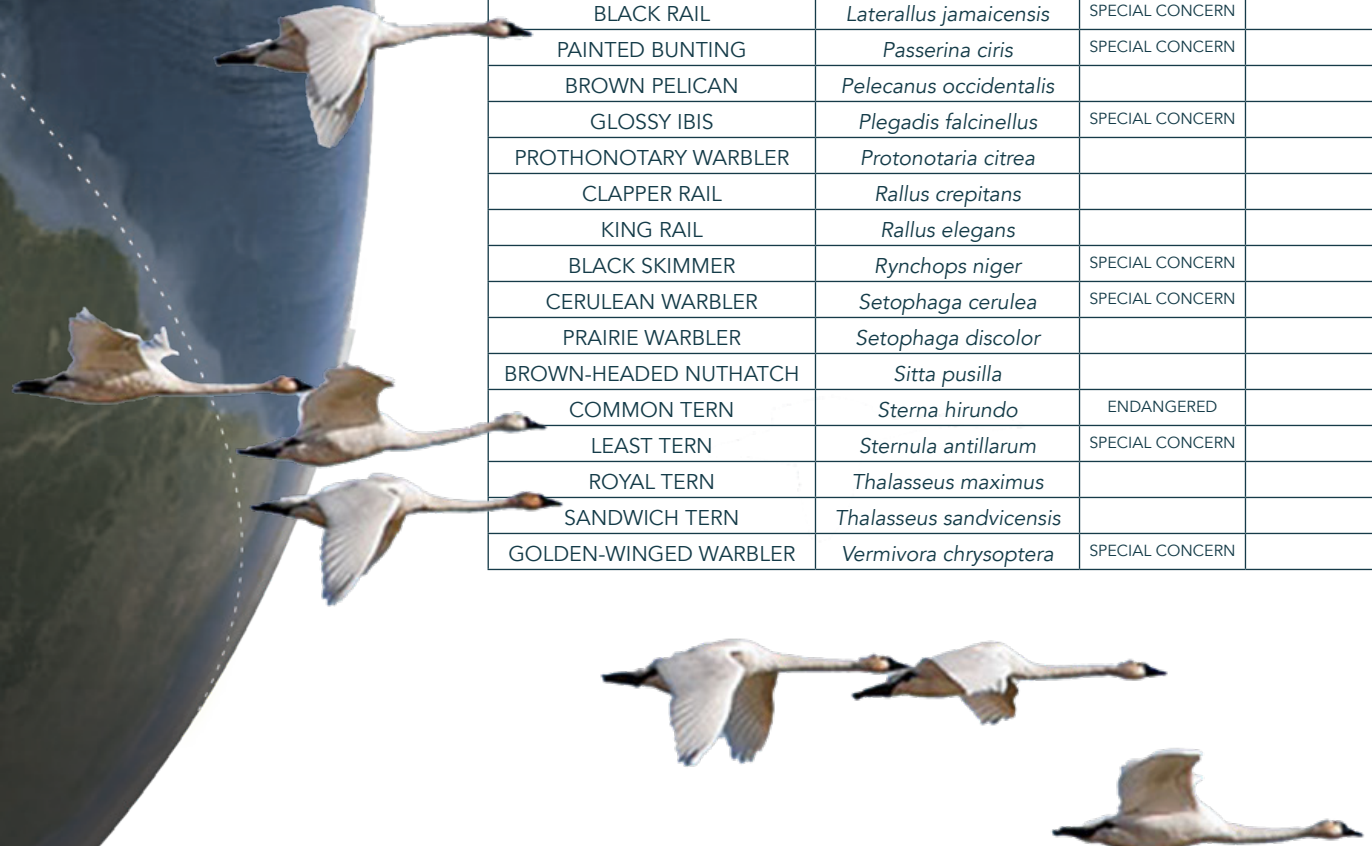
Each year, over 500 bird species and millions of individual birds travel a path along the eastern seaboard known as the Atlantic Flyway. 40% of these birds have been identified as priority conservation species (Audubon, 2018) and over 160 of these species regularly nest in the coastal plain (Partners in Flight, 2001). Most of the birds that migrate along the Atlantic Flyway require suitable habitat to rest, recover, and forage for periods of time between where they breed and where they winter. Due to North Carolina's central position within the flyway, migratory birds frequently utilize the productive wetland and estuarine conditions along its coast.

North Carolina has more than 460 native bird species. The North Carolina Wildlife Action Plan explains that "managers and researchers have better knowledge and understanding of many of our bird species compared to other taxonomic groups, largely because of the popularity of bird-watching and subsequent ability to collect data from researchers and the public alike" (NC Wildlife Action Plan, 2015). One such example of citizen science is eBird. Birdwatchers use this online platform to post about birds that they've spotted, locate bird hotspots near them, and connect with a community of bird enthusiasts. It's one of the most widely used online birding websites, which gives researchers an accurate snapshot of bird population patterns that is continually updated.

Eagles Island has two locations listed as bird hotspots on eBird, indicating that it is a popular location for birdwatching due to the large number of species and high frequency of bird sightings. According to eBird, 150 bird species have been spotted at the 'USS North Carolina Battleship Memorial' hotspot, and 143 species have been identified within the 'Eagles Island Spoil Ponds' hotspot. The table at right contains the 39 species of birds listed as Priority or Responsibility Species by Audubon North Carolina. Of these, 24 species have been positively identified on Eagles Island via eBird, and many others are suspected to be present based on available habitat conditions and similar genus found on site. A complete list of the species identified at the two eBird hotspots can be found in Appendix H.

AUDUBON NORTH CAROLINA PRIORITY BIRD SPECIES

COMMON NAME	SCIENTIFIC NAME	NC STATUS	US STATUS	eBIRD OBSERVATIONS
SALTMARSH SPARROW	<i>Ammospiza caudacuta</i>			1
SEASIDE SPARROW	<i>Ammospiza maritima</i>			
NELSON'S SPARROW	<i>Ammospiza nelsoni</i>			
NORTHERN PINTAIL	<i>Anas acuta</i>			
GREEN-WINGED TEAL	<i>Anas crecca</i>			7
AMERICAN BLACK DUCK	<i>Anas rubripes</i>			3
GREAT EGRET	<i>Ardea alba</i>			78
SANDERLING	<i>Calidris alba</i>			1
RED KNOT	<i>Calidris canutus</i>	THREATENED	THREATENED	
WESTERN SANDPIPER	<i>Calidris mauri</i>			7
SEMIPALMATED SANDPIPER	<i>Calidris pusilla</i>			1
CHIMNEY SWIFTS	<i>Chaetura pelagica</i>			32
PIPING PLOVER	<i>Charadrius melodus</i>	ENDANGERED	ENDANGERED	
WILSON'S PLOVER	<i>Charadrius wilsonia</i>	SPECIAL CONCERN		
TUNDRA SWAN	<i>Cygnus columbianus</i>			1
BOBOLINK	<i>Dolichonyx oryzivorus</i>			
LITTLE BLUE HERON	<i>Egretta caerulea</i>	SPECIAL CONCERN		23
SNOWY EGRET	<i>Egretta thula</i>	SPECIAL CONCERN		26
TRICOLORED HERON	<i>Egretta tricolor</i>	SPECIAL CONCERN		1
WHITE IBIS	<i>Eudocimus albus</i>			29
GULL-BILLED TERN	<i>Gelochelidon nilotica</i>	THREATENED		
AMERICAN OYSTERCATCHER	<i>Haematopus palliatus</i>	SPECIAL CONCERN		2
WOOD THRUSH	<i>Hylocichla mustelina</i>			
BLACK RAIL	<i>Laterallus jamaicensis</i>	SPECIAL CONCERN		
PAINTED BUNTING	<i>Passerina ciris</i>	SPECIAL CONCERN		2
BROWN PELICAN	<i>Pelecanus occidentalis</i>			17
GLOSSY IBIS	<i>Plegadis falcinellus</i>	SPECIAL CONCERN		
PROTHONOTARY WARBLER	<i>Protonotaria citrea</i>			2
CLAPPER RAIL	<i>Rallus crepitans</i>			62
KING RAIL	<i>Rallus elegans</i>			51
BLACK SKIMMER	<i>Rynchops niger</i>	SPECIAL CONCERN		
CERULEAN WARBLER	<i>Setophaga cerulea</i>	SPECIAL CONCERN		
PRAIRIE WARBLER	<i>Setophaga discolor</i>			3
BROWN-HEADED NUTHATCH	<i>Sitta pusilla</i>			10
COMMON TERN	<i>Sterna hirundo</i>	ENDANGERED		
LEAST TERN	<i>Sternula antillarum</i>	SPECIAL CONCERN		2
ROYAL TERN	<i>Thalasseus maximus</i>			9
SANDWICH TERN	<i>Thalasseus sandvicensis</i>			2
GOLDEN-WINGED WARBLER	<i>Vermivora chrysoptera</i>	SPECIAL CONCERN		





WATER RESOURCES & QUALITY

Water quality around Eagles Island is inherently linked to upstream factors and conditions as well as downstream Atlantic tidal influences. Situated along the lower reach of the Cape Fear River, sediment and pollutants throughout most of the 9,000 square mile watershed eventually reach Eagles Island through a network of nearly 6,000 miles of tributary streams (Cape Fear River Partnership, 2021). A number of upstream factors, including urbanization and agricultural land use contribute sediment and pollutants from stormwater runoff to local tributary streams, which has led to declining water quality throughout the watershed. The waters around Eagles Island have been designated as impaired for aquatic life due to low dissolved oxygen and low pH during seasonally dry conditions, and occasional high turbidity, usually following heavy rain events upstream (Smith et al., 2011, EPA, 2018). As described earlier, the combination of rising sea levels and human modification to the natural river channel have also led to gradual but pronounced increases in the salinity around Eagles Island which has resulted in significant changes in species composition of the island's Freshwater Tidal Marsh communities.

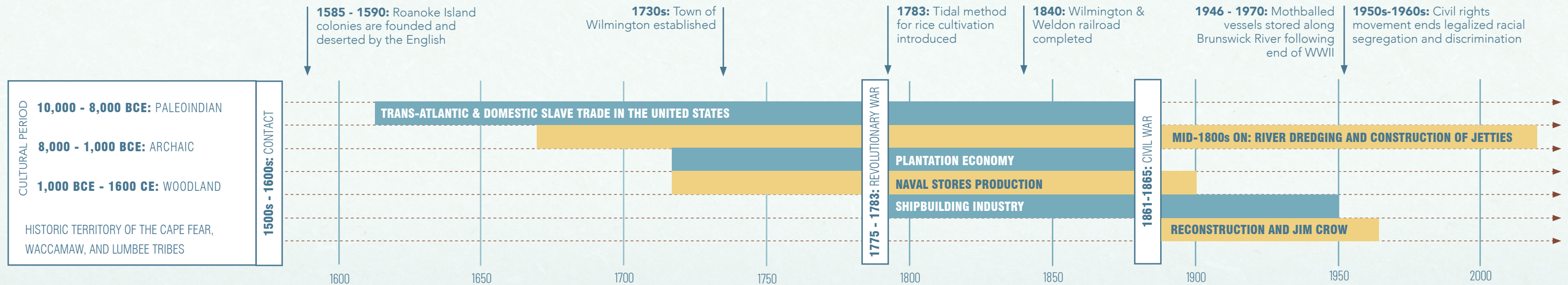
Since 1995, the Aquatic Ecology Laboratory at UNC Wilmington has continuously collected water quality data at 35 locations within the Lower Cape Fear River Watershed, compiling an invaluable record of water quality trends accessible to a wide range of stakeholders. More information about the water quality factors listed above and the extensive collection of data can be found on their website.



SECTION FIVE

HISTORY & CULTURE

LOWER CAPE FEAR HISTORICAL OVERVIEW



PRE-CONTACT

While there are no prehistoric archaeological sites formally recorded on Eagles Island, the Lower Cape Fear region has been occupied by indigenous peoples for thousands of years. Early Native Americans had a mobile way of life, moving to several campsites a year to hunt game, fish, and gather food. By the Woodland period, area tribes established more permanent settlements, and likely used the Cape Fear River as an important trade route. Prior to European colonization, indigenous people practiced limited agriculture and used fire to maintain the vast longleaf pine forests. By the 1720s, remaining Native American populations were scarce in the region (Davidson, 2020).

AGRICULTURE

During the colonial era, the majority of residents of the Lower Cape Fear region relied on agriculture for their livelihoods, cultivating wheat, corn, rice, indigo, and tobacco, as well as raising livestock. The emergence of the cash crop economy led to the development of large plantations, with rice playing a particularly important role in Wilmington's economy. Many of the enslaved people that were brought to the region to work on the plantations were of West and Central African descent, leading to the enduring Gullah Geechee culture found along the southeastern coast of the United States. Following the abolition of the slave system, large plantations broke into smaller farms, and cotton and tobacco replaced rice as the main agricultural exports (Markham et al., 2011).

INDUSTRY

Early colonists made use of the abundant longleaf pine forests that once dominated the coastal plain, extracting tar, rosin, and turpentine for the production of naval stores and milling lumber to produce barrels and construction supplies. Since its founding in the 1730s, Wilmington had become an important port for the transshipment of naval stores, agricultural products, and other goods. At the height of production in the mid-1700s, the Cape Fear region was the largest supplier of naval stores to the British Empire. Shipbuilding peaked in the 19th century, and textile mills began to appear in Wilmington following the Civil War. By the early 20th century, the naval stores industry was in significant decline, due in part to modernized shipbuilding materials and the exhaustion of longleaf pine resources (Markham et al., 2011).

20TH CENTURY DEVELOPMENT

Following the Reconstruction period, the region began to experience increased modernization. The lumber industry remained strong into the new century, while shipbuilding continued through WWI and WWII, declining shortly thereafter. While the steamship and railroad industries also began to decline, the hard paving of roads and proliferation of the automobile made transportation easier, thereby contributing to the diversification of new industries and commerce through tourism. In order to accommodate larger container vessels, regular dredging of the Cape Fear River continues to this day.

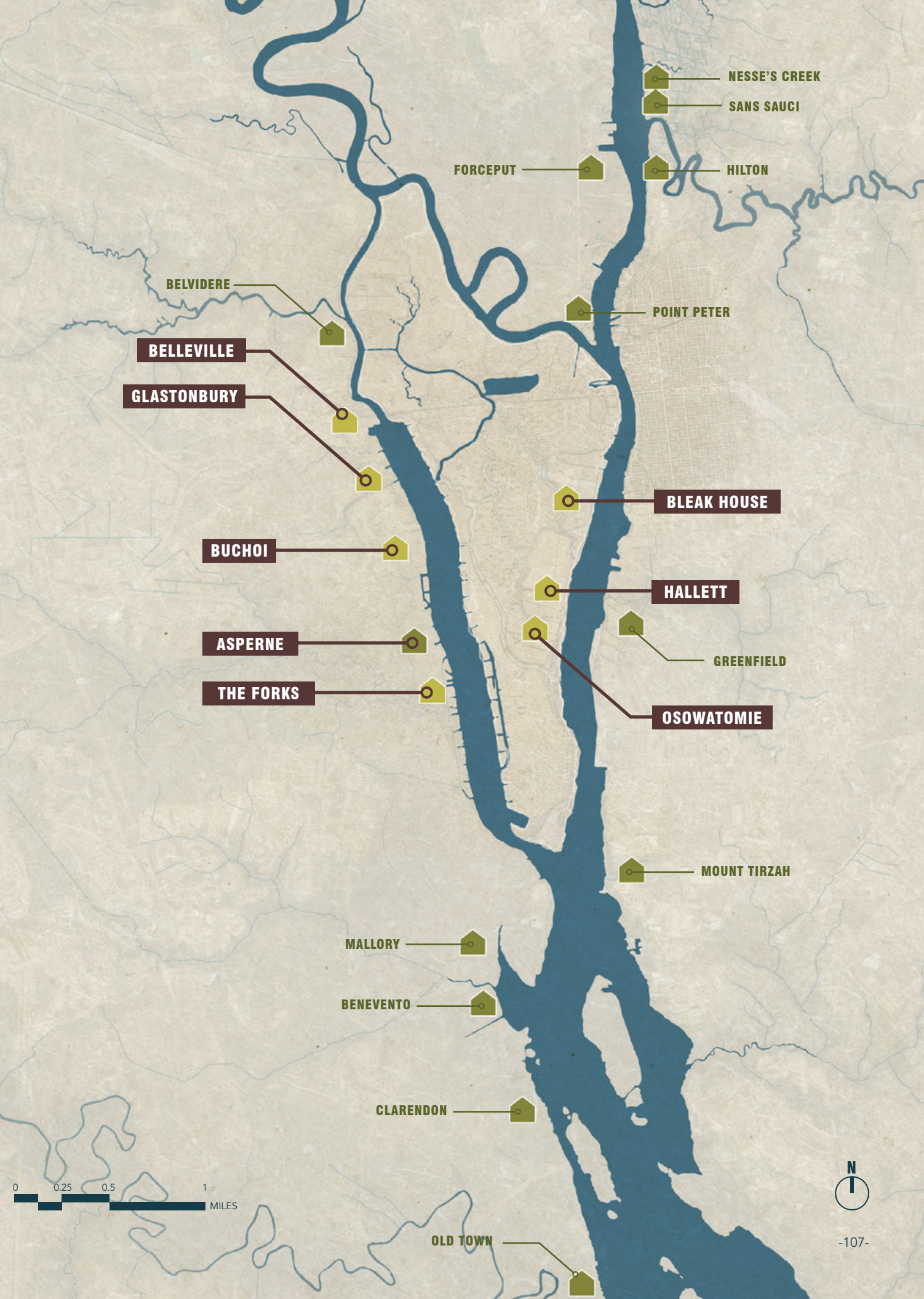
RICE PLANTATIONS

Rice cultivation was introduced to the Lower Cape Fear region when planters relocated to the area from locations along the Cooper River near Charleston, South Carolina, where a large rice industry existed. Along with the preferred Carolina Gold rice grains, they brought numerous enslaved people from the Gullah culture who, due to their generational knowledge with growing rice in West Africa, were sought specifically for their expertise in rice cultivation and the natural resistance they had to mosquito-borne diseases. Rice was initially cultivated using the upland production method, but shifted to the tidal flow method that was perfected in the late 1700s (Markham et al., 2011). Several plantations had landholdings on Eagles Island during the 18th and 19th centuries, extensively modifying the landscape through the clearing of forested wetlands and the construction of ditches and levees.

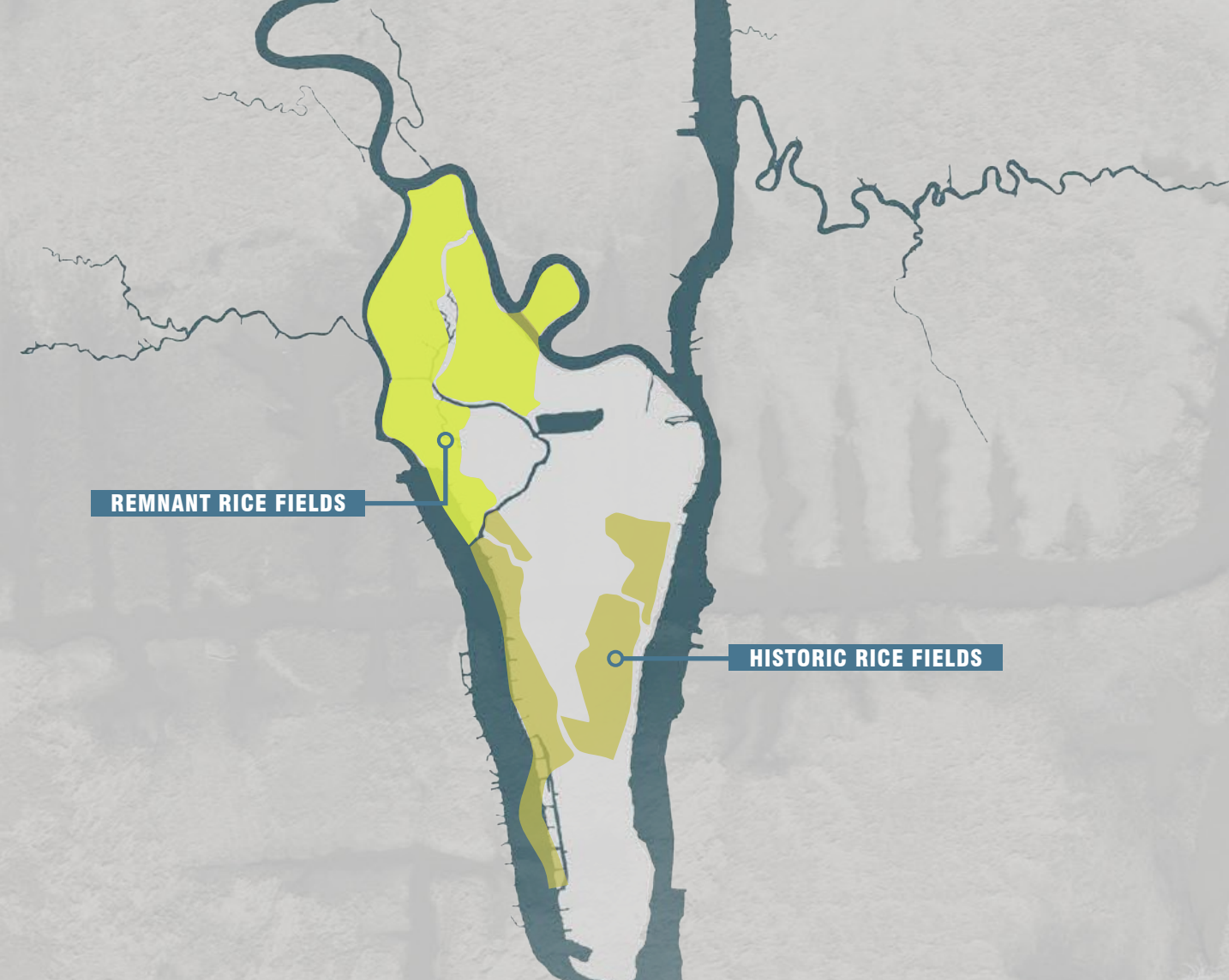
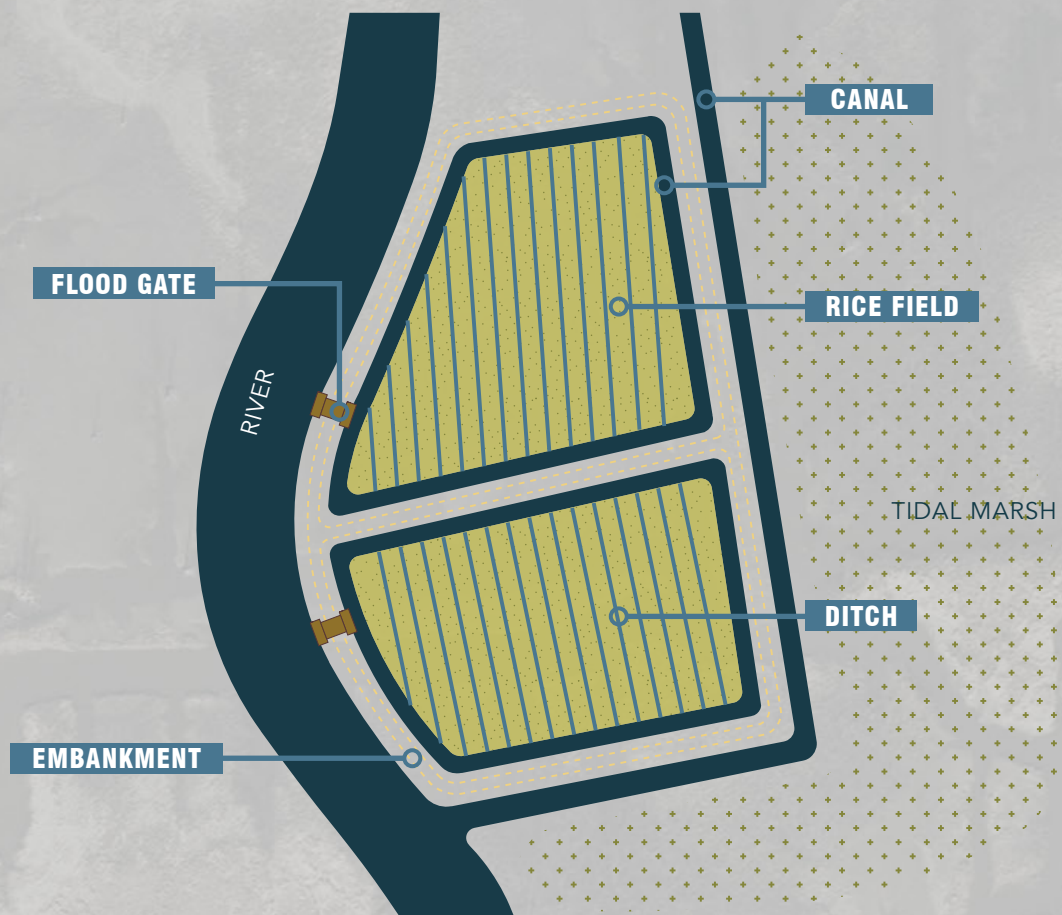
The Forks plantation was first owned by Richard Eagles Sr., an English merchant and planter who was one of the first settlers to come to the Wilmington (formerly Newton) area. In 1737, he was granted the major portion of a "big island" across from Newton, and purchased more land on the island and the western side of the Brunswick River over the following years. In the 18th century, the Eagles family owned over 6,500 total acres in the region, including 900+ acres on the island, resulting in the naming of Eagles Island. At his death, Richard Eagles Sr. bequeathed the plantation lands and 73 enslaved African Americans to his son, Richard Eagles Jr., who continued to operate The Forks before bequeathing it to his own children. The Forks plantation remained in the Eagles family until 1853 (Jackson, 1996).

Eventually, The Forks came into the ownership of Thomas C. McIlhenny, who also owned the Buchoi and Asperne plantations. McIlhenny was one of the largest rice producers in the area, with landholdings that produced 864,000 pounds of rice through the labor of around 100 enslaved people at the peak of the rice plantation economy in 1860 (Markham et al., 2011). Additional plantations that sprawled across the river onto Eagles Island were that of Belleville and Glastonbury, and three plantations existed directly on Eagles Island: Hallett, Bleak House, and Osawotomie. Bleak House and Osawotomie both relied on convict labor from the state penitentiary to harvest rice, and were leased by the Cape Fear Rice Company in 1902. Remnants of these three plantations have since been destroyed or covered by dredge spoils.

As efforts to shape the future of Eagles Island continue, the surrounding communities will need to reckon with the island's history as a place of enslavement. Conversations about how this history is remembered and honored should be at the forefront of planning efforts, and as Eagles Island Nature Park takes shape, it's worth exploring alternative names for the park and the island.



The Orton Plantation, Brunswick County, NC

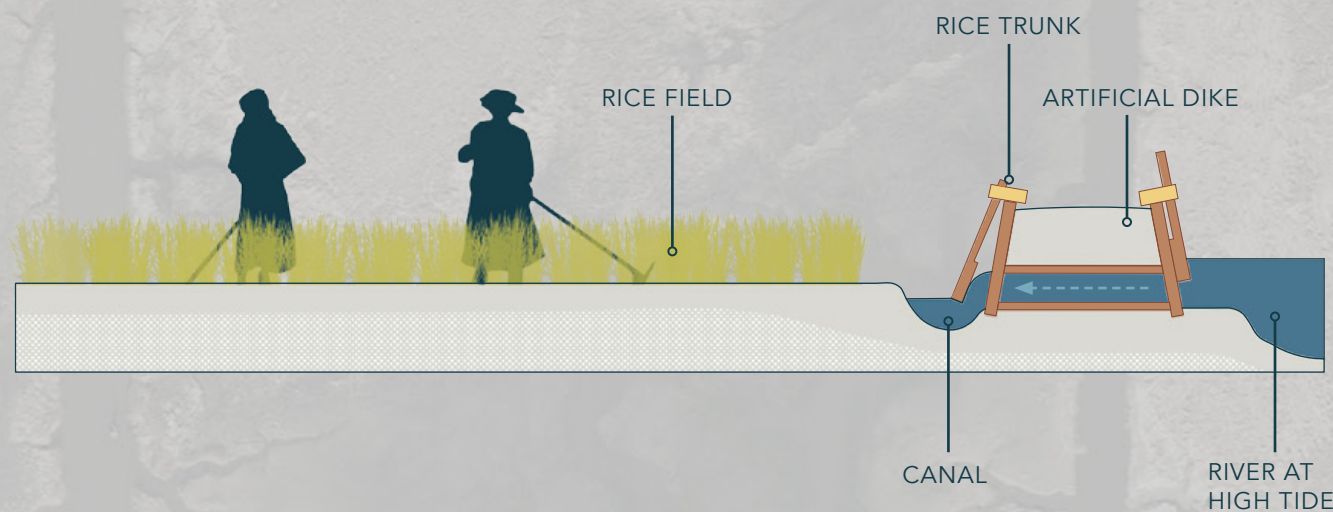


Map adapted from James Kapetsky
2015 Coastal GeoTools presentation

RICE CULTIVATION

Approximately 50% of Eagles Island has been covered with rice fields over time. The resulting water management system and divisions of land into level, 20-acre (+/-) plots created a series of canals that are still visible today in the northwest part of the island. Although threatened by sedimentation, erosion, and sea level rise, these remnants are a lasting symbol of the region's Gullah cultural heritage.

The tidal method of rice production was a laborious process that required a significant amount of labor, including the initial clearing of land by hand, the construction of levees and canals, and the ongoing maintenance, cultivation, and processing of fields. Levees along the river and smaller perimeter embankments were constructed to keep unwanted flooding out of the fields and irrigation was carefully controlled through sluice gates and canals. Fields were periodically flooded and drained for days or weeks at a time, which controlled the growth of weeds and supported the heads of rice as they matured. This created the benefits of a predictable water supply and the constant replenishment of nutrients. Once matured, the crop would be harvested and threshed by hand and then polished in a mill (Clifton, 1973).



EAGLES ISLAND REMNANT RICE FIELDS

In this aerial image, outlines of former rice fields are apparent from the main canals and the across-field ditches. Traces of low embankments that enclosed the fields and high embankments that protected them at the river's edge are also visible. The wetlands that reestablished after rice cultivation ended are important for sustaining fishery resources and other estuarine life. The dendritic erosion pattern emanating along some of the ditches and canals are evidence of ongoing subsidence and erosion (Kapetsky, 2021).



BRUNSWICK RIVER

EMBANKMENT

CANAL

DITCH

RICE FIELD

STURGEON CREEK





GULLAH GEECHEE HISTORY

The Gullah Geechee people are descendants of enslaved West Africans, targeted by Europeans and Americans for their expertise in growing rice and indigo. The tidal riverine conditions in coastal West Africa (presently Senegal, the Gambia, Sierra Leone, and Liberia) where rice cultivation was refined over millennia bear many similarities to coastal environments of the Southeastern United States from the Cape Fear region to Northern Florida. The traditional West African growing techniques were adopted on plantations throughout the region, building immense wealth throughout the lowcountry (Tibbets, 2014). Enslaved growers were relatively isolated on these very rural plantations, and as a result, their diverse cultural traditions and languages melded to form the unique creole culture called Gullah Geechee.

After emancipation, some Gullah Geechee communities continued a primarily agricultural lifestyle on barrier islands along the coast of South Carolina and Georgia, with continued isolation further strengthening the identity of their

blended cultural customs. However, the proximity to urban centers led many Gullah Geechee people in the Cape Fear region to leave agriculture and pursue jobs in the emerging industrial sector (Sutton, Talton, 2020). Navassa, North Carolina, located along the Brunswick River, is an example of an industrial town settled by emancipated slaves. Today, the Gullah language isn't spoken by residents of Navassa, but the culture and influences are still important parts of the town and landscape. Reaves Chapel, built just after the Civil War by formerly enslaved people is currently undergoing extensive restoration, and is described as "one of the Cape Fear region's most culturally and historically significant African American structures" (Coastal Land Trust). Additional efforts to preserve and celebrate Gullah Geechee heritage in the Cape Fear region include the proposed Gullah Geechee Heritage Trail linking Navassa and Southport, NC, and the proposed Moze Heritage Center.

Photographs: Jola women (Senegal) harvest and transplant rice. Credit: Smithsonian Tropical Research Institute



Naval stores barrels on Eagles Island ca. 1892
 Courtesy of New Hanover County

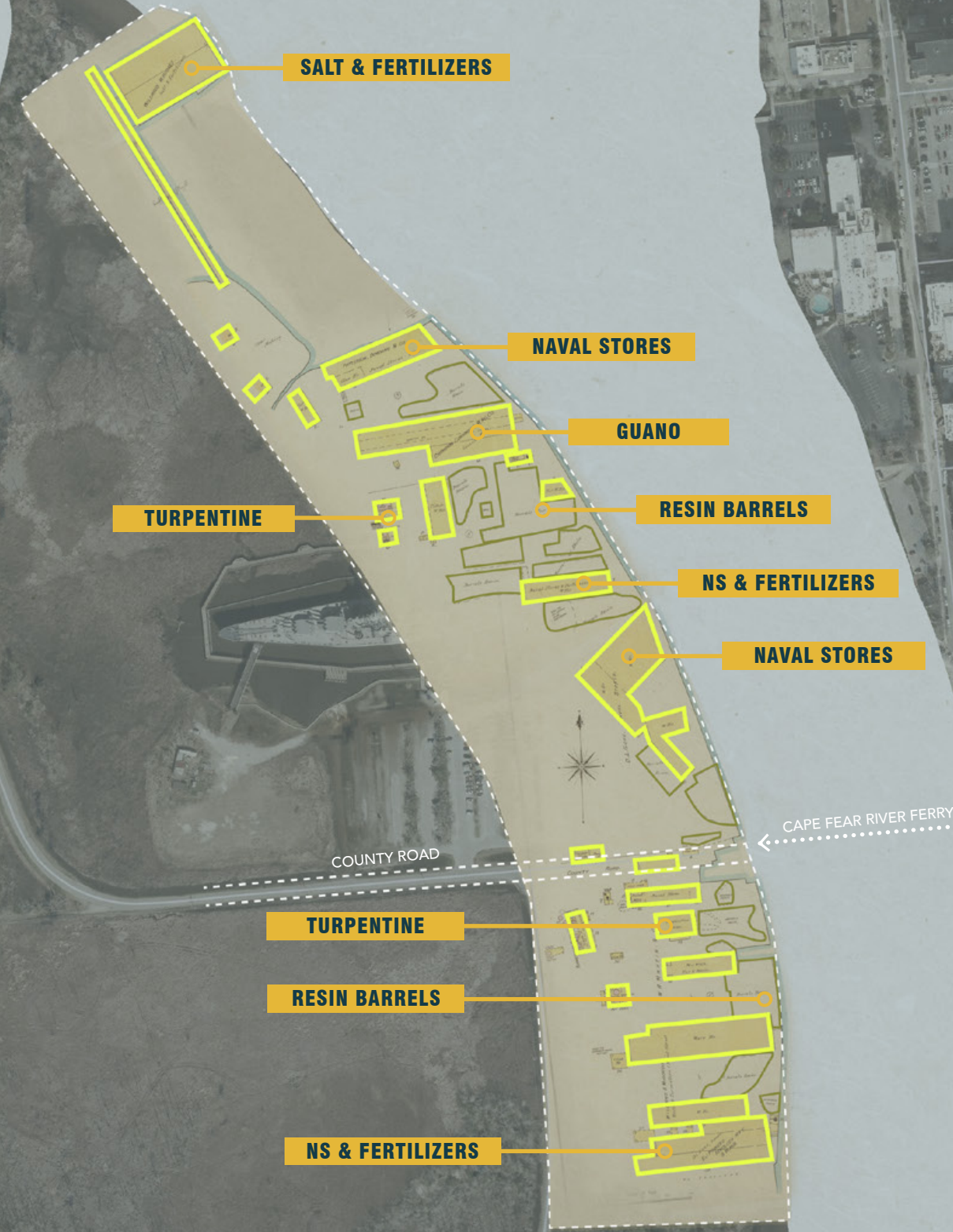
NAVAL STORES

From the mid-1700s into the early 1900s, the eastern side of Eagles Island was used as a manufacturing and processing center for naval stores. The products produced from the gum of coniferous trees, such as tar, pitch, spirits of turpentine, and rosin, were used in the marine and shipbuilding industries. This industry took advantage of the island's prime location at the confluence of the Cape Fear and Northeast Cape Fear Rivers and adjacency to the important shipping port of Wilmington, as raw materials could be brought downriver to the island for processing and transshipment. The lack of dense development on the island was also an advantage as the highly flammable products and manufacturing processes would not have been a danger to Wilmington's houses and commercial buildings, although distillery and warehouse fires were so frequent that the Eagle [sic] Island Fire Company was established on the island in 1871 (Markham et al, 2011).

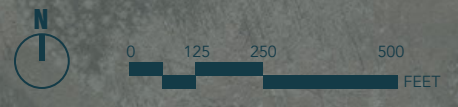
Sanborn Fire Insurance Maps from the late 1800s through the early 1900s illustrate the presence of a number of warehouses, distilleries, and naval stores barrels along the eastern side of Eagles Island, as well as lumber mills, docks, wharves, and agricultural product warehouses.

CAPE FEAR RIVER

NE CAPE FEAR RIVER



1889 Sanborn map overlay

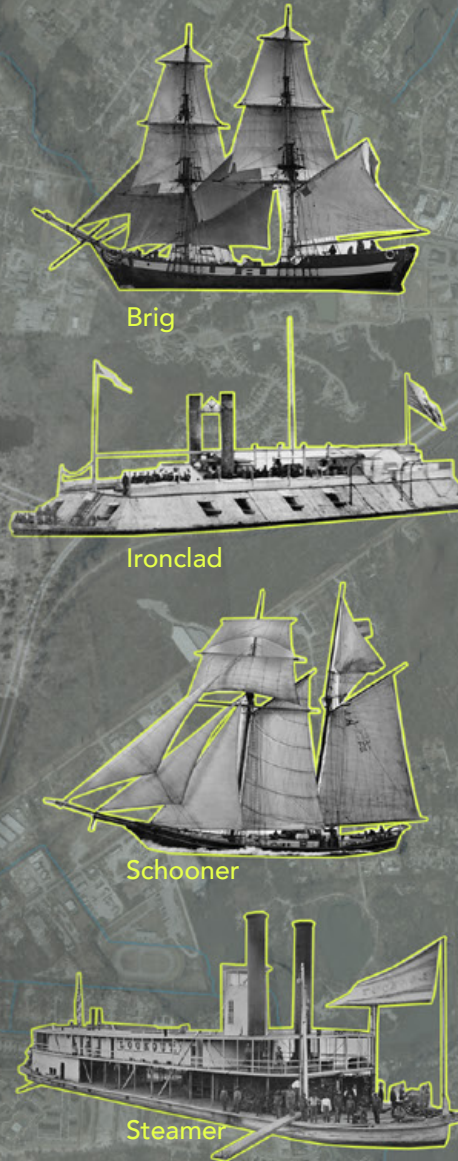


Mothballed reserve fleet.
Minford, c/o Kristina Fischer

SHIPBUILDING HISTORY

Shipbuilding in the Lower Cape Fear region peaked in the 19th century, and swiftly declined in the early 20th century as construction methods shifted from wood to iron and steel. A number of shipyards were located on Eagles Island, the first of which was Beery's Shipyard, also known as the Commercial Mill and Shipyard and the Confederate Navy Yard. Opened in 1848 by Samuel Beery and his two sons, this shipyard produced commercial vessels until the Civil War, when it shifted its focus to building ships for the confederate navy. In 1911, Beery's Shipyard was purchased by Wilmington Iron Works, who established the Wilmington Marine Railway Company in its place. In 1924, Stone Towing Company – formed in 1895 as a towing business and grocer – purchased the Wilmington Marine Railway Company as well as the Naul Shipyard (Diamond Steamboat and Wrecking Company) to the north and operated until 1946 when a fire destroyed most of its facilities. To the south of the Wilmington Marine Railway Company was Hamme Marine Railway, a small railway used to haul vessels for repair. In 1910, the US Army Corps of Engineers constructed wharves and docks for the Government Shipyard and Marine Railway, which continues to operate today as the US Engineer Yard (Markham et al, 2011).

Shipbuilding in the region increased for a short period during WWI and again during WWII, when the North Carolina Shipbuilding Company produced 243 vessels for the war effort through the US Maritime Commission. After the war ended, the decommissioned fleet was sold, scrapped, or stored ("mothballed") along both sides of the Brunswick River, which was dredged and widened to accommodate the anchorage. By the early 1970s, the entire fleet had been sold or scrapped (Minford, 2012).



1924 - 1946
STONE TOWING

1917 - 1918
NAUL SHIPYARD

1848 - 1911
BEERY'S SHIPYARD

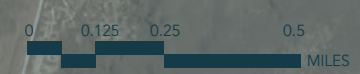
1911 - 1924 **WILMINGTON IRON WORKS
MARINE RAILWAY COMPANY**

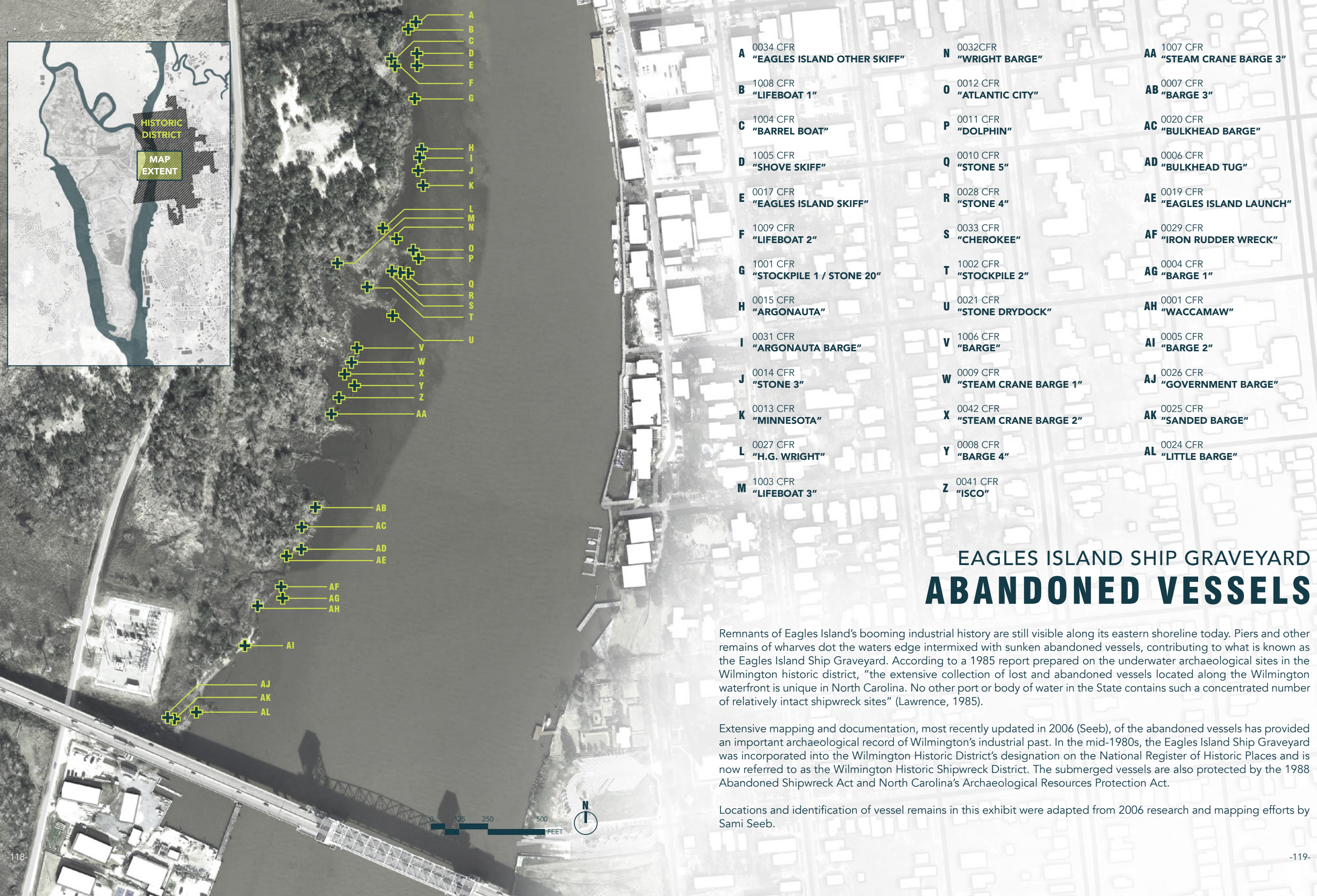
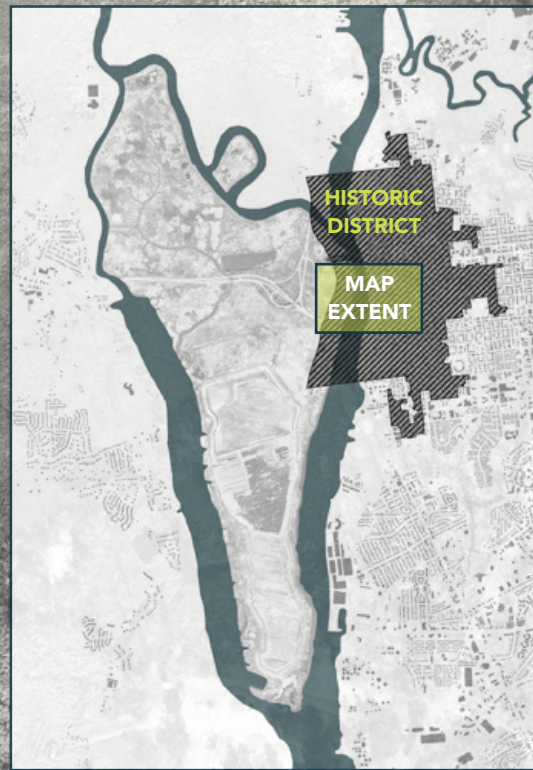
1915 - 1946
HAMME RAILWAY

1910 - PRESENT
US ENGINEER YARD

DOCKED 1946 - 1970
LIBERTY SHIPS

1941 - 1946
NCSC SHIPYARD





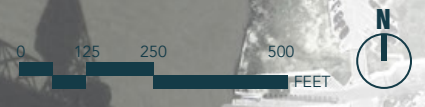
- A** 0034 CFR
"EAGLES ISLAND OTHER SKIFF"
- B** 1008 CFR
"LIFEBOAT 1"
- C** 1004 CFR
"BARREL BOAT"
- D** 1005 CFR
"SHOVE SKIFF"
- E** 0017 CFR
"EAGLES ISLAND SKIFF"
- F** 1009 CFR
"LIFEBOAT 2"
- G** 1001 CFR
"STOCKPILE 1 / STONE 20"
- H** 0015 CFR
"ARGONAUTA"
- I** 0031 CFR
"ARGONAUTA BARGE"
- J** 0014 CFR
"STONE 3"
- K** 0013 CFR
"MINNESOTA"
- L** 0027 CFR
"H.G. WRIGHT"
- M** 1003 CFR
"LIFEBOAT 3"
- N** 0032 CFR
"WRIGHT BARGE"
- O** 0012 CFR
"ATLANTIC CITY"
- P** 0011 CFR
"DOLPHIN"
- Q** 0010 CFR
"STONE 5"
- R** 0028 CFR
"STONE 4"
- S** 0033 CFR
"CHEROKEE"
- T** 1002 CFR
"STOCKPILE 2"
- U** 0021 CFR
"STONE DRYDOCK"
- V** 1006 CFR
"BARGE"
- W** 0009 CFR
"STEAM CRANE BARGE 1"
- X** 0042 CFR
"STEAM CRANE BARGE 2"
- Y** 0008 CFR
"BARGE 4"
- Z** 0041 CFR
"ISCO"
- AA** 1007 CFR
"STEAM CRANE BARGE 3"
- AB** 0007 CFR
"BARGE 3"
- AC** 0020 CFR
"BULKHEAD BARGE"
- AD** 0006 CFR
"BULKHEAD TUG"
- AE** 0019 CFR
"EAGLES ISLAND LAUNCH"
- AF** 0029 CFR
"IRON RUDDER WRECK"
- AG** 0004 CFR
"BARGE 1"
- AH** 0001 CFR
"WACCAMAW"
- AI** 0005 CFR
"BARGE 2"
- AJ** 0026 CFR
"GOVERNMENT BARGE"
- AK** 0025 CFR
"SANDED BARGE"
- AL** 0024 CFR
"LITTLE BARGE"

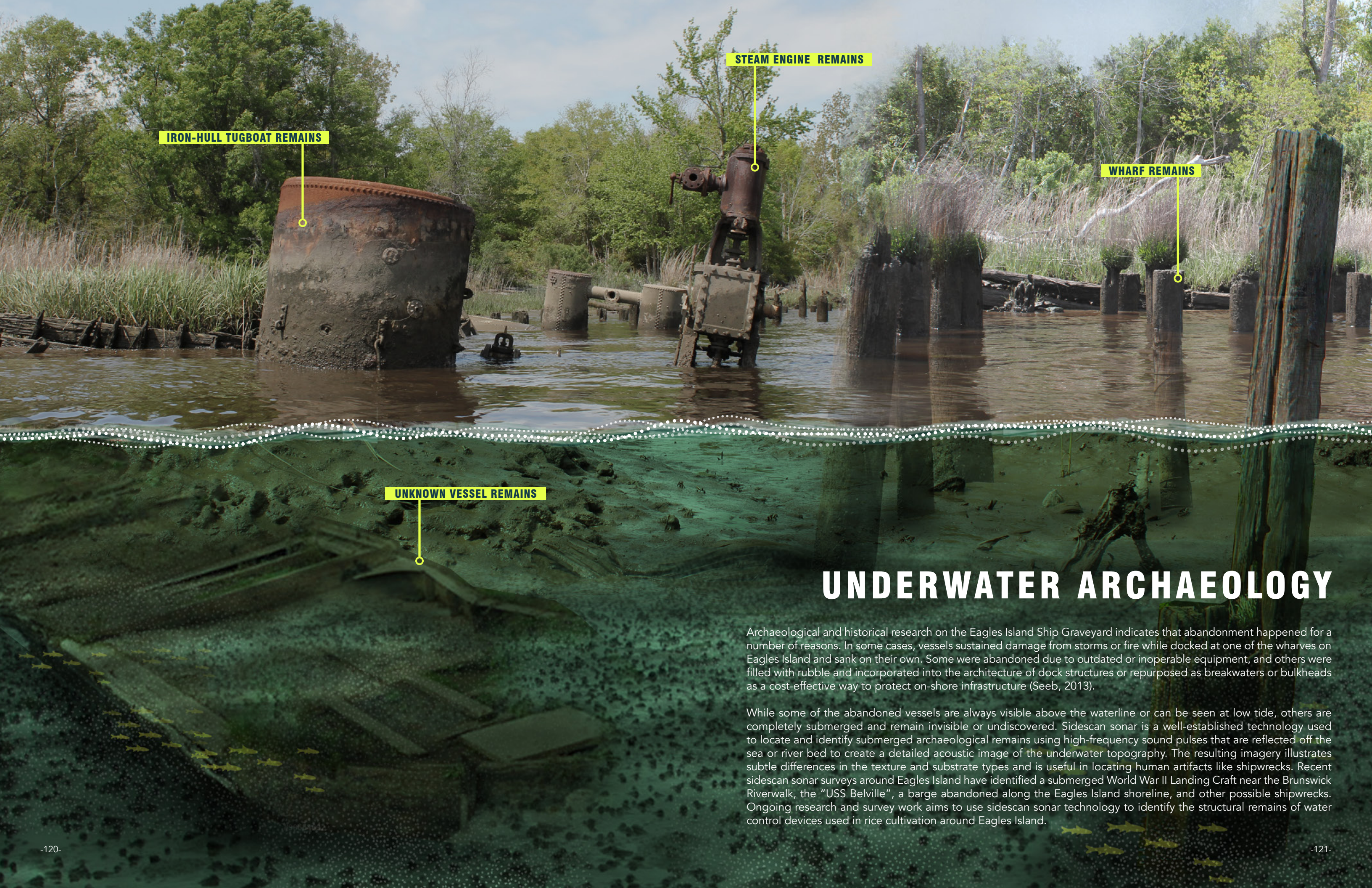
EAGLES ISLAND SHIP GRAVEYARD ABANDONED VESSELS

Remnants of Eagles Island's booming industrial history are still visible along its eastern shoreline today. Piers and other remains of wharves dot the waters edge intermixed with sunken abandoned vessels, contributing to what is known as the Eagles Island Ship Graveyard. According to a 1985 report prepared on the underwater archaeological sites in the Wilmington historic district, "the extensive collection of lost and abandoned vessels located along the Wilmington waterfront is unique in North Carolina. No other port or body of water in the State contains such a concentrated number of relatively intact shipwreck sites" (Lawrence, 1985).

Extensive mapping and documentation, most recently updated in 2006 (Seeb), of the abandoned vessels has provided an important archaeological record of Wilmington's industrial past. In the mid-1980s, the Eagles Island Ship Graveyard was incorporated into the Wilmington Historic District's designation on the National Register of Historic Places and is now referred to as the Wilmington Historic Shipwreck District. The submerged vessels are also protected by the 1988 Abandoned Shipwreck Act and North Carolina's Archaeological Resources Protection Act.

Locations and identification of vessel remains in this exhibit were adapted from 2006 research and mapping efforts by Sami Seeb.





IRON-HULL TUGBOAT REMAINS

STEAM ENGINE REMAINS

WHARF REMAINS

UNKNOWN VESSEL REMAINS

UNDERWATER ARCHAEOLOGY

Archaeological and historical research on the Eagles Island Ship Graveyard indicates that abandonment happened for a number of reasons. In some cases, vessels sustained damage from storms or fire while docked at one of the wharves on Eagles Island and sank on their own. Some were abandoned due to outdated or inoperable equipment, and others were filled with rubble and incorporated into the architecture of dock structures or repurposed as breakwaters or bulkheads as a cost-effective way to protect on-shore infrastructure (Seeb, 2013).

While some of the abandoned vessels are always visible above the waterline or can be seen at low tide, others are completely submerged and remain invisible or undiscovered. Sidescan sonar is a well-established technology used to locate and identify submerged archaeological remains using high-frequency sound pulses that are reflected off the sea or river bed to create a detailed acoustic image of the underwater topography. The resulting imagery illustrates subtle differences in the texture and substrate types and is useful in locating human artifacts like shipwrecks. Recent sidescan sonar surveys around Eagles Island have identified a submerged World War II Landing Craft near the Brunswick Riverwalk, the "USS Belville", a barge abandoned along the Eagles Island shoreline, and other possible shipwrecks. Ongoing research and survey work aims to use sidescan sonar technology to identify the structural remains of water control devices used in rice cultivation around Eagles Island.

EAGLES ISLAND NATURE PARK A CALL TO ACTION



MANAGED BY
US ARMY CORPS
OF ENGINEERS

BRUNSWICK RIVER

CAPE FEAR RIVER

THE TIME IS NOW

As a region, we are growing so rapidly that we may forever destroy the natural resources and remaining artifacts of this special historic site. Eagles Island Nature Park will provide a place to connect with nature, history, and one another. There's no other place like it in the southeast. No matter your vantage, Eagles Island will speak to you.

Eagles Island Central Park Task Force is seeking public input on the comprehensive plan for Eagles Island Nature Park. If you are inspired by this project, we invite you to learn more by visiting: www.EaglesIslandNaturePark.org

In Conservation, Education & Recreation,
The Eagles Island Central Park Task Force





APPENDICES

APPENDIX A REFERENCES

Audubon Society. (2021) Important Bird Area: Eagles Island North Carolina. <https://www.audubon.org/important-bird-areas/eagles-island>

Audubon Society. (2021) Important Bird Areas: North Carolina. <https://www.audubon.org/important-bird-areas/state/north-carolina>

Audubon Society. (2021) Priority Species. <https://nc.audubon.org/birds-0/priority-species>

Ballard, Allison. (2016) Coastal Plain is one of World's "Bio" Hotspots. <https://coastalreview.org/2016/04/coastal-plain-gets-hotspot-map/>

Bellamy, Cammie. (2016) As Developer Ponders Eagles Island, No Plans to Move Historic Boats. Star News Online. <https://www.starnewsonline.com/article/NC/20160212/News/605048290/WM>

Cape Fear River Partnership. (2021) The Cape Fear River: One of North Carolina's Most Precious Resources. <https://capefearriverpartnership.com/river/>

Clifton, James M. (1973) Golden Grains of White: Rice Planting on the Lower Cape Fear. The North Carolina Historical Review 50, no. 4: 365-93. <https://www.jstor.org/stable/23529957>.

Davidson, Jan. (2020) Native Americans in the Cape Fear. <https://www.capefearmuseum.com/wp-content/uploads/2020/04/Native-Americans.pdf>

DeWitt, Dave. (2016) Eastern NC is a Biodiversity Hotspot. <https://www.wunc.org/environment/2016-02-25/eastern-nc-is-a-global-biodiversity-hotspot>

East Coast Greenway. (2021) Design Guide. <https://www.greenway.org/uploads/attachments/ckmwce1zy5iti82qi31gralax-2021-design-guide-final-032621.pdf>

Economic Development Partnership of North Carolina. (2020) Visitor Profile Studies. <https://partners.visitnc.com/visitor-profile-studies>

Economic Development Partnership of North Carolina. (2021) Economic Impact Studies. Visit NC. <https://partners.visitnc.com/economic-impact-studies>

Economic Development Partnership of North Carolina. (2019) 2019 North Carolina Regional Visitor Profile. Visit NC. <https://partners.visitnc.com/contents/sdownload/71940/file/2019-North-Carolina-Regional-Visitor-Profile.pdf>

Hackney, C.T. (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, et al. (eds) Wetland Ecology and Management: Case Studies pp 55-61

Herlevich, Camilla. (2016) What is a Global Biodiversity Hotspot. Coastlines <https://coastallandtrust.org/wp-content/uploads/2017/06/2016.2-Summer-Coastlines-Global-Biodiversity-Hotspot.pdf>

Jackson, Claude V. (1996) Maritime History and Survey of the Cape Fear and Northeast Cape Fear Rivers, Wilmington Harbor, North Carolina. Volume I: Maritime History. Underwater Archaeology Unit, State Historic Preservation Office, Division of Archives and History and U. S. Army Corps of Engineers, Wilmington District, NC. <https://digital.ncdcr.gov/digital/collection/p249901coll22/id/397710>

Lawrence, Richard. (1985) Underwater Archaeological Sites in the Wilmington Historical District. NC Department of Natural and Cultural Resources Underwater Archaeology Unit. <https://archaeology.ncdcr.gov/media/6/download?attachment>

LeBlond, Richard. (1995) Inventory of the Natural Areas and Rare Species of Brunswick County, North Carolina. <https://digital.ncdcr.gov/digital/collection/p249901coll22/id/658546>

LeBlond, Richard. (2003) Natural Area Inventory of New Hanover County, North Carolina. <https://laserfiche.nhcgov.com/weblink/0/edoc/3273275/Natural-Heritage-Inventory-of-NHC.pdf>

Linares, Olga. (2002) African Rice (*Oryza glaberrima*): History and Future Potential. Proceedings of the National Academy of Sciences of the United States of America. <https://www.pnas.org/content/99/25/16360/tab-article-info#sec-3>

Mallin, Michael., McIver, Matthew., & Merritt, James. (2016). Environmental Assessment of the Lower Cape Fear River System, 2015. <https://uncw.edu/cms/aelab/lcfrp/wq%20reports/lcfrp%202015%20environmental%20report.pdf>

Mosher, Katie. (2015) Demographic Data Offer Insights. Coastwatch. <https://ncseagrant.ncsu.edu/coastwatch/previous-issues/2015-2/spring-2015/demographic-data-offer-insights/>

National Park Service. (2019). National Park Brings Millions in Economic Benefits. <https://www.nps.gov/timu/learn/news/2018-economic-impact.htm>.

National Recreation and Park Association. (2020). The Economic Impact of Parks: An Examination of the Economic Impacts of Operations and Capital Spending by Local Park and Recreation Agencies on the U.S. Economy. Center for Regional Analysis, George Mason University. <https://www.nrpa.org/siteassets/research/economic-impact-study-full-report-2020.pdf>

NOAA. (2021) Relative Sea Level Trend 8658120 Wilmington, North Carolina. https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8658120

NOAA. (2012) Ecological Effects of Sea Level Rise in North Carolina: Maps, Marshes, and Management Applications. <https://coastalscience.noaa.gov/project/ecological-effects-sea-level-rise-north-carolina/>

North Carolina Coastal Resources Commission Science Panel. (2015) North Carolina Sea Level Rise Assessment Report. <https://files.nc.gov/ncdeq/Coastal%20Management/documents/PDF/Science%20Panel/2015%20NC%20SLR%20Assessment-FINAL%20REPORT%20Jan%2028%202016.pdf>

North Carolina Department of Environment and Natural Resources. (2000) Cape Fear River Basinwide Water Quality Plan. https://files.nc.gov/ncdeq/Water%20Quality/Planning/BPU/BPU/Cape_Fear/Cape%20Fear%20Plans/2000%20Plan/CPF_2000.pdf

North Carolina Division of Coastal Management. (2010) Sea Level Rise. <http://www.conservation.nc.gov/web/cm/sea-level-rise>

North Carolina East Alliance. (2020) Demographic Information. <https://www.nceast.org/overview/demographics/#:~:text=Population%20%26%20Growth,1.48%20million%20in%20July%202029>

North Carolina Natural Heritage Program. Biodiversity and Wildlife Habitat Assessment. North Carolina Conservation Planning Tool Report http://portal.ncdenr.org/c/document_library/get_file?uuid=3ec15517-277f-4a2c-b646-2831c619c236&groupId=5118315

North Carolina Natural Heritage Program. Freshwater Tidal Wetlands. <https://www.ncnhp.org/media/62/open>

North Carolina Natural Heritage Program. Tidal Swamp (Cypress-Gum Subtype). <https://www.ncnhp.org/media/34/open>

North Carolina Office of State Budget and Management. (2017) Regional and County Population Change in North Carolina: A Summary of Trends from April 1, 2010 through July 1, 2016.
<https://files.nc.gov/ncosbm/demog/CountyEstimatesOverview2016.pdf>

North Carolina Office of State Budget and Management. (2021) County/State Population Projections.
<https://www.osbm.nc.gov/facts-figures/population-demographics/state-demographer/countystate-population-projections>

North Carolina Wildlife Resources Commission. (2017) Protected Wildlife Species of North Carolina.
https://www.ncwildlife.org/Portals/0/Conserving/documents/WildlifeDiversity/ETSC_UPDATE_040518_FINAL.pdf

North Carolina Wildlife Resources Commission. (2020). Tidal Swamp Forests and Wetlands.
https://www.ncwildlife.org/Portals/0/Conserving/documents/Coast/CP_Tidal_swamp_forest_and_wetlands.pdf?ver=Dq2Zsfl_yDxyjnAhQ6WSMg%3d%3d

Noss, Reed. (2016) Announcing the World's 36th Biodiversity Hotspot: The North American Coastal Plain. Critical Ecosystem Partnership Fund
<https://www.cepf.net/stories/announcing-worlds-36th-biodiversity-hotspot-north-american-coastal-plain>

Suriam, Jennifer. (2016) History of 'African Rice' and its Expansion to North and South America.
<https://blackheritagetours.wordpress.com/2016/05/15/history-of-african-rice-and-its-expansion-to-north-south-america/>

Talton, Trista. (2020) Heritage Center Would Boost Pride: Mayor. Coastal Review
<https://coastalreview.org/2020/01/heritage-center-would-boost-pride-mayor/>

Talton, Trista. (2020) Navassa History Misunderstood: Planner. Coastal Review
<https://coastalreview.org/2020/03/navassa-history-misunderstood-town-planner/>

The Nature Conservancy. (2018) North American Coastal Plain: World's 36th Biodiversity Hotspot.
<https://www.conservationgateway.org/ConservationPractices/FireLandscapes/LANDFIRE/Pages/BiodiversityHotSpot.aspx>

Tibbets, John. (2014) Carolina's Gold Coast: The Culture of Rice and Slavery. Coastal Heritage Magazine.
<https://www.scseagrant.org/carolinas-gold-coast-the-culture-of-rice-and-slavery/>

Trust for Public Land. (2009). The Economic Benefits of the Park and Recreation System of Mecklenburg County, North Carolina. https://www.tpl.org/sites/default/files/cloud.tpl.org/pubs/ccpe_MecklenburgNC_econben.pdf

US Environmental Protection Agency. (2018) Waterbody Report.
<https://mywaterway.epa.gov/waterbody-report/21NC01WQ/NC18-77/2018>

Wilson, Steven & Fischetti, Thomas. (2010) Coastline Population Trends in the United States: 1960 to 2008.
<https://www.census.gov/prod/2010pubs/p25-1139.pdf>

World Population Review. (2021). US County Populations 2021.
<https://worldpopulationreview.com/us-counties>

APPENDIX B

GEOSPATIAL DATA SOURCES

ANIMAL OPERATIONS PERMITS

North Carolina Department of Environmental Quality Open Data Portal
<https://data-ncdenr.opendata.arcgis.com/>

AUDUBON IMPORTANT BIRD AREAS

Audubon Society ArcGIS Portal
<https://gis.audubon.org/arcgisweb/rest/services>

BIODIVERSITY HOTSPOTS

Critical Ecosystem Partnership Fund
<https://www.arcgis.com/home/item.html?id=fb8ec2af7cfc40c7af89d9b7e922d4d8>

BIODIVERSITY & WILDLIFE HABITAT ASSESSMENT

North Carolina Natural Heritage Program Data Download
<https://ncnhde.natureserve.org/content/data-download>

BUILDING FOOTPRINTS

North Carolina Emergency Management Spatial Data Download Portal
<https://sdd.nc.gov/DataDownload.aspx>

CAPE FEAR WATERSHED

NC One Map GIS Portal
<https://www.nconemap.gov/>

COUNTY BOUNDARIES

United States Census
<https://www.census.gov/cgi-bin/geo/shapefiles/index.php>

DIGITAL ELEVATION MODEL

North Carolina Emergency Management Spatial Data Download Portal
<https://sdd.nc.gov/DataDownload.aspx>

EAST COAST GREENWAY

North Carolina Open Space and Conservation Lands Dataset
<https://www.ncnhp.org/activities/conservation/managed-areas>

FLOODPLAIN

North Carolina Emergency Management Spatial Data Download Portal
<https://sdd.nc.gov/DataDownload.aspx>

GULLAH GEECHEE CULTURAL HERITAGE CORRIDOR

ArcGIS Online - Created by Barry Robinson (Queens University)
maps.arcgis.com/home/item.html?id=a9ba7aa169204be7bcafb36ccd0f77c3

HIGHWAYS + ROADS

Connect NCDOT GIS Data Layer Download
<https://connect.ncdot.gov/resources/gis/Pages/GIS-Data-Layers.aspx>

LANDCOVER RASTER

GAP/LANDFIRE National Terrestrial Ecosystems 2011 Raster
https://www.usgs.gov/core-science-systems/science-analytics-and-synthesis/gap/science/land-cover-data-overview?qt-science_center_objects=0#qt-science_center_objects

LANDCOVER RASTER

National Landcover Dataset
<https://www.mrlc.gov/>

LIDAR

North Carolina Emergency Management Spatial Data Download Portal
<https://sdd.nc.gov/DataDownload.aspx>

NATURAL HERITAGE PROGRAM NATURAL AREAS

North Carolina Natural Heritage Program Data Download
<https://ncnhde.natureserve.org/content/data-download>

NORTH CAROLINA STATE BOUNDARY

United States Census
<https://www.census.gov/cgi-bin/geo/shapefiles/index.php>

ORTHO-IMAGERY

NC One Map GIS Portal
<https://www.nconemap.gov/>

PARCELS & OWNERSHIP

NC One Map GIS Portal
<https://www.nconemap.gov/>

PARKS

Carteret County GIS Portal
<https://gisdata-cc-gis.opendata.arcgis.com/>

SEA LEVEL RISE

NOAA Sea Level Rise Data Download
<https://coast.noaa.gov/slrdata/>

STREAMS + RIVERS

National Hydrography Dataset
<https://www.usgs.gov/core-science-systems/ngp/national-hydrography>

TOPOGRAPHY - 2' CONTOURS

NC One Map GIS Portal
<https://www.nconemap.gov/>

US BOUNDARY

United States Census
<https://www.census.gov/cgi-bin/geo/shapefiles/index.php>

WASTEWATER DISCHARGE PERMITS

North Carolina Department of Environmental Quality Open Data Portal
<https://data-ncdenr.opendata.arcgis.com/>

WETLANDS

North Carolina Wetlands Geodatabase - National Wetlands Inventory
<https://www.fws.gov/wetlands/data/data-download.html>

APPENDIX C EAGLES ISLAND REPORTS

Lawrence, Richard W. (1985) "Underwater Archaeological Sites in the Wilmington Historical District". Addendum. <https://archaeology.ncdcr.gov/media/6/download?attachment>

Description: In the summer of 1983, the Underwater Archaeology Unit of the North Carolina Division of Archives and History surveyed and documented 37 wrecked and abandoned vessels in the Cape Fear River adjacent to Wilmington, North Carolina, 34 of which were found along the shores of Eagles Island. This report contains brief descriptions and observations of each site, including location, condition, and specific historical information where identifiable. Vessels have been grouped into seven categories based on their type and function, including paddle wheel steamboats, tugboats, launches, skiffs, ferries, miscellaneous vessels, and barges; and inventory maps identify wreck sites, wharf remains, and abandoned structures.

Minford, Robert J. (2012) "For the Love of Profit: Examining Traditional Capitalism on Eagles Island, North Carolina". Master's Thesis, East Carolina University. <https://archaeology.ncdcr.gov/media/6/download?attachment>

Abstract: "As European colonists first arrived in the North American colonies, they brought with them the nascent principles of capitalism. Since then, the theories and practices regarding capitalism have changed, going through phases that are potentially manifested in the archaeological record. Eagles Island, North Carolina, has been home to a historically important maritime industrial complex that has experienced the changes of capitalism, beginning as an agricultural economy, then adapting to the region's growing maritime needs, and now presently as a service economy. Only by performing historical and archaeological explorations of Eagles Island can we fully understand the phases of capitalism and the motivations that brought upon the economic changes."

Markham, Kevin W., Scott Seibel, Matthew K. Smith, and Land Management Group (2011) "Eagles Island: A History of a Landscape". Environmental Services, Inc. https://soilwater.nhcgov.com/wp-content/uploads/2014/05/Eagles-Island-Report_July-2011.pdf

Description: As a landscape of dynamic change, Eagles Island is rich in both natural and cultural history and assets. This report is a compilation of known research documentation regarding Eagles Island's current and historical conditions, with an emphasis on how the landscape has been altered by human interventions over time. It addresses human occupation, environmental conditions and change, significant events and activities, and present conditions and management status at the time of investigation, and serves as a baseline 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." This report is the product of a collaboration between Land Management Group and Environmental Services, Inc., and was developed in support of the goals set forth by the Eagles Island Coalition.

Seeb, Sami K. (2013) "Cape Fear's Forgotten Fleet: The Eagles Island Ship Graveyard, Wilmington, North Carolina". In: Richards N., Seeb S. (eds) *The Archaeology of Watercraft Abandonment*. Springer, New York, NY. https://doi-org.prox.lib.ncsu.edu/10.1007/978-1-4614-7342-8_12

Abstract: "Settlers established Wilmington, North Carolina, on the east bank of the Cape Fear River in 1731. The town grew rapidly as a result of the lucrative naval stores industry supported by the abundant pine forests of the surrounding area. From the early nineteenth century through the turn of the twentieth century, Wilmington grew to be the most populous city in North Carolina and the only significant port. Wilmington continued to grow and decline with changing local and global economic and cultural conditions, but its maritime industry always remained at the forefront of the development of the port city. Eagles Island sits directly across from downtown Wilmington and for decades was the location of several industrious commercial maritime operations. The active maritime commerce no longer exists in that location on Eagles Island, but the abandoned vessels adjacent to Eagles Island are a reminder of the vibrant industrial past. This chapter demonstrates how the wrecked and discarded abandoned watercraft that form the Eagles Island Ship Graveyard represent a microcosm of the cultural, economic, and technological characteristics and changes of Wilmington and Southeastern North Carolina. Correlating data from archaeological fieldwork to the comprehensive historical record of the area provides the means for analysis. Interpretation of the archaeological remains is based on the theoretical framework of behavioral archaeology. Accordingly, site formation processes reflect behaviors motivated by conditions of the cultural climate."

APPENDIX D EAGLES ISLAND PRESENTATIONS

Kapetsky, James McDaid. I. "Erosion of Aquatic Habitat in the Cape Fear Estuary: What's Known, What's New and What's Next?" Cape Fear River Partnership 1st Quarter Meeting. Fayetteville, NC, Feb. 2020. <https://capefearriverpartnership.com/wp-content/uploads/2020/03/Lower-CFR-Estuarine-Erosion-Trends-2-24-20.pdf>

II. "Erosion of Aquatic Habitat in the LCF Estuary: Are There Important Consequences for Fisheries Productivity?" Cape Fear River Partnership Habitat Meeting. Raleigh, NC, Nov. 2018. <https://capefearriverpartnership.com/wp-content/uploads/2018/11/Erosion-of-Aquatic-Habitat-in-the-LCFR-Kapetsky.pdf>

III. "Measures of Erosion of Fish Habitat in the Former Tidewater Rice Fields of the Lower Cape Fear Estuary, North Carolina, Using LiDAR". Coastal GeoTools 2019. Myrtle Beach, SC, Feb. 2019. <https://coastalgeotools.org/wp-content/uploads/Kapetsky-1.pdf>

IV. Remnants of Tidewater Rice Farming as Important and Unique Fish and Shellfish Habitat in the Lower Cape Fear". Cape Fear River Partnership 4th Annual Meeting. Fayetteville, NC, May 2017. <https://capefearriverpartnership.com/wp-content/uploads/2018/03/CFP-rev.pdf>

V. "Updating the Remains of the Wilmington and Manchester Railroad near Wilmington NC using Historical Nautical Charts, High Resolution Aerial Photos, and GIS". Prepared for the Eagles Island Coalition, Nov. 2015.

VI. "Using NOAA Historical Charts, Maps, Aerial Photography, Digital Coast and Other Satellite Imagery to Establish the Status and Threats to Remnant Tidewater Rice Fields and Canal Systems Along the Lower Cape Fear River, NC". Coastal GeoTools 2015. Charleston, SC, March 2015.

Shew, Roger. "Eagles Island Update: A Little History, A Few Issues, Island Treasures and Possibilities." Cape Fear River Watch First Saturday Seminar, Feb. 2021. <https://www.youtube.com/watch?v=X2iOzNsOtv8>

APPENDIX E LOCAL & REGIONAL PLANS

Cape Fear Arch Conservation Collaboration: Conservation Plan
www.capefeararch.org/resources

Cape Fear Council of Governments: Cape Fear Regional Bicycle Plan
<https://capefearcog.org/regionalbikeplan/>

Cape Fear River Partnership: Cape Fear River Basin Action Plan for Migratory Fish
www.capefearriverpartnership.com/wp-content/uploads/2017/03/FINAL_CapeFearRiverActionPlanforMigratoryFish_13Feb13.pdf

City of Wilmington: Comprehensive Plan
<https://www.wilmingtonnc.gov/departments/planning-development-and-transportation/comprehensive-plan>

City of Wilmington: Walk Wilmington: A Comprehensive Pedestrian Plan
https://www.wmpo.org/wp-content/uploads/2016/06/2009-08_WalkWilmington_PlanFINAL.pdf

Eagles Island Coalition: Eagles Island Conservation Management Plan - 2015-2025
<https://eaglesisland.org/wp-content/uploads/2021/09/eagles-island-conservation-mgt-plan-1.pdf>

New Hanover County: Unified Development Ordinance
https://laserfiche.nhcgov.com/weblink/0/edoc/4828381/Unified%20Development%20Ordinance_Updated_05-03-2021.pdf

NOAA/ USFWS/ NCDEQ: Restoration Plan and Environmental Assessment for the Kerr-McGee Chemical Corp. Site, Navassa, NC
pub-data.diver.orr.noaa.gov/admin-record/6102/Kerr-McGee_Final_RP-EA_04-02-20.pdf

Town of Belville: Vision 2030 Plan
www.townofbelville.com/vision2030/

Town of Leland: Leland 2045 Plan
www.townofleland.com/planning-inspections/planning-zoning/leland-2045-planning-generations

Town of Leland & NCDOT: Pedestrian Plan
<https://connect.ncdot.gov/municipalities/PlanningGrants/Documents/Leland%20Ped%20Plan.pdf>

Town of Navassa: Future Land Use Plan 2011-2030
www.townofnavassa.org/assets/Navassa_-_Future_land_Use_Plan_-_DRAFT_6-13-12.pdf

Wilmington/ New Hanover County: Comprehensive Greenway Plan
https://www.wmpo.org/wp-content/uploads/2016/05/2013_wilmingtongreenwayplan_mainchapters_optimized.pdf

Wilmington Urban Area Metropolitan Planning Organization: Cape Fear Moving Forward 2045
www.wmpo.org/mtp

APPENDIX F WEB RESOURCES

Audubon North Carolina
www.nc.audubon.org

Battleship North Carolina
www.battleshipnc.com

Brunswick County NAACP
www.brunswicknaacp.org

Cape Fear Council of Governments
<https://capefearcog.org/>

Cape Fear Museum
www.capefearmuseum.com

Cape Fear Resource Conservation and Development
www.capefearrcd.org

Cape Fear River Watch
www.capefearriverwatch.org

East Coast Greenway
www.greenway.org

Gullah Geechee Cultural Heritage Corridor Commission
www.gullahgeecheecorridor.org

Lower Cape Fear Stewardship Development Coalition
<http://www.stewardshipdev.org/about-us>

National Park Service
www.nps.gov

North Carolina Natural Heritage Program
www.ncnhp.org

APPENDIX G

IMAGE CREDIT: EXAMPLES AND INSPIRATION

PATHS & ACCESS (PAGES 36-37)

Surface Treatment: Natural Surface

Upper: Scarborough Marsh Trail at the Scarborough Marsh Audubon Center. Scarborough, ME

Accessed from: <http://www.mainebirdingtrail.com/Sites/ScarboroughMarsh.html>

Lower: West Ashley Greenway. Charleston, SC

Accessed from: <https://www.sctrails.net/trails/trail/west-ashley-greenway>

Surface Treatment: Asphalt

Anacostia River Trail. Washington, D.C.

Accessed from: www.eastcoastgreenway.com

Surface Treatment: Boardwalk

Jack A. Markell Trail. Wilmington, DE

Accessed from: <https://delawaregreenways.org/trail/jack-a-markell-trail/>

Surface Treatment: Concrete

Upper: Buffalo Bayou Greenways. Houston, TX

Accessed from: <https://houstonparksboard.org/about/bayou-greenways-2020>

Lower: Buffalo Bayou Greenways. Houston, TX

Accessed from: <https://houstonparksboard.org/trips/take-a-family-ride-along-white-oak-bayou>

Wildlife Viewing Platform

Tipperne Bird Sanctuary. Norre Nebel, Denmark. Designer: Johansen Skovsted Arkitekter

Accessed from: <https://www.archdaily.com/883075/tipperne-bird-sanctuary-johansen-skovsted-arkitekter>

Boardwalk & Seating Amenities

Upper: Crosby Arboretum. Picayune, MS

Accessed from: <https://jcra.ncsu.edu/resources/photographs/details.php?serial=6744>

Lower: Brooklyn Navy Yard. Brooklyn, NY

Accessed from: <https://turnstiletoours.com/janes-walk-around-the-brooklyn-navy-yard-may-4/>

Low Impact Parking

Right: Brian C. Nevin Welcome Center. Ithaca, NY. Designer: Halvorson Design Partnership Inc.,

Accessed from: <https://www.landscapeperformance.org/case-study-briefs/nevin-welcome-center>

Left: UNC Botanical Garden Education Center. Chapel Hill, NC. Designer: Swanson and Associates, P.A.

Accessed from: <https://www.landscapeperformance.org/case-study-briefs/north-carolina-botanical-garden>

PATHS & ACCESS (PAGES 42-43)

Pedestrian Bridge: Iconic

Yanweizhou Park. Jinhua City, China. Designer: Turenscape

All images accessed from: <https://www.turenscape.com/en/project/detail/4629.html>

Pedestrian Bridge: Adaptive Reuse

Walnut Street Bridge. Chattanooga, TN

All images accessed from: <https://www.visitchattanooga.com/listing/walnut-street-pedestrian-bridge/2485/>

Pedestrian Bridge: Greenway Crossing

American Tobacco Trail. Durham, NC. Designer: WSP USA

All images accessed from: <https://www.wsp.com/en-US/projects/american-tobacco-trail-bridge>

Pedestrian Access: Traffic Calming / Complete Streets

Left: Portland, OR Complete Streets

Accessed from: <https://www.sightline.org/2018/08/09/portland-street-design-complete-streets-greenways/>

Upper Right: East Boulevard Road Diet. Charlotte, NC

Accessed from: <https://www.completestreetsnc.org/project-examples/ex-eastblvdroaddiet/>

Lower Right: Comox-Helmken Bikeway. Vancouver, Canada

Accessed from Paul Krueger: <https://www.flickr.com/photos/pwkrueger/9102830589/in/album-72157634252488325/>

PARK FACILITIES (PAGES 50-53)

Marine Education Center at Gulf Coast Research Lab

All photos accessed from: <https://www.lakeflato.com/eco-conservation/marine-education-center>

Walnut Creek Wetlands Center

All photos accessed from: <https://www.frankharmon.com/walnutcreek/>

Gulf State Park Interpretive Center

Upper Left: <https://architectureworks.com/project/interpretive-center/?awref=39>

Lower Left: <https://www.sasaki.com/projects/gulf-state-park-master-plan/>

Right: <https://www.sasaki.com/projects/gulf-state-park-master-plan/>

Tillamook Forest Interpretive Center

Left: <https://millerhull.com/project/tillamook-forest-interpretive-center/>

Upper Right: <https://millerhull.com/project/tillamook-forest-interpretive-center/>

Lower Right: <https://aldrichpears.com/project/tillamook-forest-center/>

Westwood Hills Nature Center

All images accessed from: <https://hga.com/projects/westwood-hills-nature-center/>

Shangri-La Nature Center

All images accessed from: <https://www.lakeflato.com/eco-conservation/shangri-la-nature-center>

Potomac Science Center

Upper Left: <https://potomacsciencecenter.gmu.edu/potomac-science-center-gallery/>

Lower Left: <https://potomacsciencecenter.gmu.edu/potomac-science-center-gallery/>

Right: <https://cos.gmu.edu/perec/public-outreach/#.YUCzXJ1KhPY>

Black Rock Sanctuary

Left: <https://www.chesco.org/4624/Black-Rock-Sanctuary>

Upper Right: <https://schuyllriver.org/map/places-to-visit/black-rock-sanctuary/>

Lower Right: <https://www.landscapeperformance.org/case-study-briefs/black-rock-sanctuary>

ECONOMIC IMPACTS OF PARKS (PAGE 57)

Case Study: Timucuan Ecological and Historic Preserve

All images accessed from: <https://www.nps.gov/timu/index.htm>

APPENDIX H COMPLETE eBIRD SPECIES SIGHTINGS

COMMON NAME	SCIENTIFIC NAME	NC STATUS	US STATUS	SPOIL POND HOTSPOT OBSERVATIONS	BATTLESHIP HOTSPOT OBSERVATIONS	TOTAL eBIRD OBSERVATIONS
COOPER'S HAWK	<i>Accipiter cooperii</i>			7	18	25
SHARP-SHINNED HAWK	<i>Accipiter striatus</i>			5	6	11
SPOTTED SANDPIPER	<i>Actitis macularius</i>			1	6	7
RED-WINGED BLACKBIRD	<i>Agelaius phoeniceus</i>			9	151	160
WOOD DUCK	<i>Aix sponsa</i>				1	1
SALTMARSH SPARROW	<i>Ammospiza caudacuta</i>				1	1
GREEN-WINGED TEAL	<i>Anas crecca</i>			5	2	7
MOTTLED DUCK	<i>Anas fulvigula</i>			1		1
MALLARD	<i>Anas platyrhynchos</i>			8	12	20
AMERICAN BLACK DUCK	<i>Anas rubripes</i>			3		3
ANHINGA	<i>Anhinga anhinga</i>			1	9	10
SNOW GOOSE	<i>Anser caerulescens</i>				1	1
AMERICAN PIPIT	<i>Anthus rubescens</i>			1	2	3
RUBY-THROATED HUMMINGBIRD	<i>Archilochus colubris</i>				3	3
GREAT EGRET	<i>Ardea alba</i>			10	68	78
GREAT BLUE HERON	<i>Ardea herodias</i>			10	49	59
LESSER SCAUP	<i>Aythya affinis</i>			8		8
REDHEAD	<i>Aythya americana</i>			6		6
RING-NECKED DUCK	<i>Aythya collaris</i>			4	1	5
CANVASBACK	<i>Aythya valisineria</i>			1		1
TUFTED TITMOUSE	<i>Baeolophus bicolor</i>			9	26	35
CEDAR WAXWING	<i>Bombycilla cedrorum</i>			1	11	12
AMERICAN BITTERN	<i>Botaurus lentiginosus</i>			2	1	3
CANADA GOOSE	<i>Branta canadensis</i>			1	99	100
CATTLE EGRET	<i>Bubulcus ibis</i>			6	6	12
BUFFLEHEAD	<i>Bucephala albeola</i>			6	3	9
RED-TAILED HAWK	<i>Buteo jamaicensis</i>			9	58	67
RED-SHOULDERED HAWK	<i>Buteo lineatus</i>			3	12	15
BROAD-WINGED HAWK	<i>Buteo platypterus</i>				3	3
GREEN HERON	<i>Butorides virescens</i>				14	14
SANDERLING	<i>Calidris alba</i>			1		1
DUNLIN	<i>Calidris alpina</i>			5		5
BAIRD'S SANDPIPER	<i>Calidris bairdii</i>			3		3
CURLEW SANDPIPER	<i>Calidris ferruginea</i>			4		4
WHITE-RUMPED SANDPIPER	<i>Calidris fuscicollis</i>			4		4
STILT SANDPIPER	<i>Calidris himantopus</i>			7		7
WESTERN SANDPIPER	<i>Calidris mauri</i>			7		7
PECTORAL SANDPIPER	<i>Calidris melanotos</i>			1		1
LEAST SANDPIPER	<i>Calidris minutilla</i>			5	4	9
RUFF	<i>Calidris pugnax</i>			5		5
SEMIPALMATED SANDPIPER	<i>Calidris pusilla</i>			1		1
NORTHERN CARDINAL	<i>Cardinalis cardinalis</i>			6	75	81
TURKEY VULTURE	<i>Cathartes aura</i>			8	57	65
HERMIT THRUSH	<i>Catharus guttatus</i>				2	2
CHIMNEY SWIFT	<i>Chaetura pelagica</i>				32	32
SEMIPALMATED PLOVER	<i>Charadrius semipalmatus</i>			2	8	10
KILLDEER	<i>Charadrius vociferus</i>			7	98	105

COMMON NAME	SCIENTIFIC NAME	NC STATUS	US STATUS	SPOIL POND HOTSPOT OBSERVATIONS	BATTLESHIP HOTSPOT OBSERVATIONS	TOTAL eBIRD OBSERVATIONS
COMMON NIGHTHAWK	<i>Chordeiles minor</i>				2	2
BONAPARTE'S GULL	<i>Chroicocephalus philadelphia</i>			1		1
NORTHERN HARRIER	<i>Circus hudsonius</i>			10	3	13
MARSH WREN	<i>Cistothorus palustris</i>			6	63	69
SEDGE WREN	<i>Cistothorus stellaris</i>			3	14	17
NORTHERN FLICKER	<i>Colaptes auratus</i>			8	60	68
ROCK PIGEON	<i>Columba livia</i>			1	88	89
EASTERN WOOD-PEWEE	<i>Contopus virens</i>				1	1
BLACK VULTURE	<i>Coragyps atratus</i>				3	3
RUBY-CROWNED KINGLET	<i>Corthylio calendula</i>			9	24	33
AMERICAN CROW	<i>Corvus brachyrhynchos</i>			8	62	70
FISH CROW	<i>Corvus ossifragus</i>			3	52	55
YELLOW RAIL	<i>Coturnicops noveboracensis</i>			1		1
BLUE JAY	<i>Cyanocitta cristata</i>			9	60	69
TUNDRA SWAN	<i>Cygnus columbianus</i>			1		1
FULVOUS WHISTLING-DUCK	<i>Dendrocygna bicolor</i>			2		2
DOWNY WOODPECKER	<i>Dryobates pubescens</i>			7	24	31
PILEATED WOODPECKER	<i>Dryocopus pileatus</i>			4	6	10
GRAY CATBIRD	<i>Dumetella carolinensis</i>			8	12	20
LITTLE BLUE HERON	<i>Egretta caerulea</i>	SPECIAL CONCERN		9	14	23
SNOWY EGRET	<i>Egretta thula</i>	SPECIAL CONCERN		5	21	26
TRICOLORED HERON	<i>Egretta tricolor</i>				1	1
WHITE IBIS	<i>Eudocimus albus</i>			7	22	29
RUSTY BLACKBIRD	<i>Euphagus carolinus</i>			6	65	71
MERLIN	<i>Falco columbarius</i>			1	2	3
PEREGRINE FALCON	<i>Falco peregrinus</i>				1	1
AMERICAN KESTREL	<i>Falco sparverius</i>			7	18	25
AMERICAN COOT	<i>Fulica americana</i>			10	1	11
WILSON'S SNIPE	<i>Gallinago delicata</i>			3	15	18
COMMON GALLINULE	<i>Gallinula galeata</i>			4		4
COMMON LOON	<i>Gavia immer</i>				1	1
MOURNING WARBLER	<i>Geothlypis philadelphia</i>			1		1
COMMON YELLOWTHROAT	<i>Geothlypis trichas</i>			3	22	25
AMERICAN OYSTERCATCHER	<i>Haematopus palliatus</i>	SPECIAL CONCERN		1	1	2
HOUSE FINCH	<i>Haemorhous mexicanus</i>			2	73	75
PURPLE FINCH	<i>Haemorhous purpureus</i>				6	6
BALD EAGLE	<i>Haliaeetus leucocephalus</i>	THREATENED		4	19	23
BLACK-NECKED STILT	<i>Himantopus mexicanus</i>			6	1	7
BARN SWALLOW	<i>Hirundo rustica</i>			1	44	45
CASPIAN TERN	<i>Hydroprogne caspia</i>	THREATENED			1	1
INDIGO BUNTING	<i>Icteria virens</i>			1	9	10
YELLOW-BREASTED CHAT	<i>Icteria virens</i>			1		1
ORCHARD ORIOLE	<i>Icterus spurius</i>				5	5
LEAST BITTERN	<i>Ixobrychus exilis</i>	SPECIAL CONCERN		1	1	2
DARK-EYED JUNCO	<i>Junco hyemalis</i>			3	18	21
LOGGERHEAD SHRIKE	<i>Lanius ludovicianus</i>	SPECIAL CONCERN		1	1	2
HERRING GULL	<i>Larus argentatus</i>			8	28	36

COMMON NAME	SCIENTIFIC NAME	NC STATUS	US STATUS	SPOIL POND HOTSPOT OBSERVATIONS	BATTLESHIP HOTSPOT OBSERVATIONS	TOTAL eBIRD OBSERVATIONS
RING-BILLED GULL	<i>Larus delawarensis</i>			9	85	94
GREAT BLACK-BACKED GULL	<i>Larus marinus</i>				10	10
ORANGE-CROWNED WARBLER	<i>Leiothlypis celata</i>			6	8	14
LAUGHING GULL	<i>Leucophaeus atricilla</i>			3	84	87
SHORT-BILLED DOWITCHER	<i>Limnodromus griseus</i>			1		1
LONG-BILLED DOWITCHER	<i>Limnodromus scolopaceus</i>			11		11
HOODED MERGANSER	<i>Lophodytes cucullatus</i>			6	3	9
AMERICAN WIGEON	<i>Mareca americana</i>			1	1	2
GADWALL	<i>Mareca strepera</i>			8	1	9
BELTED KINGFISHER	<i>Megaceryle alcyon</i>			4	49	53
RED-BELLIED WOODPECKER	<i>Melanerpes carolinus</i>			9	69	78
RED-HEADED WOODPECKER	<i>Melanerpes erythrocephalus</i>				45	45
SWAMP SPARROW	<i>Melospiza georgiana</i>			8	54	62
LINCOLN'S SPARROW	<i>Melospiza lincolnii</i>				1	1
SONG SPARROW	<i>Melospiza melodia</i>			10	51	61
NORTHERN MOCKINGBIRD	<i>Mimus polyglottos</i>			11	99	110
BLACK-AND-WHITE WARBLER	<i>Mniotilta varia</i>			1	4	5
BROWN-HEADED COWBIRD	<i>Molothrus ater</i>				15	15
WOOD STORK	<i>Mycteria americana</i>	THREATENED	THREATENED	1		1
GREAT CRESTED FLYCATCHER	<i>Myiarchus crinitus</i>				11	11
DOUBLE-CRESTED CORMORANT	<i>Nannopterum auritum</i>			8	91	99
YELLOW-CROWNED NIGHT-HERON	<i>Nyctanassa violacea</i>				1	1
BLACK-CROWNED NIGHT-HERON	<i>Nycticorax nycticorax</i>				5	5
RUDDY DUCK	<i>Oxyura jamaicensis</i>			11	1	12
OSPREY	<i>Pandion haliaetus</i>			5	39	44
HOUSE SPARROW	<i>Passer domesticus</i>				28	28
SAVANNAH SPARROW	<i>Passerculus sandwichensis</i>			9	11	20
FOX SPARROW	<i>Passerella iliaca</i>			4	2	6
BUE GROSBEAK	<i>Passerina caerulea</i>				8	8
PAINTED BUNTING	<i>Passerina ciris</i>	SPECIAL CONCERN		1	1	2
AMERICAN WHITE PELICAN	<i>Pelecanus erythrorhynchos</i>				1	1
BROWN PELICAN	<i>Pelecanus occidentalis</i>			4	13	17
CAVE SWALLOW	<i>Petrochelidon fulva</i>			2		2
RED PHALAROPE	<i>Phalaropus fulicarius</i>			1		1
RED-NECKED PHALAROPE	<i>Phalaropus lobatus</i>			5		5
WILSON'S PHALAROPE	<i>Phalaropus tricolor</i>			5		5
EASTERN TOWHEE	<i>Pipilo erythrophthalmus</i>			4	3	7
ROSEATE SPOONBILL	<i>Platalea ajaja</i>			3		3
PIED-BILLED GREBE	<i>Podilymbus podiceps</i>			5	2	7
CAROLINA CHICKADEE	<i>Poecile carolinensis</i>			9	46	55
BLUE-GRAY GNATCATCHER	<i>Polioptila caerulea</i>			6	10	16
VESPER SPARROW	<i>Poocetes gramineus</i>	SPECIAL CONCERN		2		2
PURPLE GALLINULE	<i>Porphyrio martinica</i>			1		1
SORA	<i>Porzana carolina</i>			4	50	54
PURPLE MARTIN	<i>Progne subis</i>				17	17
PROTHONOTARY WARBLER	<i>Protonotaria citrea</i>				2	2
BOAT-TAILED GRACKLE	<i>Quiscalus major</i>			4	107	111
COMMON GRACKLE	<i>Quiscalus quiscula</i>				74	74

COMMON NAME	SCIENTIFIC NAME	NC STATUS	US STATUS	SPOIL POND HOTSPOT OBSERVATIONS	BATTLESHIP HOTSPOT OBSERVATIONS	TOTAL eBIRD OBSERVATIONS
CLAPPER RAIL	<i>Rallus crepitans</i>			4	58	62
KING RAIL	<i>Rallus elegans</i>				51	51
VIRGINIA RAIL	<i>Rallus limicola</i>			4	47	51
AMERICAN AVOCET	<i>Recurvirostra americana</i>			5		5
GOLDEN-CROWNED KINGLET	<i>Regulus satrapa</i>			1	1	2
EASTERN PHOEBE	<i>Sayornis phoebe</i>			8	16	24
NORTHERN PARULA	<i>Setophaga americana</i>				1	1
YELLOW-RUMPED WARBLER	<i>Setophaga coronata</i>			10	104	114
PRAIRIE WARBLER	<i>Setophaga discolor</i>			3		3
YELLOW-THROATED WARBLER	<i>Setophaga dominica</i>				1	1
PALM WARBLER	<i>Setophaga palmarum</i>			7	19	26
YELLOW WARBLER	<i>Setophaga petechia</i>				1	1
PINE WARBLER	<i>Setophaga pinus</i>			1	2	3
AMERICAN REDSTART	<i>Setophaga ruticilla</i>				1	1
CAPE MAY WARBLER	<i>Setophaga tigrina</i>				1	1
EASTERN BLUEBIRD	<i>Sialia sialis</i>			9	65	74
WHITE-BREASTED NUTHATCH	<i>Sitta carolinensis</i>				1	1
BROWN-HEADED NUTHATCH	<i>Sitta pusilla</i>				10	10
NORTHERN SHOVELER	<i>Spatula clypeata</i>			8		8
BLUE-WINGED TEAL	<i>Spatula discors</i>			1		1
YELLOW-BELLIED SAPSUCKER	<i>Sphyrapicus varius</i>			8	13	21
AMERICAN GOLDFINCH	<i>Spinus tristis</i>			1	7	8
CHIPPING SPARROW	<i>Spizella passerina</i>				4	4
FIELD SPARROW	<i>Spizella pusilla</i>			3		3
N. ROUGH-WINGED SWALLOW	<i>Stelgidopteryx serripennis</i>				29	29
FORSTER'S TERN	<i>Sterna forsteri</i>			6	2	8
LEAST TERN	<i>Sternula antillarum</i>			1	1	2
EURASIAN COLLARED-DOVE	<i>Streptopelia decaocto</i>				27	27
EASTERN MEADOWLARK	<i>Sturnella magna</i>			5	3	8
EUROPEAN STARLING	<i>Sturnus vulgaris</i>			1	110	111
TREE SWALLOW	<i>Tachycineta bicolor</i>				10	10
ROYAL TERN	<i>Thalasseus maximus</i>				9	9
SANDWICH TERN	<i>Thalasseus sandvicensis</i>			1	1	2
CAROLINA WREN	<i>Thryothorus ludovicianus</i>			9	52	61
BROWN THRASHER	<i>Toxostoma rufum</i>			4	12	16
LESSER YELLOWLEGS	<i>Tringa flavipes</i>			8	1	9
GREATER YELLOWLEGS	<i>Tringa melanoleuca</i>			8	1	9
WILLET	<i>Tringa semipalmata</i>				2	2
HOUSE WREN	<i>Troglodytes aedon</i>			8	14	22
WINTER WREN	<i>Troglodytes hiemalis</i>			1		1
AMERICAN ROBIN	<i>Turdus migratorius</i>			7	44	51
EASTERN KINGBIRD	<i>Tyrannus tyrannus</i>			2	3	5
WHITE-EYED VIREO	<i>Vireo griseus</i>				1	1
BLUE-HEADED VIREO	<i>Vireo solitarius</i>			1		1
WHITE-WINGED DOVE	<i>Zenaida asiatica</i>				3	3
MOURNING DOVE	<i>Zenaida macroura</i>			7	154	161
WHITE-THROATED SPARROW	<i>Zonotrichia albicollis</i>			6	25	31