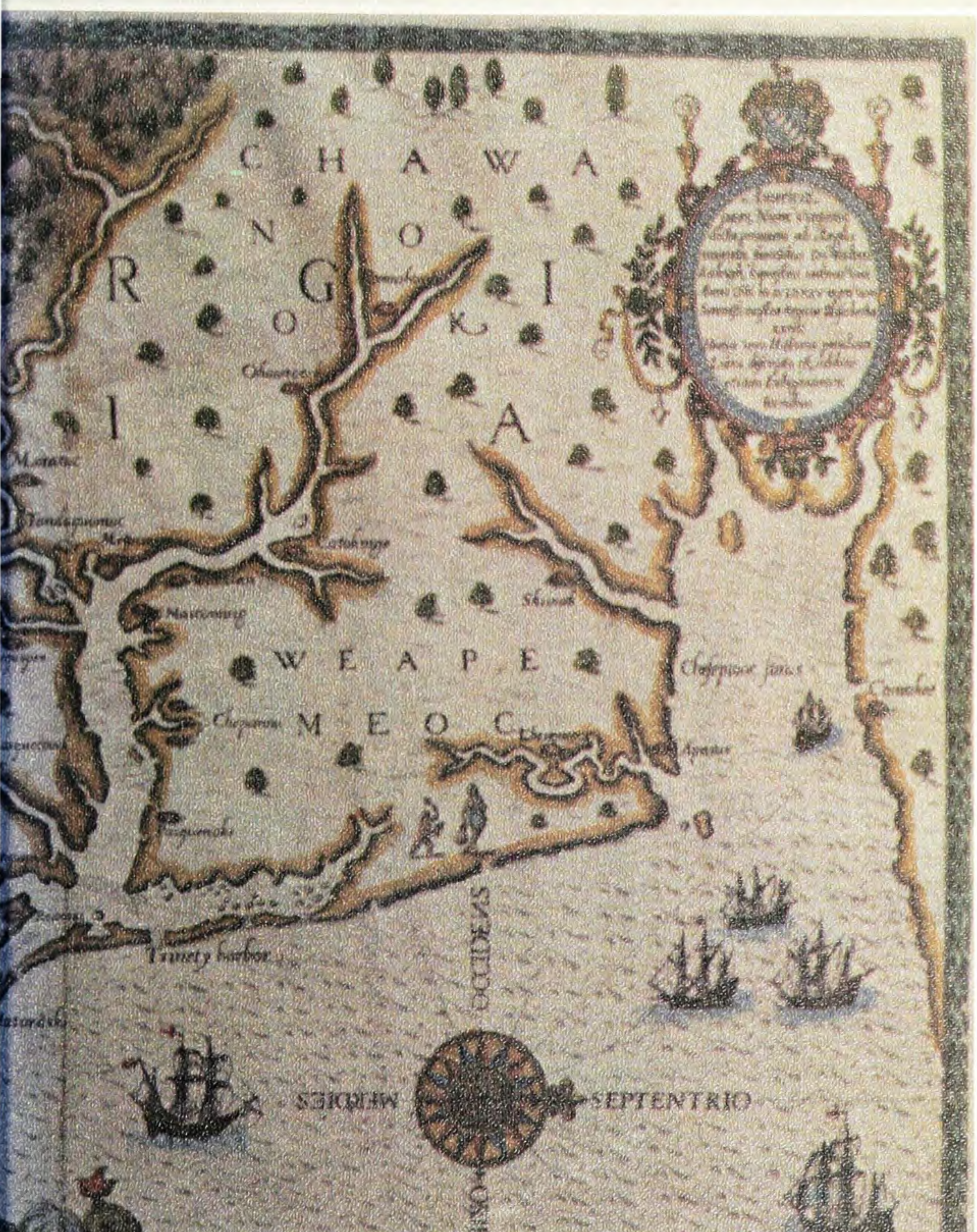
To Great and Useful Purpose



A History of the Wilmington District
U.S. Army Corps of Engineers

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The map on the opposite page and on the cover is from a drawing by John White.

In 1590 Theodore de Bry published Thomas Harriot's commentary and John White's drawings as the first volume of his Grands Voyages.

This published map was engraved by de Bry from the manuscript drawings done by John White, 1585 to 1587. The map title is Americae Pars, Nunc Virginia.

This map remains the major source of late 16th century information concerning the Virginia-North Carolina coastal area including the "Lost Colony" site. When the map was released to the public, John White was on his way back to the New World. He did not learn that his colony was lost until he arrived.

Map photo by Jim Melchor

America
pars, Nunc Virginia
CHAWANOOK
VIRGINIA
SECOTAN
WEAPEMEOC
Mongoack
Moratuc
Tandaquomuc
Catokinge
Mascoming
Skicoak
Chesepiooc sinus
Chepanuu
Pasquenoke
Apasus
Secota
Cotan
Aquascogoc
Pomeiooc
Wokokon
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TO GREAT AND USEFUL PURPOSE

A History of the Wilmington District
U.S. Army Corps of Engineers

Ronald B. Hartzer
of
David A. Clary and Associates

ACKNOWLEDGEMENTS

Design, layout and graphics: Susan Page, assisted by Virginia Herman
and Alverta Sandy

Photographs: Bud Davis
Editorial assistance: Barbara Johnson
Irma Brown

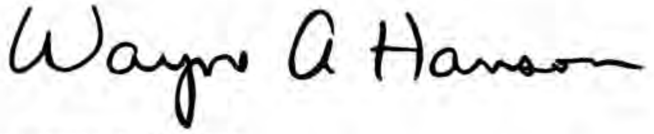
This history is dedicated to the men and women of the Wilmington District. Without their loyal service to the Corps of Engineers, there would be no history.

Foreword

The history of the Wilmington District is a record of engineering efforts to develop water resources in North Carolina and a portion of south central Virginia. Although the district was not established until 1884, the Corps of Engineers has worked to improve navigation in this area's coastal regions and rivers for more than 160 years. In recent years, our role has grown to encompass river basin development as we built and managed dams and reservoirs. Our history traces the growing responsiveness of the Corps to ecological and environmental concerns. It emphasizes the District's increased responsibilities for protection of estuarine regions; regulation of wetlands through the permit process; and beach erosion control and hurricane flood protection. Intermittently, military construction assignments have been added to the civil works mission.

Our study of the past shows the interdependence of all levels of government. Without cooperation of federal, state and local agencies, Corps of Engineers' projects could neither begin nor continue to completion.

This history of the District ends with the year 1982 and covers more than a century of service to the people of the area. The legacy of this past is the foundation on which Wilmington District will build in the future.



Wayne A. Hanson
Colonel, Corps of Engineers
District Engineer
May 1984

Introduction

The inland navigations of the Rivers of these three States [Georgia, South Carolina, and North Carolina], may be improved (according to ideas I have formed of the matter) to a very extensive degree—to great & useful purpose and at a very moderate expense compared with the vast utility of the measure; inasmuch as the falls in all of them are trifling and their lengths great.

—George Washington

The history of the Wilmington District, United States Army Corps of Engineers, is the story of people using the resources of the federal government to help Virginia and North and South Carolina residents overcome geographic disadvantages and develop their states' economies. The District's work has been defined by the states' physiography and the people's desire to make the best of what nature gave them. The Corps of Engineers has responded with perseverence and ingenuity in performing a wide variety of activities, including fortification work, construction of military bases, dredging, opening waterways, designing waterborne equipment, digging canals, protecting and restoring beaches, building locks and dams, and controlling floods and providing recreational facilities by building reservoirs.

The Wilmington District is one of the smaller of the 36 civil works districts in the United States, and its projects have generally been on a smaller scale than work performed in other districts. But that does not lessen the Corps' relative importance to the people in the Wilmington District. Virginia's and North and South Carolina's economies have been strengthened by the work of the Wilmington District.

The contributions of the Wilmington District have been largely ignored by historians writing on North Carolina's past. Hugh Lefler and Albert Newsome, authors of the standard text of North Carolina history, *North Carolina: A History of a Southern State*, do not mention the Army Corps of Engineers. They describe the role in war of Forts Johnston, Caswell, and Macon, the growth of the state's ports, and the development of North Carolina's economy, but do not depict the role of the Corps of Engineers in the state's history. Even Malcolm Ross's *The Cape Fear* refers to the Corps of Engineers only in reference to flood control projects on the upper part of the river. The Wilmington District has played an important part in the history of North Carolina and adjoining states, and this book is an account of that contribution.

I have been assisted in my research and writing by many people. The personnel of the Wilmington District made research among office records a pleasant task. I owe special thanks to LaVerne Edens for helping me find my way through the Records Holding Area, and to Virginia Herman for her enthusiasm and interest in the project and her ability to answer many questions by tracking down the right person to ask. She, James Boyle and many others carefully reviewed the manuscript and offered many suggestions to improve the narrative. Among those who reviewed the entire manuscript were District Historical Committee members E. G. Long, Ed Shuford and Bernard Ingram; retirees Maurice Wester and Bill Sanderson; and former Deputy District Engineer Lt. Col. Art Kopcsak.

A special acknowledgement also goes to Lt. Col. Kopcsak for working tirelessly to get the history project moving and for his strong support throughout all phases of preparation of the history.

The most enjoyable part of the research was interviewing past and present District employees. Most of those people have dedicated their adult lives to the Wilmington District. I spent many instructive hours talking with them.

The archival research was greatly enhanced by advice from John Greenwood's Historical Division at the Office of the Chief of Engineers, Washington, D.C. I appreciate the efforts of Robert Matchette of the National Archives, who

meticulously retrieved individual documents and expedited the research. At the Atlanta Federal Archives and Records Center, Gayle Peters and Charles Reeves were most helpful. The librarians of the Government Documents Department of the Indiana University Library will be greatly relieved to learn that I have finished this project. They assisted me by tracking down government publications kept in places only they know of.

I am deeply grateful to David A. Clary, Principal, David A. Clary and Associates, for the opportunity to research and write this book, for his editorial review, and for his confidence in my ability to carry out the project.

Finally, a special thanks to my son, Richie, for understanding why Dad could not always play a game with him.

Bloomington, Indiana
March 1983

Ronald B. Hartzer

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CHAPTER I

The Playground of Billows and Tempests

The physical formation of a country is the key to the history of its early settlement.

—George Macaulay Trevelyan

Few other districts of the Corps of Engineers, perhaps, have been so thoroughly enmeshed in the economic history of one state as the Wilmington District has been with that of North Carolina. That appears to be a strange accident, for district boundaries are established mostly according to the lay of the land, while political boundaries reflect mostly other considerations. And in fact, nearly one-fifth of the present Wilmington District lies in south central Virginia. But allowing for that, does this near conjunction of district and state suggest that here political boundary-making followed the lay of the land, that North Carolina is a natural geographic unit?

On the contrary, nothing could be further from the case. North Carolina, its very existence and its cultural history, reflects persistent contravention of human endeavor by an unyielding landscape. North Carolina's economy is what it is today because of the nature of its geographic setting. But equally, the state is a unit despite the character of its geography.[1]

Geographic Setting

If political boundaries were aligned on geographical features, North and South Carolina would have been three colonies instead of two. The three colonies, each within one of three physiographic regions—Mountain Region, Piedmont Region, and Coastal Plain—would have been clearly defined geographically and economically. Instead, both North and South Carolina share a portion of each of the three physiographic provinces that affected the development of the two colonies. But North Carolina, lacking good natural harbors like those in South Carolina, was further barred from the ocean by a forbidding coastline.

The western boundary of the Wilmington District lies in the Mountain Region of North Carolina, a broad plateau bounded on the east by the Blue Ridge Mountains and on the west by the Great Smoky Mountains. Punctuated by the highest peaks east of the Mississippi River, the mountains have a worn appearance reflecting long periods of erosion. The outstanding characteristic of the Mountain Region is its rough terrain.

The Piedmont Plateau is an intermediary region between the rugged mountains and the flatness of the Coastal Plain. As part of a great plateau extending from New York to Alabama, the Piedmont passes through central North Carolina and Virginia with an average east-west width of 200 miles. In North Carolina the Piedmont is a succession of gently rolling hills of rocky, red clay.

Eastern North Carolina is a broad plain stretching from the continental shelf on the east, 100 to 150 miles into the interior. The Coastal Plain is divided into the Western Coastal Plain subregion and the Tidewater subregion. The Western Coastal Plain is hilly as it slopes gently from the Piedmont Plateau to the Tidewater. Along the coast, the Tidewater subregion is quite flat, poorly drained, and often marshy. The eastern part of the Tidewater lies underwater in the sounds of North Carolina.

North Carolina possesses vast inland water resources in its rivers, lakes, and sounds. The major rivers of the Wilmington District divide the Piedmont Plateau and Coastal Plain into slices layered north to south down the coast. In the Piedmont the rivers are narrow, shallow, and swift. After they pass through the Fall

Zone, dividing the Piedmont from the Coastal Plain, the streams become sluggish as they flow over the Coastal Plain.

The Roanoke River, located in southern Virginia and northern North Carolina, meanders across the state line several times before entering Albemarle Sound below Plymouth, North Carolina. Rising on the eastern slope of the Appalachian Mountains, the Roanoke and its tributary, the Dan River, are nearly 220 miles long. The Roanoke River Basin includes an area of 9,580 square miles, making it the largest in the Wilmington District.

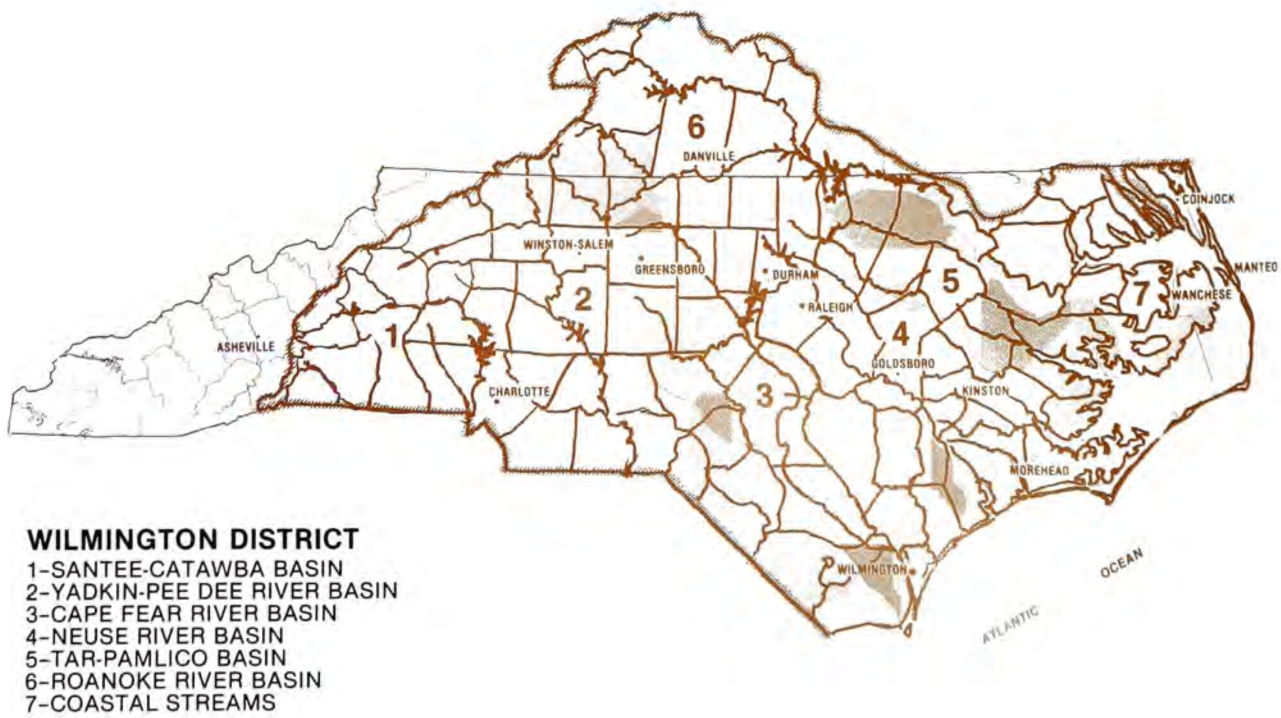
Directly south of the Roanoke River Basin, the Tar-Pamlico River rises in Person County, North Carolina, and flows through the town of Washington on its way to the coast. Below Washington, the Tar River becomes the Pamlico River and an estuary of Pamlico Sound. With its tributaries—Fishing, Swift, and Town creeks—the Tar-Pamlico Basin covers an area of about 3,100 square miles. The Tar River extends 228 miles.

Neuse River, shortest of the major rivers in the Wilmington District, is 180 miles long. The Neuse River Basin has an area of 5,710 square miles. From the confluence of Eno and Flat rivers in Durham County, the river flows to the southeast through the Piedmont and Coastal Plain, becoming an estuary of Pamlico Sound below New Bern. Trent River and Contentnea Creek are its two primary tributaries.

The Cape Fear River, formed by the junction of the Deep and Haw rivers in Chatham County in east central North Carolina, also flows to the southeast. The basin, shaped like an inverted comma with its tail in the hills of the Piedmont and head in the sea at Cape Fear, covers 8,570 square miles with a length of 200 miles. Besides the Deep and Haw rivers, the Cape Fear's other main tributary is the Northeast (Cape Fear) River. The Cape Fear is the only North Carolina river of any importance that empties directly into the Atlantic Ocean. The others either flow into the sounds or pass into South Carolina, where they ultimately reach the coast of that state.

And last, since 1980 the Wilmington District has had responsibility for the Yadkin-Pee Dee and Catawba river basins rising in the North Carolina uplands and flowing toward the sea in South Carolina. In all, the District's 53,000 square miles include six river basins and 1,500 miles of navigable waterways.

Map of Wilmington District showing river basins



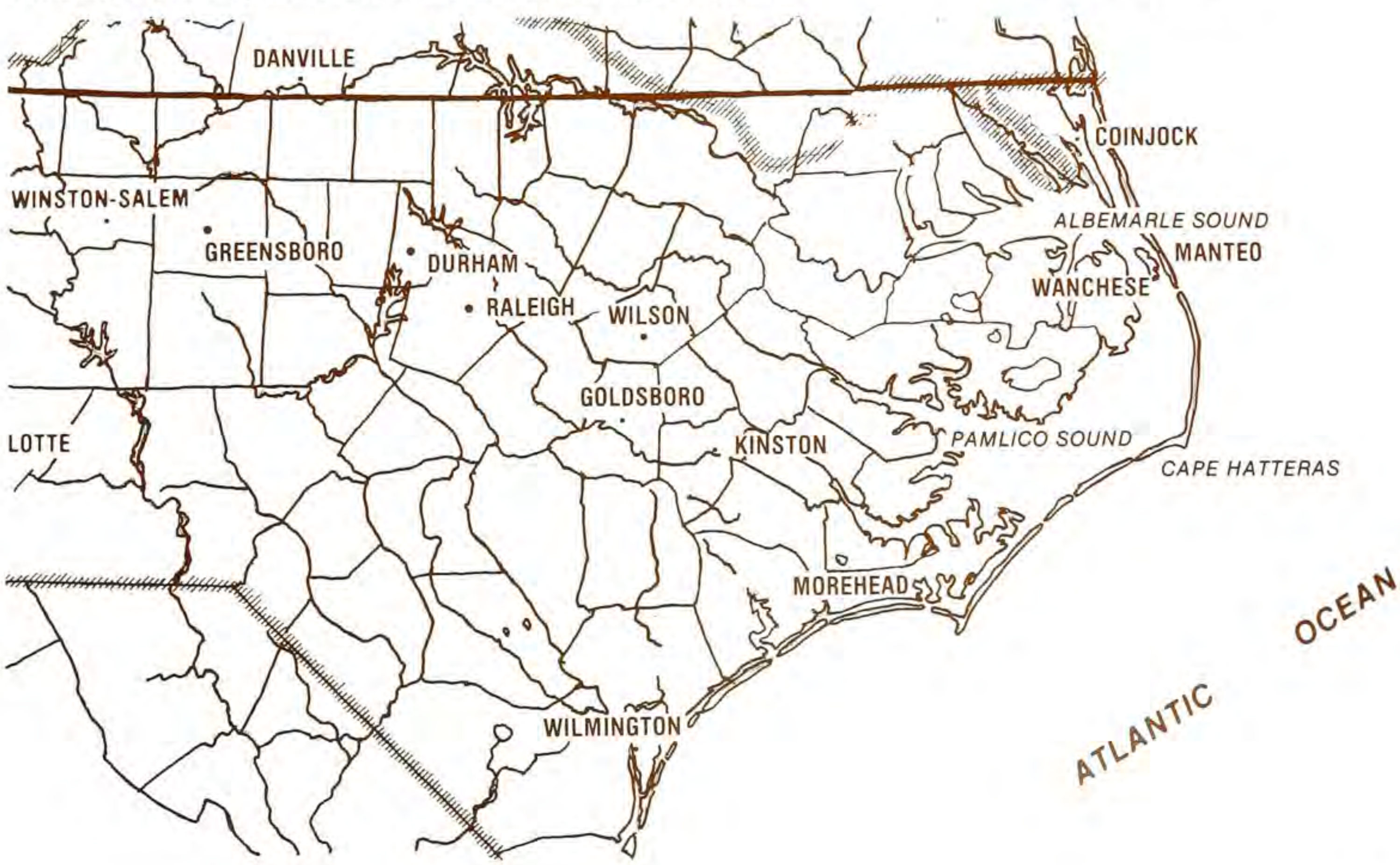
The District also includes 320 miles of North Carolina coastal shorelines, with 2,700 square miles of estuaries. The rivers of North Carolina created its unique coastline, a geologically ephemeral boundary formed by a barrier beach facing the ocean and separated from the mainland by a series of lagoons or sounds. The coastline of the mainland is so deeply indented by bays and estuaries that it is little more than a fringe of peninsulas trimmed by a chain of sandy islands.[2]

Great barrier islands are by no means unique to North Carolina, but nowhere else do they reach so far from the mainland. The Outer Banks—composed mostly of sediments deposited annually by mainland rivers onto the submerged part of the Coastal Plain, and there shaped by the breaker and undertow action of the ocean—parallel the contour of the shore. Crescent-shaped, the Banks lie about three miles offshore at the northernmost point of North Carolina, but then swing southeast to Cape Hatteras, at a distance of 20 miles from the mainland. Below Cape Hatteras the islands once more approach the shore; the southern third of the chain is often separated from the mainland only by narrow marshes. The sandy barrier beaches vary in width from a few hundred feet to nearly three miles in the Cape Hatteras area. In general, they have a higher elevation than the mainland, ranging in height from over 100 feet in the Dare Banks area to only a few feet above sea level elsewhere.

The Outer Banks are not continuous, but are occasionally broken by inlets of various widths forming connections between the inner waters of the sounds and the ocean. Inlets of the North Carolina coastline are shallow, shifting channels undergoing constant change. Not permanent features of the coast, inlets may close quickly during storms or more gradually in response to mechanical processes. New inlets may appear and remain open for days or years.

For mariners seeking a passage to safety through the barrier islands, the inlets can be as perilous as the hazards of the stormy deep. The waters near the Outer Banks are among the most threatening of the entire Atlantic Coast. Off Cape Hatteras the warm Gulf Stream meets the colder waters of the North Atlantic, posing significant dangers to shipping, especially sailing vessels following the Gulf Stream current. The area's frequent storms have driven scores of ships aground on the Outer Banks and on the many hidden shoals extending into the ocean. The Cape Hatteras area became known long ago as the Graveyard of the Atlantic, so named by the sailors all too familiar with its deadly perils.[3]

Map showing Coastal and Piedmont regions of North Carolina



Colonial North Carolina

Elsewhere on America's Atlantic seaboard, from the time of the earliest white settlements, the coast was a magnet attracting colonists, merchants, and sailors. Only in North Carolina was the coast a barrier to Europeans. Colonists had to travel overland to settle in North Carolina, merchants shipped their goods overland or by river to other colonies, and mariners usually avoided the area in favor of ports in Virginia or South Carolina. Because of North Carolina's unique geography, the colony developed differently from its neighbors to the north and south.[4]

At the time of European exploration of the North American continent, about 30 Indian tribes lived in the North Carolina area. Of that number, five played significant roles in later North Carolina history—the Hatteras, Chowanocs, Tuscarora, Catawba, and Cherokee. Following the initial contact with Europeans, most of the Indians died off from disease, were killed in battles with the invaders, or moved west under the pressure of white colonization.[5]

Giovanni da Verrazzano, the first European to explore the North Carolina coast, sailed under the French flag in 1524 from Cape Fear northward to the present Kitty Hawk. Despite his glowing report, the French made no attempt to colonize the area. In 1526, Spaniards under the leadership of Luis Vazquez de Ayllon established a colony along the Cape Fear River, which they called the Jordan. Despite the Biblical evocation, the vicinity of "San Romano" (Cape Fear) was not the Promised Land. Plagued by shipwreck, mutiny, illness, and death, the settlers abandoned the colony later that same year.

The first English colonists, under the sponsorship of Sir Walter Raleigh, landed on Roanoke Island in 1585. Raleigh selected the site from reports of a reconnaissance of the coast by his agents in 1584 and conversations with two young Indians, Manteo and Wanchese, who returned to England with the survey expedition. Unprepared for the rigors of life in the wilderness, even with the assistance of the Hatteras Indians, the colonists abandoned their new home the following year. Sir Francis Drake, returning from an expedition against the Spanish, landed at Roanoke Island and carried them back to England.

Raleigh's next attempt at colonization set out for Chesapeake Bay in 1587. But the captain of the ship refused to venture beyond Roanoke, forcing the colonists to settle in the same place as before. Although better prepared than its predecessor, the second Roanoke colony ran short of supplies in only a few weeks. The governor, John White, returned immediately to England to obtain speedy replenishment. But a threat of war with Spain and the promise of privateering delayed relief for the colony. In 1590, White found the settlement deserted; because of a violent storm, he could not search for his fellow colonists. White returned to England with the mystery of the "lost colony" but without his granddaughter, Virginia Dare, the first child of English parents born in the present United States.

North Carolina apparently could not be settled from the coast. Accordingly, the next English colony was planted in 1607 near Chesapeake Bay, where Raleigh had intended to establish his colony in 1587. After a few difficult years, the Virginia pioneers prospered, claiming the best land along navigable streams. Hunters, traders, and farmers gradually pushed their way along the rivers of southeastern Virginia into the Albemarle area in the early 1650s.[6]

King Charles I granted the land south of Virginia to Sir Robert Heath in 1629. Although Heath never established a permanent colony there, the land now had a name, thanks to the royal charter. It was "Carolana," derived from the Latin form of Charles. In 1663 Charles II made a second grant of the land south of Virginia, now calling it "Carolina," to eight men loyal to the crown during the English Civil War.[7] From the beginning the proprietors proposed two distinct centers of settlement—Albemarle and Cape Fear.

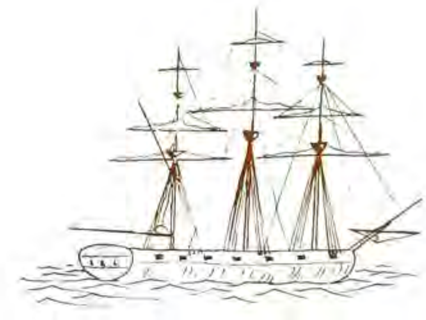
Under the proprietary rule the two settlements grew slowly. By 1663 the Albemarle already had a small population, and throughout the remainder of the 17th century settlers continued to enter the territory through Virginia. By 1700 the population was estimated to be four or five thousand.

But farther south, along the Cape Fear River, things were not so easy. New Englanders who had tried to settle there in 1663 had pulled out after posting a sign at the mouth of the river, warning future settlers that the country was not worth occupying. In 1665 the proprietors planted a colony that lasted two years.

They sponsored another in 1669, along the Ashley River. But in 1680 the settlers gave up and moved to the present site of Charleston, the beginning of the South Carolina colony. After 1691 the Albemarle colony was known as North Carolina.[8]

Into the second decade of the 18th century the Cape Fear area remained without a permanent settlement. Several factors worked against the establishment of a lasting colony in the region, among them the character of the coast at the mouth of the river; the pirates who sought refuge there; the hostility of the Cape Fear Indians; and the closing of the Carolina land offices by the proprietors.[9]

Cape Fear received its name from Captain William Hilton, a 17th-century New England mariner who in some confusion transferred it from the former name of Cape Lookout. Frying Pan Shoals, extending south of Cape Fear nearly 25 miles into the ocean, presented the chief danger to seamen. Although the shoals protect the river mouth from the northeasters that buffet the Carolina coast, they also offer a deadly challenge to the sailor's skills. Cape Fear surely deserves respect:



> Looking then to the cape for the idea and reason of its name, we find that it is the southernmost point of Smith's Island, a naked, bleak elbow of sand, jutting far out into the ocean. Immediately in its front are the Frying Pan Shoals pushing out still farther twenty miles to the sea. Together they stand for warning and for woe; and together they catch the long majestic roll of the Atlantic as it sweeps through a thousand miles of grandeur and power from the Arctic towards the Gulf. It is the playground of billows and tempests, the kingdom of silence and awe, disturbed by no sound save the seagull's shriek and the breakers' roar. Its whole aspect is suggestive not of repose and beauty, but of desolation and terror. . . . And as its nature, so its name, is now, always has been, and always will be the Cape of Fear.[10]

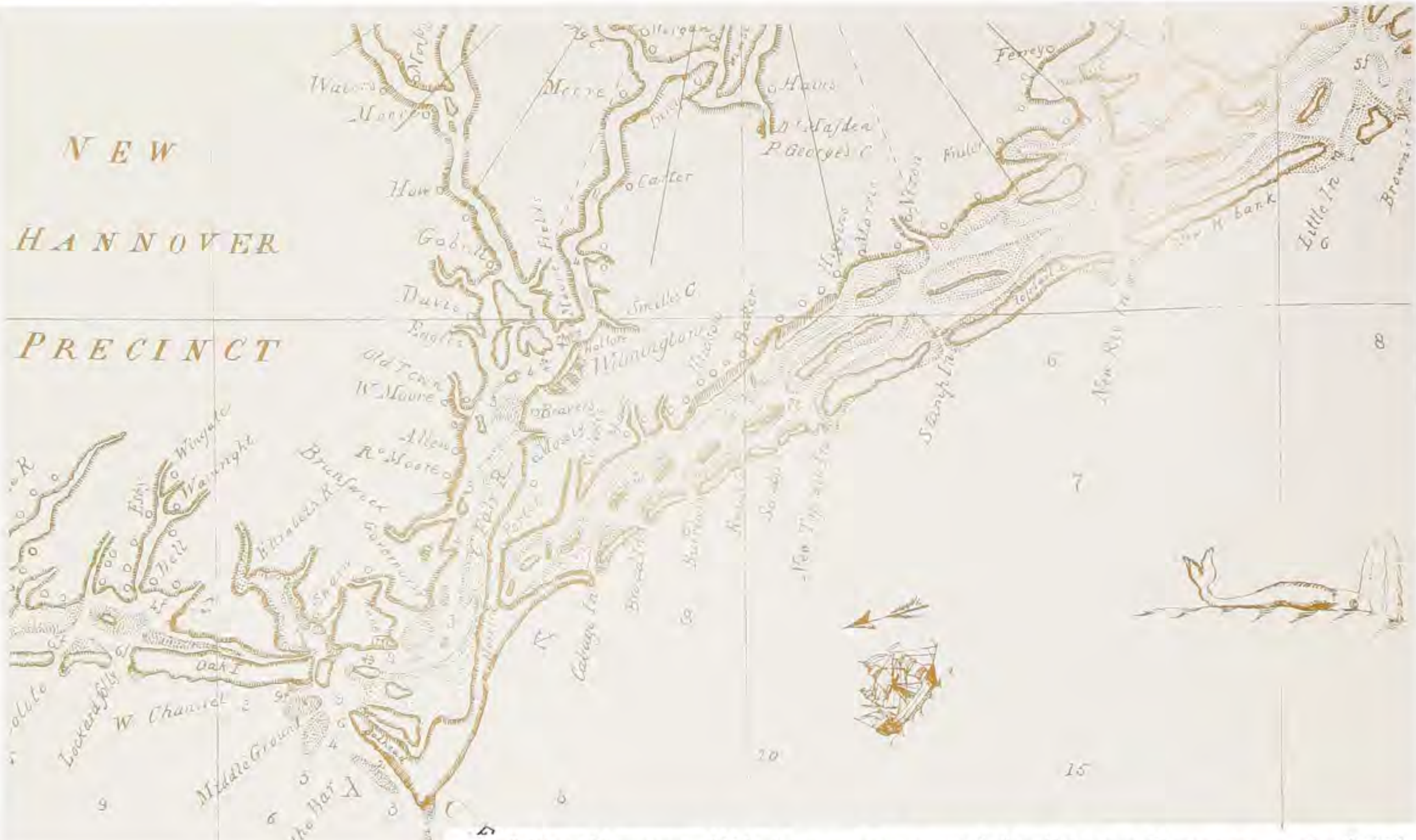
But not all of the dangers that repelled traders and merchants from that region were works of nature. The southern half of the North Carolina coast, with its hidden coves and shallow inlets, for many years harbored pirates and villains of every stripe. Edward Teach, the notorious "Blackbeard," raided the coast and plundered shipping over a wide area, splitting his spoils and boodle with the governor of North Carolina. He overreached his hand in 1718 when he began to extort tolls from shipping in Pamlico Sound. A naval expedition from Virginia ran him down and killed him in a fierce battle at Ocracoke Island. Meanwhile, Stede Bonnet preyed upon South Carolina shipping from his lair on the lower Cape Fear, until he was captured by an expedition fitted out by South Carolina Governor Robert Johnson. Bonnet's trial and execution in 1718 made the area safer, but the legend of piracy on the North Carolina coast persisted.[11]

Indians of the Cape Fear lived with little direct contact from whites until early in the 18th century. Although few in number, they were feared by the Europeans settling in North Carolina. In 1711 the Cape Fear Indians joined with the Tuscaroras in a bloody, two-year uprising against the whites. North Carolinians, with substantial aid from South Carolina, defeated the Indians and cleared the way for permanent colonization of the Cape Fear area after 1720.

The proprietors closed the land office for the Cape Fear region in 1667 to promote settlement of other parts of the Carolina colony. By the 1720s the lower Cape Fear River could no longer remain closed to individuals familiar with the area. During the Indian wars, Colonel Maurice Moore visited the Cape Fear area and determined to return and settle there. Moore founded the town of Brunswick in 1725, 12 miles above the mouth of the Cape Fear River and several miles below the Flats, a zone of sandbars in the river. Accepting the settlement of the lower Cape Fear as a fait accompli, proprietary governor George Burrington reopened the land office in 1725. North Carolina became a royal colony in 1729 with the formal surrender of the charter by the proprietors.

A brigantine

In 1733 a new town was established about 16 miles upstream from Brunswick. New Town, or Newton, quickly rivaled Brunswick for commercial and political domination of southeastern North Carolina. By 1740 Newton's name had changed to Wilmington, and the city replaced Brunswick as county seat



Portion of "Chart of his Majesties Province of North Carolina" by James Wimble, 1738

of New Hanover. Wilmington was named for Spencer Compton, earl of Wilmington, destined to become prime minister of England.[12]

Wilmington and Brunswick developed as centers for different types of trade. Naval stores—tar, pitch, rosin, and turpentine—were the leading export of North Carolina; it led the world in the production of naval stores from 1720 to 1870. Naval stores were so important to maritime England that Parliament offered bounties to producers. Within North Carolina Brunswick dominated the naval stores trade because the larger ships it required could not cross the Flats to reach Wilmington.[13] Smaller ships, those involved in West Indian and coastal trade, could navigate the Cape Fear to Wilmington. Because it was more convenient than Brunswick for people inland, Wilmington became the center of local trade.

The economy of the Albemarle area developed quite differently from that of the Cape Fear region. Tobacco, instead of naval stores, was the leading cash crop of northern North Carolina. Albemarle lacked both a strong commercial center and an outlet to the sea. Smaller ships of the coastal trade could reach cities such as Edenton in the northern part of the state, but that commerce was dwarfed by traffic through the Virginia ports. The larger share of Albemarle exports went overland to Virginia, making the area politically and economically almost a colony of Virginia.[14]

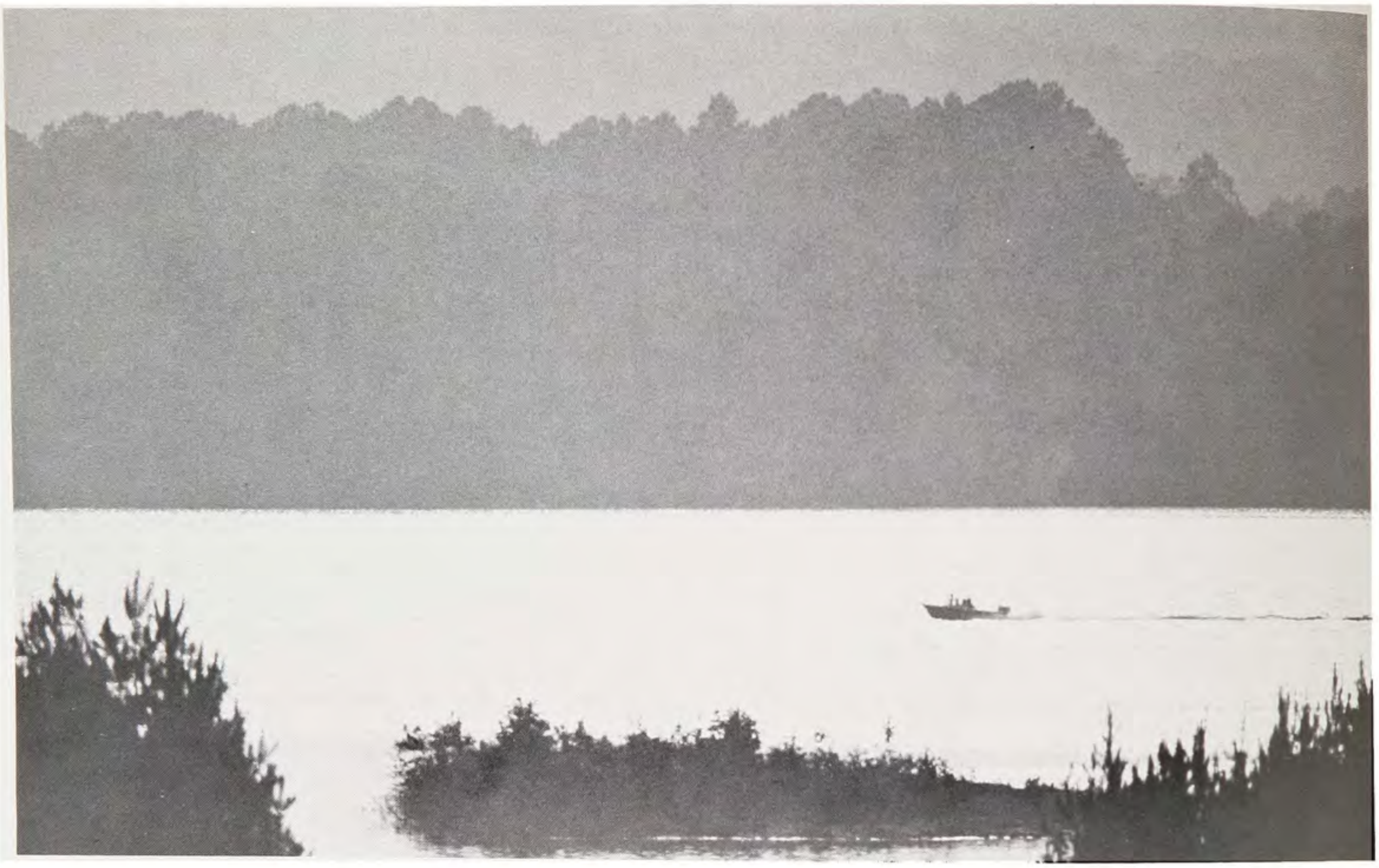
Albemarle's limited coastal shipping was hampered in 1673 when Parliament levied a duty on tobacco shipped from one colony to another. That act led in part to Culpepper's Rebellion of 1677 against the proprietary government in the Albemarle. The economy of Albemarle, already weakened by the actions of Parliament, was damaged further by Virginia. An act passed in 1679 by the Virginia Assembly prohibited the importation of North Carolina tobacco; the ban continued in force until 1729. Farmers recognized their vulnerability—at the mercy of Virginia, Parliament, and a hostile seacoast—but there was little they could do to improve the situation.

By the time of the War for American Independence, North Carolina was beset by sectional strife, to a great extent a natural effect of the varied geography. The first important sectional controversy developed between the Albemarle region and the lower Cape Fear. Although part of the same colony, the residents of the two areas had little in common. The Albemarle area depended on Virginia economically while the lower Cape Fear had direct, albeit hazardous, connections with the outside world. Sectionalism increased in the mid-18th century with the settlement of the Piedmont by non-English ethnic groups. The result was that, in

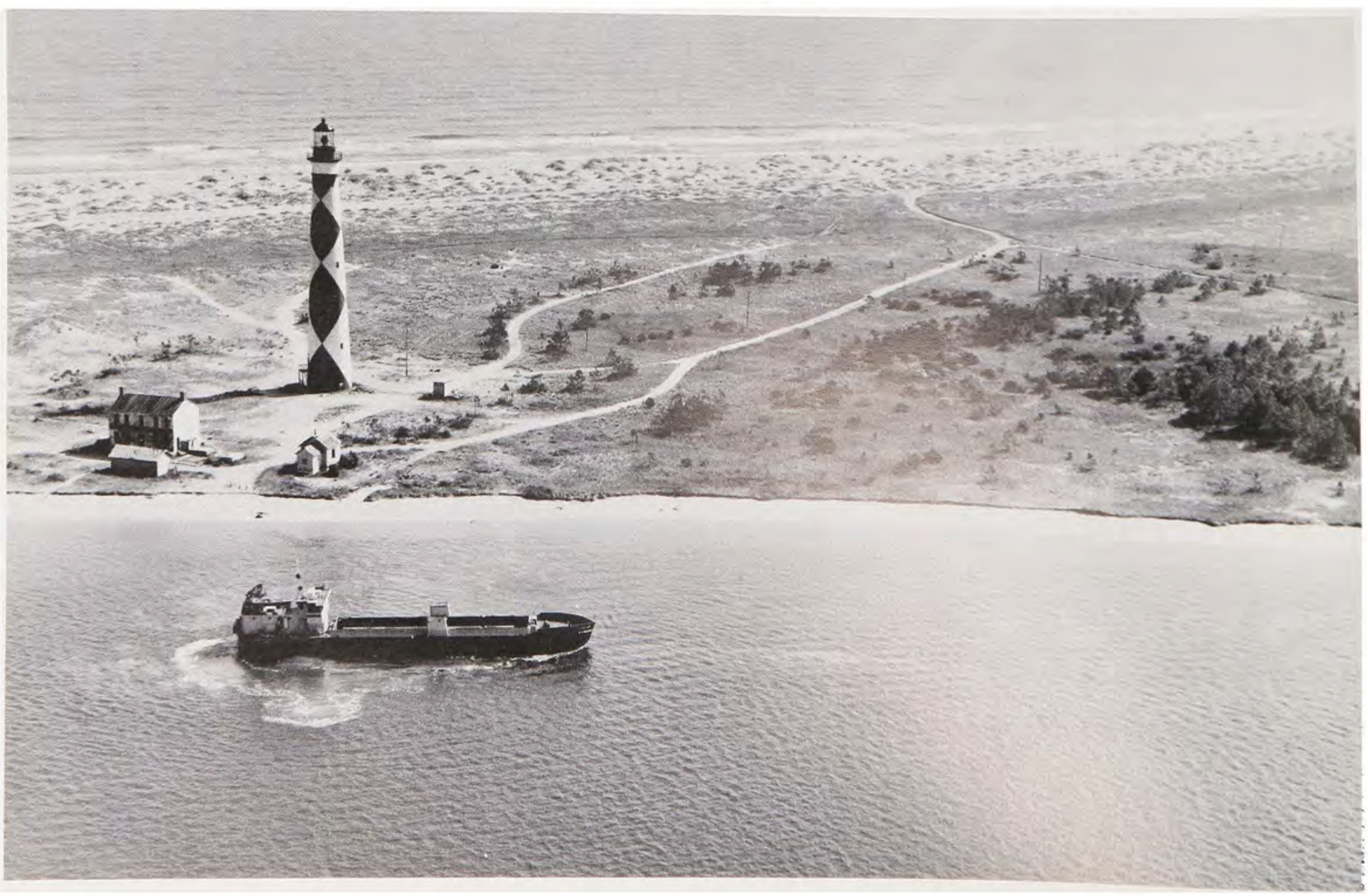
North Carolina during the Revolution, the struggle was often more a civil war than a united campaign for independence from England.

Several things divided North Carolina during the 18th century, but geographical factors were at the root of the problem. North Carolina's geography led to the settlement of the colony at different times and by different groups; it dictated that the economies of the sections would develop along dissimilar lines; and it separated residents of the different regions one from another and from the sea. If North Carolina were to take its place, economically and politically, among the other states in the 19th century, its people must open the rivers and join the regions together, and all of them with the sea.

Portion of "A Compleat Map of North Carolina from an actual Survey" by John Collet, 1777



The varied geographic sections of North Carolina stretch from the mountains through the Piedmont and coastal area to the sea.



CHAPTER II

A State Without Foreign Commerce

The seaboard of a country is one of its frontiers; and the easier the access offered by the frontier to the region beyond, in this case the sea, the greater will be the tendency of a people toward intercourse with the rest of the world by it. If a country be imagined having a long seaboard, but entirely without a harbor, such a country can have no sea trade of its own, no shipping, no navy.

—Alfred Thayer Mahan

Early in the state's history, the people of North Carolina faced the problem of finding an outlet to the sea, through which they could export their agricultural products and import manufactured goods. The natural obstructions along the coast inhibited growth of seaport cities. The dispersal of settlements over a vast interior, together with an absence of adequate means of communication, prevented the growth of an inland population center. The products of the northern counties on the Roanoke, Tar, and Neuse rivers went into Virginia. Those from the Broad and Catawba rivers went into South Carolina. Less than one-third of the agricultural products of North Carolina went through the state's own ports. A favorite metaphor of the early days likened North Carolina to a man bleeding at both arms.[1]

The state paid a heavy price for its inadequate transportation system: high freight rates and restricted commerce; higher prices for goods purchased; lower prices and profits for goods sold; scarcity of capital; low land valuations; low income and standard of living; backwardness in agriculture, manufacturing, and urban development; inadequate revenue for state and local governments; and an absence of state unity and patriotism.

Pervasive among North Carolinians was a belief that by improving the rivers and seacoast the state's economic development would be greatly stimulated.[2] But both public and private ventures to improve the state's waterways generally met with failure.

The colonial government had made feeble attempts to improve the colony's transportation system. Waterways, supplemented by roads, remained the primary avenues of commerce, and access to the streams was economically vital to North Carolina farmers. Riverside land, usually the most valuable, passed quickly into private ownership. In 1745, an act of the colonial assembly made it the duty of road commissioners in certain districts, upon the petition of persons whose lands were hemmed in by those of others, to open roads to the nearest landings.[3]

To supplement the waterways (and in the absence of roads), the colonial assembly passed legislation to build canals. In 1766, the assembly appointed commissioners to cut a canal from the head of Harlowe Creek to that of Clubfoot Creek, to connect New Bern with Old Topsail Inlet. Similar measures passed in 1783 and 1784, but the canal was not completed until the 19th century. Even then, it carried only a few small vessels and lost money.[4]

In 1786, officials from North Carolina and Virginia met in Fayetteville and agreed to construct a canal joining the Elizabeth River in Virginia with the Pasquotank River in North Carolina. The resulting Dismal Swamp Canal was built by a private company under dual charters from the two states. It was moderately successful, but it increased the dependence of the northern part of the state on Virginia for an outlet to the sea.

The Dismal Swamp Canal reflected a post-Revolutionary burst of enthusiasm for improving river and coastal navigation in the state. In 1783, the state appointed commissioners for each port of entry—Brunswick, Beaufort, Bath, Roanoke, and Currituck—to mark out channels, erect beacons, and regulate and examine pilots. The following year the general assembly authorized North Carolina's first lighthouse, to be built at some point where it would enable ships to avoid Frying Pan Shoals. The assembly passed several other laws in 1784 for clearing the Roanoke, Neuse, Trent, and Tar rivers, but little was accomplished. Even after the lawmakers authorized county governments to "purchase or hire a flat, windlass, and necessary appurtenances," in order to clear obstructions from streams, the rivers remained blocked by trees and other snags.[5]

In spite of the enthusiasm, state and local governments in North Carolina lacked the knowledge and wherewithal to pursue anything but a haphazard program of local navigational improvements. In addition, the general assembly split on east-west lines over internal development. The east, except for cities such as Wilmington and Beaufort, generally opposed state-sponsored internal improvements that would benefit the western half of the state, but be financed by the wealthier eastern part. Private enterprise seemed to be the answer to the transportation problems afflicting North Carolina.

Cape Fear River above Wilmington

Navigation Companies

By 1792 the state's general policy on internal improvements was to aid private corporations working on development, in one of two ways. The state could either make an appropriation outright to a company for a specific project, or purchase part of the company's stock. The state usually followed the latter course.

Legislators chose the Cape Fear as the first river to be so developed, because of its central location, its direct access to the sea, and a popular belief that improvement in its navigability could be accomplished easily. Lawmakers hoped to attract the commerce of the rapidly growing west through Wilmington, the leading North Carolina port. And after a vein of coal was discovered in Lee

County, people began to dream of a great water route to the outside world—with Fayetteville becoming the Manchester of the United States.

A 1792 act of the general assembly chartered a company for the improvement of Cape Fear River from Fayetteville to the junction of Haw and Deep rivers. But real interest did not develop until 1796, when the assembly established guidelines for the purchase of shares in the Cape Fear Navigation Company. The legislators gave the company the right to collect tolls on the improved portion of the river and exempted the company's property from taxation.[6]

The Cape Fear Navigation Company planned the construction of two canals above Fayetteville. The first project was to bypass Buckhorn Falls, near the junction of the Haw and Deep rivers, with canals and flumes. But a granite ridge running through the state stymied the canal builders. Before dynamite, black powder was used to blast rock; but that was useless against the hard granite below Buckhorn Falls. Frustrated by that obstacle, the engineers abandoned their project; the completed section of the canal remained as a jumping place for children and a hazard to livestock.

Colonel Archie S. McNeill battled the river and the granite for a number of years. Later, as he lay dying, he asked that the granite that defeated him provide his headstone. McNeill's friends hauled a piece of blasted river rock to the graveyard in the ghost town of Summerville and placed it on the grave. As a sort of epitaph for the canal as well as for McNeill, his headstone shows five drilled blast holes.

The company's second project, a 27-mile canal above Fayetteville, was also only partially completed, falling victim to financial difficulties. The Cape Fear Navigation Company finally called it quits after 1818.[7] But the spirit of private enterprise, aided by the state assembly, refused to allow the company to die. In 1821 the firm called upon its stockholders to pay past-due installments. Still lacking funds two years later, the company requested and received a $25,000 subscription from the state. Stipulations on the subscription put the state in charge of the work and required the company to begin at Wilmington and proceed upriver as far as the money would stretch.

Throughout the 1820s and 1830s the Cape Fear Navigation Company continued to collect tolls on the river and persuade the state that the company was improving the river. But people using the stream complained constantly about its poor condition, and the state at last despaired at the company's failure to perform. In 1835 a legislative resolution directed the governor to sell the company's derelict dredging machine, by then unused and lying in an exposed condition near Wilmington. The following year another resolution recommended a lawsuit against the company for $1,375 in dividends due to the state. By 1840 the Cape Fear Navigation Company existed in name only.[8]

A group of investors organized a new company at Pittsboro on 14 April 1849. With a state charter and a state subscription of $40,000, the Cape Fear and Deep River Navigation Company (CF & DR) proposed to open the upper Cape Fear and lower Deep rivers to steamboats from Fayetteville to Hancock's Mill in Moore County, a distance of about 98 miles. Instead of canals, the CF & DR built a series of locks and dams at 19 sites. By 1855 most of the works were completed, but they did not last long. Nearly every freshet destroyed or damaged the poorly constructed, wooden structures, eroded the banks, and swept equipment and material downriver. The result was a constant—and expensive—need to repair and reconstruct the locks and dams. At a sale forced by creditors on 23 April 1859, the state purchased the remainder of the company's stock to protect its own investment, which by that time exceeded $800,000. Finally, in 1873, the state sold its interest at public auction. No appreciable income was ever received from the use of the "improved" waterway, and reliable and continuous navigation on the upper parts of the river remained but a fond hope.[9]

Private companies, assisted by the state, worked on other rivers as well. The state chartered ventures to develop the Roanoke, Tar, Neuse, Yadkin, and New rivers. The Roanoke Navigation Company was the most successful. It expended over $365,000 between 1816 and 1828, building sluices and canals to improve the Roanoke from its mouth to Salem, Virginia, a distance of about 350 miles. River traffic increased, but remained below expectations. None of the river companies could overcome the one major obstacle to greater commerce on the rivers—absence of a suitable outlet to the Atlantic. By the Civil War, none of the private ventures functioned any longer.[10]

Hamilton Fulton

The North Carolina legislature, under the leadership of Archibald D. Murphey, made one other effort to improve the state's waterways. From 1815 to 1818, the visionary Murphey, a well-educated Hillsborough lawyer, presented a series of reports to the state senate, offering a plan for the state's economic, social, and political development. The program's cornerstone, internal improvements, included development of a land and water transportation system. By 1819, the state had responded by establishing a Board of Internal Improvements to oversee expenditures from a fund designated for internal development.[11]

After spending 18 months searching for a competent American, the board hired Hamilton Fulton, an English civil engineer, as principal engineer for the state. The board directed Fulton to visit the state's chief rivers; advise the several navigation companies; examine proposed routes for water communications between the Catawba and Pee Dee rivers, the Pee Dee and Cape Fear, the Roanoke and Tar, the Tar and Neuse, and Clubfoot and Harlowe creeks; and examine the coastal inlets.

Following a thorough examination of the state's waterways in 1819, Fulton proposed a comprehensive program of waterway development to fulfill Murphey's dream. But it was an expensive plan, particularly for a state that had spent almost nothing on internal improvements theretofore. Although the Panic of 1819 destroyed any hope of adopting all of Fulton's proposals, the general assembly did authorize him to begin work on a handful of projects, including in particular the Cape Fear River.[12]

When Fulton began his work in 1823, the Cape Fear had changed dramatically over the past six decades. Edward Moseley's map of 1733, one of the earliest, showed Wilmington harbor to be spacious, with good anchorage and a depth of 14 feet on the bar, and about the same depth in a direct channel on the east side of Campbell's Island to Wilmington. Beginning on 20 September 1761, a violent storm battered the North Carolina coast for four days, during which the ocean broke through the sand of the outer beach about 20 miles below Wilmington. It created a breach—a "new inlet"—at a place known as the haulover, where fishermen had dragged their boats over the narrow beach between river and ocean to bypass Frying Pan Shoals, thus wearing away the beach's vegetation in the process.

Southeastern North Carolina as shown in "A New and Correct Map of the Province of North Carolina" by Edward Moseley, 1733

According to tradition, the equinoctial storm of 1761 was a "dry blow." Therefore, the wind and the difference of water levels on either side, rather than wave action, probably created the breach. In the years following, the river began to shoal opposite "New Inlet" and the depth over the bar decreased.[13] A 1794 map drawn by Captain H. Holland showed a depth of only ten feet over the bar at low water. The river continued to shoal during the 19th century, according to a table (below) prepared by the Corps of Engineers in 1853.

From 1823 to 1829, the Board of Internal Improvements attempted to improve the channel between New Inlet and Wilmington by dike closures of minor channels, jetty contraction of the main channel, and dredging across the shoals. Beginning in May 1823, Fulton's crews built two embankments and one jetty. Applying a principle that recommended the stoppage of all channels except one combining the best qualities, Fulton closed the passage between Clark's and Eagle islands with an embankment.[14] Early in October 1823, Fulton's contractors built a jetty beginning on the western bank and extending 2,000 feet into the river. An embankment designed to close the channel between Campbell's Island and the western bank began to wash away during the winter of 1826. As the wooden structure failed, the alluvial accumulation reduced the channel depth from 19 to 3.5 feet.[15]

Fulton also attempted to dredge the shoals below Wilmington in the vicinity of Campbell's Island. In 1823 he arranged for the assembly of a contraption that he called a "bear":

> It was a gum log, two feet in diameter and twenty feet long. It had nine rows of shovels drove [*sic*] into it, extending regularly round the log and in each end a large iron gudgeon, in all attaching to this log two thousand three hundred pounds of iron.[16]

A steamboat dragged the "bear" across the shoals to stir up the sand and mud so that the current might carry it away. After several attempts, Fulton admitted his device was a failure. He then procured a dredging machine attached to a low-pressure, eight-horsepower engine. Unwilling to await the construction of a proper carriage, Fulton purchased a schooner in which he installed the engine and machinery. That vessel proved too small, and the machinery was removed and stored in a warehouse. Fulton's service with North Carolina terminated at the end of 1825, and the dredging machine was not used again until January 1827.[17]

Work on the Cape Fear continued until 1829 under direction of the Board of Internal Improvements. Another jetty was built according to Fulton's plan, and the dredging machine was installed in a sufficiently large ship. But since it had an average daily capacity of only 100 cubic yards, the work progressed slowly. With frequent malfunctions the dredge operated on the river until July 1831.[18] The table below shows changes in the depths of the entrance to the Cape Fear River.

TABLE
Depths of Cape Fear Entrance

Author of Map	Date	Depths on, in Feet: Main Outlet — Main Bar	Main Outlet — Bulkhead or Shallowest Part of West Channel	New Inlet
Edward Moseley	1733	14	~9	Did Not Exist
William Wimble	1738	16	4	—
Joshua Potts	1797-1798	15	6	6
Col. Kearney, TE	1820	10.5	3	6.5
Capt. Glynn, USN	1839	9	9	10
Pilots, etc.	1850	8	9.5	7
Coast Survey	1851	8	7	8
Coast Survey	1852	7.5	7	8

[Source: *Annual Report of the Chief of Engineers, 1853.*]

State and local governments and private individuals expended time, effort, and money in a series of ineffectual attempts to improve the state's waterways. In 1830 a legislative committee, observing that the results were nil, described North Carolina as

> a State without foreign commerce, for want of seaports, or a staple; without internal communication by rivers, roads, or canals; without a cash market for any article of agricultural product; without manufactures; in short without any object to which native industry and active enterprise could be directed.[19]

About the time of Fulton's dismissal, the people of North Carolina concluded that the state lacked the means to carry out an effective program of waterway improvement. They began to petition Congress for assistance from the federal government. The federal agency that answered their call was the United States Army Corps of Engineers.

CHAPTER III

The Distressing Spectacle of the Dredging Boat Lying in the Swamp

Towards this tongue of land then, the men to whom the business was assigned carried out a double bridge from Abydos. . . . When, therefore, the channel had been bridged successfully, it happened that a great storm arising broke the whole work to pieces, and destroyed all that had been done. So when Xerxes heard of it he was full of wrath, and straightway gave orders that the Hellespont should receive three hundred lashes, and that a pair of fetters should be cast into it. Nay, I have even heard it said that he bade the branders take their irons and therewith brand the Hellespont.

—Herodotus

When the Corps of Engineers answered the call of the people of North Carolina in the 1820s, it already had a tradition of service to the nation in peace as in war. The Corps' military responsibility was obvious—military engineers built fortifications in peacetime and fieldworks on the battlefield. In fact, the Corps traditionally traced its origins to the Battle of Bunker Hill where Colonel Richard Gridley, the Continental Army's first "Chief Engineer," designed the fortifications and was wounded during the fighting. Actually, on 16 June 1775, the day before the battle, the Continental Congress authorized one chief engineer and two assistants for the "Grand Army," and a chief engineer and two assistants "in a separate department." Several European engineers rendered valuable assistance to the Continental Army and played important roles in nearly every major battle. On 27 May 1778, Congress established three companies of engineers known as sappers and miners. They became the Corps of Engineers on 11 March 1779.

The Corps vanished along with the rest of the Continental Army in 1783, but the needs it served did not. In 1794, it received modified revival in the Corps of Artillerists and Engineers, and in 1802 was permanently established at the behest of President Thomas Jefferson as the Corps of Engineers. At first, the Corps was identified with the new United States Military Academy at West Point, New York, and in fact the academy remained a Corps responsibility until 1866.

If he desired anything of the United States Army, Jefferson wished that it be useful to the nation. In nonmilitary public service, the Corps of Engineers was supposed to lead the way. The President reflected long-standing sentiments in the nation (Congress had directed in 1777 that the engineers include a "geographer and surveyor of the roads"), and his successors agreed with him. In 1813 Congress added eight topographical engineers and eight assistants to the Corps. They became the Topographical Bureau of the War Department in 1818, grew more distinct in 1831, and finally became a separate Corps of Topographical Engineers in 1838 (merged once again into the Corps of Engineers in 1863).

Army engineers, therefore, were the foundation of the civil engineering profession in the United States. From the earliest days they not only built defensive works, but explored and mapped the nation and plotted the navigability of its waterways. When, on 30 April 1824, Congress passed the first rivers and harbors act to improve navigation on the Ohio and Mississippi rivers, it handed the job to the Corps of Engineers as a matter of course. Other regions took notice and asked for the same assistance. Among the petitioners was North Carolina, where the Corps was already at work on fortifications. Its attention drawn to that state's navigational difficulties and previously frustrated attempts at improvement, the Corps went to work.[1]

Cape Fear River

North Carolinians had asked the Congress to authorize surveys of several areas in the state. An act of Congress on 20 May 1826 appropriated $1,000

> for making a survey of the Swash, in Pamptico [*sic*] Sound, near Ocracock [*sic*] Inlet, for the purpose of ascertaining whether the channel through the same can be deepened; and, for the same purpose, and also for a survey of Roanoke Inlet and Sound, with a view of ascertaining the practicability of making a permanent ship channel between Albemarle Sound and the Atlantic Ocean, at Roanoke Inlet or elsewhere. . . .[2]

In September 1826, Major General Alexander Macomb, Chief of Engineers, directed Captain Hartman Bache, Topographical Engineers, to complete the authorized surveys.[3] Captain Bache, a great-grandson of Benjamin Franklin, was one of the leading topographical engineers of his day. He conducted surveys for coastal defenses, naval depots, river and harbor improvements, roads, canals, and lighthouse sites for nearly 30 years.[4]

In North Carolina, assisted by Lieutenants Samuel Wragg and William Boyce, Bache made the required surveys throughout 1827, despite frequent illnesses in his party. His survey reports led to congressional approval of work to be done on the Cape Fear River, Ocracoke Inlet, and near Roanoke Inlet.

Bache approved of Fulton's general plan for improvement of the Cape Fear River—with one exception.[5] Bache disagreed with the closing of the channel west of Campbell's Island. However, new shoals had formed, making it, in his opinion, inadvisable to reopen the channel. Bache proposed to build a series of jetties beginning at the upper shoals and progressing slowly toward the sea, allowing sufficient time between the construction of jetties to determine their exact influence upon the river. Through the use of jetties, Bache believed the cause of the shoaling below Wilmington—the sudden widening of the river—could be eliminated.

Bache did not believe that forcing the river into the western channel, thereby increasing the scour in that channel, would be sufficient to increase the depth to 12 feet, the draft of the largest class of vessels then engaged in trade on the Cape Fear. The shoals would have to be dredged. Bache recommended the employment of a steam dredging machine similar to the one used by the state. He estimated that a complete dredging machine and a six-horsepower steam engine capable of removing 25 cubic yards per hour could be purchased for $7,500. To dredge a channel 12 feet deep at average high water, and 500 feet wide through the shoals below Wilmington, would require the removal of 171,874 cubic yards of material. Estimating the working days of a year at 250, of ten hours each, it would take 2 years and 187.5 days to dredge the channel.

Cape Fear River below Wilmington


On 2 March 1829, Congress appropriated $20,000 for the improvement of the Cape Fear below Wilmington, in accordance with Bache's survey report. Brigadier General Charles Gratiot, Chief of Engineers, hoped to place the work under state supervision, but the North Carolina Board of Internal Improvements refused to accept the task. In a ceremony at Wilmington 1 July 1829, Governor John Owen delivered the state's dredging boat, as a loan, to Captain George Blaney, Corps of Engineers, supervisor of the work. Blaney delayed starting work on the river until 30 September, the end of the fever season on the riverbanks.[6]

During the years before the Civil War, the army engineers serving in North Carolina were under the direct authority of the Chief of Engineers' office. Generally, an engineer officer in North Carolina supervised more than one project. Blaney undertook the Cape Fear River project while he was also in charge of construction at Fort Caswell on Oak Island at the mouth of the Cape Fear.

Captain Blaney began to build the jetties in January 1830. Eight months later, four jetties had been completed and a fifth was nearing completion when a gale struck. The storm began early on a Monday morning and continued until 3:00 Tuesday morning. When the laborers returned to work on Tuesday, they found "the distressing spectacle of the dredging boat lying in the swamp on the western side of the river, entirely above high water, having parted all her cables during the gale, and about 2 o'clock in the morning having gone ashore." Worse, the storm had destroyed 6,000 feet of completed jetty, scattering the materials so thoroughly that the project was a total loss.[7]

Captain Blaney's crew hauled the dredge back into the river and used it until November 1830, when the boiler became dangerously corroded by salt water. Blaney returned the dredge to the governor in 1832, because it had not proven sufficiently powerful to accomplish the necessary work on the river. In July 1831, another dredging boat, prepared under Blaney's direction, began work. Superior in design and effectiveness, it averaged 300 cubic yards per day and operated on the river for a number of years.[8]

The engineer in charge of both the construction of Fort Caswell since 1825 and the improvement of the Cape Fear, Major Blaney, died 15 May 1835. He was replaced the following year by Lieutenant Alexander J. Swift. A North Carolina native, Swift was the son of Brigadier General Joseph Gardner Swift, the Chief of Engineers, 1812-1818, who supervised construction at Fort Johnston on the Cape Fear River, 1804-1807. The younger Swift had also served previously in North Carolina as assistant engineer under Blaney for two years beginning in 1830, at Fort Caswell and on the Cape Fear. In 1836, he also had charge of the work at Ocracoke Inlet.[9]

During the three years Swift worked on the Cape Fear, his operations were mostly dredging and jettying. The wooden jetties built by Blaney had been continually under repair until 1834, when stone was placed on each side of them, beginning with the one near Old Town. The stone protected the structures against normal currents and from the effects of a major storm that hit the area on 4 and 5 September 1834. Six jetties were completed by 1839.

Between 1829 and 1839, Congress appropriated $202,627 for the improvement of the Cape Fear River below Wilmington. The Corps achieved only moderate success in its efforts to deepen the river. In 1827, Bache reported that the condition of the Cape Fear allowed vessels drawing only nine feet or less to reach Wilmington. By 1839, the depth had increased by two feet, remaining short of the desired depth of 14 feet.[10]

On 22 January 1839, all river and harbor work in North Carolina was transferred to the Corps of Topographical Engineers and placed under the supervision of Captain John McClellan of the Topographical Engineers. That arrangement lasted until 1841, but little work was done during the period.[11]

The Corps of Engineers did no further work toward navigational improvement of the Cape Fear until 1853. During the 1840s the jetties constructed by Blaney and Swift maintained the river at about 11 feet, but the depth at the mouth of the river decreased.

Before 1853, no work was attempted for the improvement of the entrance to the Cape Fear. In that year, Secretary of War Jefferson Davis appointed a commission to report on the improvement of Cape Fear River at and below Wilmington. Its members were Professor Alexander D. Bache, Superintendent of the United States Coast Survey; Lieutenant Charles H. Davis, United States Navy;

and Captain Daniel P. Woodbury and Lieutenant Isaac I. Stevens, both of the Corps of Engineers.[12]

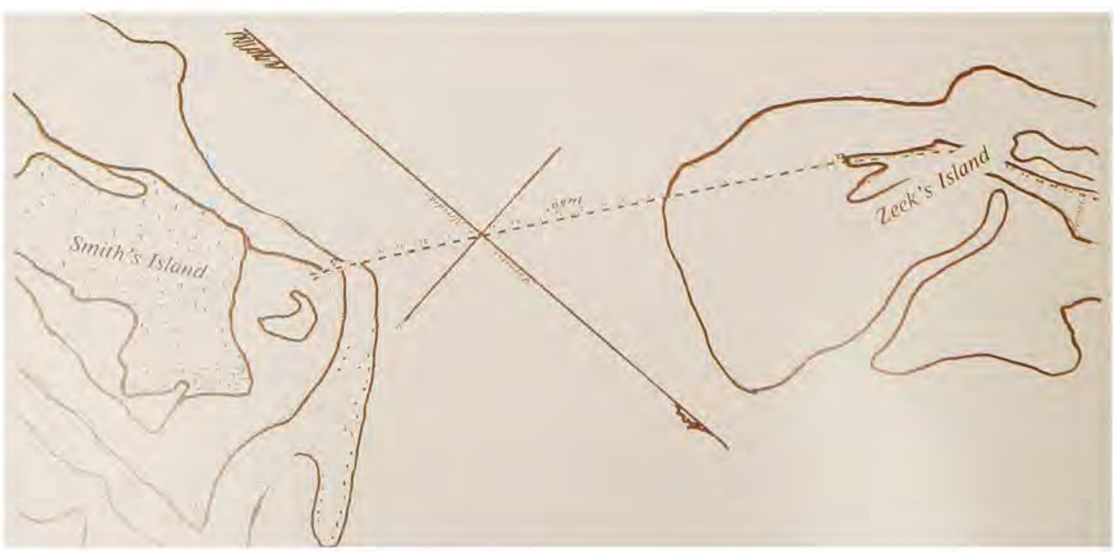
The commissioners expressed strong opinions about both the importance to Wilmington of improved navigation and the work previously done on the river. Their report observed "that a harbor which once afforded easy access to vessels drawing nineteen feet of water will now admit only those with less than thirteen; and we cannot but regard this deterioration as a great national misfortune." The panel's report castigated Hamilton Fulton and his plan for the improvement of the river, charging that Fulton had destroyed the best channels by closing those west of Clark's and Campbell's islands. The old channels had allowed the passage, at ordinary high water, of ships drawing 12 feet, nearly the capacity of the river in 1853. They had possessed the advantages of narrowness and depth, making their improvements a routine task. The commission complained:

> This plan of Mr. Fulton's was, moreover, in violation of what we regard as an important principle in river improvements, and one which can be disregarded only in rare and peculiar cases. The executed work should be perfectly safe—should threaten no permanent or temporary harm, but effect at every step a direct and positive good. This principle, which forbids the destruction of the existing state of things in the hope of finally obtaining a better, can never be safely violated where works are carried on by the State or general government, and are liable at all times to suspension, or even abandonment.

The commission proposed a plan for the improvement of the river's mouth, hoping to restore conditions on the river to what they had been before the opening of New Inlet. The river's 1853 capacity exceeded the depth available over the bar, which was deteriorating rapidly. As the depth increased at New Inlet, it had decreased correspondingly at the river's mouth. The Cape Fear discharged into the ocean at its original mouth through two channels separated by a middle ground. The main or eastern channel hugged the bend of Bald Head as it passed nearby, and the western channel ran near Oak Island. Bald Head had eroded nearly three-quarters of a mile between 1761 and 1853. The commission blamed the eroded sand for obstructing the main bar.

The report recommended four stages of operations to restore a 20-foot depth over the bar. Protection of Bald Head from further abrasion by means of jetties and sand fences would be the initial step. Immediately following the commencement of work at Bald Head, the two small openings south of New Inlet were to be closed to prevent them from increasing in size. A jetty from Zeke's Island and the closure of New Inlet would complete restoration of the river to its pre-1761 condition, and increase the depth over the bar by forcing all of the river's discharge out the original mouth—or so the commissioners predicted.

Topographical survey of Zeek's [sic] and part of Smith's islands made under the direction of Captain D.P. Woodbury, April 1855.



Brigadier General Joseph G. Totten, Chief of Engineers, and Secretary Davis approved the commission's proposals, except for the complete closure of New Inlet. On 6 March 1854, Captain Woodbury requested a reevaluation of the decision not to close New Inlet. The Board of River and Harbor Improvements of the Corps of Engineers had recommended only a jetty from Federal Point to a shoal west of Zeke's Island, instead of closure of the entire inlet. Woodbury disagreed with the board, saying "I am still fully of the opinion that the most economical plan for Improving the Capacity of the Cape Fear Main bar . . . is the complete closing of New Inlet." Professor Bache, of the Coast Survey, supported Woodbury's proposal and recommended it be implemented at once, but the Chief refused.[13]

Congress had appropriated $20,000 for the improvement of the Cape Fear in 1852, but Totten considered that amount insufficient to begin the work. A $60,000 grant to the federal government from a few Wilmington citizens allowed the Corps of Engineers to begin work on the river without waiting for more money from Congress.

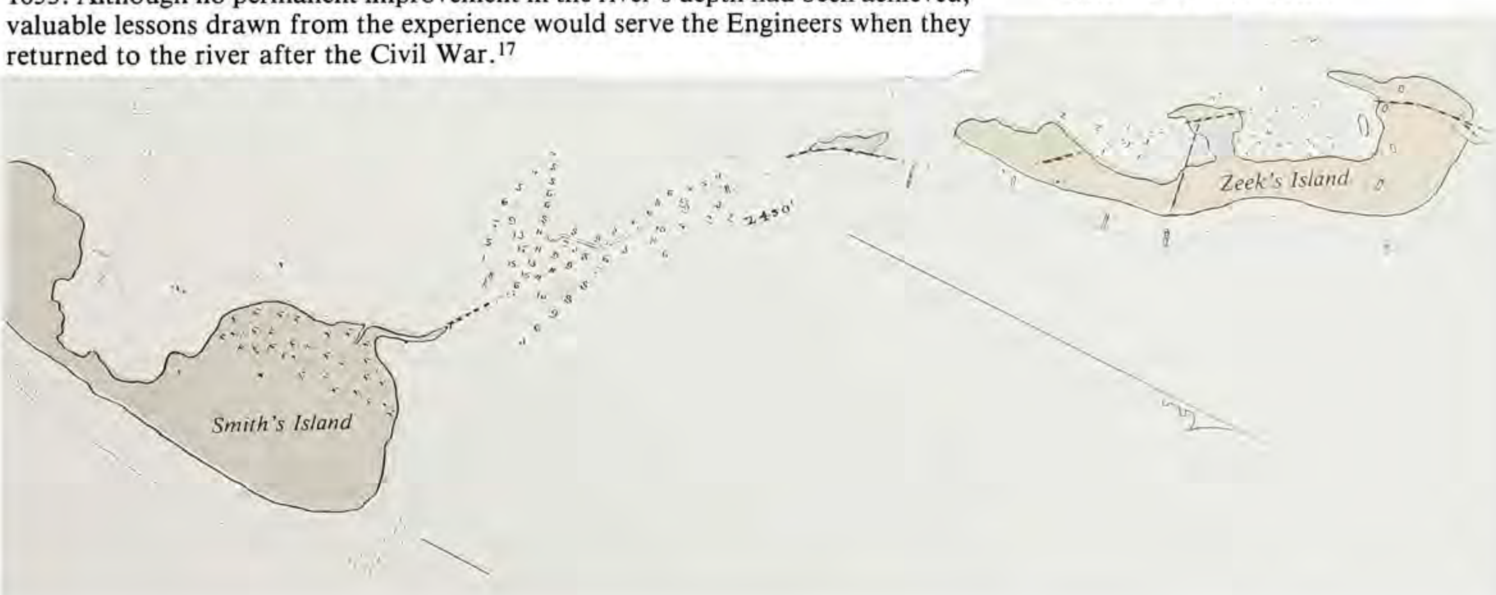
Under the supervision of Captain Woodbury during 1853, a crew of one overseer, one part-time clerk, four carpenters, one smith, and 24 laborers, using one small schooner with a master and crew, built two stone jetties on Bald Head perpendicular to the outer beach. The northernmost of the small inlets had been partially closed by the summer of 1854, when a storm enlarged it to about twice its previous width and deepened it considerably. Later that year, the two inlets joined to become one, gaping 2,300 feet wide. A grillage loaded with stone was sunk across the enlarged inlet during 1855, constricting it to 700 feet at low water. But another storm in November 1855 destroyed the new works.[14]

Lieutenant William H. C. Whiting, who replaced Captain Woodbury in March 1856, rebuilt the structure for the third time during 1856, using sheet piling, brush, and sandbags. Crews also strengthened the jetties built during 1855 at Zeke's Island. Colonel William Turnbull, Topographical Engineers, replaced Lieutenant Whiting in July 1857. On 1 September, Turnbull reported that sand had accumulated across the closed inlet. Ten days later, a three-day gale lashed the area, destroying the structure a third time and reopening the inlet to a width of 2,400 feet. Meanwhile, two other breaches opened south of that inlet.[15]

Following the death of Colonel Turnbull on 9 December 1857, a new commission assembled to study the Cape Fear. It concluded that the jetties at Bald Head had stopped the erosion and that sand was accumulating around them. The works at Zeke's Island had achieved their objective, it seemed, until the storm of September 1857. The commission recommended that the old works at Zeke's Island be rebuilt; if the depth at the river's main entrance did not increase within three years, then New Inlet should be closed.[16]

But no further work was done on the Cape Fear until after the Civil War. The Engineers had spent nearly $200,000 of private and public money on the river between 1853 and 1857. Examinations in 1858 by the Coast Survey showed a low-water depth of eight feet on the eastern channel, seven feet on the western channel, and eight feet at New Inlet—the identical soundings of those channels in 1853. Although no permanent improvement in the river's depth had been achieved, valuable lessons drawn from the experience would serve the Engineers when they returned to the river after the Civil War.[17]

Survey of Zeek's [sic] and part of Smith's islands showing the effect of the storm, September 11, 12, 13, 1857.



Ocracoke Inlet

While the Engineers battled nature on the Cape Fear River, another skirmish was taking place 130 miles northeast at Ocracoke Inlet, located on the North Carolina coast about 29 miles southwest of Cape Hatteras. In the 1820s the inlet was about 1.7 miles wide between the points of Ocracoke and Portsmouth islands. Ocracoke Inlet, such as it was, offered the deepest and most practicable of several passages from the ocean into Pamlico Sound throughout the 19th century.

The outlet for the Chowan, Roanoke, Tar-Pamlico, and Neuse rivers, Ocracoke Inlet retained the character of the mouth of a river. Connecting the vast waters of Albemarle and Pamlico sounds with the ocean, its character was also that of a strait between two seas. Flowing with force through the narrow pass, the ebb tide from within formed a bar with its deposit where it met the ocean. Likewise, the flood tide from the ocean formed with its deposit a large body of shoal within the sound. The tides cut several channels through the shoal, but all of them were obstructed.

Improved navigation at Ocracoke Inlet was vital to 19th-century North Carolina commerce. Delegates from the different towns on the rivers emptying into Albemarle and Pamlico sounds, whose trade passed through the inlet, addressed a memorial to the state assembly. In it, they described the economic hardships of shipping through Ocracoke. Annual imports and exports through the inlet were estimated at 200,000 tons with a value of $5 million. But cargoes had to be offloaded and carried across the bar on barges, because deep-draft vessels could not make the passage. The charge on vessels for lighterage and detention at the swash averaged one dollar per ton, according to the memorial. And because of the risk, insurance surcharges were levied averaging $75,000 on the cargoes and $60,000 on the ships. That placed an annual tax of $335,000 upon navigation through Ocracoke Inlet. North Carolinians accordingly petitioned Congress in the 1820s to improve the channels at Ocracoke.[18]

On 30 August 1826, Major General Alexander Macomb ordered Captain Bache to survey the swash in Pamlico Sound, near Ocracoke Inlet.[19] Bache, assisted by Lieutenants Boyce and Wragg, made an extensive survey of all islands near the inlet and the channels to the north and west of them, from the Bulkhead Shoal around to Wallace's Channel, by way of the swash and Flounder Slough. When he finished, Bache presented a dismal report to Major General Alexander Macomb, Chief of Engineers. "The present state of the navigation at Ocracock [*sic*] is deplorable in the extreme," he said, "and the more so because depending upon circumstances so entirely without the control of human efforts and to leave very little hope of the success of any measures which may be pursued for its improvement, combined with permanency."[20] The only feasible plan, Bache believed, was the use of dredging machines and camels.[21] He rejected as too risky any attempt to close one or more channels with embankments.

Acting upon Bache's survey report, Congress appropriated $20,000 in 1828, "For purchasing a dredging machine, to be worked by steam, and employing the same for the removal of the shoals forming obstructions to the navigation near Ocracock [*sic*] Inlet."[22] Brigadier General Charles Gratiot assigned the project to Lieutenant William A. Eliason, the engineer directing work at Fort Macon.

The first step in opening Ocracoke Inlet to ships with a ten-foot draft was the design and construction of a dredging machine, steam engines, a vessel, towboat, and four relieving lighters. Because facilities for building the steam engines and dredging machine were not available in North Carolina, the government contracted with firms in the Baltimore area.

The first contract, 6 October 1828, with John Grant to furnish a 15-horsepower steam engine for $7,500 was canceled for cause. A second contract dated 19 May 1829 for the same object went to John P. Streppel, who fulfilled its terms successfully.[23]

Watchman and Bratt, contractors for an eight-horsepower steam engine for the towboat, failed to complete the engine within the time specified or according to specifications. A port official, James Carney, acting as agent for Lieutenant Eliason, inspected the towboat at a New Bern, North Carolina, wharf and "then and there at the request of the said Agent . . . protested and do hereby solemnly protest against the Steam Engine and the Machinery furnished to said boat by Watchman & Bratt as not being in conformity to the contract."[24] The remaining contracts were completed faithfully, but the failure of two contractors delayed the start of operations at Ocracoke Inlet.

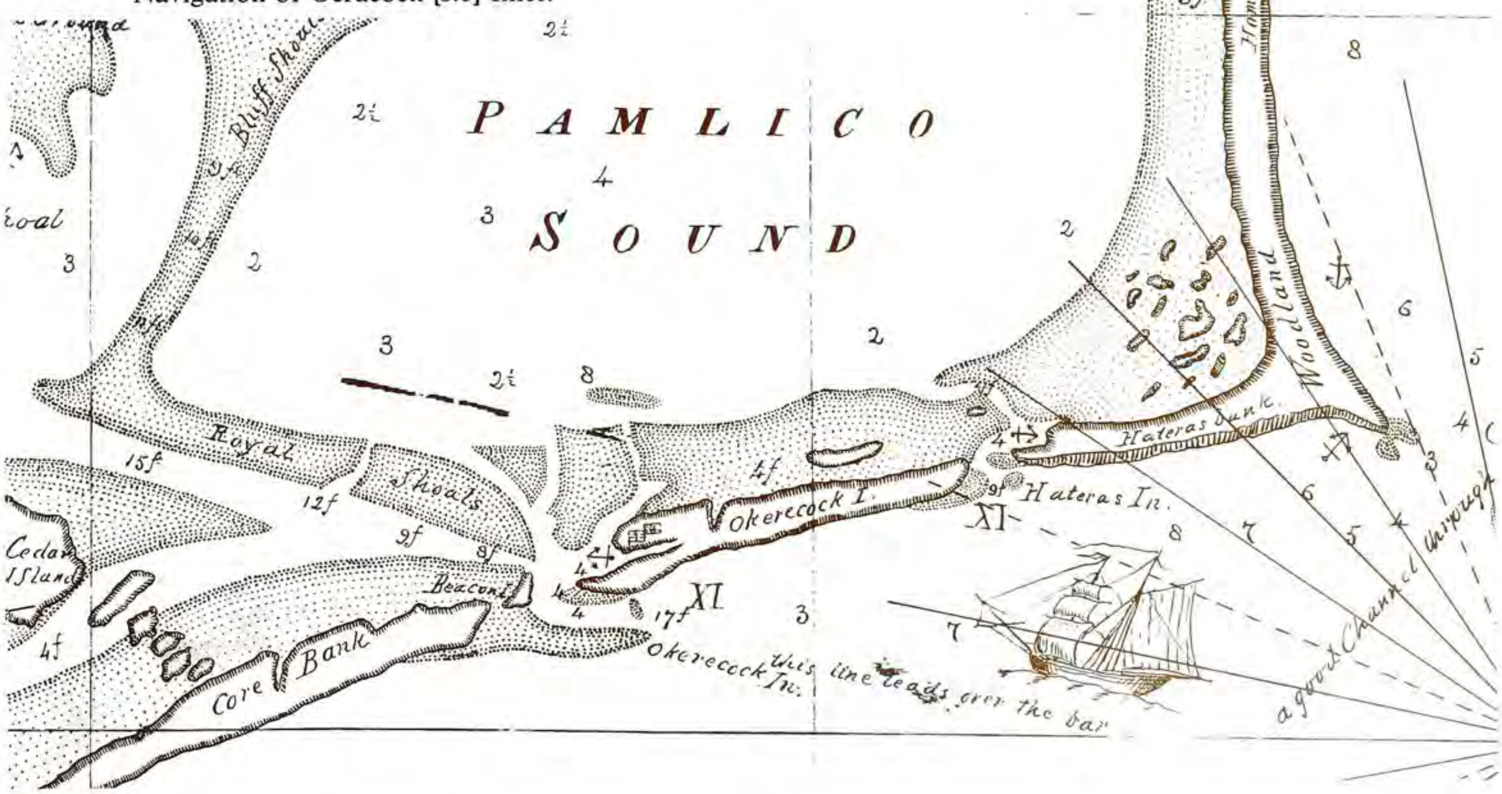
The dredge boat was finally assembled at New Bern in April 1830, but Lieutenant George Dutton, who replaced Eliason in 1829, found it to be unacceptable. The channel to be deepened would allow only vessels drawing less than four feet. The dredging vessel, designed to carry two sets of scoops, drew nearly six feet with only one set installed. Under that weight, the guards along the deck were within six inches of the waterline. The frames carrying the scoops, weighing each about seven tons, were suspended from a framework of heavy timber by chains of one-inch iron at a height of 23 feet above the deck. The design of the scooping machine put the center of gravity of the whole mass on or above the deck when the scoops were hauled up. With the scoops above deck, the foot of the carrying frame was immersed nearly five feet, making the vessel unmanageable—downright dangerous—when changing locations.[25]

Dutton was also dissatisfied with the smallness of the vessel, its instability, and its operation. He reported, "I have made a trial of the machinery alongside of the wharf at New Bern, being afraid to trust the boat therefrom, and the operation of the chains which move the scoops was imperfect and irregular to such a degree as to render the apparatus inefficient."[26]

Dutton believed that with certain modifications the boat could still be used safely and efficiently at Ocracoke. He proposed altering the scooping apparatus so that the highest part of the machinery would be only 8.5 feet above the deck, eliminating between 10 and 12 tons of material. He also recommended a change that would allow the scoops to be hauled entirely out of the water and stowed securely, making the vessel manageable and safe in rough weather. With those modifications, Dutton estimated, the boat should not draw over 5.5 feet. Dutton was anxious to put the boat in operation under almost any circumstances, in order to save time and gain experience for future work.[27]

The dredge boat finally began work at Flounder Slough on 7 August 1830 under Dutton's close supervision. He remained on board for the first several weeks of operation and was gratified with the results:

> [I]ts success has more than realized my expectations and I think its performance will double that of any Machine of the kind which has come under my observation, as it is capable of raising in fair weather about 50 Cubic Yards of sand per hour. . . . I have not the least doubt but that we Shall be able to remove with ease the obstructions to the Navigation of Ocracock [*sic*] Inlet.[28]



Dutton's confidence was short-lived. By November the boat could remove only 24 cubic yards per hour during the few days of good weather that permitted work at the inlet. In his 1830 report, he requested money for the construction of a larger and more powerful dredge.[29]

The second dredge, a 160-ton vessel equipped with a 28-horsepower steam engine, began work on Wallace's Channel during late summer 1832. Within six weeks, the two dredges had removed 8,000 cubic yards and cleared a channel varying from seven to nine feet deep at flood tide and 50 yards wide. Lieutenant Dutton beamed with satisfaction in his 1832 report. "The most gratifying circumstances attending the operations at Ocracoke," he boasted, "is the apparent permanency of the work already executed, contradicting in this essential point the opinions generally entertained, and affording the surest guaranty of the eventual success of the work."[30]

Work on Wallace's Channel continued throughout 1833 and 1834, removing about 34,000 cubic yards of material within a 12-month period. On 1 September 1834, Dutton took the older dredge boat and its worn-out machinery out of service, but the other dredge continued to work on the channel during the fall. Flounder Slough deepened from 9 to 11 feet at a width of nearly 100 feet.[31]

But Dutton's 1834 report evinced discouragement and frustration:

> There are circumstances, however, arising out of the peculiar nature of the locality which, according to the experience of the last season, are such as to create strong doubts of the practicability of improving the navigation to that extent desired by those interested in its improvement. . . . The causes here alluded to are the uncertain and shifting character of the shoals lying near the inlet.[32]

All work up to that point had been done on Wallace's Channel and Flounder Slough, several miles northwest of the inlet. Dutton considered the mouth of Wallace's Channel unsuitable for dredging, so a stable channel with an adequate depth had to be located elsewhere. An 11-foot channel, at high water, offered itself near Wallace's Channel, and Dutton pursued work there on the assumption that the mouth would remain at a constant depth.

Twelve months after dredging Wallace's Channel to a depth of nearly ten feet, Dutton realized that his stable channel was shoaling at the mouth and had to be abandoned. About a mile above the mouth of Wallace's Channel, he found yet another channel with a six-foot depth. A dredge worked there for six weeks, removing 7,500 cubic yards of material and creating a narrow channel nine feet deep at high water. But when he resumed operations in the spring of 1833, Dutton discovered that the new channel had disappeared.[33]

At about the same time, Dutton learned to his further dismay that the mouth of Wallace's Channel had changed its position and deepened to ten feet. Recognizing the futility of dredging in loose, sandy bottoms, Dutton ordered the work on Flounder Slough to proceed rapidly to raise the volume and speed of the water flowing through the new mouth. The current in Flounder Slough increased from 22 to 32 inches per second as the depth increased, but that had little effect on the new mouth, which during the summer of 1834 shoaled to a low-water depth of five feet. Dutton concluded that little could be done to maintain a ten-foot channel at the mouth by dredging only, avowing that "whatever depth may be obtained by the present process, it can hardly be relied on as possessing permanency so long as the gradual operations of nature remain the same."[34]

Dutton transferred to work on the Ohio River in 1835. He was replaced by Lieutenant Alexander J. Swift, even as the course of the operations at Ocracoke Inlet was changing.

Swift continued to use the dredge on Flounder Slough, increasing the depth by one foot to 8.5 feet during 1835. But he also began to plan work to stabilize the mouth of Wallace's Channel. Using data obtained from an 1835 survey, Swift proposed the erection of a jetty across a strip of shoal separating Wallace's Channel from Beacon Island Slough, to turn the course of the channel's ebb tide. He wanted to restore conditions as they were in the 1820s, when a shoal formed near the mouth and forced the ebb tide to cut a channel 15 feet deep. Swift predicted that a similar channel would develop south of the jetty to a depth of 18 or 20 feet.[35]

Swift's proposed jetty received approval, and Congress appropriated $9,000 for the project in 1836. But because of the exposed position of the jetty, work on it could proceed only during the months of March through August. Swift postponed operations until 1837.[36]

Swift and his crew began construction of the brush-and-wood jetty in March 1837. The work progressed well until August 1837. Then, on 18 and 19 August, a violent gale devastated the nearly completed structure. The extent of the destruction was so great that Swift found it impossible to finish the job. He was as frustrated as Dutton had been in 1834, and from the same cause—nature posed a challenge at Ocracoke Inlet that could not be met with the equipment and knowledge of the 1830s. While trusting in the future and hoping that the Corps of Engineers had suffered only a temporary setback, Swift must for now concede defeat:

> The changes which are continually taking place in the navigation of Ocracoke Inlet, may at some future time, present an opportunity of permanently improving it at but little expense, but such is its exposed situation, that I *now* regard the possibility of any *immediate* improvement as very doubtful, and therefore respectfully recommend to the Department a cessation for the present of the operations there.[37]

No further appropriations came forth for Ocracoke Inlet until 1890.

The federal government spent nearly $133,750 on the improvement of Ocracoke Inlet from 1826 to 1837. The Engineers surveyed, dredged, and jettied, but in the end, the results were temporary or nil. The passage reverted to its former shallow and hazardous condition after 1837, and the people dependent upon Ocracoke Inlet continued to pay a premium to pass through it.

Residents of other parts of North Carolina requested federal assistance on their waterways before the Civil War. The dredge boat used at Ocracoke Inlet began work on a shoal in the Pamlico River below Washington in 1836. The work progressed rapidly, and a channel eight feet deep and 150 feet wide was nearly completed when the boat burned (Swift believed that to be the work of an arsonist) on 30 November 1836. Another dredge completed the channel in 1838. Congress appropriated money for New River, Core Sound, Washington Harbor, Beaufort Harbor, and Roanoke Inlet, but little work was completed on those projects before the Civil War.[38]

One of the numerous inlets on the North Carolina coast

CHAPTER IV

Nothing of This Kind is Provided In the Modern Forts

Without the power of repelling the most significant force . . . the honor of our flag may be jeopardized by a demonstration at this point of our maritime frontier, by the smallest force of an Enterprising Enemy.

—Captain R.H. Kirby

In the first half of the 19th century, as the Corps of Engineers pursued both parts of its dual mission, the engineers built three major and a handful of minor works of fortification in North Carolina. The War Department and local residents were anxious to protect the state's ports, especially Wilmington, North Carolina's leading port. But while the army engineers might erect forts to protect the coastline from raiders or invaders, the works were of little use without armament or garrison.

Fort Johnston

Situated on a bluff overlooking the Cape Fear River, Fort Johnston was originally designed to protect the river against Spanish pirates, when it was authorized by the North Carolina colonial assembly in 1745. Named in honor of Governor Gabriel Johnston, the fort was not completed until 1764. Royal Governor Josiah Martin took refuge there for a few weeks in 1775, then fled the place just before colonial militiamen burned it to the ground. In 1794 the state ceded the site to the federal government on condition that a new fort be built there for protection against a possible British attack.[1]

A special congressional committee on fortifications studied the state of defenses on the Atlantic Coast and recommended the fortification of 16 ports. The committee suggested earthen batteries as the most economicial, yet secure, type of defense. Congress appropriated funds for the development of the facilities in March 1794. On the site of Fort Johnston, a small earthen battery was erected and manned by a small garrison. A proposed battery and blockhouse at Ocracoke Inlet never rose above the foundation.[2]

In 1798, again under the threat of war, Congress developed another program for coastal defense. Benjamin Smith, a local resident, agreed to build Fort Johnston to discharge a liability owed to the federal government. Work on the fort progressed haltingly and had stopped completely by 1800, according to a report by Lieutenant Colonel Jonathan Williams, who visited Wilmington and the Cape Fear area in May 1803 to inspect the work at Fort Johnston.[3]

Williams, grandnephew of Benjamin Franklin, served as Chief of Engineers and first superintendent of the new military academy at West Point for several years beginning in 1802. He wrote two reports on the defense of the Cape Fear River. Describing the river entrance as the most vulnerable part of the North Carolina coast, Williams recommended three small batteries behind a sand bank at Bald Head and Oak Island, with a more substantial work at Fort Johnston. The Bald Head and Oak Island works were to be built only in time of war. Williams' visit to Wilmington came during the transfer to the Corps of Engineers of the duties of construction and repair of fortifications formerly vested in the defunct Corps of Artillerists and Engineers. It was also the first of several visits to North Carolina by some of the leading army engineers of the 19th century.[4]

In 1804, Second Lieutenant Joseph Gardner Swift was the first Corps of Engineers officer assigned to what is now the Wilmington District. He was sent to supervise the construction of Fort Johnston. Swift later served as Chief Engineer of the Army from 1812 to 1818.

Second Lieutenant Joseph Gardner Swift, the first West Point graduate and later Chief of Engineers, 1812-1818, was ordered to supervise the construction of Fort Johnston in 1804. Swift submitted a report in July 1804 to Secretary of War Henry Dearborn, calling for the completion of Fort Johnston under a contract with Benjamin Smith. Until Swift received his orders in September, he spent a summer of leisure "among agreeable families from Wilmington, that passed the warm season in slight frame houses at 'The Fort' as the village of Smithville was called." During that time he met (and later married) Louisa Margaret Walker of Wilmington.[5]

In September, Benjamin Smith's slaves began the construction of a tapia battery on the foundation completed several years before. The tapia, a masonry comprised of oyster shells, lime, sand, and water, was poured into wooden forms raised to the dimension of the parapet, six feet high and seven feet thick. Smith suspended work on the battery in April 1805 because of a contract dispute with the government. Again, Swift found himself with few official duties while he awaited further orders. Afflicted by yellow fever and generally poor health, Swift requested reassignment to a northern post. He and his family left Wilmington for New York in March 1807, to assume a post at West Point.[6]

Diplomatic relations with England and France deteriorated throughout 1807. By February 1808, Secretary of War Dearborn had selected 55 coastal sites where defenses were to be repaired, completed, or begun. In North Carolina they included Ocracoke Inlet, Wilmington, and Beaufort. Colonel Williams assigned Major Alexander Macomb, Captains William McRee and Charles Gratiot, and Lieutenant William Partridge to Charleston, South Carolina, to supervise fortification work in the Carolinas and Georgia. Macomb and Gratiot would later serve as Chiefs of Engineers.[7]

During the summer of 1808, Major Macomb, accompanied by Captain Gratiot, visited Beaufort, Ocracoke, and Cape Fear to make arrangements for the defense of the harbors. At Beaufort, Macomb proposed a semi-circular fort of tapia, with five guns mounted on traveling carriages. The small structure, Fort Hampton, was completed under the supervision of Captain Gratiot in 1809. However, it was built too near the inlet and washed away in a storm in 1815. Macomb recommended against the construction of a fort on Beacon Island at Ocracoke Inlet.[8]

Fort Johnston remained unfinished because of the lingering contract dispute with Benjamin Smith, who was elected governor in 1810. Macomb finally completed negotiations with Smith in 1809, and Captain Gratiot transferred from Beaufort to Smithville to begin collecting materials to complete Fort Johnston. Before he could accomplish much, he was ordered to suspend work and transferred to Mississippi.[9]

Major Swift was named engineer for North Carolina, reporting to Macomb in Charleston. In 1810, he returned to North Carolina to resume command at Fort Johnston. A January inspection of the fort by Swift and members of the Wilmington Defense Committee found it in a dilapidated condition. Swift recommended to Secretary of War William Eustis that no extensive work be erected at Fort Johnston unless a suitable fort also were to be built at Oak Island.[10]

Early in April, Swift received orders to make necessary repairs on the fort, move a guardhouse, and build a permanent brick barracks and a fence to surround the property. Instead of slaves, hired workmen supervised by troops completed the construction in January 1811. In July, eight new 24-pounder cannons and carriages arrived at the fort. Swift was finally able to report "that the Battery is in such a state of defense, as a Water Battery of Eight 24 Poundr [*sic*] Cannon is susceptible of."[11]

The War of 1812 did not directly affect North Carolina. At the outbreak of hostilities, Swift and most North Carolina officials considered the state's coast, particularly the Cape Fear area, vulnerable to attack. He again recommended the construction of a permanent fort on Oak Island to defend the river, and submitted plans to the Secretary of War in 1813. But the only fortification work done along the river during the war was the erection of a temporary battery at Federal Point near New Inlet.[12]

The United States entered the War of 1812 with its coastal defenses unprepared for a major conflict. As it happened, the war demonstrated the ineffectiveness of low-budget earthen works like Forts Johnston and Hampton. In 1816, the Board of Engineers for Fortifications was established and given responsibility for selecting sites and planning fortifications for a new, comprehensive system of defense incorporating naval and military planning and the latest defensive doctrines. By the 1820s, the engineers had begun construction of several masonry forts, which dominated coast-defense work until the Civil War. Two of them were in North Carolina—Fort Caswell on Oak Island and Fort Macon at the mouth of Beaufort Harbor.[13]

Fort Johnston Map, 1810

Fort Caswell

A defensive work on Oak Island had been suggested by Williams during his first visit in 1802. The site chosen for the fort was on the eastern end of Oak Island, an area susceptible to severe erosion. The original plan for the fort (named in honor of Richard Caswell, North Carolina's first governor) called for an irregular polygon of masonry with a perimeter of the enclosing walls of about 425 yards. The fort was designed for a garrision of 500 men and 90 guns in two tiers of bombproof casemates and one tier of guns *en barbette* (that is, so mounted as to fire over the parapet). However, the fort was garrisoned by a small number of troops for only a few years. In 1860, it housed only 18 unmounted guns.[14]

Under the supervision of Captain George Blaney from 1825 to 1835, the construction advanced slowly. Not enough competent workmen could be found in the area, forcing Blaney to import them from the north before building the main structure. By 1829, Blaney reported that the greater portion of the masonry work had been completed. Although not finished until 1838, Blaney began requesting a garrison for the fort in 1832.[15]

Several years before the fort's completion, the beach surrounding the site began to erode, prompting Blaney to build two jetties in 1833. By August, he reported sand accumulating around them. The jetties protected the beach until a northeaster struck the coast on 18 August 1837. Lieutenant Alexander J. Swift reported that about 100 yards of the southeastern point of Oak Island washed away and, "where the day before the gale, one might have walked dry shod, there is now from 14 to 15 feet [of] water."[16] In 1839 Swift requested funds to repair one of the jetties and remove the other using the stone along the beach, but no further work was done at the site before the Civil War.[17]

Throughout the 1840s and 1850s, a caretaker or ordnance sergeant maintained the fort. In January 1861, three months before the firing on Fort Sumter, North Carolina militiamen prematurely captured Forts Caswell and Johnston without a struggle. Governor John Ellis ordered the forts returned with his apologies. But on 16 April, the militiamen retook the places and began to prepare for their defense.[18]

Fort Macon

North Carolina's other major defensive work, Fort Macon, guarded Beaufort Harbor at the entrance of Beaufort Inlet. Named in honor of Nathaniel Macon, a North Carolina senator, Fort Macon rose simultaneously with Fort Caswell under supervision of Lieutenants William Eliason, George Dutton, and Alexander Swift and Captain John L. Smith. They faced many of the same difficulties at Fort Macon as their counterparts at Oak Island. Progress on the fort was delayed by shortages of skilled workmen and bricks of suitable quality. Poor weather hampered the work force as several major storms damaged the fort. As at Oak Island, the site of Fort Macon eroded during the fort's construction.[19]

An enclosed pentagonal masonry work with casemate quarters on all faces and surrounded by a dry ditch, Fort Macon was an example of the use of counter-fire rooms to flank the ditch. Designed for an armament of 56 barbette guns and six flank-defense howitzers, Fort Macon was protected on the land side by an earth slope called a glacis. The approach to the sally port, through the glacis, curved sharply to prevent the exposure of the gate to a direct hit.[20] Years later, Colonel Dan C. Kingman inspected the fort and commented on its design:

> One is also impressed with the care taken by their designers to provide for a very strong passive defense on the part of the garrison, thereby enabling a small force to resist successfully, for a considerable length of time, the assaults of a very much larger one. Nothing of this kind is provided in the modern forts. . . .[21]

Colonel Kingman, writing in 1907, must have been unfamiliar with the history of Fort Macon. The fort was completed and garrisoned in 1834 at a total cost of $463,700. The garrison withdrew in 1836 as a result of congressional economizing and the demands of the Seminole War, but it returned during the years 1842-1845 and again in 1848-1849. Throughout the 1850s, a caretaker or ordnance sergeant manned the place, which lacked weaponry. According to Captain R.H. Kirby, who inspected the fort in 1835, "There is no armament of any description for this work. Should hostilities occur with any power, the place is liable to insult. A Privateer might occupy the harbor with impunity, and without our being able to fire a shot."[22]

During the Civil War, North Carolina militiamen seized Fort Macon easily in April 1861. The Confederates held the fort until 26 April 1862, when a ten-hour assault by Union land and sea forces forced Colonel Moses J. White to surrender his garrison of nearly 500 men. The federal government turned the place into a military prison for the remainder of the war.[23]

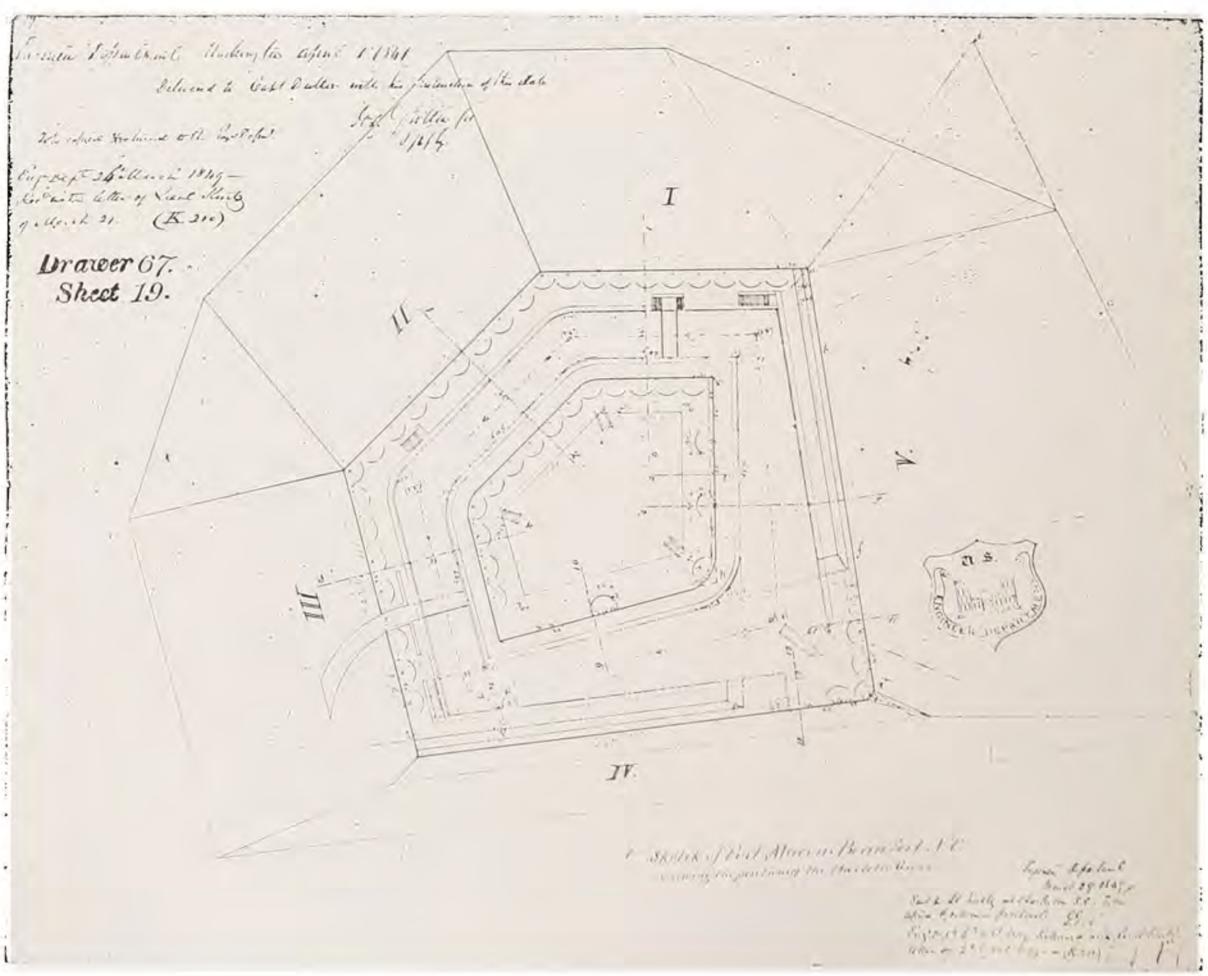
The most persistent and troublesome battle fought at Fort Macon was the struggle to save the structure from encroachment by the sea. In 1834, Dutton surveyed the water surrounding the fort and built a series of jetties. Six more jetties appeared in 1844-1845, according to a design drawn up by Captain Robert E. Lee, who inspected the place in 1841 and wrote an 18-page report of his findings

Robert E. Lee as a captain in the Corps of Engineers visited Forts Caswell and Macon in 1841.

and recommendations.[24] By October 1846, the beach was reported to be in excellent condition, with the jetties causing a large accumulation of sand. But 12 years later, the jetties had settled and several had separated from the beach. The struggle to preserve the site of Fort Macon would continue after the Civil War.[25]

The fortifications built by the Corps of Engineers before 1860 saw little actual combat. The Army garrisoned and armed the forts sporadically, usually during times of national emergency. The engineers renovated and expanded Fort Caswell in the 1890s and early 1900s. It is now the site of a church campground. Some of the buildings at Fort Johnston have been used as a public library, a base for Corps of Engineers survey parties, and an office for the Military Ocean Terminal at Sunny Point. Fort Macon is part of the most visited state park in North Carolina.[26]

Map of Fort Macon showing the positions of barbette guns, 1849



CHAPTER V

Best Ever

It is certain that he commanded those who scourged the waters to utter, as they lashed them, these barbarian and wicked words: "Thou bitter water, thy lord lays on thee this punishment because thou hast wronged him without a cause, having suffered no evil at his hands. Verily King Xerxes will cross thee, whether thou wilt or no. Well dost thou deserve that no man should honour thee with sacrifice; for thou art of a truth a treacherous and unsavoury river." While the sea was thus punished by his orders, he likewise commanded that the overseers of the work should lose their heads. Then they, whose business it was, executed the unpleasing task laid upon them; and other master-builders were set over the work, who accomplished it in the way which I will now describe.

—Herodotus

At the end of the Civil War, North Carolina was defeated, ravaged, and economically desolate. The state's financial system faced collapse. More than 40,000 North Carolina men had lost their lives during the war and were no longer a part of the work force. Slavery no longer existed. The state's transportation system lay in shambles, with millions of dollars worth of railroads, bridges, and roads destroyed. North Carolina's most important rivers were blocked by artificial obstructions planted to deter Yankee vessels. Again, North Carolinians looked to the federal government for assistance in improving the state's waterways.

When the Corps of Engineers resumed work in North Carolina in 1870, the engineers there were under the supervision of Major William P. Craighill, head of the Corps office in Baltimore. A Virginia native, Craighill served with the Union Army during the Civil War, building defensive works in Tennessee, Pennsylvania, and Baltimore. After the war, he remained in Baltimore as District Engineer for most of a quarter-century. Ultimately, he rose to the rank of brigadier general and served as Chief of Engineers, 1895 to 1897. One of the leading engineers of the late 19th century, Craighill oversaw river and harbor work in North Carolina during the critical period following the Civil War.[1]

The engineers supervising the work on the Cape Fear River maintained an office at Smithville (now Southport), rather than Wilmington, in order to be close to the work and in a healthier climate. Captain Charles B. Phillips, Assistant Engineer under Craighill, opened a second office in New Bern in 1878, better to supervise work on the Neuse River and other river and harbor projects in the northern part of the state. Both civilians and military officers oversaw individual projects or groups of projects under the purview of the Corps of Engineers.[2] In the 1870s and 1880s, the most important project in North Carolina was the improvement of the Cape Fear River below Wilmington, in particular the erection of two structures that came to be known as the Rocks—New Inlet Dam and Swash Defense Dam.

Wilmington had played a key role during the Civil War. President Abraham Lincoln proclaimed a blockade of southern ports in 1861, and the Union fleet maintained an effective screen throughout the war, covering most southern harbors. Almost the only vessels that could successfully enter and leave southern ports were swift, shallow-draft blockade runners. Those privately owned vessels sailed between the Confederate states and the British Bahamas, bringing food and weapons in exchange for southern cotton. Wilmington—one of the blockade runners' favorite ports because the Cape Fear River's two mouths proved difficult to blockade—remained open until late in the war. It was one of the last avenues for supplies available to Robert E. Lee's Army of Northern Virginia. Blockade runners sailed in and out of the river's mouths under the protection of stout defensive works.[3]

Four positions protected the Cape Fear River—Forts Caswell, Johnston, Anderson, and Fisher. The bulwark of the river's defense was the imposing structure of Fort Fisher, an L-shaped earthwork located on Federal Point (renamed Confederate Point during the war), north of New Inlet. Stretching from the river across the peninsula half a mile and then south down the beach for a mile, the fort took its Confederate builders nearly three years to complete. A land-and-sea attack by Union forces on 23-25 December 1864 ended with Fort Fisher intact, still garrisoned by Confederates. About two weeks later, an armada of 60 warships and a detachment of 8,000 men, under the command of Admiral David Dixon Porter and Brigadier General Alfred Terry, launched the heaviest land-and-sea attack of the war. Fort Fisher fell on 15 January 1865 after receiving over 40,000 rounds of Union artillery during the two attacks, which also involved bloody hand-to-hand combat. Union forces entered Wilmington on 22 February, cutting off Lee's last major source of supplies.[4]

New Inlet had been invaluable to Wilmington and the South during the Civil War. When the firing stopped, however, it again became a liability. The depth over the bar continued to decrease, and Wilmington, a busy port during the war, suffered a loss of commerce. Wilmington businessmen again sought assistance from the Army Corps of Engineers. Their leading spokesman was Henry Nutt.

Nutt, a Wilmington businessman, worked with the city's Chamber of Commerce nearly all of his adult life, serving as chairman of the chamber's Committee on River and Harbor Improvements. In 1868, he forwarded a memorial from Wilmington residents to Senator Joseph C. Abbott, who introduced it in Congress. Abbott, labeled a carpetbagger by his political enemies, had fought for the North and was cited for gallantry in the capture of Fort Fisher. He settled in Wilmington after the war to edit the *Wilmington Post*, a Republican weekly. In Congress, Abbott pushed for appropriations to improve the Cape Fear.[5]

Plan of Fort Fisher, 1865

Closing New Inlet

In 1869, Congress authorized a preliminary examination of the river, conducted by Colonel James H. Simpson in August 1869. He concurred with the 1858 commission's findings, "That the first important step in any further attempt to improve the entrance of Cape Fear River is to renew the works for the closing of the small inlets in Zeke's Island and the jetties for the preservation of the outer beach of that island."[6] According to Simpson, those inlets weakened the force of the currents through the original mouth. In that manner they allowed sand from the sea to wash over into the river, to be carried down by the ebb tide and deposited on the bar. He believed that the remains of the works constructed by Woodbury in the 1850s could be used in building the breakwater, and he rather precisely estimated the breakwater's cost at $256,415.53. The Chief of Engineers approved the project and Congress appropriated $100,000 in 1870. The work on the river proceeded in three phases: closing New Inlet and nearby swashes, removing natural and artificial obstructions, and dredging a channel 12 feet deep.[7]

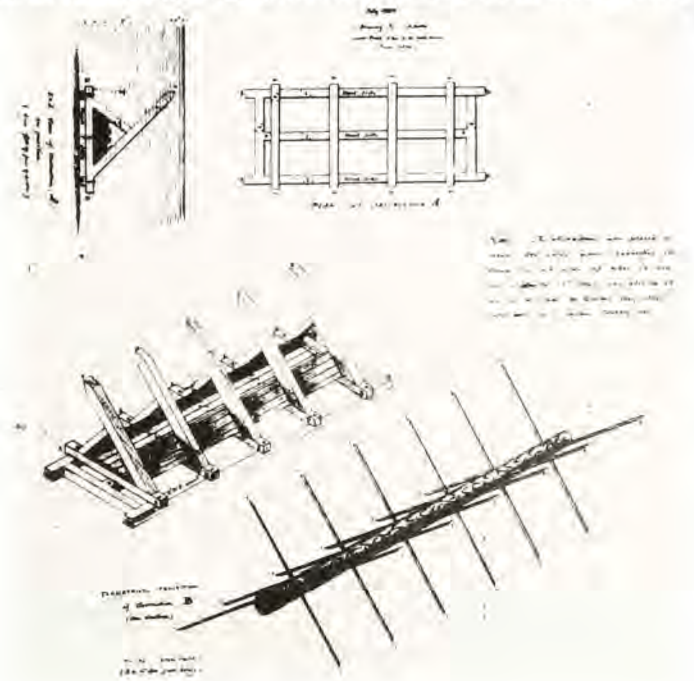
The breakwater, a wooden crib-work, was built across the breach along the same lines as Woodbury's structure of 1855. On 30 June 1873, the final spike was driven, completing 4,403 feet of works connecting Smith's and Zeke's islands. As the breakwater was built, a sand spit followed along on the sea side of the work, always remaining a little behind the superstructure's leading point. The sand spit lay from 40 to 200 feet away from the work, running parallel to the breakwater and leaving between the sand and the structure a body of water that rose and fell with the tides. To fill in the space with sand and protect the crib-work from shipworms, several worn-out flats were sunk at the narrow points of the water and sandbags placed on both sides of the structure. By 1877, the name Zeke's Island was a misnomer because the sand had connected the two islands and closed the breach.[8]

In 1871, Major Craighill asked that a Board of Engineers assemble to discuss the improvement of the Cape Fear. Meeting in Wilmington and New York, the board issued a report recommending the dredging of Bald Head Channel and the closing of New Inlet. At Bald Head, the extreme western point had suffered severe abrasion from the increased flow through the channel as the breach was closed. The jetty built by Woodbury had been completely turned, and a channel more than 200 yards wide had formed between it and the shore. The board advised that nothing be done to protect or repair the jetty.[9]

The main obstacle in the river by 1872 was the "logs," a shoal of relict timber about eight miles below Wilmington. The work done according to Hamilton Fulton's plan forced the river's main channel to seek a new passage over the "logs." But it never managed to find more than a nine-foot channel. A cut through the obstruction seemed to offer the most practical method of deepening the channel.

Phillips chartered a large dredge boat equipped with grappling apparatus to remove the trees. In March 1874, the boat began pulling stumps from the riverbed, but the process took much longer than anticipated. Instead of a shoal with trees washed down by the river, the "logs" was the site of an old cypress swamp. The dredge pulled up stumps as much as eight feet thick. Many of the taller stumps had apparently been hit by the keels of passing vessels. Nonetheless, by 1875 the dredge had cut a channel 245 feet wide and 12 feet deep at low water through the "logs."[10]

The Engineers also removed a set of Confederate man-made obstructions in the river three miles below Wilmington, placed there during the Civil War. Most of them were in rows of grillages, loaded with stone to anchor them in position,



Yankee Catchers were obstructions to navigation placed by the Confederates in parts of the Cape Fear, Neuse, Pamlico and Roanoke rivers.

with ten-by-ten-inch timbers pointing downstream at a 45-degree angle. Mounted on the upstream sides of the grillages and armed with iron points, the timbers lurked just below the low-water mark. As a boat crossed the hazard, the timbers would turn as on a hinge until, as they approached a vertical position, they punctured the vessel's hull. The Confederates had placed 500 yards of the grillages in two rows on the western side of the channel and one row on the eastern side. Scattered around the end of the rows lay a number of other obstructions made of railroad iron, leaving only a narrow passageway. The Engineers removed the hazards in July and August 1875, breaking off the pointed timbers with a hawser attached to a tug pulling upstream, and tackling attached to the temporary yard-arm of a chartered schooner.[11]

Besides clearing wartime obstructions, the Corps of Engineers oversaw the dredging of the river by contract and by the Corps' own hopper dredge. The 1873 project for the Cape Fear called for the purchase of a steamer to be fitted out as a suction hopper dredge for work at Bald Head Channel. The following year, the engineers bought a 145-ton, propeller-driven steamer. They equipped her with a nine-inch centrifugal pump and hoppers on the main deck with a total capacity of 40 cubic yards. They also renamed the dredge *Woodbury* in honor of Captain Daniel P. Woodbury.[12]

The *Woodbury* and a dredge belonging to Curtis & Fobes began work on Horseshoe Shoal in 1874. Horseshoe Shoal, on the western side of the river opposite and below New Inlet, was once the site of the river's main channel, which the current from New Inlet gradually drew eastward. The shoal was formed there by the constant meeting and separating of contrary currents. The two dredges cut a nine-foot channel with a bottom width of 100 feet, removing 95,000 cubic yards of material by May 1875.[13]

The *Woodbury* worked on Bald Head Channel in 1874 and 1875, when not engaged at the Horseshoe cut. Not well adapted to working in rough water, the dredge was able to remove, carry over the bar, and dump only 160 cubic yards per day, under good conditions. In June 1875, soundings showed a depth of 11.5 feet at low water at Bald Head, an increase of just 18 inches. But dredging and removal of obstructions were only supplemental to the principal work for the river's improvement—closing New Inlet.[14]

The Board of Engineers had said that the closure of New Inlet was "very desirable and should be attempted as soon as funds are available."[15] The first step in closing the inlet was the erection of a jetty from Federal Point on the northern side of New Inlet, following a line of shoals in a southwesterly direction. Under the supervision of Phillips, a crib-work similar to that used between Smith's and Zeke's islands, loaded with stone to the high-water level, slowly extended out into the inlet. By the time 200 linear feet had been built, a serious deepening had developed ahead of the jetty. Cribs 12 feet deep were required where originally there had been just six feet of water. In November 1873, crews sank the last crib-work in 20 feet of water, only 500 feet from the shore. Phillips decided to halt at that point to determine the effect of the work already completed.[16]

Lower Cape Fear River--area where New Inlet and Swash Defense dams would be constructed.

Henry Bacon, wearing derby and white whiskers, directed the construction of mattresses used as foundations for a rubble stone dam. New Inlet was cut by storm in 1761 and was a convenient passage for blockade runners during the Civil War. The dam closed the inlet to provide a deeper channel in the Cape Fear River, 1876.

Captain Phillips called for proposals for the construction of a foundation or apron across New Inlet. None of the bids opened on 21 June was accepted, but the proposals did provide valuable information on the views of the contractors willing to take on such a risky project. Phillips estimated the cost of closing the inlet at $300,000.[17]

The following August, new proposals were opened and the Corps of Engineers awarded the contract to Bangs & Dolby of New York, for $120,000, to build an apron across the inlet. Bangs & Dolby laid a wood, brush, and stone apron across New Inlet beginning at the end of the 500-foot deflector jetty already in place. The apron comprised a layer of round timbers one foot thick, closely tied, carrying from 8 to 12 inches of brush, and enough stone to make the apron's aggregate thickness four feet. Each section of the "mattress"—the wood-and-brush part of the apron—was 36 feet wide and 36 feet long and was floated out to the proper position and held in place by anchors. Workmen placed stone on the mattress until it sank, after which the required amount of stone was dumped on the mattress to a height of four feet. Bangs & Dolby laid the total length of the apron, 4,352 feet, between 7 October 1875 and 17 June 1876. The apron's width varied from 40 to 70 feet, with an average of 53 feet. The contractor guaranteed the work for one year.[18]

Initially, the structure showed little sign of settlement, but scouring occurred just ahead and on both sides of the apron as it was laid. The scouring formed an irregular channel parallel to the apron and three feet below the original bottom. That caused little concern, however, because sand was also accumulating over the apron, protecting it. The engineer in charge of the work at New Inlet, Henry Bacon, was satisfied with the results.[19]

Bacon, a civilian, replaced Captain Phillips on 1 February 1876. Born in Natick, Massachusetts, in 1822, Bacon had spent most of his life working on railroad construction, in particular the Illinois Central and Boston and Maine lines throughout the Midwest and New England. He moved to Smithville in January 1876 to supervise the construction of the New Inlet Dam and the dredging of the river, and to conduct surveys. He later moved to Wilmington and lived there until his death in 1891.[20]

For the completion of the portion of New Inlet Dam above high water, the Corps awarded Bangs & Dolby a contract for the delivery of 45,000 cubic yards of stone. The first load of stone, from the Magnolia Quarry on the Cape Fear, 14 miles above Wilmington, was dumped on the dam in January 1877. The dumping proceeded from both ends of the apron, working toward the middle. By June 1878, the dam had reached the low-water mark but still lacked a proper width and slope.[21]

Henry Bacon (upper right), *engineer in charge, observed workers using hand tools to uncover stone for use in building the rock dam to close New Inlet. To his right is Colonel Craighill (in civilian clothes) who directed operations in North Carolina from the Baltimore office, c. 1884.*

As the height and width of the dam increased, the scouring on each side also advanced. The overfall of the water formed channels parallel to the dam to a depth of 30 feet below low water and 8 to 12 feet below the dam's original foundation. In addition, the middle sections of the mattress began to settle. The water worked its way between and under the logs of the mattress and gradually lowered the foundation so that for nearly the entire length of the dam the base was 12 feet below low water. Little or no settlement occurred where the mattress lay 14 feet or deeper at low water. As a result of the scouring and settlement, the dam rested on a ridge with deep channels on either side.[22]

Bacon believed the scouring and subsidence left the dam in a more secure state and promised a better chance for the ultimate security and permanence of the structure. But the subsidence also required more stone riprap than had been expected. Bacon decided against widening the mattress foundation or building jetties perpendicular to the dam after crews constructed an experimental 100-foot jetty, without producing any apparent effect.

He proposed merely filling out the slopes with more stone. On the completion of the apron in June 1876, Captain Phillips had estimated that 85,000 cubic yards of stone would be required to bring the closing work to the high-water mark. In a special report in March 1878, he estimated that 62,000 cubic yards already had been placed on the dam and that an additional 80,000 cubic yards would be required to finish the work to high water.[23]

During the dam's construction, a gap had been left to enable light-draft vessels to pass in and out as they had been accustomed to doing for over a century. For "corn crackers," a fleet of small coastal schooners carrying grain to Wilmington from Albemarle Sound, the distance was 64 miles longer by way of the Bald Head mouth than by New Inlet, because of Frying Pan Shoals. The longer route was also more dangerous, forcing the corn crackers to navigate the hazardous waters off Cape Fear. In spite of protests from the owners of vessels using New Inlet, Bacon decided he could no longer leave the dam unfinished. On 14 June 1879, the Corps of Engineers officially closed New Inlet, and Henry Nutt received the honor of being the first person to walk across it with dry feet.[24]

Once the dam was completed to the project height of two feet above high water, workmen continued to deposit riprap on the dam where it fell onto the slopes. That formed a slope of two to one on the sea side and one and one-half to one on the river side.[25]

A severe gale swept off the top of the dam to the low-water level in August 1879, demonstrating that, as previously supposed, it would be necessary to cover the dam with large stones to assure its permanence. Heavy stones were shipped to Wilmington from Columbia, South Carolina, by rail, then transferred to two large lighters built especially for the task. A steam hoist placed the rock on the dam with the assistance of two hand-worked floating derricks. Workers fitted the stones together to form a smooth surface.[26]

Bacon finished the work on New Inlet Dam in July 1881. As oysters and barnacles solidified the riprap below half tide, the completed structure appeared to be one solid rock 4,800 feet long. The central portion had an average height of 37 feet and a width at the base ranging from 75 to 120 feet. The more than 181,000 cubic yards of stone used to complete the dam was equivalent to a wall eight feet high, four feet thick, and 100 miles long. Occasionally a storm damages the structure, but only minor repairs have been necessary over the past century. The dam continues to separate the waters of the Cape Fear River from the Atlantic.[27]

Swash Defense Dam

Before Bacon and the Corps of Engineers could close New Inlet, a storm opened a breach between New Inlet and the closed Smith's-Zeke's islands swash on 13 April 1877. Because of the fears of many Wilmingtonians that a new inlet had broken through, Bacon wrote a letter, published in the *Wilmington Star*, promising that the Corps of Engineers would not allow a new inlet to develop.[28]

The first attempt to close the new breach by artificial means was made in February 1881. Bacon tried scantling and sheet piling driven by hand, but that proved inadequate. About 35 men had nearly completed the work when the tides caused a difference in level of more than 15 inches on either side. The sheet piling suddenly gave way, and all materials and labors were lost.[29]

Bacon made a second attempt to build a sturdier structure during the spring and summer of 1881. A machine with a 2,000-pound hammer drove over 400 heavy piles eight feet apart in two lines nine feet apart. An accretion of sand on the sea side, the real defense, followed the work as it progressed, and it appeared that the structure would be a success. However, a succession of storms in August and September 1881 broke through the beach on the north side of the breakwater, flanking the defense and forcing its abandonment. To save the work would require contending directly with the ocean, at enormous cost and substantial risk.[30]

Bacon recommended a line of defense extending from Zeke's Island over the shoal water, as nearly as practicable to the line of the neutral currents, thus reducing the tidal differences. After the dam's completion, Bacon anticipated the closing of the swashes by natural processes. The closure of New Inlet tended to increase the tidal currents through the swashes, preventing the natural closure that had occurred before with other swashes.[31]

Following a trip to Galveston, Texas, with Craighill to examine the Corps of Engineers' harbor improvement there, Bacon proposed a mattress similar to that used in Galveston Harbor. Composed entirely of small brush, the mattress would be strong, yet pliable enough to conform to the foundation in all conditions. Bacon hoped that settlement from overfall scouring would be prevented by a mattress of that type. The plan of operations called for a row of mattresses, 40 to 60 feet wide, to be laid along the line earlier proposed, with riprap covering the mattresses to the ordinary high-water mark.[32]

Before a crew of 40 men could complete the mattresses, a major storm, with an average wind velocity of 81 miles per hour for 24 continuous hours, opened a new swash just north of the other two and nearer New Inlet Dam. That forced Bacon to lengthen and adjust the line of mattresses. After several delays Ross and Lara, contractor for the stone, began delivering in December 1884, bringing it from a quarry on Gander Hall plantation, about 12 miles below Wilmington.[33]

The men placed the stone on the mattress to a depth of about ten feet and then waited for the structure to settle. However, the dam settled only 4 to 12 inches. The work proceeded slowly but smoothly over the next few years, hampered only by an occasional storm. By 1891, the entire 12,800 feet of the Swash Defense Dam had been finished to the proper height and width.[34]

The 1870s and 1880s were a period of transition for Wilmington shipping interests. Closing New Inlet drastically reduced the number of coastal vessels docking at Wilmington. Yet, the improvement of the river allowed increasing numbers of larger ships involved in foreign trade to use Wilmington Harbor, as the accompanying table demonstrates.

TABLE

Number of Vessels Over 60 Tons Register Departing Wilmington

Year	Coastwise	Foreign
1870	532	40
1873	446	144
1880	272	316
1885	268	230

[Source: *Annual Report of the Chief of Engineers, 1885.*]

The real magnitude and difficulties of the task of building the dams were not fully appreciated at the outset. Both were much larger and more expensive than originally planned. New Inlet Dam cost $540,000 and Swash Defense Dam $226,000. (Although nearly three times longer than New Inlet Dam, Swash Defense Dam cost less because materials were available nearby, and a smaller volume of stone was used.) Both structures have served their purpose well and still protect the beach in the area. Long after they had proved their value, the Wilmington District received an award in the "Best Ever" category of the 1975 Chief of Engineers Distinguished Design Awards Program, South Atlantic Division, for the design and construction of the "Rocks."[35]

The Rocks today. In commemoration of the 200th anniversary of the U.S. Army Corps of Engineers, the 1975 Chief of Engineers Awards Program was expanded to include special recognition of an outstanding project from each division. South Atlantic Division submitted the New Inlet Dam or "The Rocks" as the best project developed in the Division's history.

CHAPTER VI

I Doubt Very Much If This River Is Worthy of Improvement

It is with rivers as it is with people: the greatest are not always the most agreeable nor the best to live with.

—Henry Van Dyke

The nature, variety, and number of its widespread responsibilities forced upon the Corps of Engineers a decentralized organization. The Office of the Chief of Engineers in Washington, D.C., could not supervise every activity separately, so officers were sent throughout the country to administer projects. During the 1870s and 1880s, the demands on Craighill and the Baltimore office of the Corps multiplied as the number of rivers and harbors under improvement in North Carolina and surrounding states increased. By 1884, a permanent Corps office closer to the work than Baltimore was required. Wilmington, the state's leading port, became the headquarters of the new Wilmington District. Major General John Newton, Chief of Engineers, selected Captain William H. Bixby to be the Wilmington District's first District Engineer.[1]

Establishment of the Wilmington District

Captain Bixby, a Massachusetts native, graduated from West Point at the head of the class of 1873. He spent most of the next 11 years at academic institutions in the United States and abroad, as both student and teacher. When ordered to Wilmington, Bixby was stationed in New York City preparing a formal report on fortifications, based on his official tour of Europe during 1881 and 1882.

The position of District Engineer in Wilmington was not Bixby's first choice. Only a few weeks after his arrival in Wilmington, Bixby wrote General Newton asking that his name be placed on the list of those who would accept the position of Professor of Engineering at West Point, if offered. It was not offered to Bixby, who remained in Wilmington to organize the new district's personnel and serve as head of the Wilmington District longer than would any other person, from 1884 to 1891. After leaving Wilmington, Bixby continued his climb in rank. In 1910, he became brigadier general and Chief of Engineers.[2]

Newton put Bixby in charge of Fort Macon and the improvement of Beaufort Harbor; Georgetown Harbor, South Carolina; Contentnea Creek; Cape Fear River above Wilmington; Neuse, Trent, and New rivers, North Carolina; and Santee, Wateree, Great Pee Dee, and Waccamaw rivers in South Carolina. Craighill retained control over the work on the Cape Fear below Wilmington until 10 January 1885, when he requested that it also be turned over to Bixby.

Newton appointed Craighill as supervising engineer over several new districts, including the Wilmington District. Under that arrangement, Bixby submitted annual and monthly reports and any plans or modifications of plans for river and harbor improvements to Craighill's office. Craighill made occasional inspections of Bixby's work and records, continuing in that role until December 1888. Under General Orders Number 12, Brigadier General Thomas Lincoln Casey, Chief of Engineers from 1888 to 1895, divided the engineering work in his charge into five geographic divisions: Pacific, Northwest, Southeast, Southwest, and New England. Wilmington became a part of the Southeast Division, with headquarters in Baltimore.[3]

Captain William H. Bixby, Wilmington District's first District Engineer. He held that position longer than any other person—1884 to 1891. He was Chief of Engineers from 1910 to 1913.

The Wilmington District officially opened in a small room on Second Street, 24 November 1884, with a staff of four or five people. The office later moved to the third floor of the Post Office Building, and in 1916 to its present location in the Customhouse, later renamed the Federal Building. Bixby, as District Engineer, supervised all river and harbor improvements and fortifications in the district. Civilian assistant engineers directed major projects or groups of projects, reporting to the District Engineer.

As Lieutenant Colonel David Porter Heap, Wilmington District Engineer in the 1890s, described to Charles Humphreys his duties as an assistant engineer:

> You will see that all contract work complies with the specifications and that work done by Government employees is faithfully and economically carried on. The inspectors and overseers will be under your orders, and you will be responsible for the manner in which they perform their duties. All correspondence between inspectors and overseers and this office will pass through you.[4]

The Wilmington District was fortunate to have several competent assistant engineers in its early years. In addition to Henry Bacon, who worked in North Carolina until his death in 1891, Charles Humphreys and William Hobbs Chadbourn, Jr., gave the district several years of faithful service. Humphreys, nephew of Major General Andrew A. Humphreys, Chief of Engineers, began work with the Corps of Engineers in 1870, at the age of 17, and continued until his death on 18 November 1906. During his years in the Wilmington District, he supervised the improvement of the Cape Fear River, Georgetown Harbor, Winyah Bay, and the military construction at Fort Caswell. He left the Wilmington District in 1902 to work for the Corps of Engineers in Wheeling, West Virginia. Chadbourn served as assistant in charge of work at New Bern beginning in 1892, and worked in the Wilmington District throughout the 1890s. After leaving North Carolina, he gained prominence as chief engineer of the Chicago and Great Western Railroad and as Herbert Hoover's assistant in Belgium relief work.[5]

A civilian whose career shaped the character of the Wilmington District was Robert C. Merritt. "Mr. Bob," as he became known, began working part-time while still in high school. In 1887, he accepted full-time employment as a rodman with a survey crew. For the next 50 years Merritt rose through the ranks to become assistant engineer, general assistant engineer, and ultimately District Engineer from 1917 to 1919. He was the only civilian to fill that position in the Wilmington District.

Lacking a college education, Merritt studied at home and learned through practical experience. He became almost indispensable to the Wilmington District. When, in 1919, the Division Engineer wanted to transfer Merritt elsewhere, Major John R.D. Matheson, District Engineer, objected loudly. "His transfer from this office would be a serious loss to the district," Matheson said, "as he is probably more familiar with the waterways of North Carolina, and the river and harbor improvements in the district, than any other man in the country."[6]

Merritt was meticulous about everything concerning his work. When he spoke of a bump in the bottom of the Cape Fear River 15.5 miles below Wilmington, one could rest assured the bump was there. For a number of years, he matched nickels with a fellow employee every morning for sodas. He kept a record of his winnings and losses in a special notebook at his desk and accounted for every nickel.[7]

Robert C. Merritt has been the only civilian to serve as District Engineer. He began as rodman in a survey crew in 1887 and rose through the ranks until he became District Engineer in 1917.

Not all assistant engineers served with distinction, however. E.D. Thompson, a long-time employee of the Wilmington District, was fired in 1893. While Thompson was out of town, Major William S. Stanton, District Engineer, picked up a scrap of paper from the floor of Thompson's office, revealing that Thompson had filed two false accounts of purchases. Shortly after that discovery, an employee opened a letter addressed to Thompson and Stanton from the Standard Paint Company of New York City. From the letter's contents, Stanton learned that Thompson had become the southeastern sales agent for the company's building materials. When Thompson had recommended a pile protector a few days earlier, he was the agent for its sale—thus serving at the same time the government, himself, and the company in the transaction. Stanton demanded Thompson's resignation and informed him that a letter of recommendation, requested of Stanton by Thompson, would not be forthcoming.[8]

In the last quarter of the 19th century and early in the 20th century, the Corps of Engineers experienced a steady increase in workload, with a growing number of rivers and harbors under improvement in North Carolina. By World War I, nearly every river and stream in the eastern part of the state had been examined or surveyed by the engineers. Before and immediately after the Civil War, the South had received proportionately less money for internal improvements than other sections, except for the far West. With the resurgence of southern influence on Capitol Hill, the region's congressmen set out to compensate for the past by strongly supporting large rivers and harbors appropriations. The political interest in internal improvements combined with an argument that waterways acted as regulators over railroad rates brought forth federal money for more and more projects.[9]

Beaufort Harbor

In North Carolina, the Corps of Engineers worked on several rivers and harbors in an effort to improve navigation by dredging, snagging, and jettying. North Carolina's second major port, Beaufort, shoaled badly in the 1860s and 1870s. A January 1881 survey by Charles Yeates, a civilian assistant engineer, showed the immediate cause of the harbor's deterioration to be the erosion of Shackleford Point at the harbor entrance opposite Fort Macon. The Shackleford Point sandbanks washed away by over 500 feet between 1864 and 1880, and 900 more feet between 1880 and 1881. Beaufort residents expressed considerable anxiety to Yeates, and not only concerning the shoaling of the harbor. They also feared that a widening harbor entrance would allow storm waves to sweep directly up to their wharves and jeopardize the town's waterfront.[10]

The work at Beaufort came under the supervision of Robert Ransom, a former Confederate general who had headed up a special police force of Confederate veterans in Wilmington, suppressing the black population during the tumultuous period following the war.[11] In 1881, Ransom began a jetty on Shackleford Point aimed directly at Fort Macon's flagpole, but only 30 feet of jetty and supplemental equipment were completed when the money ran out. Funds appropriated in 1882 and 1883 allowed Ransom to complete the jetty to a length of 535 feet and to build a smaller jetty east of the first, up Core Sound. For the next few years, the structures were maintained as the Engineers observed their effects on the harbor. The jetties at Fort Macon, built in the 1840s, were also repaired in the 1880s.[12]

The jetties and sand fences on both sides of the inlet halted the inlet's widening and migration, but the deterioration of the depths in the main channel was quite rapid. That was because the inlet was still too wide for its tidal discharge to keep the channel scoured out to the proper depth. The project of 1890 authorized a seven-foot channel to Beaufort by dredging. In 1910, competition between Beaufort and Morehead City emerged as both cities sought to become the southern terminus of a waterway being built between Pamlico Sound and Beaufort Inlet. (The two cities are on opposite shores of the Newport River, only about two miles apart.) Beaufort was selected, but its importance soon began to wane as Morehead City grew.[13]

Tar-Pamlico River

A survey of the Tar-Pamlico River by George Elliot in 1872 showed that natural and artificial obstructions blocked the river. About six miles below Washington, four rows of piles—driven in pairs, the second row about ten feet from the first and each pile driven so as to divide the space of the preceding row—had been placed in the river during the Civil War by the Confederates. Swindell & Sparrow of Washington, North Carolina, removed 895 piles using a windlass and snag-hooks. Dredging under contract with G.H. Ferris of Baltimore began 1 October 1877. After completing a cut through a bar near Washington, the dredge went a mile and a quarter downriver to remove a shoal of sand, mud, and a mass of roots and stumps—work that continually caused the dredge to break down.[14]

On the Tar River, hired crews built 22 inexpensive brush jetties during 1880 and 1881. The jetties were two rows of piles, the rows three feet apart and the piles five feet apart. The space between the rows was filled with solidly packed brush, and the sides were interwoven with small limbs and brush. Over 3,233 linear feet of jetties were built by March 1881. Workmen completed an additional 2,000 feet of jetties by 1884.[15]

The Corps of Engineers expended $45,666.33 before 30 June 1884 to secure a nine-foot channel at low water, varying from 108 to 175 feet wide, in the Pamlico River up to Washington, and to clear and deepen the Tar River. The work on the Pamlico showed some signs of longevity, but according to the engineer in charge of the project, John P. Darling, the Tar was "not susceptible of entire and permanent improvement."[16]

After the jetties were built, the only work necessary to keep the channel open until 1900, when dredging began, was the removal of snags, stumps, and trees from the river and banks. In 1897, a survey report for a possible ten-foot channel to Washington, prepared by Lieutenant Colonel David P. Heap, District Engineer, noted that 80 percent of the river's commerce passed through the Albemarle and Chesapeake Canal, which had only a seven-foot channel. Most of the remainder of the traffic came through Ocracoke Inlet, with a nine-foot depth. He concluded that a ten-foot channel was needless. In 1912, a 10-by-200-foot channel to Washington, a 6-by-75-foot channel to Greenville, and a 20-inch-by-60-foot channel to Tarboro were approved. Those remained the project depths until 1931.[17]

TAR-PAMLICO BASIN

NEUSE RIVER BASIN

Neuse River

The Neuse River was a tortuous waterway obstructed by thousands of natural and artificial obstacles. It had almost no commerce when surveyed by the Corps of Engineers in 1871 and 1878. Congress appropriated $40,000 on 18 June 1878 to clear the stream of obstructions from the mouth to Goldsboro, and to make certain cutoffs to provide a channel five feet deep to Goldsboro and three feet deep to Smithfield. The Corps decided to use the appropriation to remove the obstructions and dredge a channel through a shoal east of New Bern. The cutoffs were abandoned.[18]

Civil War blockades blocked the Neuse River at four locations. First, at Johnson's Point, four miles below New Bern, stood a row of "Yankee Catchers," inclined spars secured to cribs or boxes filled with stone, similar to the Confederate obstructions in the Cape Fear River; second, three miles below New Bern sat another row of Yankee Catchers a short distance below a line of scuttled vessels filled with stone and flanked with piles; third, three miles above New Bern lay a row of sunken cribs, barges, and vessels filled with stone; and fourth, seven miles below Kinston two rows of sunken cribs filled with stone arranged checker-wise stretched across the channel. Under the supervision of Robert Ransom, the hazards were removed by blasting in 1879 and 1880. But natural obstacles were also a problem. Instead of the estimated 6,000 logs and snags to be removed, crews pulled out over 16,000.[19]

The river required extensive jettying to obtain the project depth. In the spring of 1879, five experimental lumber jetties were erected just below Kinston to remove a shoal. Because they worked well, over the next 20 years the Corps built hundreds of lumber-and-brush jetties in the river. Between July 1881 and June 1882, the Corps constructed 14,550 linear feet of plank jetties on the lower Neuse. The District also built several brush jetties, but they could not withstand the action of the current, especially during freshets, so after 1881 the jetties were all made of lumber. The Rivers and Harbors Act of 13 June 1902 provided for a channel 300 feet wide and eight feet deep below New Bern, four feet to Kinston, and during nine months of the year, three feet to Smithfield. That project required dredging and snagging to complete.[20]

The improvement of the Neuse River sparked a substantial growth in commerce, which increased from practically nothing in 1878 to a million dollars per year in 1885. The commerce of 1890 amounted to $6,469,103, while the total expenditures for the river's improvement to that date were $233,267. Each dollar spent in improvement promoted $20 in annual commerce. By 1922, however, the ratio had dropped to one to ten because of a decrease in river traffic and an annual increase in total expenditures.[21]

Throughout the late 19th and early 20th centuries, the Wilmington District surveyed or improved over 50 streams, harbors, and inlets. Besides the Tar-Pamlico and Neuse rivers, the Wilmington engineers made significant improvements on the Trent, Roanoke, and New rivers and Contentnea Creek.[22] They built jetties, snagged the rivers, and dredged, but most of North Carolina's rivers still depended on the hazardous inlets for access to the sea. In 1889, Congress asked Bixby to make an examination of Ocracoke Inlet to determine if it could be deepened.

Ocracoke Inlet

In October 1890, Secretary of War Redfield Procter approved a project for Ocracoke Inlet based on Bixby's survey report. Bixby recommended dredging Wallace's Channel, and estimated the cost to be $100,000 at ten feet deep, $190,000 at 13 feet deep, and $280,000 at 15 feet deep. To protect the dredged channel, if necessary, training walls or protecting dikes would be built at an additional cost of $320,000. The project provided for dredging a first cut at least 200 feet wide and 12 feet deep at low water, at an estimated cost of $83,000. Congress appropriated $90,000 for the improvement of Ocracoke Inlet in the Rivers and Harbors Act of 19 September 1890.[23]

The Corps entered into a contract with the Alabama Dredging & Jetty Company on 28 November 1891 for the dredging of Ocracoke Inlet. The dilatory contractor requested three extensions between 1891 and 1893 before beginning the work. During the delay, the new District Engineer, Major William S. Stanton, discovered that an attempt had been made to improve Ocracoke Inlet in the 1820s and 1830s (see Chapter III)—something that Bixby had not known. When Stanton brought that information to his superior's attention, he was directed to make a further study of the project, including a new survey. Stanton assigned the resurvey of Ocracoke Inlet to his assistant, Lieutenant Eugene W. Van C. Lucas, who made estimates for dredging Wallace's Channel and Beacon Island Slough to depths of 9, 10, 12, 14, and 15 feet, with costs ranging from $45,129.88 to $208,075.44.[24]

Map of Ocracoke Inlet, 1891

Captain William P. Craighill, Wilmington District Engineer, 1897-1899

On 15 May 1893, Stanton issued a report with his recommendations. After reviewing the records of the earlier attempted improvement; studying Lucas's survey report; receiving advice from agents, shipowners, and mariners familiar with the sounds; and personally inspecting the location, Stanton considered any "attempt to make and maintain such an enlargement of any one of the channels on the inner shoals as hazardous in the extreme." In conclusion, he stated, "I would *not* recommend the expenditure of any money upon the improvement of the inner shoals, except, perhaps, $15,000 to obtain 8½ feet at Ocracoke Swash."[25] Instead of spending thousands of dollars on a risky attempt at improving Ocracoke Inlet, Stanton advocated a liberal application of funds for the improvement of the Dismal Swamp Canal. He considered the canal much safer because it entailed "no hazardous or doubtful features of engineering."[26]

Stanton's recommendations upset many residents of eastern North Carolina, including Congressman William A.B. Branch, who fired off a letter to General Casey protesting Stanton's proposals. Asking Casey how Stanton could disapprove of a project already approved by the Chief of Engineers, Branch called for the immediate application of the money available for the work. Stanton was directed to resurvey the inlet and make new recommendations for its improvement. Although Stanton still preferred the use of the Dismal Swamp Canal to Ocracoke, he recommended dredging a 9-by-400-foot channel through Teachs Hole Swash, instead of Wallace's Channel.[27]

The Teachs Hole Swash project, adopted in May 1894, was revised two months later. As modified, the project called for a dredge to make cuts nine feet deep at mean low water and 300 feet wide, about 5,000 feet long at the head of Wallace's Channel and about 700 feet long on Beacon Island Slough, to obtain a nine-foot channel through the inner shoals to Pamlico Sound. Under a contract with Chester T. Caler, dredging began on 23 April 1895. The Wallace's Channel cut was completed in October 1896 with the removal of a total of 80,608 cubic yards of sand. By January 1897, Caler had finished the Beacon Island Slough channel.[28]

Stanton's predictions about the futility of any dredging on the shoals within the inlet came true. Captain William E. Craighill, District Engineer and son of Lieutenant Colonel William P. Craighill, surveyed Beacon Island Slough in June 1898. He found that most of the dredged channel through Beacon Island Slough had shoaled to its pre-1895 condition. By 1903 the governing depth in the channel had deteriorated to less than five feet. The commerce passing through the inlet also withered. During 1896, vessels carrying 50,000 tons of freight traversed the inlet. Four years later, the total decreased to 5,000 tons, owing to the worsening conditions at the inlet and the reopening of the Dismal Swamp Canal. The Engineers again sounded retreat and, at least for the time being, gave up on the idea of maintaining a permanent channel through Ocracoke Inlet and the inside shoals.[29]

Cape Fear River

Whatever went on elsewhere in North Carolina, the Cape Fear River, the state's only major stream not dependent upon an inlet for access to the Atlantic Ocean and accordingly its most important commercial waterway, remained the center of attention. Once the Engineers closed New Inlet, dredging began in earnest. In the Rivers and Harbors Act of 3 March 1881, Congress adopted a project for a channel 16 feet deep and 270 feet wide from the bar to Wilmington. The work was done by the Corps of Engineers' own dredges and by others hired under contract.

The most troublesome part of the river to keep open to 16 feet was at Horseshoe Shoal, opposite New Inlet Dam. Dredging under contract by Rittenhouse Moore of Mobile, Alabama, completed the channel through the shoal in December 1883. The cut immediately began to shoal and was redredged in 1887 and 1888. In 1887, Bixby and Bacon recommended abandoning the channel and dredging a new one that would follow the natural course of the river. The new cut was completed in 1890 and renamed Snows Marsh Channel. The prospects for the channel's stability encouraged Bacon, who said, "It is not probable that much if any repairs will be needed at the new channel. . . . The wisdom of the change from the Old Snows Marsh Cut seems already demonstrated."[30]

Rittenhouse Moore received a contract in 1884 for the dredging of a 16-foot channel through three shoals on the Cape Fear just below Wilmington. Moore encountered several problems in fulfilling the contract. The dredge he had planned to use was unavailable when he needed it, so he was forced to lease a dredge from another company. When several other contractors refused to lease him a dredge, he accused them of conspiring against him and trying to force him to default on his contract.

After Moore finally secured a dredge, he requested permission from Lieutenant Colonel William P. Craighill to work seven days a week, day and night. Craighill permitted Moore's dredge to work 24 hours a day, but refused to allow him to dredge on Sunday. Craighill asked Bacon, "Is there no law of the state of North Carolina which forbids work on Sunday? If there is, we should observe it. At any rate there is the higher law of the Decalogue, and we will observe that."[31] Craighill also warned Bacon about reaching any oral understandings with "tricky contractors" such as Moore, who in any event completed his contract in February 1886, eight months late.[32]

The Wilmington District also had problems with another dredging contractor, C.P.E. Burgwyn of Richmond, Virginia. Burgwyn bid on a contract for dredging the Cape Fear below Wilmington in October 1892. A few hours before the bids were officially opened on 3 November 1892, significant quantitative errors were discovered in the specifications, affecting the entire course of the work. Burgwyn maintained later that his representative was not notified of the errors, making his bid wrongfully low and leaving Burgwyn to discover the mistake the hard way in January 1894—by the results of his dredging.[33]

Before Burgwyn realized the miscalculation, Major Stanton tried to amend his $140,000 contract by curtailing the amount of work by $35,000, in order to free enough money for the government to build a suction dredge to replace the *Woodbury*, which on 16 December 1893 burned to the waterline while tied up at the yard near Southport. (The remains of the dredge sank three years later, and it was abandoned shortly thereafter.) The only funds immediately available to purchase a new dredge, Stanton proposed, could come from amending Burgwyn's contract.[34]

Burgwyn objected to the reduction of his contract and offered several counterproposals. He suggested that Stanton exchange $35,000 worth of dredging for $35,000 worth of work in building a new suction dredge. His second proposal called for the application of the $35,000 toward building a dike near Snows Marsh Channel. Burgwyn next offered to do $35,000 worth of work at Ocracoke Inlet. Stanton rejected all three suggestions. On 8 March 1894, Burgwyn and Stanton finally agreed to reduce the contract by $27,000 and relieve Burgwyn of any further dredging at Snows Marsh Shoal, the most difficult and least profitable section of the river. By that time, relations between Stanton and Burgwyn had become thoroughly strained.[35]

Problems developed when Burgwyn's dredge began removing too much material. The contract read, "to deepen to 18 feet at mean low water for as great a width as the above amount of funds will allow the present channel through eight shoals. . . . An allowance of 12 inches will be made for *occasional* excess in depth, but nothing will be paid for excavation lower than 19 feet below mean low water."[36] Burgwyn used a clamshell dredge to work on the river, but it was not well suited for skimming only a small amount of material from the river bottom. Because the existing depth was less than Burgwyn anticipated, he had to undertake a large amount of excess dredging.

In dredging in soft bottoms with a clamshell dredge, the captain of the dredge usually regulated his dips and the length of his move by the known capacity of his scows. After the work was done the government inspector sounded over the cut and calculated how much had been removed below the limited line. Stanton defined "occasional" as meaning that Burgwyn would be paid for dredging to the depth of 19 feet for one-half the area dredged, provided that on the whole area the average excess below 18 feet did not exceed six inches. Burgwyn conducted the work on the assumption that upon completion of the dredging, the average of soundings taken over the entire area should be less than 19 feet. The difference of six inches meant a loss of $12,000 to Burgwyn.[37]

The dispute continued to fester as Burgwyn went over Stanton's head to Brigadier General Thomas Lincoln Casey, Chief of Engineers, and Secretary of War Daniel S. Lamont. Eventually Burgwyn suffered a breakdown in his health, and his attorney, J. Clements Shafer, took over the company and offered to complete the contract to the original amount of $140,000. Major Stanton accepted the offer and the contract was completed in 1895.[38]

The desired depth and width of the river increased as new projects started. The project of 1890 provided for a 20-foot channel at mean low water with a width of 270 feet. A 1912 project provided for a channel with a uniform depth of 26 feet, 300 feet wide, and 400 feet wide on the bar. As the depth increased, the size of ships docking at Wilmington also increased. The average tonnage per ship coming to Wilmington in 1886 was 421, while in 1904 the average was 1,032, rising to 1,259 in 1911.

A survey report prepared in 1900 by Captain Eugene W. Van C. Lucas, District Engineer, recommended the dredging of an anchorage and turning basin, deep and wide enough for vessels then using Wilmington Harbor to turn around, at a cost of $291,500. Both the Division Engineer and the Chief of Engineers recommended against the proposed improvements, on the grounds that it was costly and unnecessary. Brigadier General John M. Wilson, Chief of Engineers, suggested that the plan adopted at Savannah—to build mooring dolphins to which vessels were secured, instead of an anchorage—could be implemented for Wilmington at a cost of only $50,000. But subsequent surveys continued to recommend an anchorage and turning basin, and in 1907 the mooring dolphins plan was dropped in favor of the larger development.[39]

At the Cape Fear bar, the designers of New Inlet and Swash Defense dams had figured that sufficient current would be concentrated over the bar to keep the channel open with only a minimum of maintenance. The Engineers allowed the channel to follow the line of least resistance, and the natural channel bar gradually shifted to the west from 1839 to the 1920s. Opposite Bald Head Point, a kink developed in the channel until in 1924 part of the flow ran at a right angle to the ebb and flood tidal currents. That presented a hazard to shipping in the channel.[40]

In addition to the danger to ships, the condition of the channel increased the cost and difficulty of maintenance dredging. The dredges concentrated their efforts on the vicinity of the kink, but they were unable to increase the depth or width. The project adopted in 1919 provided for a 30-by-400-foot channel over the bar. But in 1922, the channel measured only 26 by 200 feet, even though hundreds of thousands of cubic yards of sand had been removed,[41] as shown in the accompanying table.

TABLE

Yardage Dredged at Cape Fear Bar Channel

Year	Yardage
1917	226,198
1918	203,235
1919	263,677
1920	658,612
1921	283,492
1922	329,976

[Source: Keuntz, *Cape Fear River Channel and Bar.*]

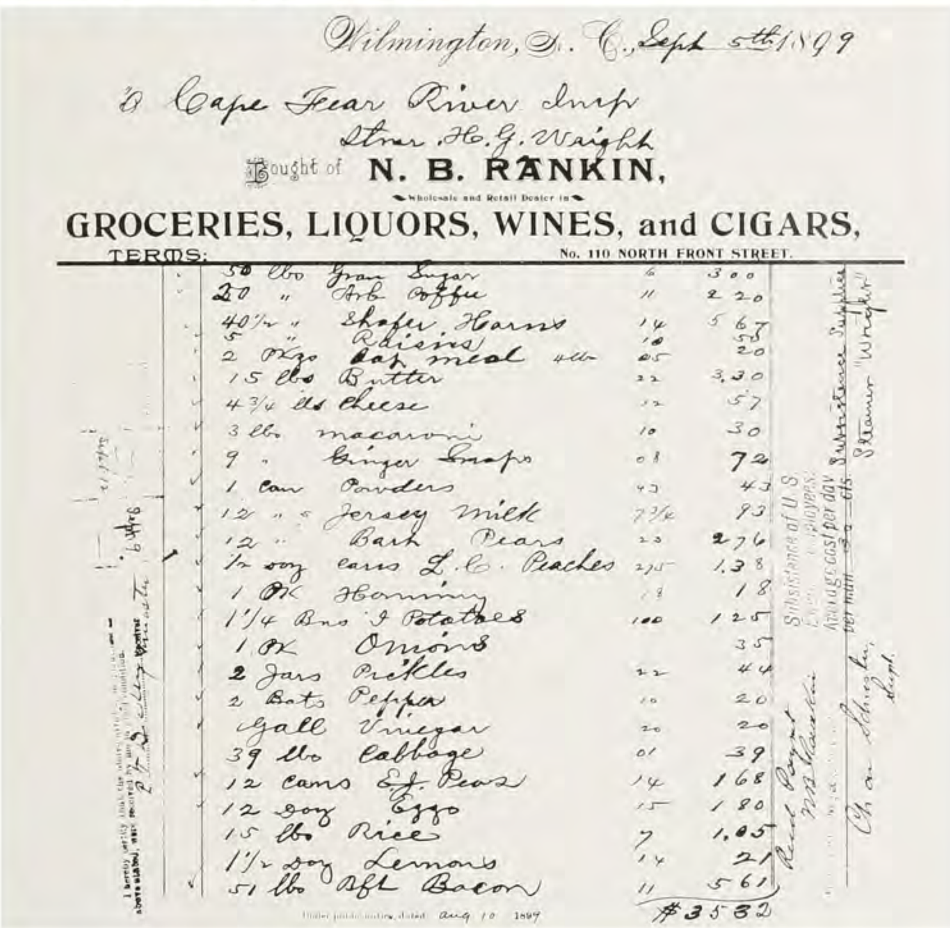
In 1921, the Corps of Engineers made a series of current observations, recording and plotting the paths of a number of floats during ebb and flood tides. The action of the floats demonstrated that the ebb tide flowed almost straight out to sea on a southwesterly course from the channel west of Bald Head Point, instead of straight west, the direction of the channel. In 1922, a new channel, following the current, was approved. The new channel has remained in the same general area and direction to the present day.[42]

Upper Cape Fear River Locks and Dams

The improvement of the Cape Fear River between Wilmington and Fayetteville had been a dream of many Fayetteville citizens. After the Civil War, the river remained under the state charter of the Cape Fear Navigation Company. Congress appropriated $30,000 in March 1881 for the river's improvement, provided the claim of the Cape Fear Navigation Company could be purchased. The federal government extinguished all rights and claims of the company by the payment of $10,000 that same year.[43]

Crews began clearing the river of snags in 1882, to provide a continuous channel over the 66 miles immediately below Fayetteville. In 1885, Congress specified a channel depth of four feet from Wilmington to Elizabethtown, a distance of 73 miles, and three feet, 42 miles farther to Fayetteville. Dredging, snagging, and jettying were all done on the river, with but few results. A freshet could wipe out the work of an entire season in just a few days. Fayetteville residents, under the leadership of Edward J. Hale III, Frederick Toomer Hale, and Thomas Hill Hale, continued to call for a year-round channel from Wilmington to Fayetteville.[44]

The Rivers and Harbors Act of 13 June 1902 provided for the construction of three locks and dams on the Cape Fear above Wilmington, at a cost of $1,350,000. They were intended to afford a depth of eight feet at mean low water between Wilmington and Fayetteville. The District completed surveys and selected three sites. Locks and dams were to be built at Kings Bluff, 39 miles above Wilmington; Browns Landing, 71 miles above Wilmington; and Tolars Landing, 95 miles above Wilmington.



Wilmington, N. C., Sept 5th 1899

To Cape Fear River Imp
Stmr H. G. Wright

Bought of N. B. RANKIN,

Wholesale and Retail Dealer in

GROCERIES, LIQUORS, WINES, and CIGARS,

TERMS: No. 110 NORTH FRONT STREET.

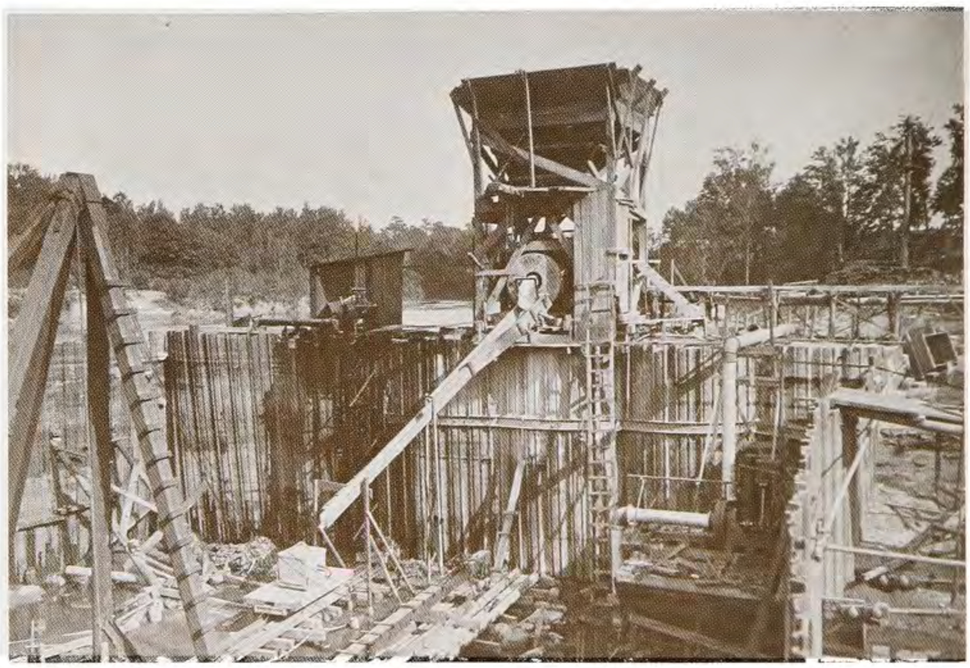
50 lbs Gran Sugar	6	3 00
20 " Arb Coffee	11	2 20
40½ " Shafer Hams	14	5 67
5 " Raisins	10	50
2 Pkgs Oat meal 4lb	05	20
15 lbs Butter	22	3 30
4¾ lbs Cheese	12	57
3 lbs macaroni	10	30
9 " Ginger Snaps	08	72
1 Can Powders	43	43
12 " " Jersey milk	7¾	93
12 " Bart Pears	23	2 76
½ doz cans L. C. Peaches	2 75	1 38
1 Pk Hominy	18	18
1¼ Bus I Potatoes	100	1 25
1 Pk Onions		35
2 Jars Pickles	22	44
2 Bots Pepper	10	20
1 Gall Vinegar	20	20
39 lbs Cabbage	01	39
12 Cans E. J. Peas	14	1 68
12 doz Eggs	15	1 80
15 lbs Rice	7	1 05
1½ doz Lemons	14	21
51 lbs Aft Bacon	11	5 61
		$35 32

Invoice for subsistence supplies for the H.G. Wright

U.S. Snagboat H.G. Wright

Sternwheeler passenger-freight boat traveled the Cape Fear River between Wilmington and Fayetteville, 1912.

Looking downstream from the coffer dam, Lock and Dam 1, is a construction scene showing concrete mixer and traveling derrick, 1914.



Construction scene at Lock and Dam 2 shows lock site and unloading trestle, 1914.

*Steamer **Mercur** passing through the lock at Lock and Dam 1, 1915.*

The three locks and dams faced strong opposition within the Corps of Engineers. The Division Engineer, Colonel Dan. C. Kingman, inspected the river and concluded, "I doubt very much if this river is worthy of improvement by locks and dams."[45]

On 11 January 1907, Major Joseph E. Kuhn, District Engineer, wrote a memorandum for the Board of Engineers for Rivers and Harbors on the project for canalization of the upper Cape Fear. Kuhn found fault with the project for several reasons. First, considered as a business proposition, the commerce on the river did not justify canalization at the estimated cost. Second, little new commerce could be expected because the river was paralleled on both sides by railroads out of Wilmington, although boats on the river might exercise a restraining influence on freight rates charged by the railroads. Third, Kuhn rejected the argument that canalization of the river would make Fayetteville a distributing point for a sizable territory beyond. "The benefits likely to result from this condition are, to say the least, extremely problematical, and probably chimerical."[46] The board agreed with Kuhn and recommended the construction of only two of the locks and dams, at Kings Bluff and Browns Landing. Congress appropriated $100,000 for the project in 1910.

The construction of the two locks and dams was hampered by the poor foundation at Kings Bluff and by high water. The test pit at Kings Bluff was begun in February 1912 by enclosing an area of 36 square feet. When the excavation reached 16.5 feet, a boiling spring burst through the clay, bringing up quicksand and rising nine feet in 30 minutes. A new test pit was enclosed, but before excavation could begin, the river began to rise; the crews worked feverishly to build a cofferdam and keep it just above the rising water. When the water receded, the excavation resumed. At an elevation of minus four feet (Bald Head datum), a new boiling spring, far greater than the first one, burst through and damaged the sides of the cofferdam. The exceedingly frustrated District Engineer, Major Horton W. Stickle, told Colonel Kingman, "If any site could be found more unsuitable for foundation purposes it has never come to my attention."[47]

By November 1913, crews had completed the cofferdam with a bottom secured with concrete, 18 feet below low water. Once the cofferdam was finished, the work progressed smoothly. On 15 July 1915, the lock gates were closed for the first time and the lock put into operation.[48] The dam is a fixed, rock-filled, timber crib structure. The lock is concrete with steel gates and measuring 40 feet wide and 200 feet long.

The District learned several lessons while building Lock and Dam 1 and applied them to the construction of Lock and Dam 2 at Browns Landing. For example, the Board of Engineers had recommended pumping out the cofferdam of Lock and Dam 2 without sealing the bottom with concrete. However, the concrete floor at Lock 1 prevented the cofferdam's failure when pumped out, by providing a secure foundation for the steel sheet piling. District Engineer Clarence S. Ridley recommended following the same method at Lock and Dam 2. By pouring the concrete lock floor in 20 feet of water, the cofferdam walls were enabled to withstand the pressure of the river.

The District completed work on Lock and Dam 2 in 1917. The dam is a rock-filled structure with a portion of the rock coming from an old Corps of Engineers jetty between Browns Landing and Fayetteville. Lock 2 is identical in size to Lock 1.[49]

A Board of Engineers appointed in 1911 postponed construction of Lock and Dam 3 to determine if an eight-foot channel could be maintained by dredging to supplement the two sets of locks and dams. Dredging began in June 1919, starting at Fayetteville. Wilmington District's pipeline dredge *Croatan* worked only three days between 18 June and 25 October because of freshets or low water. Ordinarily the *Croatan* would remove between 1,500 and 2,000 cubic yards per day, but while on the Cape Fear she seldom removed more than 300 cubic yards. The material was a fine and heavy sand with a large percentage of gravel in places. Also, the large number of stumps, roots, and rocks in the stream frequently stopped the pumps, requiring repairs.

Although during the time the dredge was in operation it removed 41,984 cubic yards, a survey made just after the work stopped showed that the cuts had shoaled 23,339 cubic yards while the work was under way. During freshets, the river erased all signs of the dredged channel. District Engineer J.R.D. Matheson reported, "The whole river bottom is alive during a freshet and the sand is constantly moving." He concluded "that the project was utterly hopeless by this means of improvement." The construction of the third set of locks and dams would be necessary if the project depth of eight feet was to be achieved.[50]

Workmen deposited concrete in abutment foundation as cableway delivered buckets to pontons at Lock and Dam 2, 1916.

The pipeline dredge Croatan, 1923

CHAPTER VII

It Is Like a Cat Eating a Grindstone

First, in peace: The government by its policy can favor the natural growth of a people's industries and its tendencies to seek adventure and gain by way of the sea; or it can try to develop such industries and such seagoing bent, when they do not naturally exist. . . . In any one of these ways the influence of the government will be felt, making or marring the sea power of the country in the matter of peaceful commerce. . . .

—Alfred Thayer Mahan

The decade of the 1930s, a period of economic depression, was a time of great activity for the Wilmington District. Using money from New Deal relief agencies, the Wilmington District completed old projects such as the canalization of the Cape Fear River; continued others such as the Inland Waterway; and planted the seeds for future projects with the "308" studies of the Cape Fear, Neuse, and Tar rivers. The 1930s were also a period of transition for the District's personnel.

Lock and Dam 3

Fayetteville residents were dissatisfied with the results following the completion of Locks and Dams 1 and 2 on the Cape Fear River. After 1920, the Corps of Engineers made no effort to achieve the project depth of eight feet. Emergency maintenance work only was done on the river. But the people of Fayetteville continued to campaign for a year-round eight-foot channel. In response, the Rivers and Harbors Act of 22 September 1922 called for an examination and survey of the Cape Fear River above Wilmington, with a view to the construction of a lock and dam about 15 miles below Fayetteville.

In the preliminary examination report, forwarded to the Chief of Engineers on 1 February 1923, the District Engineer, Major Oscar O. Kuentz, concluded that an eight-foot channel to Fayetteville was justified, in the belief that a boom in commerce on the river would follow the completion of the Inland Waterway from Beaufort to Wilmington. Kuentz recommended a survey and preparation of estimates to determine the advisability of a third lock and dam, as compared with dredging to a year-round navigable depth. The Board of Engineers for Rivers and Harbors remained unpersuaded, but approved the District Engineer's recommended survey anyway.[1]

The survey report, completed the next year, offered the finding of Major Kuentz that the present and prospective commerce on the river did not justify the expense of a third lock and dam. Kuentz anticipated that when the Inland Waterway was extended to Wilmington, the project would probably provide for a depth of 12 feet. Barges using the waterway would naturally draw more than eight feet, which would necessitate breaking cargoes for upriver points at Wilmington, even if there were eight feet of water to Fayetteville. Kuentz predicted that a depth of eight feet to Fayetteville would not result in a large enough increase in commerce to justify a third lock and dam. The Division Engineer, Colonel J.C. Oakes, concurred in the District Engineer's conclusions. But the people of Fayetteville were not ready to give up their fight.

Community leaders met with Kuentz in Wilmington on 16 April 1925 to present additional data concerning the development of future commerce on the river. A member of the delegation, Senator Furnifold M. Simmons, one of the project's strongest supporters, was responsible for keeping it alive in Congress. Major Kuentz simply rejected the proposal once more. Division Engineer Oakes agreed with Kuentz and apparently shut the door on the project, saying, "The District Engineer, Assistant Engineer Merritt and I are all convinced that, under present conditions, there is no possibility of developing a traffic on the stream commensurate with the additional cost of a third lock and dam. . . . I am positively convinced that the Government should not complete the project."[2]

Finally, in 1929, the Office of the Chief of Engineers directed Major William A. Snow, District Engineer, to prepare a supplemental report on the survey of the Cape Fear River. The report was completed by Major Raymond A. Wheeler, Snow's successor as District Engineer, who served in Wilmington from 1930 to 1933, and later was Chief of Engineers, 1945 to 1949. The survey report included Wheeler's recommendation that the existing project be completed by raising Lock and Dam 1 three feet and Lock and Dam 2 nine feet, supplemented by dredging, at a total estimated cost of $652,500, rather than building a more expensive third lock and dam.

However, a decision to complete the project was made possible by the anticipated completion of the Beaufort-to-Wilmington section of the Inland Waterway. Wheeler, the Board of Engineers for Rivers and Harbors, and Major General Lytle Brown, Chief of Engineers, reversed the earlier decision. They determined that sufficient commerce to warrant the expense of a third lock and dam was anticipated upon completion of the Inland Waterway from Beaufort to Wilmington.

The Board of Engineers for Rivers and Harbors modified Wheeler's recommendations and reinstated the construction of the third lock and dam at Tolars Landing. The board determined that the subsoil structure and foundation materials at Browns Landing would not permit loading an additional nine feet of dam onto the existing substructure without endangering the dam's stability. The board believed also that Lock and Dam 1 at Kings Bluff should be raised three feet to achieve the eight-foot channel at Fayetteville. General Lytle Brown, Chief of Engineers, concurred with the board's conclusions.[3]

Wheeler's replacement as District Engineer was Lieutenant Colonel Eugene Reybold. Reybold served as Chief of Engineers during World War II, becoming the first non-West Point graduate appointed Chief since the early 19th century. On 21 November 1933 he awarded a contract for the lock and dam to William Eisenberg & Sons of Camden, North Carolina, in the amount of $522,616.20. Construction of a cofferdam began on 3 February 1934, with the last sheet of steel driven on 19 March. As the cofferdam was unwatered on 22 and 23 March, the river began to rise. At 5AM on 28 March the gauge read 29.2 feet. By 8:50 the next morning, the water had reached a stage of 36.9 feet, at which point the cofferdam gave way. The collapse caused a loss of approximately $15,000 and four to five weeks of time, but no lives. Reybold accused the contractor of using some "poorly considered assumptions in design coupled with a somewhat flagrant disregard for local physical conditions."[4]

Using money appropriated under the National Industrial Recovery Act of 1933, Eisenberg & Sons built a 300-by-40-foot concrete lock with a nine-foot lift and a concrete dam. Lock and Dam 3 was 100 feet longer than the other two locks and dams, its dam concrete instead of the timber cribs filled with rock at the others. The first commercial cargo from Wilmington after the completion of the project reached Fayetteville 14 March 1936. It was a barge drawing 8.2 feet, loaded with gasoline and kerosene. The arrival of the tow at Lock 3 was greeted by a welcoming ceremony conducted by William O. Huske, president of the Upper Cape Fear River Improvement Association.[5]

The opening of Lock and Dam 3 meant a boost to the Fayetteville economy—to the point where the city could not obtain any Works Progress Administration projects that required skilled laborers, because there were none unemployed there. But maintaining a channel to project depth was a constant struggle for the Wilmington District.

On 1 May 1936, Huske complained to Congressman J. Bayard Clark about conditions on the river. Recent freshets had shoaled the stream so that the boats were going to have to suspend operations. The District Engineer, Major Ralph Millis, had cooperated in the effort to dredge the river. He dispatched a snagboat with a clamshell bucket on it to follow the barges and sound at every point where they met any difficulty. The snagboat began dredging a large shoal below Lock and Dam 2, but, snorted Huske, "The snagboat only has a ½ yard clam shell bucket on it, and with the shoal, which has developed it is like a cat eating a grindstone."[6] Huske kept the Wilmington office informed on the river's condition, and the District Engineer usually made every effort to keep boats moving on the waterway. In 1965, Lock and Dam 3 was renamed the W.O. Huske Lock and Dam in honor of Fayetteville's tireless promoter of improvements on the Cape Fear River.

The locks and dams produced a problem for fishermen on the river. The construction of Lock and Dam 1 destroyed the shad fishery. Before 1916, Fayetteville residents had caught several thousand shad every spring, and a number of people worked in commercial operations. But in the spring of 1916, fishermen caught only seven shad, because the lock and dam prevented the fish from swimming upstream to their traditional spawning area on the upper Cape Fear.

The District Engineer, Captain Clarence S. Ridley, studied the problem and recommended delaying the building of fish ladders at Locks and Dams 1 and 2 until an experiment suggested by D.J. Fergus of Wilmington could be tried. Fergus proposed stretching a net from the lower end of the locks diagonally across the stream to the opposite bank to guide the fish into the locks during the month of March. Then every hour during the day, Fergus wanted to close the lower gates, open the upper gates, and tap the lock floors with an iron rod or pipe to drive the shad through the upper gates. The experiment, carried out in the spring of 1917, proved unsuccessful.[7]

During the construction of Lock and Dam 3 and the renovations of Locks and Dams 1 and 2, fish ladders were added to the structures. The concrete ladders comprised a series of several pools, each seven inches wide by seven feet, nine inches long. But shad are sluggish by nature. They seldom jump out of water, so few used the ladders.

1934 construction scene at Lock and Dam 3, now called William O. Huske

Shad count in lock area at Lock and Dam 1. Early each shad season, workers count shad to determine when enough fish are going upstream to spawn. When the count is high, the lockmaster begins to lock them through the gates of the lock.

In 1961 a design memorandum covering major rehabilitation of Lock and Dam 1, prepared by the Wilmington District, went to the U.S. Fish and Wildlife Service for comment in accordance with the Fish and Wildlife Coordination Act of 1958. The Fish and Wildlife Service recommended a new fish ladder that would permit the shad to bypass the dam in large numbers. The District Engineer, Colonel Richard P. Davidson, estimated the cost of the fish ladder to be approximately $100,000—as much as the estimated cost for all the rehabilitation work planned. As an alternative, Davidson adopted a suggestion by Edwin (Peck) G. Long of the Engineering Division and proposed passing the shad through the navigation locks by a series of lockings.[8]

In the spring of 1962, the Wilmington District, the U.S. Bureau of Commercial Fisheries, and the North Carolina Wildlife Resources Commission carried out a joint study to determine the practicality of locking fish through Lock and Dam 1. They created an attraction flow through the lock, enticing the shad into the lock chamber and then lifting them to the upper pool. After the shad were counted, the upper gates and the lower eight valves opened to create a current so the shad would move upstream. During the first year's locking, an estimated 1,030 shad passed through Lock 1. After four years, the experiment was deemed fruitful, and the locking program expanded to include Locks 2 and 3 in 1967. The locking continues at the present and is still considered to be a success.[9]

Intracoastal Waterway

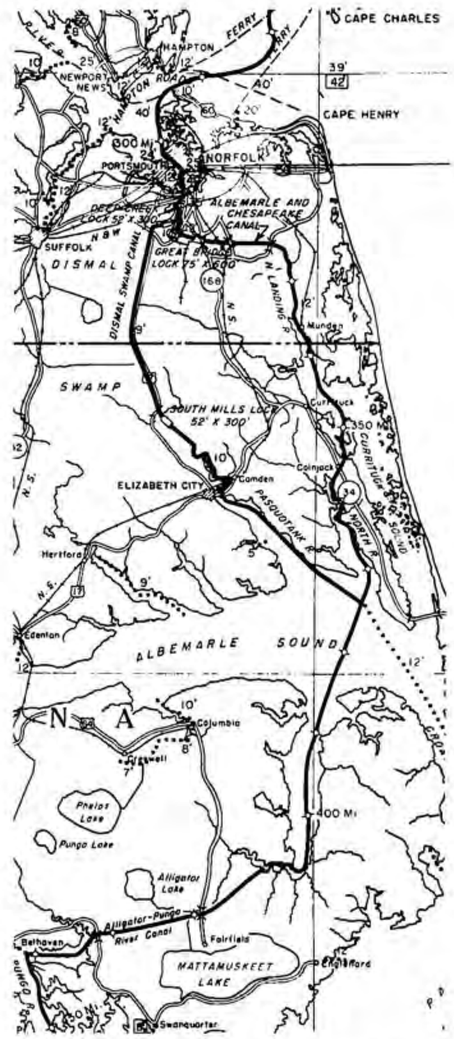
Just as a year-round channel from Wilmington to Fayetteville had been a dream for many Fayetteville citizens, the construction of a waterway paralleling the Atlantic Coast was an objective many people wanted to achieve. The existence of natural channels from the North Carolina sounds to within a short distance of Norfolk suggested the possibility of an inland water route from Norfolk to

Albemarle Sound in the 18th century. Dismal Swamp Canal, the first waterway built in the area, opened in 1827 after 30 years of work. Another route from Norfolk to Albemarle Sound via the Albemarle and Chesapeake Canal was finished shortly after the Civil War. Both canals became important parts of eastern North Carolina's transportation system. Throughout the 19th and early 20th centuries, whichever canal offered the greater depth captured the greater amount of business. The fact that commerce using either canal paid a toll to the canal's owners, thereby adding to the shipping costs, increased the desirability of a government-owned, toll-free waterway.[10]

The idea of establishing continuous inland navigation between Florida and the north had been before Congress since 1837, when a survey was authorized beginning at the southern end of the Dismal Swamp Canal, and extending to Winyah Bay, South Carolina. Colonel James Kearney made the first survey in 1837, which produced few results. In 1875, Congress authorized another survey from the Dismal Swamp Canal to the Cape Fear River. S.T. Abert, a civilian engineer and leader of the survey party, could not find Kearney's report and was thus forced to resurvey much of the same line between the Neuse and Cape Fear rivers. (The report was located after the survey had been completed.) Abert concluded that further surveys were necessary before any construction should begin.[11]

After 1875, several other reports were made, but none of particular interest until that of a board of engineer officers in compliance with the Rivers and Harbors Act of 1902. Congress directed the board to determine the most advantageous route for a waterway, with a channel depth not less than 16 feet, between Norfolk and Albemarle Sound. The Board of Engineers for Rivers and Harbors, reviewing the report, concluded that the cost of a 16-foot waterway from the southern branch of the Elizabeth River near Norfolk, across land by canal to the Pasquotank River at Cooper Creek and down the river to Albemarle Sound, was greater than its benefits would justify. The board added, however, that its study of the whole question suggested that a free waterway, with a 10- or 12-foot depth, would benefit commerce, offer military advantages, and cost much less than a 16-foot channel. A subsequent report recommended a 12-foot waterway via the Elizabeth River and the Albemarle and Chesapeake Canal, provided the canal could be purchased for less than $500,000.[12]

In 1909, Congress authorized a survey for a continuous waterway from Boston to Beaufort, inland where practicable. The survey report became the basis of a project authorized by the Rivers and Harbors Act of 25 July 1912. The federal government purchased the Albemarle and Chesapeake Canal for $500,000 in 1913, and the Dismal Swamp Canal in 1929 for the same amount.



Map showing Intracoastal Waterway from Virginia–North Carolina border to Belhaven

During construction of Inland Waterway (1923) from Pamlico Sound to Beaufort Inlet, cutterhead encountered cypress roots.

Scene at construction of waterway shows length of pipeline and banks lined with cypress roots, 1923.

The Norfolk and Wilmington districts constructed portions of the Norfolk-to-Beaufort waterway. One of the most important sections of the route had already been built by the Wilmington District from 1907 to 1910. That was an inland waterway from Neuse River to Beaufort Inlet via Adams Creek, which cost over $500,000. Under a contract with the Maryland Dredging and Contracting Company, dated 15 August 1908, two dredges began work from each end of the waterway. The two vessels met on 15 November 1910, completing the waterway to the project dimensions of 10 feet deep with a bottom width of 90 feet through the land portion and 12 feet through the water portion. The District also constructed a highway bridge over Core Creek after the original contractor failed to complete the structure.[13]

The Wilmington District did little work on the Norfolk-to-Beaufort section of the waterway other than surveys and design work between 1912 and 1919. In 1919, about the time the dredging reached the portion of the waterway within the Wilmington District boundaries, Major General William M. Black, Chief of Engineers, transferred the entire waterway to the Norfolk District's jurisdiction. Black did that so the appropriation for the project would not have to be split between two districts. He also considered Norfolk a more convenient location for supervising the work.

The first dredging of the 1912 project took place within the boundaries of the Norfolk District on Coinjock Bay and Currituck Sound, North Carolina, and on the Virginia portion of the waterway in 1914. The dredging proceeded generally southward. The Norfolk-to-Beaufort section of the waterway consisted of five land cuts, totaling about 41.75 miles, and about 56.16 miles of channels in natural waterways. The U.S. pipeline dredge *Currituck* literally cut Hyde County in half between 1922 and 1928, by completing the longest of the five land cuts from the Alligator River to the Pungo River. The dredging and other work such as surveys and inspections continued until 1932, when the waterway reached project dimensions of 90 feet wide and bottom widths varying from 90 feet in land cuts to 300 feet in open waters. Major General Julian L. Schley returned the portion of the waterway from the Neuse to Beaufort to the Wilmington District in 1939.[14]

As part of the Norfolk-to-Beaufort waterway construction, the Norfolk District built five highway bridges over the waterway under contract with private contractors. The original bridges at Hobucken (1930), Wilkerson Creek (1934), Fairfield (1935), Core Creek (1935), and Coinjock (1940) were all narrow, two-lane, swing-span structures. (The Wilkerson Creek bridge was replaced in 1981—see below.) The old bridges, which require the presence of tenders, remained under the authority of the Corps of Engineers. By the 1960s, the antiquated structures became dangerous for traffic both on and under the bridges and were expensive to operate and maintain. All of the original bridges have timber-pile guide walls, which were frequently damaged by tugs or barges. With the exception of Coinjock, the bridges have limited vertical clearances. The Corps sought to turn over control and operation of the bridges to the state of North Carolina, but the state refused to accept them.

Beginning in the 1960s, the Wilmington District and local residents launched a campaign for the replacement of the outmoded bridges. Congress authorized

G & W Manufacturing Co. working on old Core Creek Bridge, 1923

the replacement of all five in the River and Harbor Act of 1970, if North Carolina would provide 25 percent of the cost and agree to accept ownership of the bridges upon completion. The state agreed to the conditions, but in 1974 withdrew its offer to contribute its share of the cost. The Water Resources Development Act of 1976 deleted the cost-sharing requirement for the Wilkerson Creek and Coinjock bridges. Under District Engineer Colonel Adolph A. Hight, Wilmington awarded a contract in 1978 for the replacement of the Wilkerson Creek Bridge. On 21 July 1981, Colonel Robert K. Hughes, District Engineer, dedicated and handed over to the state of North Carolina to maintain the new fixed-span bridge, named in honor of Congressman Walter B. Jones. In 1982, preconstruction work on the replacement for Coinjock Bridge was under way. The District looks forward to the day when all five bridges are replaced and turned over to the state of North Carolina.[15]

Electrically-operated bridge at Coinjock

One of the strongest supporters of the Inland Waterway was the Atlantic Deeper Waterways Association. Organized in 1907, the association chose as its main purpose the promotion of an intracoastal waterway from Maine to Florida. North Carolina was well represented in the association. One of its founders was Congressman John H. Small of Washington, North Carolina, who served as Chairman of the House Committee on Rivers and Harbors for several of his 22 years in Congress.

The Corps of Engineers maintained a long relationship with the Atlantic Deeper Waterways Association. Anticipating the association's 23d annual convention, to be held 7 to 10 October 1930 in Wilmington, District Engineer Major William A. Snow wrote the association's president, J. Hampton Moore, that he expected several of the District Engineers in the Eastern Division to be ordered to attend the convention for a few days. The association met in Wilmington to observe the work being done then on the Beaufort-to-Cape Fear section of the Inland Waterway.[16]

The section of the waterway between Beaufort and the Cape Fear follows the general line of the coast, passing through Bogue Sound and the sounds and marine marshes to the south, to a point in Myrtle Sound just north of Carolina Beach. There it crosses the mainland into the Cape Fear River, which it enters about 16 miles below Wilmington. The project called for a waterway 12 feet deep at mean low water with a bottom width of 90 feet, extending the 93.5 miles from Beaufort to the Cape Fear. The project also provided for a channel three feet deep and 40 feet wide in New River to Jacksonville. The estimated cost of the work was $3.8 million.[17]

The Rivers and Harbors Act of 21 January 1927, which authorized the 12-foot project, imposed a condition that local interests furnish, without cost to the federal government, a right-of-way 1,000 feet wide. The state of North Carolina fulfilled the local cooperation requirements by authorizing and directing the state's Transportation Advisory Commission to secure the right-of-way in the name of the state. The general assembly empowered the commission to acquire the land by purchase, donation, or condemnation. Much of the land was donated by property owners. Condemnation was resorted to in only a few cases, principally because heirs to property could not be located or titles were faulty.

A line was laid out for dredging a portion of the Intracoastal Waterway in North Carolina, 1923.

Map showing the Atlantic Intracoastal Waterway, NC

The methods adopted by the state resulted in the conveyance to the federal government of a large part of the property at an early date. The right-of-way was conveyed with sufficient promptness to insure that there would be no interruptions in construction. The sections were large enough so that the work could be advertised in large units. Contractors, therefore, instead of having to bid on a great number of small jobs, could bid on a small number of large jobs. That permitted the government to secure low unit prices for the dredging.[18]

Major Snow divided the Beaufort-to-Cape Fear waterway into five sections. The W.H. Gahagan Realty Company, Inc., bid for the dredging of Section I, from Beaufort to Bogue Inlet, was about $2,000 less than the government estimate of $312,562.22. But when an estimated $30,880.43 for government supervision and inspection was added, the government estimate was $29,024.09 less than the bid. The Gahagan Company protested the government's estimate, which was based on the performance of the hydraulic pipeline dredge *Henry Bacon*. The government denied the protest, but awarded the contract to the Gahagan Company anyway. The use of the *Henry Bacon* on Section I would have prevented it from dredging on the Cape Fear River and necessitated renting a dredge from another district. Snow estimated that the cost of bringing that dredge to the Wilmington District and then returning it to the owning district later would probably be almost $20,000. He therefore recommended that the contract for Section I be awarded to the Gahagan Company. The work in Section II was awarded to the Atlantic, Gulf, and Pacific Company.[19]

Sections I, II, III, and IV passed through open water or marshland, and Major Snow did not anticipate any problems with roots, stumps, or rocks in those sections. A part of Section V was a land cut through an old swamp, with the likelihood that a good many roots and stumps would be encountered. Waldeck-Deal Dredging Company of Miami, Florida, received the contract to dredge approximately 1,689,375 cubic yards of material at $198,163.69, or 11.73 cents per cubic yard, in Section V. A representative of the competing Atlantic, Gulf, and Pacific Company predicted at the time of the contract award that Waldeck-Deal would not be able to complete the work at that figure. Atlantic, Gulf, and Pacific had bid $284,997.56, or 16.87 cents per cubic yard. Waldeck-Deal and the Corps of Engineers signed a contract on 5 April 1929.[20]

Major William A. Snow, District Engineer, 1926–1930

Waldeck-Deal started clearing operations 2 May 1929 and dredging two days later. On 5 July 1929, the company's dredge began to encounter submerged stumps and roots. The dredge continued work until 31 October 1929. But all of the material dredged after 5 July contained great numbers of stumps and roots and differed from the material described in the specifications. The work cost the company 35 cents per cubic yard, over three times its estimate, bankrupting the firm.

A receiver was appointed for the company on 22 October 1929. At a meeting in Washington, D.C., between representatives of the Chief's office, the receivers, representatives of the Southern Surety Company (makers of the contractor's bond), and Major Snow, the District Engineer agreed to have the *Henry Bacon* complete the dredging through the marsh. Major Snow predicted that the *Henry Bacon* could dredge the channel for 21 cents a cubic yard. When, after the first week, costs were running about 45 cents, he began to worry; but the vessel finished the work on 14 December 1929 at less than 21 cents. Southern Surety contracted with Atlantic, Gulf, and Pacific Company to complete Waldeck-Deal's contract, and that firm finished Section V on 4 April 1930.[21]

The project of 1927 provided for the construction of a tidal lock near the Cape Fear end of Section V, at an estimated cost of $500,000. Section V was a land cut joining two tidal waters that were out of phase in their tidal movements. The project designers feared that the water-level differential on each side would generate a swift current. When the cut was made, it was not known if the currents produced would allow for navigation. The Wilmington District maintained tide gauges near the cut, but the data obtained were not sufficient to warrant a definite decision as to the need for the lock. After the completion of Section V, the lock proved not to be necessary, and it was never built.[22]

The Beaufort-to-Cape Fear section of the Inland Waterway officially opened on 3 June 1932, but the project was not completed until 23 December 1932. Because of both the method used by the state of North Carolina to acquire the land and the elimination of the tidal lock, the Beaufort-to-Cape Fear waterway was completed at a cost of $2,243,507.82, or $1,556,492 below the estimated cost of the project. The citizens of Wilmington applauded the efficiency shown by Major Snow and the Wilmington District. The Wilmington Chamber of Commerce adopted a resolution in recognition of Snow's work, proposing that the land cut in Section V be known as Snow's cut. The Corps of Engineers or the Board on Geographic Names could not officially so designate the waterway, but local interests were permitted to recognize Major Snow in that manner.[23]

The final portion of the Inland Waterway in North Carolina, from Cape Fear River to the South Carolina state line, was part of a larger project—Cape Fear River to Winyah Bay, South Carolina—authorized by the Rivers and Harbors Act of 3 July 1930. Before construction of the waterway, nearly all of the commerce to and from the Cape Fear River and Little River, South Carolina, was carried on small boats drawing about four feet. Those boats were compelled to go into the ocean, between the Cape Fear and the various inlets along the route, and were frequently delayed for several days awaiting favorable weather. By using the waterway, the delays would be eliminated.

The state of North Carolina conveyed the right-of-way for the waterway to the Corps of Engineers in the same manner as before. The Corps possessed a perpetual easement along the 1,000-foot right-of-way, which gave the Engineers the exclusive right to excavate, enter upon, and deposit dredged material on the property. By 1979, nearly 100 homes had been built within the federal government's easement at Holden Beach, Ocean Isle, and surrounding areas near the South Carolina state line. When the Wilmington District sought to exercise its authority over the property, a dispute arose. Through a series of conferences with local officials over the next year, the District agreed to relinquish the rights to cut away land and deposit dredged material on portions of the easement in exchange for a 40-acre site outside the existing easement to be used as a disposal area.

Construction on the 94.5 miles of waterway began in 1931. The Wilmington District divided its part of the work into two sections. The R.C. Huffman Construction Company of Cleveland, Ohio, submitted the only bid on Section I, Cape Fear River to Lockwoods Folly River. Although the bid was higher than the government estimate, the Huffman Company's plant was idle; and Colonel Ferguson, the Division Engineer, recommended that the District Engineer, Major

Raymond A. Wheeler, award the contract to Huffman. Colonel Ferguson also recommended that the work in Section II, Lockwoods Folly River to Little River, South Carolina, be done by government plant. *Currituck*, a large, hydraulic pipeline dredge, completed most of the work in Section II. By 1934, the Wilmington District's part of the Cape Fear River to Winyah Bay segment was finished to project dimensions of eight feet deep and 75 feet wide. The entire project was completed at $909,000 below the estimated cost of $5,269,000.[24]

The Atlantic Intracoastal Waterway, as it is now known, allows water traffic to bypass both the dangerous waters off the North Carolina coast and the shallow inlets. Goods are transported more safely and cheaper. Militarily, the waterway was invaluable during World War II. Badly needed war supplies, particularly oil, were shipped on barges through the waterway, avoiding the submarine-infested ocean near North Carolina.

Much of the money used by the Corps of Engineers during the 1930s came from the federal government's relief agencies. Lock and Dam 3 on the Cape Fear River was built with an appropriation of $1,104,390 from the National Industrial Recovery Act. Over $2 million for the construction of the Cape Fear-to-Winyah Bay portion of the Inland Waterway came from the National Industrial Recovery Act and the Public Works Administration Act. One other project that received a large sum of money from relief agencies was Morehead City Harbor.

Barges on the Atlantic Intracoastal Waterway

Morehead City Harbor

The Wilmington District made Morehead City Harbor a deep-water port using money from the National Recovery Administration and the Public Works Administration. The original project for Morehead City Harbor was authorized by the Rivers and Harbors Act of 25 June 1910, which provided for a channel ten feet deep from Beaufort Inlet to Morehead City. The act of 3 July 1930 enlarged the channel to 12 feet. In July 1934, the Public Works Administration allotted $1,555,000 to the War Department to dredge a 30-foot channel from Beaufort Inlet to Morehead City. The allotment was contingent on local interests' furnishing satisfactory assurances that marine terminal facilities, suitable for ocean-going vessels, would be built. To erect the port facilities, the Morehead City Port Commission received a loan and grant of $425,000 from the Public Works Administration.[25]

Because the governing low-water depth on the bar channel through the inlet was only ten feet when the Corps of Engineers' seagoing hopper dredge *Comstock* began work on 23 August 1934, the vessel could dredge only at high tide until a safe depth was obtained. After the *Comstock* had dredged to a depth of 22 feet, the hopper dredge *Manhattan* went to work on the project, assisted by the *Absecon*. The Gahagan Construction Corporation did the work on the inner reach of the channel, from within the inlet to the terminals at Morehead City. The dredging of the channel was completed in August 1936. The Chief of Engineers had also authorized the construction of two jetties on both sides of Beaufort Inlet to stabilize the sandy channel, in case the dredging produced unsatisfactory results. The jetties have not been built.[26]

Flood Control

Relief funds also financed the beginning of flood control work in the Wilmington District. The Flood Control Act of 22 June 1936 established, for the first time, a definite policy of federal participation in the construction of economically justified flood control projects, in cooperation with the states or local interests. In North Carolina, the Flood Control Act authorized the clearing of obstructions from the Tar River between Tarboro and Rocky Mount, in order to reduce flood heights. The cost was estimated at $90,000.[27]

The Wilmington District used government plant and hired labor from the local Works Progress Administration office. Hamilton Hicks, a permanent employee of the Wilmington District, supervised the clearing of the river. The job was much larger than originally anticipated because streamside landowners would cut down trees and drop them into the river for the work crews to remove. The operation appeared more like a timber harvest than a snagging job, as the crews used tractors with winches to pull the snags out of the river and onto the bank where the timber would be cut. The local farmers followed the crews down the river, hauling off the cut wood. Hicks and his crews snagged the 40 miles of the Tar River between November 1937 and July 1938 at a cost of about $81,000. The District continued other flood control work in the form of snagging, clearing, and dredging on the Tar River and its tributaries—Fishing, Swift, Town, and Otter creeks—in the late 1930s and early 1940s.[28]

Cape Fear River Basin
Neuse River Basin
Pamlico-Tar River Basin

During the 1930s, the Wilmington District submitted to Congress three comprehensive planning reports on the Cape Fear, Neuse, and Tar rivers. Congress had authorized the reports in the Rivers and Harbors Act of 21 January 1927, based on House Document 308 (69th Congress, First Session). The reports, known as 308 reports, were general plans for the improvement of rivers for the purposes of navigation, irrigation, flood control, and power development. They constituted the most complete and comprehensive river basin studies made up to that time. They also provided the foundation for later flood control legislation and major projects such as those of the Tennessee Valley Authority.[29]

The 308 report for the Cape Fear River was prepared under the direction of R.G. West and John E. Goodrich. The Wilmington District obtained data from all known available sources on rainfall, evaporation, and runoff in the basin; collected all available maps of the area; and undertook a reconnaissance of the river and its tributaries to select the most promising sites for power developments and storage reservoirs. After the elimination of certain sites, District specialists thoroughly investigated the geological structure, storage capacity, and power possibilities of the remainder. They also estimated the costs and other pertinent considerations affecting their development. Last, the teams prepared topographic maps of potential development sites and compiled information on navigation on the river.[30]

Using the collected data, the District studied various phases of possible development separately and in combination. Plans for power development alone, power development with flood control, and flood control alone took shape, together with assessments of costs and benefits. The results are summarized in the accompanying table.

District Engineer Wheeler concluded from the analysis that,

> there is no necessity for irrigation in this region; that until the market for power develops, which prospect is now remote, the production of increased amounts of hydroelectric power on the streams of the basin will not be economically justified; that the prevention of floods as an isolated project or in conjunction with power development is not economical; that based on present conditions, which is a conservative basis, the benefits to be derived from the provision of an 8-foot year around navigable channel between Wilmington and Fayetteville are approximately equal to the cost of providing these facilities.[31]

The flood control, power, irrigation, and navigation problems and potentials of the river were judged to be local in nature, to be addressed by local interests, not the federal government.

Although the report did not recommend any projects for the Cape Fear River basin, the document has since served as the basis for development of the river. The sites of the B. Everett Jordan (New Hope) and Howards Mill lakes were selected during the preparation of the Cape Fear 308 report. According to the report's estimate, at New Hope a gravity-type spillway dam with earthen abutments on each side, built to a crest elevation of 223.5 feet above mean sea level, including site purchase and preparation, would have cost $4,425,780 if built in 1932.[32]

District Engineer Snow considered the data collected concerning the potential development of the Neuse River, and concluded that the federal government should not participate in any program of power development, flood control, irrigation, or navigation beyond what the Wilmington District was already doing. Snow believed that a flood control project designed to protect against the ten-year flood by the construction of four storage reservoirs—two on the Neuse, one on Little River, and one on Contentnea Creek—was economically justifiable. The dams for those reservoirs should be so built that they might support power development at a later date. However, he recommended that the cost of the flood control works be borne by local interests. As with the Cape Fear River 308 report, the report on the Neuse has served as the basis for the system of flood control projects on the river.[33]

The Wilmington District's 308 report for the Tar River produced conclusions similar to those in the Neuse River document. The best plan for the development

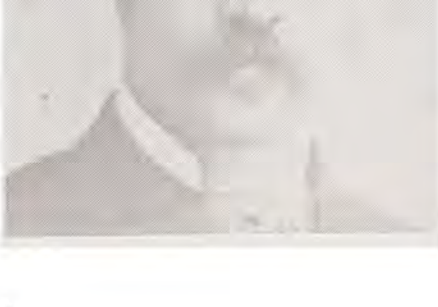
Carl J. Josenhans worked for the Wilmington District from 1909 to 1919 and from 1936 to 1943. He designed three Atlantic Intracoastal Waterway Bridges and the William O. Huske Lock and Dam. He was assistant chief of the Engineering Division for more than 15 years.

Paul M. Snell, an authority on dredging, served in the Corps of Engineers for 43 years, from 1914 to 1956. He was chief of the Construction-Operations Division from 1941 until his retirement in 1956. The **Snell** *is named for him.*

Thomas J. Hewitt worked in both civil works and military construction during his 43-year career with the Corps from 1913 to 1956. Named Chief of Engineering Division in 1936, he also became Executive Officer in 1945 and held both positions until he retired.

Harry T. Paterson (center of column) *worked for the Corps for 41 years from 1904 to 1943 and was in charge of construction of a portion of the Atlantic Intracoastal Waterway.*

James C. Lodor (bottom) *joined the Corps as a member of the original staff when Wilmington became a District in 1884 and served as Chief Clerk until his death in 1915.*



of the river included two storage reservoirs and two power facilities. In addition, building two locks and dams below Tarboro, to provide a 10-by-80-foot channel from Washington to Tarboro, was economically feasible. But Snow recommended that no further action be taken to improve the Tar River to any greater extent than already under way.[34]

The People of the District

The 1930s and 1940s saw important changes among the staff of the Wilmington District. Some of the men who had worked there for decades retired or died and were replaced by people who would provide leadership for the future. The most important loss to the District occurred in 1938, when Robert C. Merritt retired after 53 years of service. For years, Merritt had been the man that most employees and even District Engineers looked to for advice and leadership.

Harry Thomas Paterson began working for the Wilmington District in 1907 and served until his death in 1943. Paterson supervised the New Bern suboffice until its closing, when he moved to Wilmington to head up the office responsible for the preparation of reports.

Carl Jonathan Josenhans worked in the Wilmington District from 1909 to 1919 and again from 1926 until his retirement in 1943. Josenhans remained in the engineering section of the district for most of his tenure in Wilmington, among other things designing three of the bridges over the Atlantic Intracoastal Waterway and Lock and Dam 3.

Horace Vincent Conly came to Wilmington in 1907 to serve as assistant to James C. Lodor, Chief Clerk of the District. Upon the death of Lodor in 1915, Conly assumed the position of Chief Clerk, which was later changed to Administrative Assistant. Conly retired in 1946.[35]

Those men were replaced by another group of long-time employees who made the Wilmington District their career, among them Paul M. Snell. "Pappy," as he was known, worked for the Wilmington District for 42 years, beginning in 1914. Since his retirement in 1956, Snell has become almost legendary for his personality, temperament, and skill. His leadership helped shape the character of the Wilmington District. Pappy worked his way up from a deckhand on a dredge to chief of the Operations Division. His expertise was known worldwide. As an authority on dredging, Pappy served as special consultant to the Chief of Engineers and on assignment in South America, the Middle East, the Pacific, and the North Atlantic. He was a Special Consultant during the Suez Canal clearing operations. General Raymond A. Wheeler, former Chief of Engineers and Wilmington District Engineer, considered Snell "the best hydraulic dredging expert in the country."[36]

Snell was also a good administrator and negotiator. His fellow employees and contractors always knew where Pappy stood on an issue, because he was not afraid to tell them. He was a man with a rough mien who dealt in honest terms with the construction people he encountered on the job daily. His insistence that a job be done right, his low tolerance for laziness and sloppiness, and his compulsion for hard work set a standard for other District employees to follow.[37]

While Pappy ran the Operations Division, his counterpart in the Engineering Division, Thomas J. Hewitt, was nearly the complete opposite of Snell, except in his demand for excellence. Hewitt was a college graduate with a quiet personality and refined demeanor, whose ability as an engineer was respected throughout the Corps of Engineers. Hewitt began working for the Wilmington District as a member of a survey party in 1913.

Because Pappy and Hewitt had worked together for so many years and understood each other, the District operated smoothly. They faced their greatest test during World War II, when the mission of the Wilmington District changed overnight.[38]

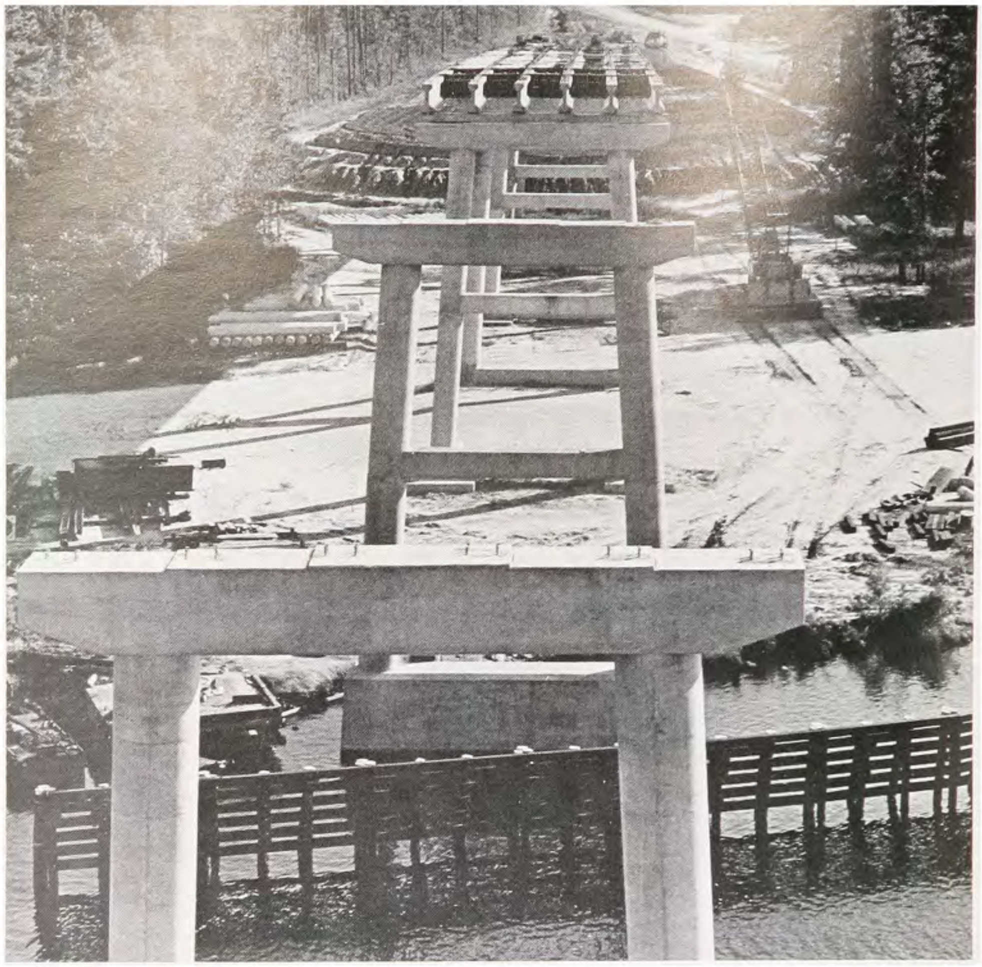
TABLE

Comparison of Plans of Development, Cape Fear River

Types of Development	Annual Cost	Annual Benefit	Annual	
			Net Profit	Loss
Power development alone	$2,582,050	$2,591,285	$9,235	—
Power development with flood control	3,076,290	2,702,655	—	$373,635
Flood control alone	680,000	130,700	—	549,300

[Source: House Document 193, 73d Congress, 2d Session.]

Construction scene, new Wilkerson Creek Bridge



The new Wilkerson Creek bridge, re-named Walter B. Jones Bridge. To the left in this photo, is the old Wilkerson Creek Bridge, later removed by the contractor.

CHAPTER VIII

The Wilmington District
"Ain't What She Used To Be"

[M]ost of our sea-coast forts are superfluous. We now have fifty millions of people, and the idea of any hostile force landing on our coast is simply preposterous. Yet our great commercial ports should be made so safe that even an apprehension of danger would not be felt. . . . All minor forts should be abandoned.

—General William T. Sherman

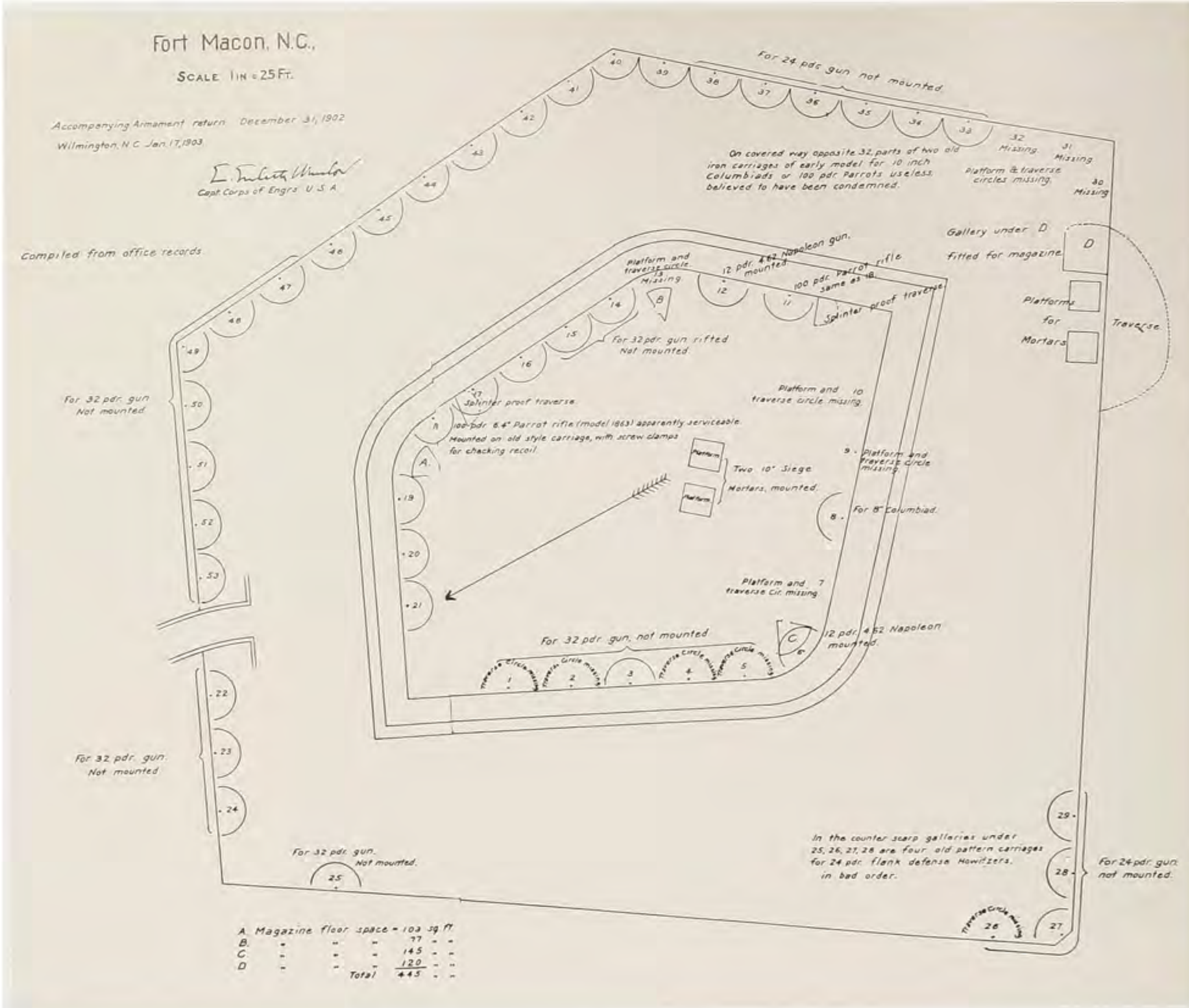
Military construction in the Wilmington District has followed a roller-coaster pattern of activity and inactivity from the end of the Civil War to 1941, when the Corps of Engineers was responsible for coastal fortifications only, and 1941 through World War II and again during the Korean Conflict, when the District was given responsibility for construction at all Army installations in North Carolina. Most of the time, only the minimum amount of maintenance work on the military installations in North Carolina was funded. But when national danger threatened, the military side of the Corps of Engineers' dual mission assumed increased importance. However, after World War II, when hostilities ended, the military work did not shrink to its former relative insignificance for the Wilmington District until 1961 when military work in North Carolina was transferred to the Savannah District.

Fort Macon

The federal government allowed the two major military posts in North Carolina—Forts Macon and Caswell—to deteriorate for nearly 30 years after the Civil War. Fort Macon remained a federal prison until closed in 1877; an ordnance sergeant remained at the site as caretaker until 1892. Following severe storms, the District made occasional repairs to the jetties protecting the site, but the fort itself was left to the elements. The army garrisoned Fort Macon during the Spanish-American War, but placed only two old Parrott rifled cannons and two ten-inch mortars in usable condition. The troops left in 1900, and a caretaker remained on duty for the next five years. In 1915, the District Engineer, Captain Clarence S. Ridley, recommended to the Chief of Engineers that the fort be preserved as an example of pre-Civil War fortifications. No troops were stationed at Fort Macon during World War I.[1]

An act of Congress, 4 June 1924, granted to the state of North Carolina a tract of 412 acres, including the fort but excluding a strip of land for the use of the United States Coast Guard. In accepting the gift, the general assembly stipulated that it should be administered by the Department of Conservation and Development and maintained as a state park. From 1941 to 1946 Fort Macon was again called into service and garrisoned by troops of the 244th Division of the Coast Artillery. The Army returned the fort to the state in October 1946.[2]

The changing military philosophies and advances in weaponry that made Fort Macon obsolete also dictated an overall reassessment of the nation's coast defenses. In 1885, Congress appointed a board of nine men, under the direction of Secretary of War William C. Endicott, to "examine and report at what ports fortifications or other defenses are most urgently required, the character and kind of defenses best adapted for each, with reference to armament."[3]



Sketch of Fort Macon, 1902

The Endicott board examined the nation's ports and designed a system of coastal defense against blockades, major naval attacks, and raids on naval bases and commercial ports. The system centered on a multielement defense based on dispersion, concealment, and lighter guns of greater rapidity and power than formerly used. The board prepared a list of 27 ports in need of fortification, arranged in order of urgency according to commercial importance and existing defenses. The board ranked Wilmington, the only North Carolina port to make the list, 20th. For the protection of Wilmington, the board recommended armored casemates, barbette batteries, with four 12-inch, 50-ton guns and five ten-inch, 27-ton guns, and submarine mines, at an estimated cost of $1,942,000.[4]

Fort Caswell

Funding for the Endicott program began in 1890, but only in small amounts. The first appropriation for the defense of Wilmington Harbor came on 21 August 1894. Congress allotted $7,000 for the construction of a mining casemate and its gallery to protect the electronic cables used to fire the mines at Fort Caswell. The casemate was finished in August 1895 and the work on the gallery began immediately. On 16 September 1895, Major Stanton suspended the project because of unhealthy working conditions. In constructing the gallery, the men labored in three to four feet of stagnant water, and many of them became ill. In December, Lieutenant Colonel Heap decided the gallery need not be extended any further.[5]

In 1897, crews began preparing three emplacements for eight-inch guns on disappearing carriages. Over the next six years 19 guns were installed at seven separate batteries. A list of the work done during the year 1899 is typical of the work at Fort Caswell around the turn of the century:

1. Completed battery for two 12-inch breech-loading rifles.
2. Mounting two 12-inch breech-loading rifles on barbette carriages.
3. Completed emplacement for and mounted one 4.724-inch rapid-fire Armstrong gun on pedestal mount.
4. Constructing mortar battery for eight 12-inch steel mortars.
5. Partly mounting eight 12-inch steel mortars.
6. Constructing emplacement for one 5-inch rapid-fire gun on balance-pillar mount.
7. Constructing cable tank.
8. Building torpedo storehouse.
9. Installing electric plant.
10. Preservation and repair of fortifications.[6]

The Wilmington District spent years improving the defense of Wilmington, but the guns at Fort Caswell never fired a shot at an enemy vessel during the Spanish-American War.

World War II

The Wilmington District did no further work on fortifications until 1941, when the construction of military facilities was transferred from the Quartermaster Corps to the Corps of Engineers. Congress directed the Secretary of War to transfer new construction for the Army and the maintenance and repair of buildings to the Corps of Engineers in December 1941; airfield construction for the Army Air Corps had been transferred in 1940. The move was made partly because the Corps of Engineers had a large construction network already in place and a long history of handling major projects. The Quartermaster General did not agree with the reasoning, but the Quartermaster Corps' Construction Division had recently come under political criticism regarding the construction of mobilization camps and cantonments, making the time for the transfer politically opportune. The main reason (among many) was a general feeling in the War Department that the Quartermaster Corps should be free of distractions from its enormous supply burden (it also lost transportation, but gained other supply activities). Although the Corps of Engineers had little experience in the type of construction necessary at an army base, it was confident that its civil works construction experience would aid in the new assignment, and that its decentralized organization experienced in contract supervision could expand as much as necessary to handle the job.[7]

The Wilmington office did not receive a large load of Air Corps construction in 1940 because there were then no Air Corps installations in the state, other than the field at Fort Bragg, which was already operating. At the end of 1941, only 36 employees worked in the District office and 210 in the field. In the next 15 months, the total force, working almost exclusively on military construction, ballooned to a high of 2,520. The office personnel occupied every inch of available space in the Federal Building, including the lobby, corridors, and basement, four floors of the Maffitt Building, and three floors of the Carolina Insurance Building. The employment by contractors on construction work under the supervision of the Wilmington District during the war reached a peak of 30,000.[8]

For the permanent employees of the Wilmington District, the growth of the military construction program meant significant changes in the organization and mission of the District. Men such as Snell and Hewitt were forced to change their orientation from rivers and harbors to runways and barracks. Snell's negotiating ability served him and the District well during the war. Hewitt's Engineering Division faced the constant pressure of deadlines. The Engineering Division designed enough work to allow the District Engineer to place jobs at a rate averaging one million dollars a day during peak periods of 1942 and 1943.

Organizationally, the District Engineer remained in charge of the District's activities during the war. A number of other regular and reserve military men came to the District to assist the civilians in their work. Hewitt remained head of the Engineering Division, but Major Paul E. Werner became his executive assistant in 1942. In the Operations Division, Major B.M. Dornblatt served as assistant chief and head of the Military Operations Branch under Pappy Snell.

Under the Operations Division, Area Engineers supervised the work at major construction sites throughout the state. In 1942, Area Engineers were stationed at Greensboro, Goldsboro, Camp Davis, Fort Fisher, Raleigh-Durham, Wilmington, Fort Bragg, Camp Butner, Bluethenthal Air Base, and Camp Mackall. Area Engineers were generally either engineers brought into the military from the private sector or Corps of Engineers' civilian employees commissioned directly into the Army. About a dozen Wilmington District employees were commissioned as captains or first or second lieutenants, including Leon C. McDuffie and Edwin G. Long, both of whom later became chiefs of the Engineering Division.[9]

The Wilmington District completed major construction projects at Fort Bragg, Camp Davis, Camp Butner, and Camp Mackall. Although some of those bases had been partially built by the Quartermaster Corps when the Wilmington District assumed responsibility for them, the Engineers carried out the remainder of the work. The work done at those bases, "mobilization construction," was temporary in nature and designed to last for ten years. However, many of the mobilization-type buildings were still in use in 1982.

The Wilmington District supervised the construction of several air bases and airfields. The Raleigh-Durham Air Base was built under the direction of Area Engineer Major R.F. Wallace in 1942 and 1943. Following the war, the air base was converted to a civilian facility as the Raleigh-Durham Airport. The Wilmington District spent approximately $14 million building Seymour Johnson Air Base near Goldsboro. Some of the largest wooden hangar facilities in the country were erected there.[10] Pope Air Base, at Fort Bragg, was already in existence in 1940 when the Army Air Corps construction work was transferred to the Corps of Engineers. The Wilmington District expanded the facilities at a cost of $4 million.[11]

In addition to the Army Air Corps facilities, the Wilmington District built airfields for the Civil Aeronautics Administration at Beaufort, Manteo, and New Bern. The Beaufort Airfield was built after the Navy Department recommended its abandonment due to estimated excessive costs of construction. The site, a low, marshy area, required approximately three to four feet of earth fill to bring it

Double cantilever hangar at Pope Air Force Base at Fort Bragg, completed in 1955 above tide level. When the Civil Aeronautics Administration called upon the Wilmington District for suggestions and an assessment of the feasibility of building the airfield, the dredging section suggested that the area be filled by using hydraulic dredging methods with government plant and forces. The government dredge *Henry Bacon* was brought to the District to perform the dredging. The completed airfield was finished at a cost considerably below the original estimates.[12]

The Manteo and New Bern airfields posed major engineering problems because the usual paving material, asphalt, was in short supply. The Wilmington District recommended that a tar-based course be used in place of asphalt to pave the runways. But neither the contractor nor the District had attempted to use a tar base on a large project before. The contractor faced the problem of rolling the tar after it was laid, as he would asphalt. However, tar did not behave like asphalt and rolled up with the machine. The contractor was forced to put the tar down after it had cooled. Inspectors checked the temperature of each load before it was put down to insure proper compaction of the tar-based course. If the load was not the correct temperature, the tar would be rejected; some was dumped in the woods. According to Hamilton Hicks, by the time the contractor finished the airfield, the woods were full of piles of tar.[13]

By early 1944, the pace of military construction in North Carolina slowed. The size of the Wilmington office staff was reduced so that in April, the office spaces and District personnel in the Maffitt Building returned across the street to the Federal Building. In June, the Personnel Section moved out of the Carolina Insurance Building.

As the volume of military construction decreased, General Reybold, Chief of Engineers, recommended consolidating the Wilmington District's military work with the Savannah District office for reasons of economy and efficiency. The military supply activities and engineering work on Camp Davis and Bluethenthal Field were transferred to Savannah in May 1944. By June, Savannah was in charge of all military construction in North Carolina formerly under the Wilmington District. The loss of the military work meant a reduction in personnel. While most of the people involved with the on-site work remained at their posts, many District employees were transferred overseas or to other engineer districts. Most of the men commissioned into the Army out of the District went to Fort Belvoir, Virginia, to train for service overseas.[14]

Between 1944 and 1946 Wilmington reverted to a civil works district concentrating on rivers and harbors. During the war only a handful of its employees had worked on civil works. Most of the dredging was done on the Atlantic Intracoastal Waterway or the Cape Fear River for defense purposes and to facilitate the movement of goods, primarily petroleum. The Chief of Engineers returned military work to the Wilmington District in 1946, but by then maintenance had replaced new construction on the few military bases still open in North Carolina. As a result, few military-construction employees were required.

Korean Conflict

The outbreak of the Korean Conflict in June 1950 at first had little effect on the Wilmington District. In the first half of 1950, the number of employees in the District averaged about 143. Of that number, nine were engaged in military work, including five at the Post Engineer Office at Fort Bragg. Family housing and recreational facilities were scheduled to be built at Fort Bragg in 1951. But otherwise, there was no significant increase in military construction immediately after the beginning of the conflict.

However, the District studied mobilization plans for Fort Bragg and conducted engineering studies and surveys for rehabilitating and utilizing existing features at several military bases in the District. The District also began to secure the necessary technical personnel to augment its technical forces. By December 1950, 30 District employees were engaged in military activities. Although little construction was accomplished during 1950, the principal part of the engineering studies and surveys and plans for future activities were made.[15]

By the spring of 1951, the office organization had nearly doubled in size, anticipating a heavy workload. But the expected increase in military work did not materialize, because of a lack of funding and an outdated Fort Bragg Master

Crash fire station at Seymour Johnson Air Force Base, completed in 1956.

Plan. In fact, the District was barely able to meet its payroll. By October 1951 the District had awarded no letter contracts, and it placed only $700,000 worth of military work by the end of the year. The long-awaited increase in military construction did not come until the fiscal years 1953 and 1954, when the District placed $7.8 million and $17.6 million worth of work, respectively.[16]

The work during and following the Korean Conflict at Fort Bragg, Seymour Johnson Air Force Base, and Pope Air Force Base was primarily an effort to rehabilitate the World War II facilities and then develop permanent structures. Seymour Johnson Air Force Base had lain idle and deteriorating after World War II. The district spent over $20 million renovating the hangars—moving one over a mile to a new site—and building new structures such as a series of eight concrete ammunition bunkers. At Pope Air Force Base, the runway was extended, and a "keel" strip constructed to reinforce the runway to accommodate B-52 bombers. The Corps also built a hangar, a hospital, an officers' club, and dormitories at a cost of over $10 million.[17]

In addition to the usual type of construction, the District undertook two major projects at Fort Bragg in the 1950s. A 500-bed hospital was authorized in June 1951, using a site adaptation of a standard Corps of Engineers' design and specifications. Ray M. Lee, Inc., of Atlanta, Georgia, general contractor for the nine-story building, began construction in May 1955 and finished in September 1958. The hospital cost $6.8 million, $400,000 below the estimate.

The other major project at Fort Bragg was the Capehart Family Housing Units, 2,000 units of duplex and single-family dwellings for married officers stationed at Fort Bragg, built between 1956 and 1961 at a cost of $28 million. The financing of the Capehart Housing did not come directly from the federal government. The Capehart Military Housing Act stipulated that the Wilmington District borrow the money from local banks to finance construction. The private financial institutions were repaid with the housing money the military received annually. The total construction program at Fort Bragg amounted to well over $50 million between 1950 and 1960.[18]

At Seymour Johnson Air Force Base, wooden hangars, constructed during World War II, were restored in 1955.

Sunny Point

One of the most interesting projects during the 1950s was the Military Ocean Terminal at Sunny Point, a specially designed ammunition loading facility. Before 1950, military authorities had become concerned about the hazards of loading ammunition into ships. Loading terminals had been located in populated areas where an explosion could cause deaths, injuries, and property damage.

The Army developed a plan of "quantity safety distances" to keep civilian populations outside the perimeters of a 20,000-acre terminal area. Such dimensions made existing terminals obsolete. The expansion necessary to acquire a 20,000-acre property would have meant the purchase of high-priced land and the displacement of many families. Caven Port Terminal at Jersey City, the leading ammunition loading terminal for the country in World War II, if expanded to meet the quantity safety distance requirements, would have extended into the densely populated areas of Jersey City.[19]

In October 1950, the Chief of Engineers was instructed to make a study of coastal areas and select locations where ammunition loading terminals could be built that would comply with the quantity safety distance requirements. He was also to prepare a design for a modern ammunition loading terminal that would incorporate all needed safety provisions. Apart from the 20,000-acre requirement, rail and deep-water accessibility, shelter from storms, suitable year-round weather, and minimum hardship for as few residents as possible were criteria for determining suitable locations. The Sunny Point location on the west bank of the Cape Fear River 15 miles south of Wilmington received first priority, and became the "guinea pig of the Ammunition Loading Terminal program."[20]

The Wilmington District began construction on the terminal in December 1952 and completed it in the fall of 1955, at a cost of $22.5 million. The terminal is a standard three-wharf type, designed for use at other locations besides Sunny Point. The three identical wharves each can accommodate two ships under normal conditions or three in an emergency. Each wharf is serviced by three railroad tracks.

During construction of Military Ocean Terminal at Sunny Point (MOTSU), a bulldozer cleared the site for construction of piers at Wharf No. 2. In this photo, a bulldozer sweeps away blackjacks, scrub timber and stumps.

Early stage of construction at Wharf No. 2

In this scene, preparations for pouring concrete at MOTSU pier are almost complete with steel reinforcements in place.

One of the more important features of the terminal is a system of earthen barricades, thrown up and sodded, to localize explosions and protect utilities. The barricades, which reduced the required quantity safety distances, enclose three sides of each spur track in the holding yards and divide the receiving and classification yards. They rise up to 16 feet in height, and some are eight feet across the top. The establishment of a deep-water extension to the main shipping channel in the river was one of the largest dredging operations supervised by the Wilmington District, with the removal of 18 million cubic yards of material.[21]

The Wilmington District directed a number of smaller military projects in North Carolina, including a ten-story, 500-bed hospital at Durham for the Veterans Administration and a 50-bed hospital at Seymour Johnson Air Force Base. At Charlotte, the old World War II Quartermaster Corps Depot was rehabilitated and modified for the Ordnance Corps to produce the NIKE guided missile. The District built a test building for Western Electric, the producers of the NIKE missile, at Burlington; three radar sites for the Aircraft Control and Warning Service of the Air Force at Fort Fisher, Roanoke Rapids, and Winston-Salem; and 12 Army Reserve training centers at various locations around North Carolina.[22]

Transfer of Military Work

The military construction program of the Wilmington District reached a peak in fiscal year 1955, when the District placed $31.3 million worth of work. Throughout the remainder of the decade the amount of military work decreased steadily until, in fiscal year 1961, only $6.3 million dollars worth of work went forward. Early in 1961, with the decrease in military construction and a shrinking civil works construction program, the Secretary of the Army approved a plan for the reorganization of the Corps of Engineers. The military construction program was consolidated from 31 into 19 districts. Wilmington District, one of the smaller ones, was reorganized and reconstituted to adapt to the low workloads of that period. The military work in North Carolina transferred from the Wilmington office to the Savannah District on 1 July 1961.[23]

Wilmington became an "operating district" and Savannah its "support district" with the transfer of the technical and administrative responsibilities to Savannah. As an operating district, Wilmington was staffed for direction, supervision, and inspection of civil construction and maintenance activities. As an exception to the operating district concept, general investigations and reports work then in progress continued, but no design capability remained in the Wilmington District. All administrative and technical support not required for immediate supervision and on-site administration of civil construction, operations, and maintenance came from the Savannah District. Wilmington combined its property and supply organizations and consolidated the Construction and Operations divisions. Legal services were the province of the support district.[24]

For the personnel of the Wilmington District, it was a black day when they filed into the federal courtroom to learn that more than half of them would lose their positions in Wilmington. Although Wilmington gained nearly 100 employees through a boundary change with the Norfolk District (see Chapter XI), the 1961 reorganization dispersed Wilmington personnel all over the world. The District suffered through a period of low morale as its people adjusted to the new situation. Earle Merrill, trying to keep in touch with the former members of the Design Branch, wrote, "The Wilmington District 'ain't what she used to be,' that's for sure. Sometimes I hardly recognize the place myself."[25]

Although the District's military work was transferred to Savannah District in 1961, the Wilmington District remains a part of the Total Army. One of the primary reasons the Corps has a civil works mission is to provide a well-trained staff of civilians with the ability to respond quickly and effectively to support mobilization of the country's resources with engineering expertise. The District maintains a mobilization plan in cooperation with the Savannah District and Army installations in North Carolina.

The District supports the Total Army in other ways. Under the direction of Lieutenant Colonel Arpad (Art) A. Kopcsak, Jr., Deputy District Engineer, troops of the 307th Engineer Battalion of the 82nd Airborne Division demolished four highway bridges at the Falls Lake Reservoir site in 1982. The tactical airborne exercise provided realistic training for the airborne engineers while conserving costs. Also, a Chinook helicopter from Fort Bragg placed a drilling platform and rig in the surf zone at Oregon Inlet permitting the District to conduct foundation investigations along a proposed jetty site. The operations solved a problem for the District and provided training for Army pilots in maneuvering heavy loads under adverse conditions.[26]

Throughout the 1940s and 1950s, the military work of the District dwarfed the civil works side. In fact, the District spent more money in fiscal year 1943 than it had in the previous 58 years combined. But the District's civil works experience had been good training to meet wartime demands. The Wilmington District demonstrated its ability to respond to changing conditions by converting almost overnight from a rivers and harbors district to a military district and back again, twice in a period of 20 years. The changes were not made without personal hardship, long hours, and hard work. But the District met the challenge.

Artist's rendering of Veterans Administration hospital, Durham, NC

CHAPTER IX

Jetty Door

We were informed by Quartermaster that they could issue such preparation if the ant to be exterminated was in the building. If it was outside of the building, the issue of such preparation properly should come from Engineering. It is difficult to determine the intentions of the ants we are attempting to exterminate—some live inside and wander outside for food, while some live outside and forage inside for food. It is a rather difficult problem to determine which ant comes from without and is what might be called an Engineering ant, and which ant comes from within and is what would be a Quartermaster ant. Some of our ants appear to be going in circles and others are apparently wandering at random with no thought of destination—such ant tactics are very confusing and could result in a Quartermaster ant being exterminated by an Engineering poison or an Engineering ant being exterminated by Quartermaster poison which would be contrary to the letter of the regulations and would probably lead to extensive investigation and lengthy letters of explanation.

—Medical Inspector, Robins Field

North Carolina's diverse coastal environment has offered challenging experiences to the Wilmington District engineers, giving them a 320-mile-long laboratory of coastal engineering. The District has endeavored to protect the state's beaches and stabilize the inlets against the action of the sea. Although the Engineers cannot control or even completely understand the interaction of winds, waves, and shore currents, the encroachment of man on beaches and the use of inlets by commercial vessels have forced the Engineers to contend with a dynamic shore and migratory inlets.

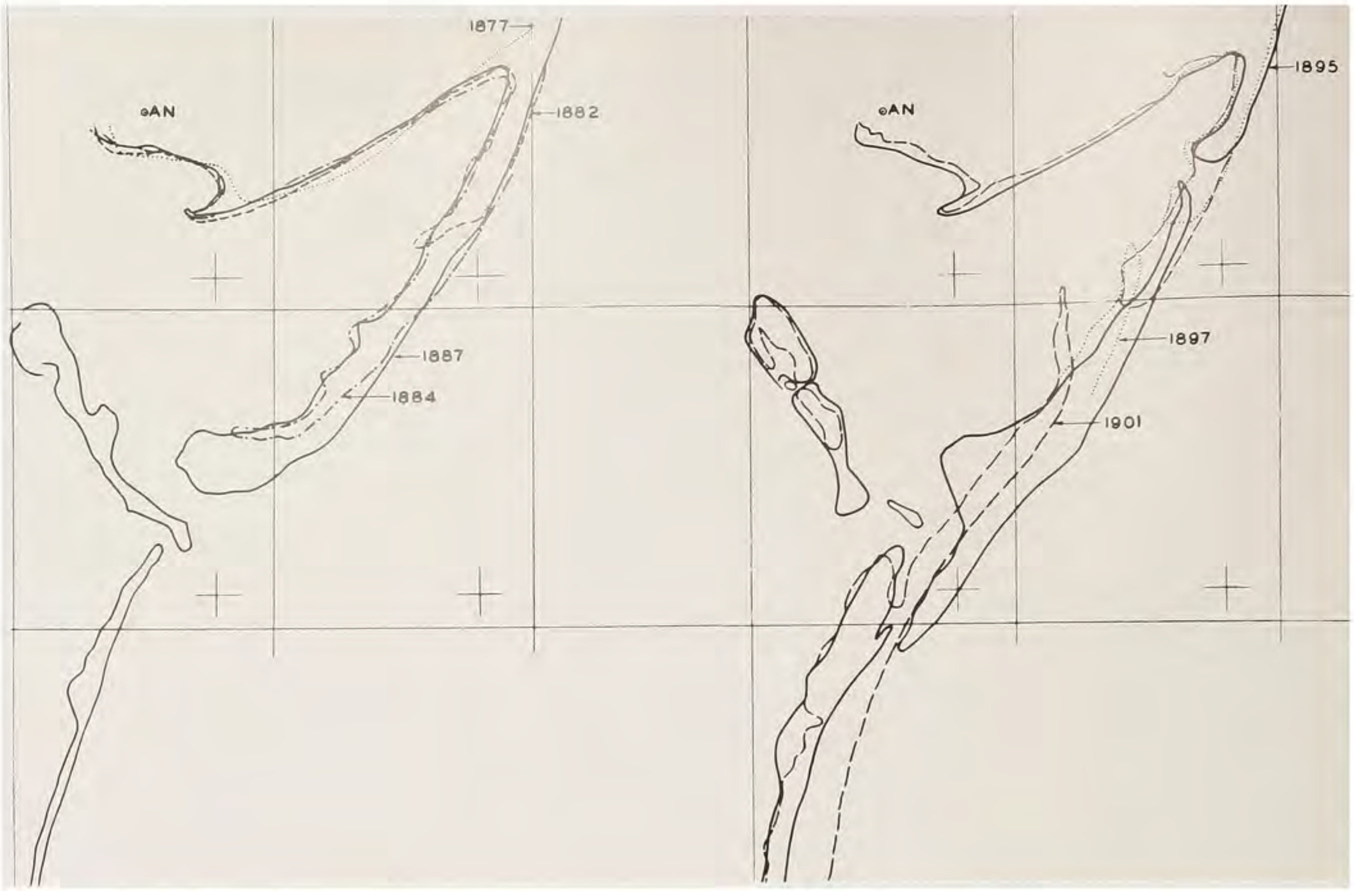
The Corps of Engineers made two attempts at coastal engineering during the 19th century, but only one was successful. In the first, an effort to establish a channel through the shoals inside Ocracoke Inlet, the Engineers spent approximately $133,000 between 1826 and 1837 before abandoning the project. They returned in the 1890s and spent just over $100,000 in another futile attempt to dredge a channel (see Chapters III and VI).

The second early project (Chapter V) ended in victory over the elements as the Engineers separated the waters of the Atlantic from the Cape Fear River by building two stone dams at New Inlet. Since their completion in 1891, the structures have required only routine maintenance and have fulfilled their designers' objectives. By forcing the Cape Fear to flow out through only one mouth, the Rocks enabled the Engineers to dredge the river to a depth that allowed Wilmington to compete successfully with neighboring ports.

The Wilmington District's later coastal projects also produced mixed results. The first coastal area to attract the District's attention was the beach just north of the Rocks and adjacent to Fort Fisher.

Fort Fisher

Fort Fisher, the site of the Civil War's greatest naval bombardment, was in danger of falling to a second foe in the 1920s. Over the period from 1852 to 1931,



Shoreline changes at Fort Fisher, 1884-1901

the beach at Fort Fisher eroded 195 feet. But the process was not continuous. From the data available to the Corps of Engineers in 1931, it appeared that the beach had experienced four periods of erosion or accretion. For the first 13 years, the beach gained a total of 485 feet. Then it eroded 460 feet over the next 58 years, showed an accretion of 60 feet for the next three years, and an erosion of 280 feet between 1926 and 1931.

By 1931 the beach had eroded a net total of 195 feet, washing away certain landmarks that could not be replaced during times of accretion. The possible loss of a local historic site distressed the New Hanover County Historical Commission and the United Daughters of the Confederacy. Members of both organizations sought assistance from state and federal agencies in an attempt to preserve the site.[1]

The Reverend Andrew J. Howell, chairman of the New Hanover Historical Commission, asked the North Carolina Department of Conservation and Development to study the erosion problem at Fort Fisher. Thorndike Saville, Chief Engineer of the department, was very interested in the project and, having already made several visual inspections of Fort Fisher, was familiar with the situation. Between 1927 and 1931, his department instituted various local studies of beach erosion and set up observational stations at Wrightsville Beach, Carolina Beach, Atlantic Beach, and Nags Head Beach. Saville and his department found little interest in the subject among citizens owning property along the beaches, except in the case of Fort Fisher. Additionally, a lack of funding restricted the department's ability to conduct further studies or construct protective works. In 1931, the department had only $2,000 to spend on the entire coastline. Saville's personal interest in the Fort Fisher erosion problem, his knowledge of coastal engineering, and his insight into the workings of the various government agencies involved in coastal management kept the project alive and led to a study of the area by the Corps of Engineers.[2]

In the spring of 1931, Howell, Saville, and Major Raymond A. Wheeler joined in a formal request for assistance from the Corps of Engineers' Beach Erosion Board, which was authorized by Congress in the Rivers and Harbors Act of 3 July 1930 to participate in cooperative beach erosion-control studies and to furnish technical assistance to the Chief of Engineers. The studies were to be made at the request of and in cooperation with local governmental agencies, with the agencies bearing one-half of the cost.

Since the Department of Conservation and Development had no funds available to match federal money, the New Hanover County Board of Commissioners, at Saville's suggestion, appropriated $1,000 and contributed the sum to the Department of Conservation and Development. Saville, a member of the Beach Erosion Board, then made a formal request for assistance from the board with the stipulation that the $1,000 be matched with federal money. Major Wheeler forwarded the request with his approval.[3]

Three members of the Beach Erosion Board, Colonel Earl I. Brown, Colonel Elliot J. Dent, and Thorndike Saville, examined the beaches in the vicinity of Fort Fisher in May 1931. Colonel Brown was familiar with the North Carolina coastline, having served as Wilmington District Engineer from 1907 to 1911. (During the early days of World War II, he came out of retirement to serve in the same position from 1940 to 1942.)

On 22 October 1931, the entire six-man board convened in Wilmington to gather information and visit the site. Delegations from the New Hanover Historical Commission and the North Carolina division of the United Daughters of the Confederacy presented their views to the board. The United Daughters of the Confederacy disclosed that $10,000 had been raised for the erection of a monument to the Confederate soldiers who died defending the fort. Construction was scheduled to begin in early 1932, and the women wanted assurance that it would not be washed away in the near future.[4]

In its report in November 1931, the Beach Erosion Board agreed that the Fort Fisher beach was eroding, but it was unable to determine at what rate it might be expected to erode in the future, or what had caused the erosion of 280 feet of beach in the past five years. The board rejected a suggestion that the sand that closed New Inlet following the construction of the Rocks came solely from the Fort Fisher area. The volume of material contained in the sand spit closing New Inlet greatly exceeded the net amount of material eroded from Fort Fisher in the same period. "Causal connection between these phenomena is wholly problematical," said the board. "As nothing can now be done at New Inlet affecting the protection of Fort Fisher, which is the practical problem before the board, the whole question of the inlet is academic for our purpose."[5]

According to the board, the only other factor even having a possible bearing on the erosion at Fort Fisher was the removal of a coquina rock outcropping from an area northeast of the fort in the 1920s. The New Hanover County Commission permitted a contractor to remove the coquina for use in completing a section of U.S. Highway 421. The contractor took it from a strip 50 to 100 feet wide for a considerable length of the beach, borrowing approximately 6,000 cubic yards of the material. The excavation of the coquina coincided with the reversal in the erosion cycle that occurred around 1926. The board offered no definite conclusion concerning the role the coquina removal played in the erosion of the fort, saying only that "It is conceivable that this, by reducing the quantity of resistant material at a critical point, has accelerated the erosion."[6]

While the Beach Erosion Board could not definitely determine the cause of the erosion, it did recommend protective works to remedy the situation. The board proposed the cheapest yet most effective form of shore protection for Fort Fisher—a series of four steel sheet-pile groins and a steel sheet-pile bulkhead.[7]

The Beach Erosion Board offered no guarantees for the success of the proposed protective works, but it represented the recommendations of the leading coastal engineering experts. That was all the board could offer at the time—recommendations. Neither the board nor the Corps of Engineers could build any protective works solely for the purpose of shore protection.

But the local groups seeking help for Fort Fisher did not seem to understand the board's limitations. Even Saville, a member of the board, expected the body to authorize construction of "one or more remedial structures immediately at Fort Fisher in order to observe the effect of their presence upon the protection of the Fort. In this way the investigation, while scientific in nature, would bring about some immediate remedial results."[8] Legally, however, the board's hands were tied. In the early years of the board's existence, it served only as a panel of consultants whose services could be secured by a state or local agency willing to pay one-half the cost.[9]

After the board published the results of its investigation, neither the state nor local government agencies were willing to put up $71,600 for the bulkhead and four groins, so the sea continued to eat away at the fort. In 1931, the waves

Beach erosion at Fort Fisher looking south, 1946

lapped at the foot of the fort's earthworks, and the erosion continued at an even greater rate in succeeding years. Within another ten years, a cove had formed in the beach at the fort, and a large part of the earthworks, including the northeast bastion, had disappeared. Thus the main features that the bulkhead and groins were intended to protect had been destroyed.

In World War II, the site once again became an active military post. The Army leveled a section of the land defense of Fort Fisher for an airstrip, and over half of one of the remaining batteries was removed for the construction of bombproofs to protect ammunition bunkers. By 1946, the shoreline had receded between 370 and 460 feet in the area where maximum erosion had occurred during a period of 20 years.[10]

The Beach Erosion Board conducted another cooperative study of the entire North Carolina coast in 1948, but again, neither the state nor local government was willing to finance the protective works at Fort Fisher. In the late 1950s, interested organizations in and around Wilmington began making plans to revive statewide interest in restoring the remaining parts of the fort as a tourist attraction. In 1960, the state leased a 180-acre tract from the federal government, cleared the site, and built a museum. The state also placed stone along the beach to retard the erosion.[11]

The shore at Fort Fisher continued to erode at an average annual rate of 15 feet—22 feet during years in which major storms occurred—one of the highest rates documented for the Atlantic Coast. Finally, after Congress authorized the Corps of Engineers to construct works for the protection of publicly owned shores in 1946, and replaced the Beach Erosion Board with the Coastal Engineering Research Center in 1963, the Senate Committee on Public Works directed the Corps to conduct a "survey of the shores of the Fort Fisher Historical Site and the area northward to Kure Beach, North Carolina, and such adjacent shores as may be necessary, in the interest of beach erosion control, hurricane protection, and related purposes."[12]

After nine years of intermittent investigations, the engineers of the Wilmington District proposed the construction of a rubble revetment along the entire upland bluff fronting the site, for a distance of 2,000 feet; the placement of an ar-

Erosion at Fort Fisher, 1982

tificial beach fill along 8,000 feet of the historic site and immediately south of the site; and the construction of seven groins to compartmentalize the artificial beach fill within the zone of erosion. In 1975, the protective works were estimated to cost $5,540,000, with the federal government to pay 70 percent of the total first cost and the state the remainder. Late in 1980 the District recommended a scaled-down project. The rubble revetment would be constructed but beach nourishment and the groins were deferred. By the end of 1982, funding for the project was still not available.[13]

Thus, even the best-laid plans sometimes come to naught. In 1982, Colonel Robert K. Hughes, District Engineer, echoed the words of Howell and Saville, 51 years earlier, when he said that if the erosion control project were not begun "in the relatively near future, we're not going to have to worry about problems because it won't be there."[14]

The state of North Carolina, the Beach Erosion Board, and the Wilmington District all agreed from the outset that the beach needed protection from erosion, yet nothing has been built. In the 1930s, when the fort could have been saved, the state of North Carolina could not afford to do the job. By the time Congress authorized the Corps of Engineers to undertake works to prevent shore erosion in 1946, most of Fort Fisher no longer existed. The wind and waves accomplished what the Union fleet and 40,000 rounds of ammunition could not—the destruction of Fort Fisher.

Wrightsville Beach

Residents of Wrightsville Beach, just north of Fort Fisher, also began expressing their concerns over beach erosion in the 1920s. In 1932, Thorndike Saville and the North Carolina Department of Conservation and Development requested a study of the Wrightsville Beach erosion problem in cooperation with the Beach Erosion Board. After frequent visits to the area by different members, the board completed its report in 1934. The board determined that the beach had eroded a net distance of 80 feet over a period of 75 years.

Repairs to the groin at Wrightsville Beach, 1923. Horses provided the power to move pilings into the surf zone.

To halt the beach's erosion, which was influenced by the presence of Moore Inlet at the northern end of Wrightsville Beach and Masonboro Inlet at the southern end, the board recommended a series of 16 steel sheet-pile groins, spaced 650 to 750 feet apart and connected at their shore ends to a steel sheet-pile bulkhead 9,855 feet long. To restore the beach to its former condition, sand from the rear of the island should be supplied to portions of the beach, according to the board's recommendations.[15]

In 1939, financed in part by the Public Works Administration, the town of Wrightsville Beach built a groin system generally in conformance with the proposals of the Beach Erosion Board, except that the bulkhead was omitted for lack of funds. The work comprised 16 creosoted pile-and-timber groins, each 325 feet long with an average spacing of 800 feet, and placement of nearly 700,000 cubic yards of fill. Between 1940 and 1960, an additional 521,000 cubic yards of sand was placed on the beach at different locations. In spite of those measures, erosion continued at Wrightsville Beach as the mean waterline moved landward 500 to 600 feet between 1930 and 1962.[16]

Six major hurricanes hit the North Carolina coast between 1954 and 1960: Hazel (1954); Connie, Diane, and Ione (1955); Helene (1958); and Donna (1960). Those six storms caused property damage totaling $12,362,200 in the Wrightsville Beach–Carolina Beach area alone. The worst of the series, Hazel, struck the coast on 15 October 1954, with water levels 12 to 13 feet above mean low water, resulting in large waves that broke directly on waterfront structures. Hurricane Hazel destroyed 89 houses at Wrightsville Beach, 362 at Carolina Beach, and over 300 at Long Beach.

The damage caused by the 1954 and 1955 hurricanes dramatized the need for protection of beach areas. Congress responded by passing Public Law 71 in 1955. The act authorized the Secretary of the Army to make a study of the eastern and southern seaboards of the United States with respect to hurricanes and with special attention to areas that had suffered severe damage. The law stated that surveys made by the Corps of Engineers should consider the economics of breakwaters, seawalls, dikes, dams, and other structures that might be required. Protection from beach erosion and the effects of hurricanes were now linked for the Corps of Engineers.

The Chief of Engineers assigned 11 different studies of the North Carolina coast to the Wilmington District. Of the 11, the two at Wrightsville and Carolina beaches were the first to be completed and their recommendations determined feasible from engineering and economic standpoints. The remaining nine studies resulted in the authorization of nine projects, but they were later deauthorized for lack of sponsorship by nonfederal interests.[17]

At Wrightsville Beach the Carolina Yacht Club is wrecked by Hurricane Hazel, 1954.

The studies made by the Wilmington District recommended similar projects for Wrightsville and Carolina beaches. At Wrightsville Beach, the Engineers determined that the most feasible project was a shore and hurricane-wave-protection berm-and-dune combination. The federal share of the project costs would be limited to a maximum of 70 percent, the remainder coming from local interests.

The District constructed the dunes with the shoreward side of their bases near the building line, and a crown width of 25 feet at an elevation of 15 feet above mean low water. The beach berm was given a crown width of 50 feet at an elevation of 12 feet. The berm and dune extended 14,000 feet northward from Masonboro Inlet. The District built the berm and dune by using hydraulic dredging, and shaped the sand with mechanical equipment. American beach grass was planted on the dune for stabilization. A total of 2.5 million cubic yards was deposited initially on Wrightsville Beach to form the berm and dune. In addition to the construction of the berm and dune, the District closed Moore Inlet. The District completed the project in September 1966 at a cost of $855,600, of which local interests provided 32.8 percent of the construction costs.[18]

As the project neared completion, the foreshore began to erode at a more rapid rate than that of historical record. That erosion was a result of the closure of Moore Inlet, changes in shoreline alignment, and a sorting of fine material from the design section by wave action. To offset the unexpectedly rapid loss of material, the District added 319,000 cubic yards of material in July 1966; 42,000 cubic yards in October 1966; and 377,000 cubic yards in the spring of 1970.

With the last addition, the District officially declared the Wrightsville Beach project complete; thenceforth all future nourishment would be cost-shared by nonfederal interests on a 50–50 basis. Under those cost-sharing arrangements, 500,000 cubic yards of material was placed on the beach in April and May 1980, and 1,250,000 cubic yards from December 1980 to April 1981 as periodic maintenance.

Wrightsville Beach berm and dune before construction was started in February 1965

Wrightsville Beach after the berm and dune were constructed, June 1965.

Carolina Beach

The berm-and-dune project constructed at Carolina Beach was identical to the Wrightsville Beach project in height and width, but 1,250 feet shorter. Between December 1965 and April 1966, a total of 2,632,000 cubic yards of material was deposited on Carolina Beach to form the berm and dune. Following the project's completion in 1966, the foreshore experienced the same rapid erosion as that at Wrightsville Beach.

During the first year after the initial nourishment of Carolina Beach, the Engineers focused their attention on the erosion experienced by the northernmost 3,000 feet of the project. Within 12 months of completion, 1,000 feet of fill at the extreme northern end was displaced from the design section; and the adjacent 2,000-foot section was also severely damaged by erosion.

While the Wilmington District undertook a special study, it placed an additional 526,000 cubic yards of fill on the northern end of the beach, and built a groin near the northern town limits of Carolina Beach. The groin reduced the rate of erosion by one-half, but the site required periodic renourishment—411,000 cubic yards in 1967; 346,000 cubic yards in 1970; and 760,000 cubic yards in 1971.

The District built a 1,000-foot stone seawall in 1970 and extended it 950 feet in 1973. The seawall halted the regression of the northern end of the project but did not prevent erosion along the remaining length of the work. The segment of the Carolina Beach project south of the seawall did not receive any additional nourishment until 1981, because of a lack of nonfederal funds. However, after a severe storm in December 1980, 406,000 cubic yards of material was placed on a badly eroded section of the project just south of the seawall.[19]

In 1981 and 1982 federal and nonfederal funds became available and 3,662,000 cubic yards of material was placed to complete the Carolina Beach project. The project was declared officially complete with all future nourishment required to be cost-shared on a 50-50 basis.

The beach erosion at Carolina Beach was directly related to the presence of Carolina Beach Inlet. Before September 1952, the shoreline between Masonboro and Corncake inlets, nine miles south of Carolina Beach, formed a continuous physiographic unit. In September 1952, the Carolina Beach Inlet Development

Corporation dynamited the last remaining barrier and opened Carolina Beach Inlet. The object was to eliminate the 12-mile trip from the Carolina Beach Yacht Basin to Masonboro Inlet previously required to gain access to the sea.[20]

Because there was conclusive evidence that the predominant direction of littoral drift was from north to south along that section of coastline, the Wilmington District and the Beach Erosion Board advised local interests, at a public hearing in January 1952, that the expected accumulation of littoral material in the vicinity of the proposed inlet would reduce the supply of material available to nourish the downdrift shore, and would cause accelerated erosion. The corporation contended that the economic benefits to the town would offset any threat from erosion. Survey data for the five years following the inlet's creation revealed a rapid rate of erosion along the shore immediately south of the inlet. The south shoulder of the inlet retreated 410 feet during the period.[21]

At the request of the town of Carolina Beach, the Senate Public Works Committee on 27 November 1968 authorized a study of Carolina Beach Inlet. The study considered improvement of the inlet by dredging both with and without jetties. The approved plan provided a channel from the Atlantic Intracoastal Waterway eight feet deep at mean low water and 150 feet wide to the Atlantic Ocean. Dredging of the ocean bar channel would be performed with a split-hull hopper dredge of the *Currituck* class capable of depositing the dredged material in the near-shore surf zone. The District completed the project in December 1982. Placement of material dredged from the Atlantic Intracoastal Waterway and the channel through Carolina Beach Inlet to the Atlantic Ocean was designed to reduce erosion south of the inlet.

Waves strike Carolina Beach seawall during northeastern storm, December 1980.

Carolina Beach berm and dune was constructed in 1965. View shows work in the boardwalk area.

Carolina Beach is renourished, 1981–82.

Masonboro Inlet

At Masonboro Inlet, the Wilmington District has combined beach erosion work with the improvement of navigation through the inlet. Located at the southern end of Wrightsville Beach, Masonboro Inlet has been shown to be open in every inspection of the North Carolina coast since 1738. Between 1857 and 1887, the inlet migrated 3,800 feet southward, but it returned to within 700 feet of its 1857 position by 1932. In 1947, the District built two groins on the north shore. Shortly thereafter, three groins were constructed on the south shore, but all five proved to be ineffective in maintaining a channel through the inlet or protecting the beach. Since then, the north shore has remained fairly stable, whereas the south shore has alternately elongated northward and been cut through, leaving middle-ground shoals in the inlet.

As part of the Atlantic Intracoastal Waterway project, Congress authorized a channel 14 feet deep and 400 feet wide across the bar at Masonboro Inlet and dual jetties extending to the 14-foot depth in the ocean. The jetties were to be built only if the channel could not be maintained by dredging alone. The Wilmington District's response to the problem of maintaining a navigable channel through the inlet, while aiding the beach renourishment north and south of it, was unique.[22]

Construction of Masonboro Inlet south jetty, completed in 1980. Barges in the forefront of the photo project the construction area by breaking sea conditions. Thirty-ton "whirlies" unload rock barges and place stone on the jetty. Each stone weighs between 14 and 22 tons.

On 1 June 1959, Masonboro Inlet Channel was completed to project dimensions by a pipeline dredge, with considerable loss of time and repairs because of rough seas. The material from the inlet channel went to Masonboro Beach as nourishment. Three months after completion, heavy shoaling in the inlet channel required maintenance dredging that removed 110,000 cubic yards of sand. A survey four months after the first maintenance dredging indicated that the channel had again shoaled extensively and that restoration was necessary. A condition survey of the channel in July 1962 revealed that the alignment of the channel across the ocean bar had shifted southwestward, and the controlling depth had reduced to approximately seven feet at mean low water. When it was found that dredging alone could not maintain the channel to project dimensions, the Wilmington District engineers and representatives from the Coastal Engineering Research Center and South Atlantic Division met to design the jetties.[23]

The engineers decided to build a jetty on the north side of the inlet. If necessary, a jetty on the south side would be built later. Instead of a rubble-mound structure, as earlier planned, they decided to experiment with a new design. The jetty was given a low-weir section to pass littoral drift or provide a sand spillway. The first 1,700 feet of the jetty was formed of concrete sheet piling and tied into the berm at the 12-foot-above-mean-low-water level. The first 1,000 feet of the weir had a top elevation of two feet above mean low water, or about midtide. The remaining 1,900 feet of the jetty was constructed with rock at a height of about seven feet above low water. The jetty was completed in 1966.[24]

Following construction of the jetty, a deposition basin was dredged between the concrete weir and the navigation channel. The dredge removed 376,300 cubic yards of material in excavating the 1,300-by-400-foot basin to a depth of 16 feet. The material was pumped northward to renourish the badly eroded hurricane-and-shore-protection project along Wrightsville Beach.

The functioning of the deposition basin was hampered by the presence of a channel running parallel and adjacent to the rubble portion of the jetty. As the channel passed through the basin, it removed some of the material previously deposited there and prevented the deposition of additional littoral material. Also, by paralleling the jetty, the channel threatened to undermine the structure by scouring its foundation. By the fall of 1969, the channel had deepened to 25 feet at some points and had migrated so that it was adjacent to the jetty. Additional stone was placed on the jetty in 1970 and 1973 to protect the foundation.[25]

Aerial view of completed Masonboro Inlet jetties

In the early 1970s, the District designed a jetty for the southern shore of the inlet. It was completed in 1980, and the District has been studying its effect on the channel since then. By 1982, the channel had deepened and moved to the centerline of the inlet. The Wilmington District was the first to design and build a weir-type jetty system of that kind.[26]

Since the maintenance of stable channels through the inlets along the coast is important to the economy of eastern North Carolina, the Corps of Engineers has attempted to provide navigable channels through various inlets in North Carolina since 1826.

Ocracoke Inlet

At Ocracoke Inlet, the Engineers again tried to dredge a channel through Wallace's Channel. Congress authorized a 12-by-20-foot channel from Ocracoke Inlet gorge to Pamlico Sound, a distance of about 7.4 miles, in 1954. The channel was dredged to project dimensions in 1958, but the Engineers soon discovered what Lieutenants Dutton and Swift had learned 125 years earlier—a channel is nearly impossible to maintain without constant dredging. After spending over $50,000 on maintenance dredging in 1961 and 1962, the Engineers could report a governing depth of only 5.5 feet in 1962.

Congress authorized a channel across the ocean bar 18 feet deep and 400 feet wide on the ocean side of Ocracoke Inlet in 1960, the first project for the ocean side of the inlet. Congress also authorized a jetty extending from Ocracoke Island, on the eastern side of the inlet, to the 20-foot depth in the Atlantic, in the event it was determined that control works would be more economical than maintaining the bar channel by dredging alone. The construction of the jetty has been deferred for restudy since the dredging has maintained the channel more economically.[27]

Drum Inlet

One of the Wilmington District's more interesting projects was the reopening of Drum Inlet, located on the Outer Banks between Ocracoke Inlet and Cape Lookout. Although maps dating back to the 17th century document an inlet in the general vicinity, Drum Inlet opened during a hurricane in September 1933. Congress authorized the dredging of a 12-by-200-foot channel through the inlet into Core Sound in 1938. Littoral material gradually shoaled the inlet so that even shallow-draft vessels could not use the channel.

During February 1971, seasonal storms closed the inlet completely. The closure had little effect on the commerce of the area, but threatened the ecological balance of Core Sound. The introduction of ocean water in 1933 had raised salinities in the sound's waters. The inlet's closure 38 years later threatened to reverse the sound's environmental conditions. Immediately, state fisheries personnel, environmental groups, and local navigation interests sought a reopening of the inlet by the Wilmington District.[28]

The Wilmington District selected a site about 2.5 miles south of the original inlet as the location for the new channel. The barrier beach at that point was only 1,000 feet wide, and the National Park Service had determined that the beach, a part of Cape Lookout National Seashore, required widening to protect it.[29]

In planning the operation to open a new inlet, the Wilmington District sought and received the assistance of the Explosive Excavation Research Office, the Coastal Engineering Research Center, and the Waterways Experiment Station. The District awarded two separate contracts for the project. The first provided for the dredging of the authorized 7-by-100-foot channel from the waterway through Core Sound to a point in the barrier beach 75 feet from the mean high-water line on the ocean side. The 400,000 cubic yards of material removed during the project created a marsh on the sound side of the beach.

The second contract called for explosive excavation of a pilot channel to connect the dredged channel with the ocean. To create the 6-by-80-by-385-foot channel, the contractor used one-ton charges in eight-foot steel canisters two feet in diameter. Eleven pairs of charges were driven into the sand 40 feet apart, with 35 feet between pairs. On 23 December 1971, all charges were detonated simultaneously during an ebbing tide, so that natural scouring would aid in the enlargement of the channel. Although the inlet quickly shoaled, the Wilmington District dredge *Merritt* cleared the channel to project dimensions of nine feet deep and 150 wide from the inlet gorge to deep water in the ocean. The initial project design to create marshland as a protective zone to prevent shoaling of the access channel to Drum Inlet was rejected by state and federal environmental agencies. As a result, the cost of maintaining the access channel could not be justified and the project has been placed on inactive status.[30]

Relations With the National Park Service

The National Park Service has managed much of the Outer Banks of North Carolina as national seashores since 1937. In that capacity, the Park Service has sought to protect the beaches from erosion. During the 1930s, various relief agencies of the federal government supplied funds for sand-fixation projects such as the construction of sand fences. The Corps of Engineers, through the Beach Erosion Board, cooperated at times with the Park Service in studies of inlet stabilization. In the 1950s, the state of North Carolina purchased and turned over to the Park Service more than 12,000 acres of the Outer Banks to become the Cape Hatteras National Seashore.[31]

The Wilmington District has served as consultant to the National Park Service on erosion problems of the Outer Banks. In 1978, Colonel Adolph A. Hight, District Engineer, and Limberios Vallianos, chief of the Coastal Engineering Studies Section of the Wilmington District, headed up a study team to investigate the erosion problems at Barden Inlet, which threatened the Cape Lookout Lighthouse. By April 1978, the inlet shoreline was only 344 feet from the base of the lighthouse and moving toward the historic structure at a rate of 1.3 feet per month. The Wilmington engineers recommended the placement of a stone riprap bank revetment along approximately 2,350 lineal feet of shore. But the Park Service did not follow through on the recommendation, and the landmark is still unprotected.[32]

In 1971, the Park service asked that a Wilmington District representative attend a meeting to discuss a dredging and beach-nourishment project at Cape Hatteras. The District's representative made several suggestions for modifications in the contract's specifications, including pumping the sand at a distance less than the 18,000 feet specified, installing the discharge line on the beach side rather than behind the dunes, and utilizing a closer borrow area. The Park Service was also warned about excessive mobilization-demobilization costs involved with the contract. But none of the changes recommended by the Wilmington District was made by the Park Service. The only specific request made to Wilmington in connection with the contract was for the District to provide inspection during the dredging work, which Wilmington agreed to do.

Oregon Inlet

One venture that has required cooperation between the Wilmington District and National Park Service is the Manteo (Shallowbag) Bay Project. The original project, authorized by Congress 17 May 1950, provided for a channel 14 feet deep at mean low water by 400 feet wide, through Oregon Inlet.

The channel was initially dredged to project diminsions in 1960 by the hopper dredge *Hyde*. For a period of 11 years the *Hyde* attempted to maintain project dimensions by dredging the bar channel once or twice a year. It was only partially successful. During that period, the *Hyde* dredged approximately two million cubic yards of sand. But Oregon Inlet continued to be a hazard to fishermen and vessels alike.

In 1964 the sidecasting dredge *Merritt* was assigned to assist the *Hyde*. Later, the *Schweizer*, a larger sidecasting dredge, was assigned full-time to Oregon Inlet maintenance, where it was assisted occasionally by the *Merritt*. Even with the intensified effort, dredging could not obtain full project width and seldom achieved full project depth over much of the channel.

In 1970 Congress modified the project to provide for a 20-foot channel over the bar and through Oregon Inlet, and stabilization of the inlet with jetties.

Because of the migratory nature of the inlet, the unstable subsurface conditions, and the harsh environment for construction, the engineering effort that has gone into the design of the stabilization structures has far surpassed anything ever done for similar structures in the United States.

The District considered several jetty design options. Foundation conditions and construction difficulties made it essential to build as light a structure as possible. One design concept included a "jetty door" with the capability of locking a dredge through the door for purpose of maintaining the normal littoral drift of sand across the jettied inlet to prevent erosion south of the inlet.

The plan recommended for the bypassing of sand accretions on the north side of the north jetty was to use a floating breakwater developed by the U.S. Navy in combination with a pipeline dredge. The bypass operation would require dredging of about two million cubic yards of material annually from the updrift side of the inlet.[33] By the end of 1982, the options for the type of jetty that would be most cost-effective were still under consideration.

The project has assumed additional importance in recent years because of the development of Wanchese Harbor by the state of North Carolina under a Public Law 90-483, Section 215, agreement. The state will provide waste treatment and other utilities, in addition to enlarging Wanchese Harbor, to encourage development of large-scale seafood handling and processing plants.

The authorization of the 1970 project provided stimulus for fishermen in the region to build and use larger vessels in anticipation of an improved stable channel through Oregon Inlet. The deeper draft vessels have created more problems for the fishermen with the loss of several of the large vessels in the period awaiting construction of the jetties.

Initially, the National Park Service and the Fish and Wildlife Service of the Department of the Interior, which controls the land on either side of the inlet, did not oppose the construction of the jetties. Later, the two agencies not only came out in opposition to the jetties but also refused to grant permits for land necessary for jetty construction on the grounds that jetties were not compatible with the purposes for which the Cape Hatteras National Seashore was established.

Numerous environmental lobbyists and the North Carolina Beach Buggy Association vigorously opposed construction of jetties at Oregon Inlet. The combined opposition of those forces and the Department of the Interior necessitated additional studies and investigations to predict storm surges through the jettied inlet; reevaluation of the dredging alternatives and of the cost-benefit ratio; and determination of the influence on erosion rates of near-shore deposit of dredged material. In late 1982 design of the jetties continued, pending resolution of the additional investigations and granting of necessary permits by the Department of the Interior.

The coast of North Carolina presents special challenges to the Engineers of the Wilmington District. The Engineers have responded with unique project designs and construction. The coast has also dictated the type of floating plant the District must use to fulfill its obligations, and the District has responded with vessels designed to tackle the jobs given them.

Location of jetties planned for Oregon Inlet

Above: *fishing trawlers at Wanchese Harbor near Oregon Inlet.* Below: *aerial view of Oregon Inlet, Dare County, NC.*

CHAPTER X

One Of Those Temporary Expedients

The first law of thermodynamics states that energy cannot be created out of nothing. But there is no law against turning one form of energy into another. The whole civilization of mankind has been built upon finding new sources of energy and harnessing it in ever more efficient and sophisticated ways.

—Isaac Asimov

Throughout its history, the Wilmington District has been chiefly a rivers and harbors district. Waterway work was the reason the Corps of Engineers opened a district office at Wilmington in 1884. It was also the reason the office remained open after the Chief of Engineers transferred military work to the Savannah District in 1961. Because of the predominance of rivers and harbors work, the Wilmington District often put high priority on designing and owning floating plant—that is, waterborne equipment—suited to its needs.

Army Engineers made two early attempts at dredging at Ocracoke Inlet and on the Cape Fear River during the 1820s and 1830s. However, the Corps of Engineers did not begin dredging on a regular basis in North Carolina until after the Civil War.

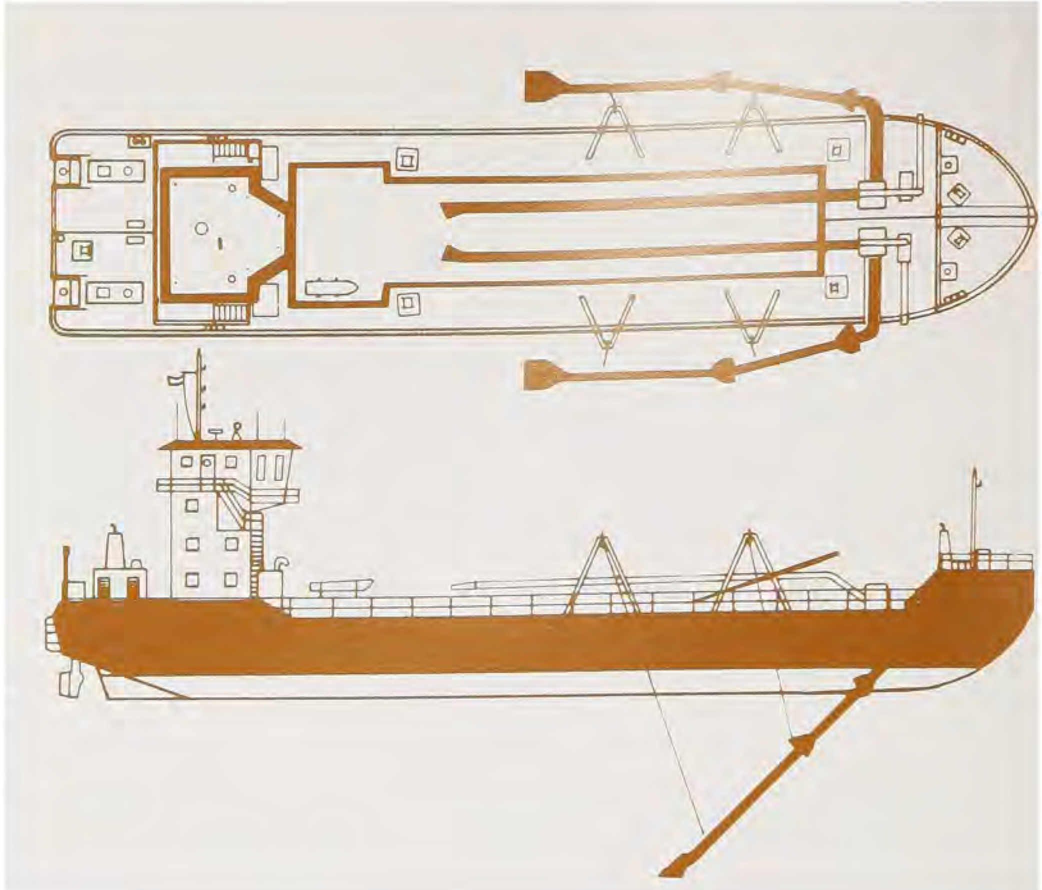
Since 1870, two types of dredges have done nearly all of the work in the Wilmington District: hopper and pipeline dredges, which differ in two basic respects. The most apparent difference is that the hopper dredge is self-propelled and can move about freely, while the pipeline dredge must be moved from job to job by tugboats.

Hopper Dredge

The more important distinction is in the way the two types handle material from waterway floors. The hopper dredge loads the material on board the ship in large bins, or "hoppers," which are later opened underneath to dump dredged material in deeper water. The pipeline dredge discharges the material through a pipeline to areas on shore or to open waters not used for navigation. Because of those characteristics, pipeline dredges cannot work in open seas without some type of protection, whereas hopper dredges are able to dredge on rivers or on the ocean.

A hopper dredge operates much as if it were a huge vacuum sweeper. It is usually equipped with two drags attached to pipe leading from the pump or pumps in the vessel to the bottom of the channel. A powerful centrifugal pump evacuates the pump casing and suction line; and as the vessel proceeds with the drag trailing along the bottom, a mixture of bottom material and water is forced up the pipe through the pumps and into the hoppers. When the bins of the hopper are full, dredging is stopped, the drags come up, and the dredge proceeds to the dump to unload the dredged material. The operation is repeated until the required depth is secured.[1]

The hopper offers several advantages over other types of dredges. The most important advantage is that hopper dredges can work in congested harbors and channels without interfering with shipping. Dredging with a hopper dredge also affords a means of improving depth uniformly throughout the length of a shoal as dredging proceeds. The stationary type of dredge, however, attacks the shoal from one end, and controlling navigable depth may remain unchanged until the dredging reaches the other end of the shoal.



A hopper dredge operates like a huge vacuum sweeper. It is usually equipped with two drags attached to a pipe leading from pumps in the vessel to the bottom of the channel. A powerful centrifugal pump evacuates the pump casing and suction line. As the vessel moves with the drag trailing along the bottom, a mixture of bottom material and water is forced up the pipe through the pumps and into the hoppers.

It is the usual practice to have a hopper dredge cover a shoal in full-length cuts. But sometimes, if a shoal includes high spots that define the limiting navigation depths available, shorter cuts may be made to afford partial improvement more quickly. Where a shoal covers the full width of a channel, the commonest practice is to make the initial cut along the centerline, to provide improved depth quickly where most needed—since navigation usually adheres to the midchannel section—and also to secure the benefit of such scour as the initial cut may afford.

Other advantages of the hopper dredge include its ability to transfer to other dredging sites quickly, under its own power and at low cost. Finally, a hopper dredge can remove more material than that retained in its hoppers by pumping overboard or by stirring up the bottom and allowing the current to carry the material away. This procedure is called agitation dredging.[2]

After the Civil War, the Corps of Engineers used hopper dredges to deepen the Cape Fear River. The project adopted for the Cape Fear in 1872 (Chapter V) included a provision for the purchase of a steamer to be fitted out as a trailing suction dredge to cut a 12-foot channel at the mouth of the river. The Engineers expected that the closure of New Inlet would increase the scour of the river below the inlet and across the bar. But they believed that dredging would also be needed to achieve and maintain the desired depth.

Woodbury

In 1874, the federal government purchased a 145-ton propeller-driven passsenger steamer and converted her into a suction hopper dredge, only the third of her kind in the United States. The people in charge renamed her the *Woodbury*. At the time, the Engineers considered the *Woodbury* to be "one of those temporary expedients that the US Engineers are so often obliged to use for the want of enough money to procure the best thing for the purpose in view."[3] The successful operation of the *Woodbury* on the Cape Fear helped to establish the practice of using suction hopper dredges in exposed areas.[4]

The *Woodbury* began working on the Cape Fear on 6 April 1874. But less than two years later she was laid up for major repairs equal to the work of building an entirely new vessel from the keel up. Repairs to the **Woodbury** did not begin until September 1878, and she returned to work 1 April 1879. Henry Bacon described the redesigned dredge in his report to Major Craighill:

> A large new boiler (12 feet in length, 7½ feet diameter, with steam-chimney 5½ feet in diameter and 6 feet high) and a new surface-condenser and propeller-wheel have been placed in her. . . . She is a propeller, 102 feet in length, 20 feet beam, and 6½ feet draft. The capacity of the sand-bins is about 50 yards. They are mostly below the deck, the top being even with the rail. When loaded, the port-holes for discharge from the bins are below the water-level. The height of the discharge from the pump is from 5½ to 7 feet, above the water-level, according to the load. The discharge from the pump leads directly through a 9-inch pipe branching into two 6 inch pipes (one for each bin), the only elbow being that from thwart-ship forward at the pump. The pump (Andrews's 9-inch centrifugal) is on the main deck near mid-ships. The 6-inch suction pipes (of galvanized iron) lead to it from the drags on each side of the vessel. Each suction-pipe has a flexible section (10 feet in length) next to the side, which allows the drag to keep its proper position on the bottom. It is drawn by a chain attached to the pipe below the flexible section. This position and attachment of the drags and pipes obviates the difficulty of operation in ordinary rough weather.[5]

The *Woodbury*, a small vessel with limited hopper capacity, averaged 1,700 cubic yards of material dredged per week, with 361 cubic yards being her one-day best. Despite the vessel's size, her effectivness could not be measured simply by the amount of material taken into the hoppers. In dredging sand from the bottom of the river and bar, the *Woodbury* loosened other material that the current carried away. In Colonel Craighill's opinion, "The most important use of the Woodbury was her movement back and forth in a fixed channel in which the sand was stirred up and carried off by tidal currents."[6]

During normal operations, nine people manned the *Woodbury*: one master, one mate, two engineers, one fireman, one cook, and three deckhands. She burned either three cords of wood or two tons of coal daily. In 1879, the *Woodbury* cost $900 per month to operate.[7]

The *Woodbury* worked mostly on the Cape Fear for almost 20 years. In 1893, Major William Stanton, District Engineer, reported that the vessel was in poor condition, and gave her only a year or two more to work on the bar, unless repaired. But later that year, while docked at Southport, the vessel caught fire and burned to the waterline. Stanton considered the dredge too old for major repairs, so the hulk remained at the yard for three years, until she finally sank and the Wilmington District abandoned her.[8]

To replace the *Woodbury*, Major Stanton requested permission to purchase, alter, and equip a steam lighter, the type of vessel he considered best adapted to conversion to a hopper dredge. Stanton traveled to New York City to examine several craft and carefully scrutinized lists of vessels for sale in New York, Philadelphia, and Baltimore. But he found nothing suitable. In March 1894, he informed Brigadier General Thomas L. Casey, Chief of Engineers, that he had a man designing a new dredging steamer capable of carrying 200 cubic yards. The dredge's estimated cost, $40,000, could be made available to the District by a reduction in C.P.E. Burgwyn's dredging contract. Colonel Craighill and Brigadier General Casey approved Stanton's plan.[9].

Cape Fear

The Wilmington District contracted with Charles Hillman Ship and Engine Building Company of Philadelphia to build a dredging steamer. The new vessel, the *Cape Fear*, appeared to be a bigger version of the *Woodbury*. Hillman Ship and Engine built the *Cape Fear* with two side drags and ten-inch dragpipes, a hopper capacity of 300 cubic yards, and two ten-inch, 80 horsepower dredge pumps. She was 131 feet long, with a beam of 29 feet and a 12-foot draft when empty. When Hillman delivered the *Cape Fear* on 8 June 1895, her crew of four officers and 18 men gave her a shakedown cruise and immediately put her to work on the Cape Fear ocean bar.[10]

The *Cape Fear* worked in the Wilmington District for nearly 30 years. But at last, in 1917, Major Albert E. Waldron, District Engineer, described her as "played out. She has become so waterlogged that her reserve buoyancy is reduced to a dangerous amount. Her draft is too great and her capacity, 300 cubic yards, too small to take care of the ocean-bar dredging."[11] Waldron asked that a new and larger dredge for the bar work be provided.

On the afternoon of 11 July 1922, the *Cape Fear*'s crew tied her up at the Engineer Yard for the last time and transferred to the dredge *Comstock*, the *Cape Fear*'s replacement on the river. (Shortly after being taken out of service in the Wilmington District, the *Cape Fear* was sold to the government of Mexico. On entering a Mexican seaport on the west coast during her first trip, she ran aground, becoming a total loss.) The *Comstock* conducted maintenance operations on the river until converted into a supply ship for war service in January 1940.[12]

***Cape Fear*, a hopper dredge, worked in the Wilmington District from 1895 to 1922.**

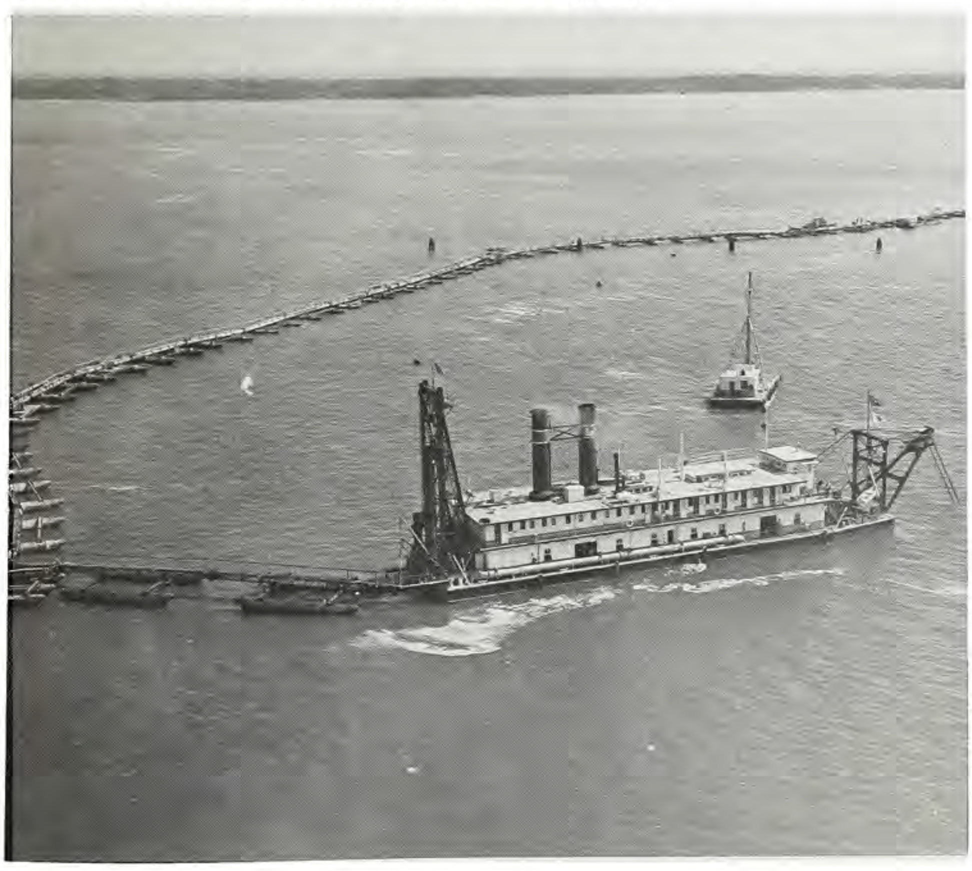
Henry Bacon

On the Cape Fear River, seagoing hopper dredges worked on the bar while pipeline dredges worked on protected portions of the river. A common sight on the lower Cape Fear River or the Intracoastal Waterway in the first half of the 20th century was the Wilmington District's pipeline dredge, the *Henry Bacon*, formerly the Bower Southern Dredging Corporation's Dredge Number 9, which the District purchased and renamed in 1914, when it was seven years old. One of the Corps of Engineers' largest dredges at the time, the *Henry Bacon* and her crew of 70 worked night and day as she stepped slowly down the Cape Fear.[13]

The *Henry Bacon*'s "feet" were two heavy steel spuds 60 feet long and 32 inches in diameter, which were mounted vertically at the stern. The *Henry Bacon* "walked" by dropping one spud and allowing it to penetrate the river bottom far enough to hold the dredge in place. The other was then raised so it would clear the bottom. The dredge swung to one side and the other spud dropped into place, followed by the lifting of the first spud again. The *Henry Bacon*'s average "step" of six feet allowed the dredge to advance over 1,200 feet per day on the Cape Fear and lesser distances on other projects. When the vessel moved from one project to another or several miles on a river, tugs and small boats maneuvered her and the pipeline.[14]

The dredge's engines were powerful mechanisms of 3,000 horsepower, divided into 2,000 on the dredging pump, 600 on the cutter engine, and 400 on the auxiliary engines. Averaging about 600,000 cubic yards per month, the *Henry Bacon* was capable of dredging over one million cubic yards per month in some material.

At one end of the dredge ladder was a large, spiral-shaped cutter, which revolved to loosen the river-bottom mud and sand. The cutter was connected to a large steel pipe running up the dredging ladder, which could be raised or lowered to the desired depth. When the ladder was lowered to the working depth, the pumps on the lower level sucked the material through the steel pipe in the dredge, out the back, and through a system of pipelines buoyed by pontoons. The dredging ladder was raised, lowered, and swung back and forth as material was removed to achieve the project depth within the swinging scope of the ladder—about 300 feet horizontally. Then the dredge would take a step ahead. The *Henry Bacon* could also dredge moderately hard rock with a special rock cutter attached to the ladder, equipped with massive hard pick teeth that broke the rock into pieces small enough to be passed through her 24-inch pump.[15]



*Wilmington District's pipeline dredge **Henry Bacon** worked on the Cape Fear River and Intracoastal Waterway in the first half of the 20th century.*

The *Henry Bacon* remained in the Wilmington District until after World War II, when she transferred to the Savannah District. But she returned to the Cape Fear River in the mid-1950s to deepen the river to 35 feet by excavating through some limestone. Although nearly 50 years old, the *Henry Bacon* sturdily completed her work on the Cape Fear at a savings to the Wilmington District. Sadly, twenty years later the *Henry Bacon* sank at the Engineer Yard on the Savannah River. She was raised but never put back into service.[16]

Because of the predominance of the rivers and harbors work in the Wilmington District and the presence of hydraulic-dredging experts such as Paul M. Snell, the District was considered to be a major center of dredging activity on the Atlantic Coast during the first half of the 20th century. In 1922, the District owned 28 different vessels, including two seagoing hopper dredges (*Comstock* and *Cape Fear*), two pipeline dredges (*Henry Bacon* and *Croatan*), three bucket dredges (*Ajax*, *Hercules*, and *Scuppernong*), two harbor tugs (*Coquet* and *Cynthia*), two District motor boats (*Sapona* and *Neuse*), one snagboat (*General H.G. Wright*), three tenders (*Faber*, *Manteo*, and *Lucas*), three motor launches (*Olive*, *Nancy*, and *Spry*), two derrick boats (*Black* and *Contentnea*), and eight barges. Also, about this time there were as many as 65 employees stationed at the District's repair yard at Eagle Island.

By the late fifties, however, the Wilmington District had been divested of nearly all of its floating plant. Some of the vessels, such as the *Comstock*, were transferred to military service during World War II and never returned to the District. Others simply wore out and were not replaced. Congress became interested in determining if the American dredging industry could handle the work previously done by government plant, so it curtailed the construction of new dredging equipment. The new policy left the Wilmington District in a bind. Private industry frequently sidestepped small dredging and snagging projects, or bid so high on the contracts that the projects became economically infeasible. Contractors eschewed in particular the difficulties of dredging inlets along the North Carolina coast, because they had no suitable equipment.[17]

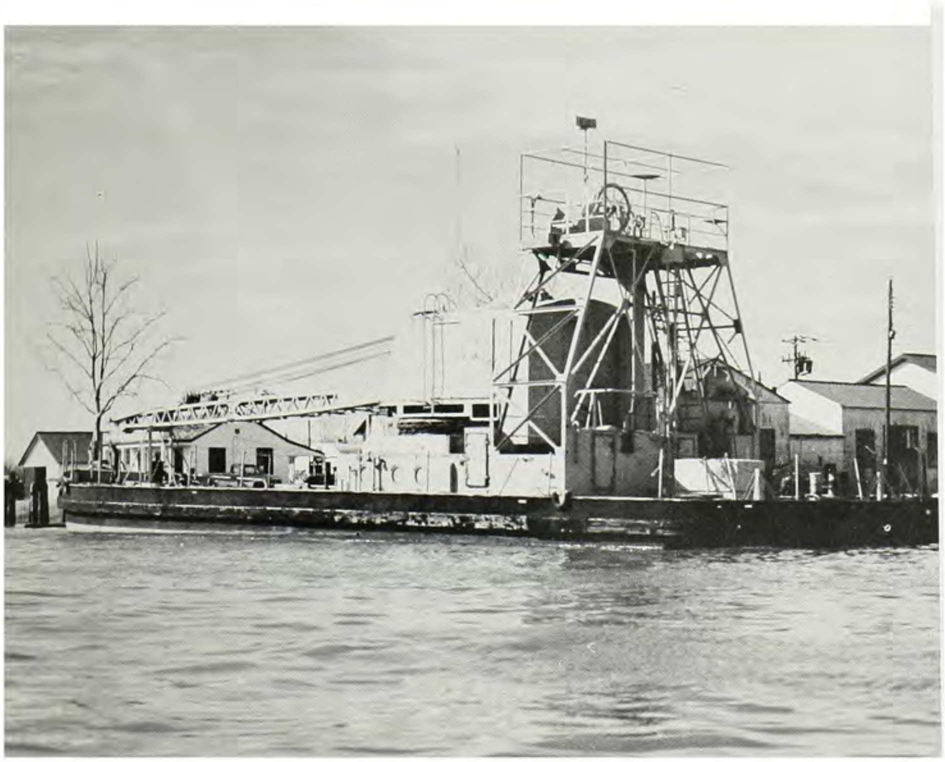
During the years 1946 to 1963, the Wilmington District used the Jacksonville District's hopper dredge *Gerig* to maintain the larger inlets and the *Hyde* in the smaller inlets. But the two vessels had drafts of 30 and 15.5 feet, respectively, which limited their ability to work on the bars.

Merritt

Various attempts to use pipeline dredges at inlets failed or were too costly. The District attempted to use the *Henry Bacon* to dredge a channel from the gorge of New River Inlet through the ocean bar, but tugs had to pull her to safety just before she suffered damage. In 1959, the Wilmington District awarded a contract to dredge a 14-foot pilot channel through Masonboro Inlet with a contract pipeline dredge. The dredge completed the channel, but only after sustaining extensive damage and at a cost nearly three times the price of later maintenance dredging by the hopper dredge *Hyde* in the same channel.[18]

Beginning in the 1940s, Pappy Snell, Chief of the Operations Division, and Donald Gardner, Chief of the Maintenance Branch, addressed the idea of using a shallow-draft sidecasting dredge at the inlets. The concept was not new, but it seemed well suited to the needs of the Wilmington District. In 1956, Colonel Henry C. Rowland, District Engineer, recommended to the Chief of Engineers, Lieutenant General Emerson C. Itschner, that funds be made available for the design and construction of a shallow-draft sidecasting dredge. The request was turned down in 1957 because the staff at the Office of the Chief of Engineers (OCE) could not decide on the merits of a sidecasting dredge as opposed to a shallow-draft hopper dredge.[19]

In August 1960, the District procured a yard salvage derrick, *YSD 59*, from Navy surplus to replace the worn-out snagboat *Northeast*. The *YSD 59* had been used during World War II as a self-propelled derrick boat to recover downed aircraft and other equipment fallen overboard. The *YSD 59* had been in mothballs since the end of the war and was in poor condition. But the Wilmington District was interested only in the hull. Two years later, OCE authorized the Marine Design Division of the Philadelphia District to prepare a design for converting the *YSD 59* into a combination snagboat-sidecaster dredge. The Wilmington



*The **Merritt** in 1963, before conversion. The District obtained a yard salvage derrick from Navy surplus—**YSD 59**. It had been used during World War II as a self-propelled derrick boat that recovered downed aircraft and other equipment fallen overboard.*

*The **Merritt** after conversion to a sidecaster dredge, 1964*

Shipyard completed the conversion in 1964, under the watchful eye of Cecil Henderson of the District's Operations Division.[20]

The vessel's design was dictated by the nature of the task it was to perform. The dredge had to have the shallowest possible draft, be completely seaworthy, have an excess of propulsion power, be more maneuverable than any other class of vessel, be small enough to turn in narrow channels with strong running tides, and operate cheaply (the projects she was designed to maintain were low-budget enterprises). The result was a small hopper dredge without a hopper.[21]

Wilmington District commissioned the *YSD 59* on 29 February 1964 and renamed her the *Merritt*, in honor of Robert C. Merritt. The *Merritt*, roughly the same size as the *Woodbury*, is equipped with two ten-inch dragarms and a 12-inch boom discharge pipe. The dragheads, at the ends of the dragarms, are the "California adjustable" type, a flat grate drag which adjusts itself and maintains constant and complete contact with the bottom. That device is particularly suited to dredging sandy material. The boom discharge, 80 feet in length, casts material 95 to 100 feet beyond the dredge's side at a rate of between 500 and 800 cubic yards per hour. Handled by a diesel-powered American revolver crane, the boom discharge can swing from one side to the other in about five minutes. A crew of eight men and four officers mans the vessel.[22]

The District put the *Merritt* to work at Oregon Inlet in March 1964, to dredge a pilot channel of sufficient depth to allow the *Hyde* to operate on a 24-hour schedule. Thus dredging operations could continue without having to wait for tidal conditions to change.

But the *Merritt* did not operate as effectively as the project's supporters had anticipated, and critics at different levels of the Corps of Engineers threatened to cut off funding for her operation. With the assistance of William R. Murden, Chief of the Plant and Supply Division, OCE, William Sanderson and Cecil Henderson were given enough time to develop an efficient operating method for the dredge.

One of the basic operational problems involved a simple matter: on which side should dredged material be cast in order to avoid doing more harm than good? Theoretically, the material should always be cast to the downdrift side of the channel. The time lost resulting from manually changing the boom from port to starboard on most projects exceeds the benefit. Until a rapid and pilothouse-controlled means of shifting the discharge pipe from port to starboard is provided, the sidecasting will be done to both sides of the dredged cut, with the boom in a fixed position throughout the dredging cycle.[23]

The dredge *Merritt* proved to be a means to dredge shallow inlets quickly and safely and to maintain the channels on a reasonably reliable basis. Commercial fishermen using the channels are able to pass through North Carolina's inlets with some assurance that a channel will still be available when they return. After the Wilmington District proved the value of sidecast dredging in coastal inlets, the *Merritt* was in great demand all along the coast. Twelve years after the *Merritt*'s commissioning, the Corps of Engineers owned four sidecasters.[24]

Schweizer

The Wilmington District acquired its second and larger sidecasting dredge, *Schweizer*, in May 1971. The Chief of Engineers had authorized the conversion of a Navy freighter to a sidecaster for the New Orleans District; it was completed in 1966. The New Orleans District operated the dredge on the inlets tributary to the Mississippi River outlet until she transferred to South Vietnam in 1968. She returned to New Orleans in July 1969 and resumed work on various projects along the coast.

In 1969 OCE assigned the *Schweizer* to the Wilmington District to evaluate her performance and potential value for East Coast work. The *Schweizer* worked at Oregon and Ocracoke inlets for two months. In 1970 a lack of work plus competition from pipeline dredge contractors led the New Orleans District to put her in mothballs. Wilmington District then requested her transfer to the District on a permanent basis. When the *Schweizer* arrived in Wilmington in 1971, the District recruited a new crew, modified the vessel, and put her to work.[25]

Sidecaster dredge Schweizer

In spite of the cost effectiveness and the success of sidecasting as a process capable of dredging and maintaining a channel in the active zone of an ocean inlet, opposition rose against the procedure. Environmental groups became concerned about the possible effects of turbidity and of bottom sediment resuspension. By 1974, the environmentalists' opposition threatened the continued operation of *Merritt* in North Carolina inlets. The engineers of the Wilmington District viewed sidecasting as an extension of the natural scour and deposition processes constantly occurring in an active inlet, and averred that sidecasting did not disturb organisms living in the inlet because there were none.[26]

Environmentalists were not the only people dubious about the sidecasters. Some coastal engineers objected to sidecasting since the dredge only rearranged the sand present in an inlet area, and could neither add to nor take from the total sand inventory of the system. For most locations, coastal engineers believed it desirable to remove shoal material and reintroduce it into the littoral system from which it came. Inlet channels interrupt the littoral processes and contribute to localized beach erosion. That is particularly true when hopper dredges remove sand and dump it in the deep ocean, but less the case where sidecasting alone is practiced.

Currituck

Objections to sidecasting by many coastal engineers, who preferred sand bypassing, presented the Wilmington District with the problem of finding a method whereby the shoal material could be economically removed and placed directly on the downdrift beach or at least in the littoral zone, thus preventing a loss of material from the system.[27]

As early as 1966, engineers in Wilmington concluded that some method of receiving effluent from a sidecasting dredge and transporting it directly to the downdrift side of an inlet would address both the sand-bypassing and environmental concerns. How to accomplish that task in a hostile environment such as an ocean inlet was the problem.

While in Europe, William R. Murden, OCE, had observed the operation of a split-hull barge which was not self-propelled. Sanderson and Henderson picked up the idea, made suggestions, and presented sketches to OCE's Marine Design Branch, which designed the vessel, the first such barge in the United States. The Chief of Engineers authorized the construction of the barge in 1971, and the Ellicott Machine Company of Baltimore built the vessel in a New Bern shipyard, finishing it in January 1974.[28]

The barge, renamed the *Currituck*, provided the Wilmington District an opportunity to evaluate the performance of such a vessel. With it they could test the process of transporting material dredged by the sidecasting dredge *Merritt* and placing it in the surf zone of a nearby beach. Such sand bypassing had never before been done, but it semed to solve one major problem involved with sidecasting—the barge collected the effluent from the *Merritt* and placed it directly on the beach, beyond the influence of the inlet but within the littoral zone.[29]

Originally, the *Currituck*'s promoters envisioned the self-propelled barge traveling parallel to the sidecaster to receive the sand-and-water slurry, retaining an economic load by allowing the water to overflow the hopper coaming, transporting the load to a preselected nearshore disposal site, running the barge perpendicular to the surf until slightly grounded, splitting the hull, dumping the load, and returning to the sidecaster. The method of deposition in the littoral zone worked well, but filling the *Currituck* while traveling parallel to the *Merritt* quickly proved to be a practical impossibility and was almost immediately abandoned.

Through experimentation, Henderson and Sanderson found that filling the barge while attached in tandem to the *Merritt* proved to be simple, efficient, and fast. The *Merritt*'s discharge could fill the *Currituck*'s 300-cubic-yard hopper with solid sand in less than 20 minutes. Navigating the two vessels in tandem, however, was awkward in the inlet currents and the ocean bar swells, and more time was lost than when sidecasting alone.

But the advantages of depositing the sand near the beach outweighed the disadvantages. For two years the *Currituck* worked in tandem with the *Merritt*, received sand, and deposited it on several beaches. The Coastal Engineering Research Center conducted a formal study of the effectiveness of the operation. Coastal engineers from Wilmington and other districts who analyzed the operations pronounced the results very encouraging.[30]

*The **Currituck**, a split hull barge, being filled by sidecaster dredge **Merritt**, 1974.*

During the time the Ellicott Machine Company was building the *Currituck* at New Bern, Henderson, Sanderson, and others involved with the project realized that the barge also would be an ideal dredge if fitted with the right equipment. The way the barge was designed, there was a void in the vessel to give additional buoyancy when loaded, and it was large enough to contain dredging equipment.

At a regular meeting of the Engineer Dredge Board in Philadelphia on 15, 16, and 17 October 1973, Sanderson, a member of the board, presented proposed modifications of the *Currituck*, then under construction, to make it self-loading. Any reference to the word "dredging" was carefully avoided because of the existing congressional moratorium on building, designing, or even improving a government-owned dredge.

The board received the proposed modifications as an innovation worth serious consideration. During the presentation someone suggested that the idea not be discussed outside the Corps of Engineers for the time being. Sanderson proposed that the Wilmington District should "receive the barge, experiment with loading by sidecast dredge as planned, and quietly perfect the design so that implementation could follow without creating undue attention."[31] The board accepted that as the proper attitude to adopt in the matter.

In July 1976, the moratorium having been lifted, OCE granted permission to install dredge pumps and make other modifications to *Currituck*. Work on the conversion by the Wilmington District's Construction-Operations Division personnel began immediately at the District's Repair Yard in Wilmington.

Converted to a self-loading hopper dredge, 1976–77, the **Currituck** *carries 300 cubic yards of sand to an ocean beach and dumps her load by opening her hoppers.*

*The **Currituck** emptying her load*

The conversion amounted to installing the dredge pumps in the previously void space, building a penetration in the hull, and installing a trunnion on each side with a trailing suction drag. The drags, dragarms, flexible sections, and through-hull trunnions were identical to those used on the *Merritt*. Not having to design and procure custom equipment saved the District nearly two years' design and construction time. In the fall of 1977, the split-hull, shallow-draft, self-propelled hopper barge *Currituck* became the split-hull, shallow-draft, self-propelled hopper dredge *Currituck*.

The *Currituck* was the first vessel of its type to operate in the United States and, after conversion, the first such vessel to operate anywhere. Shortly after the District first proposed the conversion of the barge *Currituck*, the private dredging industry took notice of the idea and made plans to build its own vessel. The Great Lakes Dredge and Dock Company's *Manhattan Island* is nearly a carbon copy of *Currituck*, except that all dimensions are doubled. It was commissioned in 1977 and began work the next year.[32]

The conversion of the *Currituck* created a great deal of excitement in the Corps of Engineers and in the private dredging industry. She was immediately in great demand by other districts. The Jacksonville District requested the *Currituck* for the St. Augustine dredging project just a week or two after Wilmington put her into service and before she could be adequately tested. Colonel Adolph A. Hight, Wilmington District Engineer, received inquiries from several people who were under the impression that the *Currituck* "has a tremendous capability to restore beaches and correct all manner of past dredging errors and erosion effects."[33]

The *Currituck* possessed many good features, but she was not a superdredge. She was economical and safe to operate and easy to maintain, and she fulfilled her two objectives—she could work in shallow inlets, and she kept the sand in the littoral system by depositing it on the beach.

But several shortcomings were apparent from the beginning. The dredge could carry only 300 cubic yards, and there were no crew quarters or galley. Transporting *Currituck* over long distances was a problem because of the absence of creature comforts and facilities on board, and her fixed trunnions required special moorings.

As a result of the *Currituck*'s development and the other innovations made by the District in the field of coastal inlet dredging, the District is better able to maintain navigable channels through the state's inlets than ever before, making access to the sea easier for most vessels.[34]

Since the 1960s, the major river and harbor dredging in the District has been done by private contractors rather than government plant. The two major dredging projects in the post-World War II era were done on the "Morehead City" and "Cape Fear River Below Wilmington" (renamed "Wilmington Harbor") projects. On 31 December 1970, Congress authorized a modification to the existing Morehead City project to provide for a channel 42 feet deep and 450 feet wide from deep water in the Atlantic Ocean through the ocean bar at Beaufort Inlet, and a channel 40 feet deep and 400 feet wide to the harbor at Morehead City.

Morehead City

The Wilmington District awarded a contract to Construction Aggregates Corporation for the dredging of a channel from 35 to 42 feet. The hopper dredge *Sensibar* began dredging 1 October 1977, but was too large to do the work efficiently. The *Sensibar* drew 30 feet loaded, and was unable to dredge the shoaled areas necessary to complete the job. On 5 May 1978 the *Sensibar* abandoned the project, and the Wilmington District terminated the contract for default five days later.

To complete the project, the District brought in the government-owned hopper dredge *Langfitt*. Because the *Langfitt* finished the project for less cost than Construction Aggregates had bid to do it with the *Sensibar*, the contractor did not have to pay for the cost of reprocurement or any excess costs. Morehead City is North Carolina's second deep-water port, with North Carolina State Ports Authority terminal facilities available for ocean-going vessels.[35]

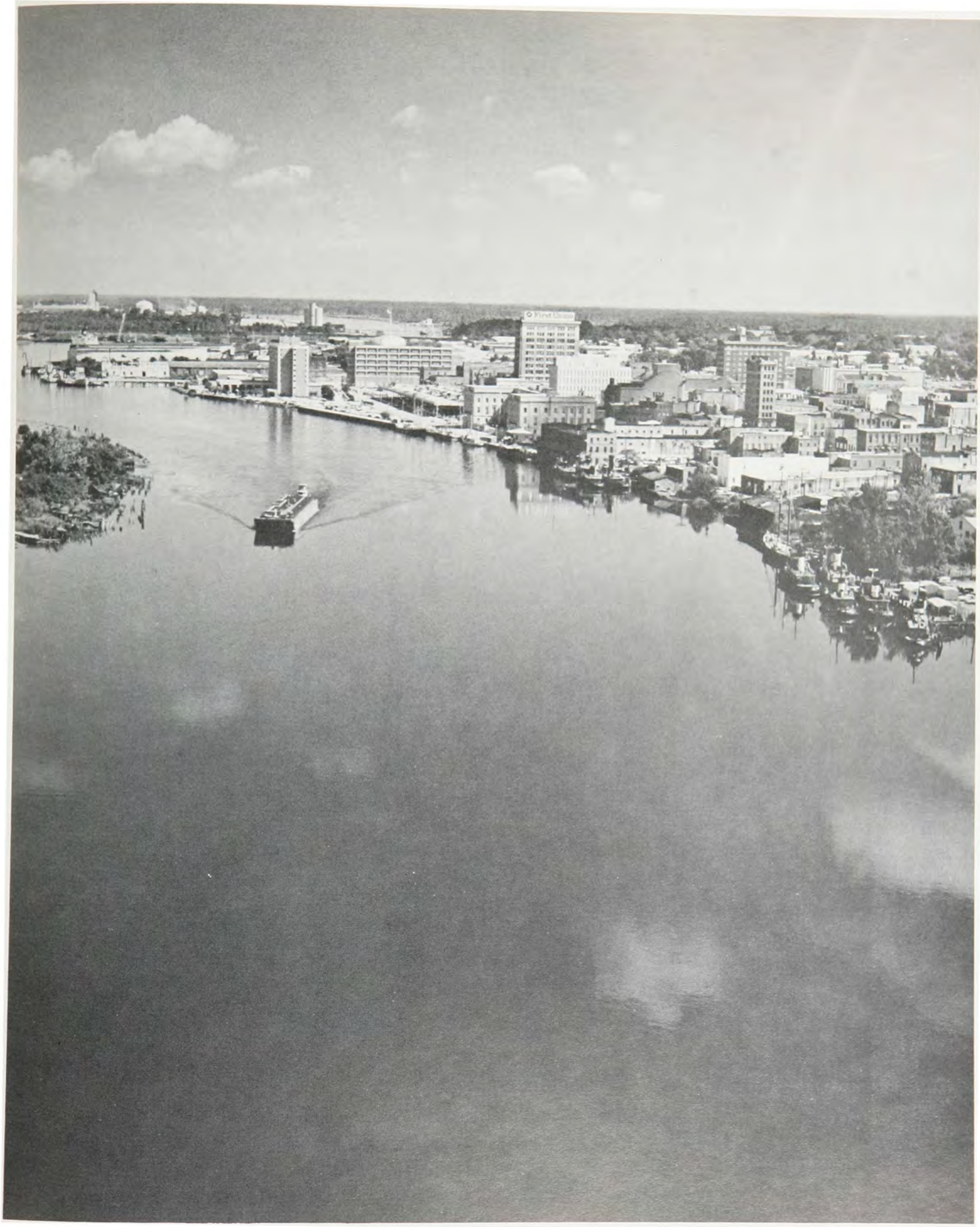
Wilmington Harbor

Wilmington evolved from a port exporting mostly naval stores in the 18th and early 19th centuries, to a cotton-exporting harbor during the last half of the 19th century and early 20th century, and finally to a petroleum-distribution center beginning in the 1930s. The Wilmington District aided in the transition to a petroleum center by building the section of the Atlantic Intracoastal Waterway from Beaufort to the South Carolina state line, permitting barges to travel in protected waters. The District also deepened Cape Fear River to allow the ever larger oil tankers to reach Wilmington without lightering, loading light initially, waiting for a favorable tide, or grounding. At public meetings held by the Wilmington District to determine if further deepening of the Cape Fear River was required by commercial interests, representatives from oil companies were present to offer their views, usually in favor of deepening the river.[36]

Wilmington Harbor received a boost from the state in 1945 with the creation of the North Carolina State Ports Authority. The state chose one of the most important men in the development of the state's waterways, Colonel George W. Gillette, as the Authority's first full-time executive director in 1948. Colonel Gillette, a native of North Carolina, took an intense interest in the state's rivers and harbors. He served the Wilmington District during three periods. He was the Military Assistant from 1931 to 1934 under Major Wheeler and Lieutenant Colonel Reybold and then was District Engineer from 1938 to 1940 and again in 1945 and 1946. Gillette became South Atlantic Division Engineer in 1946, and served in that position until his retirement from military duty in 1947.

When asked to assume the position of executive director of the North Carolina State Ports Authority, Gillette found it an easy decision to make: "I wanted to go back to the Cape Fear River and to my North Carolina coastal friends and friends all over the state," he recalled, "and I wanted to work for my native state on the developments that I knew so well."[37] The monument to Gillette's years as executive director is the Authority's terminal facilities at Wilmington Harbor, dedicated in 1954. Those facilities have made Wilmington Harbor one of the Southeast's leading trade centers.[38]

State Ports Authority's terminal facilities, Wilmington



View of Wilmington Harbor looking north

In 1945, Congress authorized the Wilmington District to increase the channel dimensions in the Cape Fear from 300 to 400 feet wide on the inside channel, from 600 to 800 feet in the turning basin, and from 30 to 32 feet deep from the ocean bar to the harbor.

Five years later, Congress again authorized the deepening of the channel to 35 feet over the ocean bar and 34 feet to the upper end of the anchorage basin at Wilmington. The deepening was to accommodate the new T-2 oil tankers, which required a depth of 35 feet for safe and efficient operation. During the dredging of the 34-foot channel, the *Henry Bacon* encountered large quantities of limestone for the first time. That told the Engineers that any further deepening would be expensive and troublesome.[39]

On 10 March 1964, Congress authorized a channel 40 feet deep and 500 feet wide through the ocean bar, and 38 feet deep, 400 feet wide, with increased width at bends, to the upper end of the anchorage basin at Wilmington.

American Dredging Dispute

The following year, the Wilmington District awarded a contract to American Dredging Company for the dredging of the river, including the rock. The contract stated that the excavation of the bottom materials was "unclassified excavation." The Corps was receptive to any proposed dredging method that promised success. The District had done extensive core drilling and had described the material in the contract; most bidders based their proposals on drilling and dynamiting the rock areas before attempting to remove it with large hydraulic pipeline dredges. The American Dredging Company, the low bidder, did not.[40]

American Dredging Company based its bid on the idea that its new dredge, the *American*, advertised as the most powerful pipeline dredge in the world, could excavate the rock without blasting. After the company finished the nonrock areas with other equipment, the *American* moved in to complete the contract.

In only a few weeks, the District realized that the *American* could not dredge the rock. With the company's reputation on the line, its executives insisted on slugging it out with the rock and tearing up the equipment. According to the contract, American Dredging Company was to have finished the work by 6 June 1968. Instead, the Wilmington District terminated the contract on that date because of the contractor's failure to diligently prosecute work under the contract. At the time of termination, the project was only 60 to 70 percent complete.[41]

American Dredging Company filed suit against the Corps of Engineers, contending that the Engineers had improperly terminated the contract and owed the company money for all the work done. The Wilmington District was willing to pay for the nonrock work completed, but refused to give any money for the work accomplished by the *American*. In addition, the District demanded that American Dredging pay the cost of the contract's reprocurement. After nearly 15 years of litigation within the Corps of Engineers and the court system, the propriety of the termination was upheld. However, American Dredging was excused from paying reprocurement costs, and the District had to pay the company a small fraction of the money for work accomplished in the rock area.[42]

The District readvertised the project and awarded the contract to Atlantic, Gulf, and Pacific Company. The company immediately brought in two drill boats to drill and blast the rock before attempting to dredge it with their pipeline dredges. The drill boats shot the rock on eight-foot centers, breaking it into football-sized pieces that were easily handled through the dredge pipe.

The company became overly optimistic and began blasting on ten-foot centers and later 15-foot centers over a large area before the dredge returned to remove the pieces. When the dredge came in to do the actual clean-up, she could not gather the pieces because the rocks were too big to be ingested by the pumping machine. Atlantic, Gulf, and Pacific was forced to bring in a dipper dredge to remove the larger pieces of rock, thus losing a considerable sum of money on the project. The company completed the 38-foot channel in February 1970.[43]

Snell

The Wilmington District faced a constant challenge in maintaining the waterways and keeping them free of obstructions. The District almost always owned a vessel designed to remove foreign objects from waterways, in order to reduce flooding and insure the safety of boats using the river or stream. The snagboat *Snell*, now owned by the District, demonstrates imaginative use of limited funds to produce a modern, efficient, versatile plant capable of nearly every job associated with waterway maintenance.

In the late 1950s, the District's old, steam-powered, non-self-propelled snagboats could no longer do their jobs effectively or efficiently. As noted earlier, in 1960 the District had converted *YSD 59* as a combination snagboat and sidecasting dredge. But the *Merritt* kept busy primarily with dredging duties and had little time for snagging.

At that point, the District was forced to contract for snagging work. It soon became evident that the preparation of contract specifications for work that defied exact description was virtually impossible. Contracting produced either high bids or substantial losses to contractors. Many contracts received no bids at all because of the high risks to equipment and personnel. Small businesses could not justify the purchase of specialized equipment to be used just for snagging. By the mid-1960s, North Carolina's waterways were choked with debris.[44]

In early 1966, the Construction-Operations Division of the Wilmington District prepared a design memorandum stating that a need existed for a modern maintenance vessel and outlining a method whereby such a craft could be obtained at a reasonable cost. The Office of the Chief of Engineers approved the design memorandum and funded the project. The Wilmington District was permitted to do all the design and construction, receiving great freedom to exercise its judgment. The Construction-Operations Division set out to provide the most vessel for the least money, to stress practicality, and to minimize frills.

The District learned of a Navy yard salvage derrick, *YSD 78*, in mothballs at Savannah, which was available for transfer at no cost. The vessel had seen service during World War II like that of the *YSD 59*. A three-man crew from Wilmington made the vessel ready for the trip to Wilmington in April 1967. Her badly worn engines started and, though every gasket leaked, kept running to the end of the trip through the Atlantic Intracoastal Waterway to Wilmington.[45]

*Snagboat **Snell** clears snags and debris from North Carolina's navigable streams and waterways.*

The District awarded a contract for the *YSD 78*'s conversion to the New Bern Shipyards, Inc. The vessel was stripped of most of its old machinery and nearly all mechanical, electrical, and control mechanisms. The structural steel, the hull plating, and a portion of her 30-ton crane were all that remained from *YSD 78*. The government furnished the engines and other equipment for the conversion. The result was virtually a new vessel equipped to perform the myriad tasks required to maintain waterways.

On 18 December 1967, *YSD 78* was commissioned as the *Snell*, in honor of Pappy Snell. Sanderson and Colonel Beverly C. Snow, Jr., Wilmington District Engineer, wanted to put Pappy's name on something bigger, because of his preeminence in the dredging field, but at the time it seemed that the Corps of Engineers would never build a new dredge. Nonetheless, *Snell* has been a credit to her namesake. She is not a glamorous vessel, but is designed for hard work and long hours.[46]

Snagging, which constitutes half of *Snell*'s duties, includes clearing riverbanks of unstable or dying trees likely to fall into the waterway, retrieving those that have already fallen, and removing debris that has accumulated in the water and obstructs traffic. Between snagging assignments, *Snell* performs tasks such as pile driving; subaqueous boring and probing; the construction of retaining walls, fender systems, mooring dolphins, and piers; and the maintenance of hundreds of dredging and navigation ranges, waterway signs, and mileposts. All of the District's four highway bridges over the Atlantic Intracoastal Waterway, and the three locks and dams, have appurtenant timber-pile fender systems or guide walls. Those are often damaged by tugs or barges and, without the *Snell*, repairs would be much more costly to the vessel owners or to the government.[47]

Gillette

Before any dredging occurs, the waterway to be dredged must be surveyed to determine the existing depth and to estimate the amount of material to be removed to obtain the desired depth. That information is used to prepare dredging specifications.

Traditionally, the Wilmington District surveyed rivers and harbors from a boat sounding with a lead line, plotting position against range markers on the shore. A typical survey party in the 1920s included a chief of party, an assistant chief (surveyor), a surveyman, an oarsman, a reelsman, a sounder, a gauge reader, a launchman (gasoline engineer), and a cook. The method was, of course, susceptible to human error, no matter how meticulous the surveyors. Even after lead lines were replaced by acoustical depth finders, errors occurred.

For example, it was assumed that a boat ran at a constant speed and along a straight line. In fact, a survey boat's speed was not absolutely constant, and the vessel crisscrossed a straight line, much like a sine wave, deviating more widely as distance from a range increased. The deviation from a straight line could be as much as 30 feet. By the late 1960s, advancing technology made more precise surveys possible.[48]

Throughout the 1970s the Wilmington District was in the forefront of the electronic hydrographic surveying field. In 1968, the Wilmington District recommended the purchase of a system of electronic positioning equipment, an on-board plotter, and an output data collection device compatible with electronic computers. At that time, the District used a terminal on line with a computer owned and operated by the Triangle Universities Computation Center near Raleigh, North Carolina. The District received its own computer in 1972.[49]

The Motorola Company offered to give the South Atlantic Division and Wilmington District a free demonstration of a complete electronic positioning system integrated with automatic data transmission, remote plotting, and navigation instrumentation. In August 1970, Motorola installed its equipment aboard the Wilmington survey launch *Carolina*. The demonstration was a success, and OCE chose Wilmington to make a major study of the utility of electronic positioning system equipment for hydrographic surveying.[50]

The Motorola representatives reinstalled the equipment on the District's new survey boat *Gillette*, which the Wilmington District acquired in October 1971. The District was pressed for time because the contract with Motorola obliged the District to have a survey boat available on or about 30 September 1971. Wilmington's Engineering Division had planned to purchase a new 31-foot stock model fiberglass boat for the new equipment, but on 21 May 1971 the South Atlantic Division disapproved the 31-foot boat and directed the Distict to purchase a 65-foot boat similar to that already authorized for two other districts.

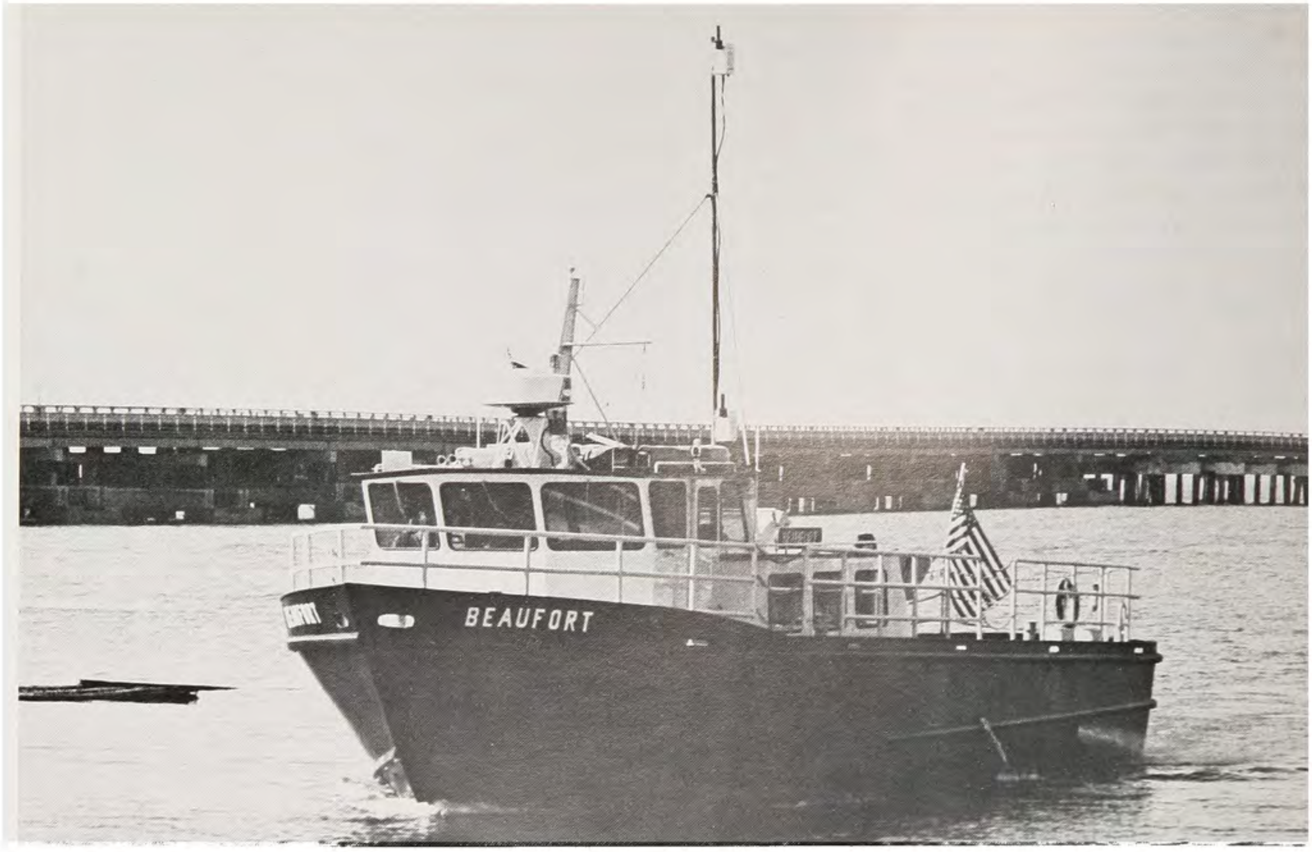
For Wilmington, the short procurement time presented serious problems. Sanderson attempted to secure permission to negotiate for the purchase of a completed boat known to be available at Sewart Seacraft plant in Berwick, Louisiana, but was turned down. Wilmington then prepared plans and specifications written around the boat available in Morgan City, Louisiana, and advertised with a very short delivery period, insuring that a completed or virtually completed vessel would of necessity be offered. Despite protests from contractors, bids were opened on 16 August 1971, and a 65-foot boat was delivered to Wilmington on 9 October 1971.[51]

The Motorola processor on board the *Gillette* records water depth, time, and position of the boat. It also provides steering information to keep the boat on a predetermined survey line. As *Gillette* travels on a waterway or the ocean, she remains in constant contact with two microwave radar transponders onshore, set on known positions. Through trilateration, the on-board computer receives the transponder signals, computes the boat's position, and directs the boat's operator on a prescribed line. At the same time, that information and depth data are recorded on magnetic tape at one-second intervals. The tape is then taken to the District office where a series of interactive programs are used to process the survey data, compute dredging quantities, and prepare a finished survey map. The result is a more accurate, rapid survey of the District's waterways. Not too many years ago, a survey of the Cape Fear River ocean bar would take five or six days to complete. By 1977, the electronic equipment had reduced that to two hours. Since then the original Motorola system has been improved and enlarged by Jim Waller and O.J. McCoy of the Wilmington District.

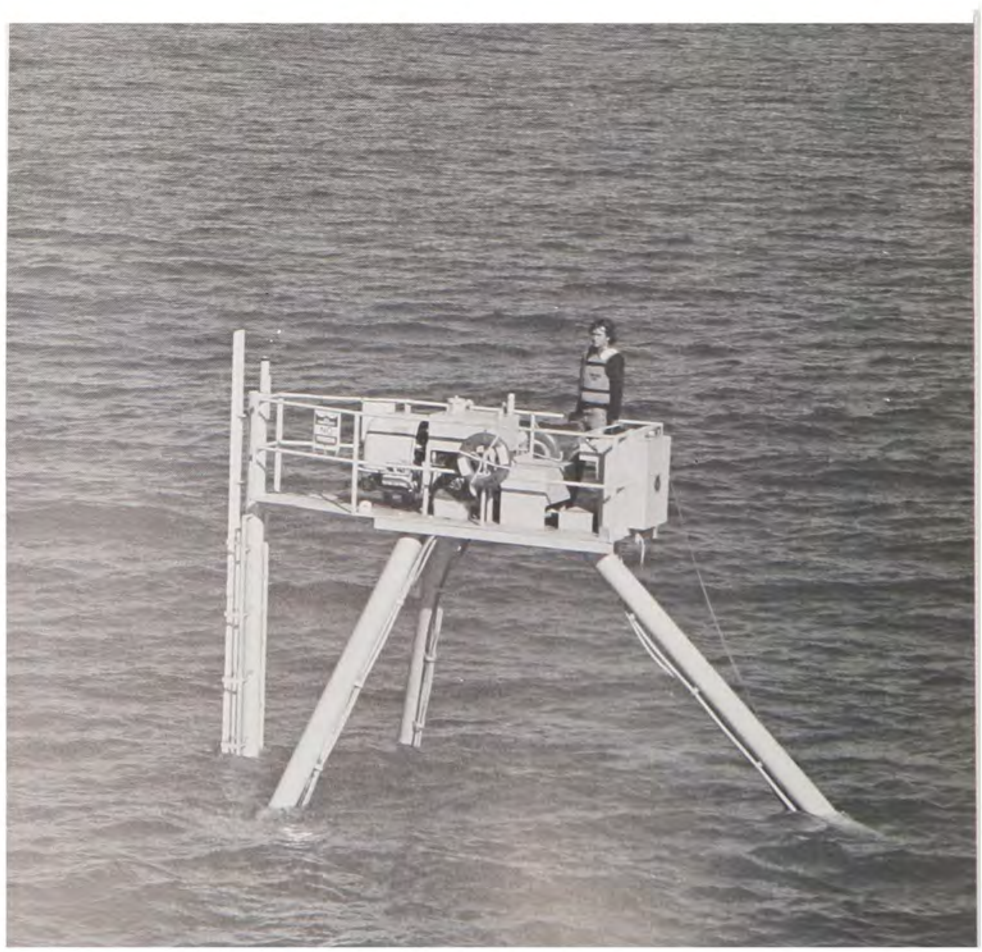
In 1978, the District obtained a 23-foot survey vessel, the *Wanchese*, and equipped it with electronic survey equipment identical to that on *Gillette*. Because of its shallow-draft characteristics, the *Wanchese* has greatly expanded Wilmington's survey capabilities, especially in shallow coastal inlet projects. In late 1981, the District added to its fleet a third modern, high-speed survey vessel, the *Beaufort*. That 47-foot vessel, stationed at Morehead City, is equipped similarly to the *Gillette* and *Wanchese*, and works on District navigation projects from Morehead City north to the Virginia line.

Use of modern state of the art field survey equipment on the District's survey vessels, coupled with a highly efficient series of interactive computer programs in the office, has made the Wilmington District a leader in the field of automated hydrographic surveying and digital cartography. District survey and Automatic Data Processing personnel have been instrumental in training other districts in those areas, and as a result other districts have adopted similar systems and methods based on the Wilmington District's experience.[52]

Survey boat Gillette is equipped with an electronic positioning system integrated with automatic data transmission, remote plotting and navigation instrumentation.



The ***Beaufort****, a high-speed, 47-foot survey boat*



A survey of the surf zone is made from the platform of the CRAB (Coastal Research Amphibious Buggy).

CRAB

The Wilmington District uses the electronic positioning system in conjunction with another of the District's innovations—the Coastal Research Amphibious Buggy, dubbed the CRAB. The District's Plant Branch designed and built the CRAB in 1978 to improve the accuracy of surveying in the surf zone along the District's beaches. Sanderson had seen a primitive version of this idea being used by the Construction Aggregate Company in a beach fill project in New York a short time before. Powered by a Volkswagen industrial engine, the CRAB is a tripod held together at the base by a horizontal triangle with a platform on top to support the operator and machinery. The original CRAB's platform was 22.5 feet high. In 1980 the District modified the vehicle for the Coastal Engineering Research Center for use at its research facility at Duck, North Carolina. The platform was raised to 35 feet above the ground.

Before the CRAB, a man would have to wade into waist-deep water with a surveying rod to complete the survey along the beaches. By using Motorola transponders placed on the beach to obtain the horizontal positioning, the CRAB drives from the beach into and through the surf zone under its own power while carrying an oversized level rod, which is read with a conventional surveyor's level to obtain the vertical dimension. The new CRAB greatly facilitates the work of the Coastal Engineering Research Center.[53]

For over a century, the Army Corps of Engineers in North Carolina has improved the state's rivers and harbors by dredging and snagging. The type of floating plant used in the work was determined by the job to be done, with the Wilmington District often designing its own specialized equipment. The influence of Wilmington's engineers and of their efforts in North Carolina from *Woodbury* to *Gillette* has extended throughout the Corps of Engineers' waterway programs.

Each point of the triangle base of the CRAB is equipped with a giant hydraulically-powered, rubber-tired wheel. The leading wheel is steerable. The platform, high above, supports the engine, the operator and the steering machine.

An egret is at home in wetlands near the Cape Fear River.

Dredge spoil islands in the Cape Fear River have become the nesting ground for a variety of birds, including brown pelicans.

CHAPTER XI

It Has Become Most Fashionable To Criticize The Corps Of Engineers

The administration of these laws will sooner or later devolve on you gentlemen, but as the most important principles have been settled by judicial and departmental construction you will not meet with so many difficult and vexing problems as have your predecessors.

—"Judge" G.W. Koonce, 1926

Since World War II, Americans have made ever-increasing demands on their environment and the government agencies responsible for managing it. Americans discovered new forms of outdoor recreation and revived some old ones. Recreational camping, boating, and hiking became national pastimes as city dwellers sought relief from the pressures of modern life. The demand for recreational facilities quickly overwhelmed existing developments, and government agencies such as the Corps of Engineers found themselves in the recreation business.

Environmentalism

The Corps of Engineers became involved in meeting expanded needs for recreation because it managed resources that attracted people from miles around. The 1944 Flood Control Act authorized the Corps to construct and operate—and to permit construction and operation by others—public parks and recreation facilities at its reservoir areas.

The federal government provided the basic facilities for access and public use of reservoir sites. Those included access roads, parking areas, launching facilities, public camping and picnic areas, water supply and sanitary facilities, beaches, and overlook stations. The 1944 law specified that the water areas be open to public use for recreation without charge.

The Land and Water Conservation Fund Act of 1965 amended the Flood Control Act of 1944 by deleting the words "without charge." Money was to be collected to establish a fund to assist the state and federal agencies in meeting future recreation demands. Much of the recreational development at reservoir sites is now controlled by the cooperation and assistance of nonfederal governmental agencies and the interest they take in meeting recreational demands. The 1965 Federal Water Project Recreation Act authorized the Corps of Engineers to include recreation in calculating benefit-cost ratios for various projects. That gave the Corps incentive to develop recreational facilities.[1]

As Americans discovered the value of the outdoors, they also demanded that government agencies put more emphasis on protecting the environment. A vocal minority began to view agencies such as the Corps of Engineers as adversaries in a campaign to preserve the country's diminishing natural resources. Congress passed legislation directing the Corps and other federal agencies to make a concerted effort to protect the environment. The requirement that federal agencies use an interdisciplinary approach to planning and decision-making resulted in a broadening of the District's technical staff.[2]

In the 1960s and 1970s, several new positions were added to the District's organization chart. The District began to hire ecologists, wildlife biologists, chemists, landscape architects, and outdoor recreation planners. With the passage of the National Environmental Policy Act of 1969 and the publication of "Principles and Standards for Planning Water and Related Land Resources" in September 1973, the Corps of Engineers increased its sensitivity to the environment. "Principles and Standards" requires that Corps of Engineers water and land activities be planned with environmental quality and national economic development as equal objectives.

The National Environmental Policy Act required the preparation of an environmental impact statement to accompany every recommendation or report on federal actions significantly affecting the quality of the human environment. The Corps of Engineers normally prepares an environmental impact statement for feasibility reports, major operations and maintenance activities, regulatory permits, and real estate management. The District hired several new people to prepare the statements.[3]

The Wilmington District, under the direction of Benjamin Kutscheid, prepared the first plan containing a true environmental quality element to be approved by the Board of Engineers for Rivers and Harbors. The environmental impact statement for Wilmington Harbor–Northeast Cape Fear River was a landmark within the Corps, and its environmental assessment techniques and approaches were used as models. The report resulted in the formulation of written Corps policy on Environmental Quality Planning.

The Wilmington District performs other work on behalf of the Environmental Protection Agency. Through an Interagency Agreement of 1978, EPA assigned to the District substantial responsibility for inspection and construction management of sanitary sewerage systems financed by EPA construction grants. In cooperation with the state of North Carolina, the Corps EPA inspectors were responsible for the inspection and construction management of plants costing $389 million by 1981.

Outdoor recreation is enjoyed by a couple on Jordan Lake.

The District's reservoir projects provide many hours of pleasure.

Regulatory Program

One particular part of the Wilmington District's functions that has greatly expanded in recent years is the regulatory program—the permits program. The Wilmington District must enforce permit requirements along 3,000 miles of estuarine and ocean shoreline, nearly 10,000 miles of rivers and streams, and over 8,000 square miles of bay and sound waters. In addition, its permit authority extends over the area of the Atlantic Ocean east of North Carolina to the continental shelf.

Two types of regulatory actions have required extensive participation by the District. Section 10 of the Rivers and Harbors Act of 1899 prohibits the unauthorized obstruction or alteration of any navigable water of the United States. The construction of any structure in or over any navigable water requires a permit from the Corps of Engineers acting in behalf of the Secretary of the Army. Section 404 of the Clean Water Act of 1977 established a federal permit program, administered by the Corps of Engineers, to regulate the discharge of dredged or fill material into navigable waters.

Wilmington's regulatory program was greatly expanded because of new laws and court decisions in the early 1970s. On 27 March 1975, the United States District Court for the District of Columbia ordered that the regulatory activities of the Corps of Engineers be expanded to include the "waters of the United States." That action greatly expanded the limits of the District's authority.

In the early 1970s, the Permits and Statistics Section of the District merely checked the small drawings submitted and insured that the application letter was properly phrased and signed before issuing a public notice. That notice sought the public comment necessary before the District determined whether the proposal interfered with navigation. By the end of the 1970s, the Regulatory Functions Branch had to consider zoning, esthetics, economics, social effects, effects on fish and wildlife, and numerous other factors before issuing permits.[4]

In responding to the increased activity, strong emphasis was placed on coordination and cooperation with other agencies at the local, state, and federal levels. The Wilmington District and the state of North Carolina have cooperated in issuing general permits covering certain dredging and construction activity. The issuance of general permits reduced the time and effort required to obtain permits.

The District's new policy proved to be highly successful and brought the District recognition throughout the nation for its innovative approach to interagency coordination and its accomplishments in joint state-Corps of Engineers procedures.[5]

Flood Plain Management

The Wilmington District expanded its functions into other new areas during the 1960s and 1970s. Section 206 of the Flood Control Act authorized the Corps to provide information, technical planning assistance, and guidance to both federal and nonfederal entities. In response to increasing flood damages, President Lyndon Johnson issued Executive Order 11296 on 10 August 1966. The order increased the role of the Corps of Engineers in assisting local communities in the use of flood plains.

The Wilmington District established the Flood Plain Management Services Branch in response to the increased duties. The branch coordinated the study of 47 separate programs in North Carolina. The branch also assisted the Federal Emergency Management Agency in carrying out the national flood insurance program by conducting investigations and delineating floodways of 4,260 miles of waterways. The flood plain management services were one of the District's first major efforts not in the traditional category of rivers and harbors projects.

Dam Inspection

The failures of Teton Dam, Idaho, and Kelly Barnes Dam, Georgia, led President Jimmy Carter to direct the Corps of Engineers to administer a nationwide safety inspection program for certain nonfederal dams. The Corps of Engineers was also directed to update the national dam inventory authorized by the National Dam Inspection Act of 8 August 1972. The Wilmington District was given the responsibility of administering the program in North Carolina. The state had been conducting its own inspection and inventory. Therefore, the District negotiated contracts with the state to perform inspections and update the inventory. Under the direction of the Design Branch, the Foundation and Materials Section supervised the work. A multidisciplinary Corps panel reviewed each inspection report. Completed in November 1981, the inspection in North Carolina found 121 unsafe dams out of the 262 inspected.

Rivers and Harbors

Despite the growth of the District in new areas, the traditional rivers and harbors work declined. The District concentrated on military construction between World War II and 1961. During the 1940s and 1950s, civil works took a back seat to the military work in the Wilmington District. The rivers and harbors work was mostly maintenance dredging or snagging. In 1945 the District placed one million dollars worth of civil works. Although the amount rose to over $4 million in the early 1950s, by 1955 it was back down to $1.25 million. During the 1950s the District laid the foundation for a strong civil works program in the 1960s and 1970s. During the 1960s, the District embarked on a series of small channel improvements to reduce flooding, primarily in eastern North Carolina.[6]

The Wilmington District undertook the small flood control projects under authority of the Flood Control Act of 1948, Section 205. That legislation provided for construction of small flood control projects not specifically authorized by Congress when, in the opinion of the Chief of Engineers, such work was advisable.

At one point in the 1960s, Major General Alvin C. Welling, South Atlantic Division Engineer, stated that he would like to see the map of North Carolina "lit up like a Christmas tree" with small flood control projects. The popularity of that program with agricultural interests resulted in one of the largest programs of that type in the country.[7]

The long list of Section 205 projects included the construction of an earthen dike, with appurtenant structures, 2.89 miles long, to protect Princeville and vicinity against flooding from the Tar River. Construction began in August 1965, and was completed in September 1967 at a cost of $390,249. By 1980, the dike had prevented an estimated $172,950 in flood damages.

On Core Creek, a tributary of Neuse River, the Wilmington District snagged and cleared for a distance of 11 miles, and enlarged and realigned the creek for a distance of just over ten miles. Taken alone, those projects were small, one-time efforts at flood control. But when taken together, they formed a substantial part of the Wilmington District's civil works in the 1960s.[8]

Wilmington-Norfolk Boundary Change

During the 1960s, 1970s, and 1980s, much of the District's time and effort did not go to the traditional area of rivers and harbors work, but to reservoir management and construction. As part of the 1961 reorganization, the Wilmington District's northern boundaries shifted, and a portion of the Roanoke River Basin above Weldon, North Carolina, was withdrawn from the Norfolk District's jurisdiction and transferred to Wilmington. That included transfer of John H. Kerr and Philpott reservoirs, developed by the Norfolk District.

The Norfolk District, in its Roanoke River Basin 308 report in 1934, said that comprehensive development by the federal government was not justified at that time. Shortly after a disastrous flood on the Roanoke River in August 1940, Congress directed Norfolk to review the 308 report to determine if the periodic floods could be alleviated. The Flood Control Act of 22 December 1944 approved a general plan for the comprehensive development of the Roanoke Basin, and authorized construction of Buggs Island (later renamed John H. Kerr) and Philpott reservoirs as the initial step of the development.[9]

Kerr Dam and Reservoir, 18 miles above the Virginia–North Carolina state line, lies partly in each state, covering part of seven counties and about 120,000 acres. As the most important unit in the plan for the river basin, Kerr Dam and Reservoir was constructed between 1946 and 1953 at a cost of nearly $87 million. The dam is a concrete gravity structure, flanked on both ends by earthen embankments. The overall length is 22,035 feet, and it is 144 feet high at the highest point. The dam was designed for flood control and generation of hydroelectric power. The dam has produced power revenues amounting to $100,550,000 and prevented an estimated $60,020,000 worth of flood damage from 1953 to 1982. Over four million people visit the reservoir annually. Between 1978 and 1982, water supply revenue amounted to $16,600.[10]

Philpott Dam and Reservoir is on Smith River in Virginia about 39 miles above the Virginia–North Carolina state line. Construction on the project began in March 1948 and ended in October 1956, although it began providing flood control in 1951. The dam is a concrete gravity structure 892 feet long with a maximum height of 220 feet. The dam was constructed for flood control and generation of hydroelectric power. Philpott has produced $11,300,000 in power revenues and prevented an estimated $16,770,000 worth of flood damage between 1951 and 1982. It prevented an estimated $5 million in damages from Hurricane Agnes in June 1972. Annual visitation at Philpott averages about 1.25 million people.[11]

The management of multipurpose projects such as Kerr and Philpott reservoirs was a new experience for the Wilmington District. Hamilton Hicks supervised the two projects and the nearly 100 project employees who came to the Wilmington District along with the projects. Besides routine supervision, the majority of the work by the Wilmington District at the two reservoirs has been the expansion of recreation facilities in cooperation with state authorities. The District developed roads, parking lots, boat ramps, picnic shelters, beaches, campsites, and numerous other recreational facilities. While the District was learning how to manage a multipurpose project, it was also trying to build two of its own.[12]

John H. Kerr Dam with powerhouse at right front of the photograph

Philpott Dam with powerhouse in foreground

Cape Fear Basin Planning

In September 1945, a disastrous flood struck Fayetteville, North Carolina, putting fully 25 percent of the city under water and causing nearly $5 million in damages. The flood produced record stages for the river at Fayetteville of 68.9 feet. The 1945 flood renewed interest in flood control on the Cape Fear. As a result of the flood, North Carolina congressmen requested the District to review the Cape Fear's 308 report. Subsequently, Congress authorized preliminary examination for the Cape Fear on 2 May 1946.[13]

Nels Magnuson of the Planning and Reports Branch assigned the preparation of the preliminary examination to District newcomer Earle Merrill. Merrill compiled the examination report from available data and field inspections without costly field surveys or office computation. Since a public hearing was required, the District held a meeting in Fayetteville on 16 September 1946. Among the 122 people in attendance was Congressman J. Bayard Clark, representative of Fayetteville's district. The speakers told of the damage and suffering caused by the 1945 flood and appealed to the engineers for a flood control development on the river. On the basis of the findings, Colonel Heston R. Cole, District Engineer, recommended that a review report of survey scope be prepared for the Cape Fear Basin. In November 1947, OCE authorized a survey report.[14]

Preparation of the survey report was a long, drawn-out process for the Wilmington District. The Planning and Reports Branch began the work in 1948 and had progressed to the point where it could begin to make recommendations when the Korean Conflict War broke out in 1950. Overnight, work on the survey report was suspended. The information collected was boxed up and set aside for several years.

Because of a lack of funds, the survey report made little headway after the war, until in 1955 Senator Kerr Scott of North Carolina pushed through Congress a bill authorizing more funds for the survey. By 1957, studies had advanced to the point that it was determined the New Hope project would be the most logical initial development, based largely on the recommendations found in the 308 report.

Because of limited time and funds, the District decided to submit a general plan for water resource development in the basin, to include three large dams and reservoirs on the Haw River, 4.3 miles above its mouth; on the Deep River, 2 miles above the town of Randleman; and on the Deep River, about 15 miles southeast of Asheboro, North Carolina. But the District recommended for construction only the New Hope project on the Haw River. According to the plan, the project would be built just below the confluence of the New Hope and Haw rivers above Deep River.[15]

B. Everett Jordan Dam and Reservoir location map

New Hope

The District presented its plan of development to the public at a hearing at Fayetteville in February 1957. People living in or owning land in the New Hope Basin, organized as the New Hope Valley Association, vehemently opposed the project. Wade Barber, a Chatham County attorney, predicted the dam and reservoir would destroy $10 million worth of business yearly and that the polluted Haw River would turn the reservoir into a giant cesspool. He asked the District officials present, "How much recreation could there be in a cesspool surrounded by mud flats?"[16]

A supporter of the project, T.F. Nance of Lee County, presented the opposing view. "The people of Lee County," he said, "are vitally interested in this project for several reasons. We need a more abundant water supply for immediate domestic and industrial use; for recreational purposes and for flood control. . . . The Cape Fear River Basin must eventually be controlled or a great regional asset will be lost."[17]

At the public meeting, someone else suggested that consideration be given to flood control by a series of small reservoirs constructed by the Soil Conservation Service of the Department of Agriculture, through its small-watershed development program.[18]

As a result of that suggestion, Senator Kerr Scott proposed that the Corps of Engineers and the Soil Conservation Service undertake a joint study of the Cape Fear River Basin, and present a joint plan for the control and development of the waters of the Cape Fear. The joint study, begun in July 1957, was not released until 1961, and then only after Senator B. Everett Jordan, Scott's successor, applied pressure to the two agencies.

The joint report was "joint" in name only, in that it comprised three separate and distinct parts—Plan A, the Corps of Engineers plan; Plan B, the Soil Conservation Service proposal; and a third section in which the two agencies commented on each of the plans. Neither plan actually recommended anything, merely outlining the agencies' respective views. Meanwhile, the Wilmington District was proceeding with its own survey report, which it submitted to Congress in 1962.[19]

The release of the joint study sparked a bitter political debate among the North Carolina congressional delegation. The proponents of the Corps of Engineers' plan included Senator Jordan, most of the state's political leaders, and most of the state's newspapers. In opposition to the Engineers' plan were the residents of New Hope Valley, whose land would be inundated by the reservoir, and their representative in Congress, Harold Cooley. Cooley, a veteran of 30 years in the House of Representatives, dean of the North Carolina congressional delegation, and one of the most powerful men in Congress, was in a commanding position as Chairman of the House Agriculture Committee. At the same time, Senator Jordan and Governor Terry Sanford came out squarely behind the Corps of Engineers' plan.[20]

In March 1963, Jordan proposed a three-step compromise plan that would allow the construction of New Hope Dam and Reservoir, followed by the smaller dams on the Deep River at Howards Mill and Randleman, and finally—in a move calculated to take the wind out of Cooley's sails—would authorize a $200,000 study of a network of small dams to be built by the Soil Conservation Service.

Many of Cooley's supporters accepted the compromise, as did the Soil Conservation Service, but Cooley refused to budge. Finally, in December 1963, with a $900 million Water Projects Authorization Bill hanging in the balance, Cooley relented and supported the inclusion of the New Hope project in the bill.

It took 18 years from the time Colonel Gillette sought to update the 308 report to the project's authorization for construction, but the struggle was just beginning. New Hope Dam and Reservoir, later to be renamed the B. Everett Jordan Dam and Lake, the victim of meager funding and court injunctions, would take nearly 20 years to complete.[21]

Because the Wilmington District had been reduced to a support district in 1961, it did not have the necessary manpower to carry out the design and construction of the project. Colonel Joseph S. Grygiel, District Engineer, requested that he be allowed to recruit a design staff for the New Hope Project. The request was denied by OCE on the ground that it would be infeasible to support such an organization just for the one project.[22]

Colonel F.E. Stevenson, Acting Division Engineer, assigned responsibility for design and real estate activities for New Hope to the Savannah District. He assigned to Wilmington responsibilities for construction, reservoir mapping, development of the Master Plan, and the negotiation of relocation contracts. The division of responsibilities worked well, except that Wilmington personnel were held responsible for Savannah's design and had to answer to the contractors when questions arose.[23]

When Congress authorized the New Hope project in 1963, the Wilmington District estimated the cost to be $25.462 million, with a benefit-to-cost ratio of 2.5 to 1 and a completion date of 1968. However, Congress declined to appropriate sufficient funds for the project's completion by 1968. In fact, by 1968 Congress had appropriated only $7.2 million for New Hope, with half of that amount coming in 1968. Congress's inability to properly fund the project led to prolonged delays in construction and a final cost approaching five times the original estimate. Because of the increasing cost of New Hope, the benefit-cost ratio declined from 2.5 to 1 in 1963 to 1.6 to 1 in 1974.[24]

As the permanent dam at B. Everett Jordan Dam reached 47-foot height, engineers began to remove the coffer dam in 1973.

Road relocation at Jordan Dam

By 1969, the influence of the environmental movement sweeping the country caught up with the New Hope project. Initially, the Corps of Engineers held that the act was not applicable to projects already completed or under construction, such as New Hope. But as a result of various court decisions, the Corps changed its policy and held that the act would be applied to those projects under construction to the extent practicable. Therefore, the District was required to file an environmental impact statement (EIS) with the Council on Environmental Quality before completing the project. For the New Hope project, a basinwide environmental study was necessary to determine the environmental impacts of the several alternative plans for water resource development then under consideration.

The District began drafting an 800-page EIS addressing the project's impact on the land, water, air, plant life, animal life, and people in the project area in May 1971. In August of the same year, the Conservation Council of North Carolina, an environmental group from Chapel Hill, and later the cities of Durham and Chapel Hill filed suit against the Wilmington District and its parent agencies. They sought to enjoin construction of the New Hope project on the grounds that the EIS was inadequate and that the decision to proceed with the project was contrary to the substantive provisions of the National Environmental Policy Act. Thus began for the Wilmington District a long series of courtroom skirmishes in its attempt to complete the dam and reservoir.[25]

James C. Wallace, president of the Conservation Council of North Carolina, claimed that the District had deceived the public in the EIS by withholding information, deliberately misrepresenting the facts, and failing to examine alternatives to the project. He maintained that the District omitted the fact that the Carolina Power and Light Company was planning to impound Buckhorn Creek, a tributary of the Cape Fear. Use of water for the impoundment would affect the amount of water flowing to the New Hope Lake.

Wallace stated that any reduction in the amount of water during dry periods would create extensive mud flats surrounding the lake, reducing the potential recreation available. He also charged that the water quality of the lake would be unsuitable for any project purposes. The cities of Durham and Chapel Hill made a comparable claim and contended that each would bear increased costs for sewage treatment as a result of the impoundment. According to Wallace, the EIS was merely a compendium of derogatory correspondence and comment left unanswered by the District. He recommended a complete reevaluation of the project and a halt to the construction.[26]

Physical work at New Hope began in 1967 with the erection of construction facilities. Ground was broken on New Hope Dam on 7 December 1970 with a scheduled completion date of May 1973. By 1972, the District had awarded major relocation contracts for U.S. Highway 64 and the Norfolk Southern Railway. But before the dam could be completed, a federal district court halted all work at the project. The dam was at a vulnerable height—48 feet above the streambed, 67 feet short of its design height—and susceptible to overtopping by high water. Fortunately, the river did not reach a stage high enough to overtop the structure during the seven months that work was halted.[27]

On 5 February 1974, after two and a half years of litigation and the death of the original judge, all parties to the suit executed a consent judgment, avoiding a long and costly trial on the merits of the case. The parties agreed that the only issue in dispute was the quality of the water in the proposed lake. Because of the plaintiffs' concerns, the Wilmington District agreed to collect additional water-quality data to verify earlier studies conducted since 1966. The District agreed to publish the results as a supplement to the project's EIS. The Corps was to study the water quality and then decide whether to proceed. If the District decided to proceed with the project, the District agreed to issue a Notice of Decision. If the plaintiffs took no action, the District could proceed with construction.[28]

The consent judgment allowed the District to complete in its entirety Jordan Dam and all road relocations, except North Carolina Roads 1715 and 1941. Additionally, all recreational roads and associated facilities could be completed except for construction of boat-launching ramps. Limited clearing of timber was allowed. The settlement permitted water to be impounded behind the dam only to the extent necessary to provide maximum flood protection to downstream areas.[29]

Construction activity at the dam site began once more in 1974, and the dam was soon completed to project height. In September 1976, the District filed the supplement to the EIS with the Council on Environmental Quality and the Notice of Decision to Impound with the U.S. District Court during that same month. At this point, the question before the court concerned the decision of the District Engineer along the lines of the Administrative Procedures Act rather than the National Environmental Policy Act. Following a hearing on the merits of the decision in November 1976, Judge Eugene A. Gordon upheld the District Engineer's decision to impound water on 28 July 1977.

But the Conservation Council of North Carolina did not give up its fight. On 3 October 1977, the Council asked the District Court for a stay of judgment pending the decision on appeal, but that was denied. The District continued the road relocations and construction of recreational facilities at the dam and reservoir.[30]

Congress authorized two other multipurpose projects for the Cape Fear River Basin in the 1968 Flood Control Act. Randleman Dam and Lake, two miles above the town of Randleman on Deep River, is in the preconstruction design stage. The project is being designed for flood control, water supply, water-quality control, and recreation and will cost an estimated $109 million when complete. The third project for the basin is Howards Mill Dam and Lake. It will be located on Deep River 15 miles southeast of Asheboro. In 1980, the Howards Mill project was reclassified to the "deferred" category because of a lack of economic justification.[31]

Neuse River basin

Falls of the Neuse

The Wilmington District has proposed a comprehensive program of river development for the Neuse River, much like that for the Cape Fear River Basin. Also like the Jordan project, the initial development of the dam and lake on the Neuse was delayed by meager funding, litigation, and politics. The delays have caused tremendous cost overruns.

The Neuse River 308 report lay on the shelf at the Wilmington District office until Dr. David J. Rose, a Goldsboro surgeon, Wayne County state legislator, and chairman of the Wake Valley Development Association, began to lobby for its review. In 1956, Senator Kerr Scott sponsored an appropriation and resolution requesting the Wilmington District to review the 308 report and other pertinent reports on Neuse River. The review was to determine whether improvements for flood control or conservation of water resources in the interest of water supply were necessary.[32]

The six-year survey was completed in 1964. The report recommended 13 possible projects for the Neuse River basin, but the main development was an $18.6 million dam near Falls Village, about ten miles north of Raleigh. The District chose the Falls Village site because that is where the river changes course, breaking through a ridge at a right angle forming a natural wall for the reservoir. The dam was to be an earth-and-rock fill structure 92 feet high and 1,900 feet long. The project was designed for flood control and recreation and, most important, as a reservoir lake to meet a critical water supply shortage in Raleigh. Congress authorized the Falls project in 1966.[33]

After World War II, Raleigh began to grow into a large city, quickly outgrowing its water supply. The city suffered severe water shortages in 1951 and 1953, during which mandatory water-use restrictions were imposed. In the 1950s, Raleigh officials sought to begin drawing water from the Neuse, but state health officials denied the request because the city of Durham was dumping raw sewage into the river upstream. The Falls Dam and Reservoir seemed to be the answer to the city's water problems when Congress first authorized the project with a scheduled completion date of 1971.[34]

From the beginning, the Falls project fell behind schedule because of small appropriations. During the first four fiscal years following authorization of the project, Congress appropriated only $675,000, not enough to begin construction. Not until Senator Jordan and Congressman Nick Galifianakis teamed up in support of the project did money begin to flow into it. In 1969, the two were able to get Congress to appropriate $500,000 for the first land purchases.

The years of delay proved costly. With 175 miles of shoreline located within easy commuting distance of Raleigh, Durham, and the Research Triangle Park, the Falls project rapidly attracted speculators. In 1965, when Congress authorized Falls, the Wilmington District estimated land costs to be $5.7 million. By 1971, the figure had risen to $17 million, and five years later it reached $35 million. In 1972, both Jordan and Galifianakis were defeated at the polls, and Falls received no appropriation the following year.[35]

In March 1973, Jordan's replacement in the Senate, Jesse Helms, aligned himself with area landowners in pushing for a reduced project. Helms introduced a bill that would cut 4,500 acres of park land from the project as an economy measure. North Carolina's other senator, Sam Ervin, opposed the Helms measure and led the fight to defeat it in July 1974.[36]

The Wilmington District also faced litigation over the project in the courts. In June 1972, three environmental groups—Research Triangle Sierra Club, ECOS, and Wake Environment—asked the courts to reduce the project on the grounds that it would have adverse environmental effects on the area. The motion was denied. In March 1973, area landowners, represented by the Neuse Valley Association, brought suit against the Corps of Engineers. The association contended that the District violated the National Environmental Policy Act by failing to prepare an adequate EIS for Falls, and by making an inadequate assessment of the project's costs and benefits. The association's request for a preliminary injunction was denied and the District was able to proceed with land acquisition. The District completed a new EIS.[37]

Uncovered at Falls Lake project during construction of the dam was a wooden dam built in the 1820s or 1830s.

Demolition of a bridge at Falls Lake project during road relocation construction provided training exercise for paratroopers of the 307th Engineer Batallion, 12th Airborne Division, Fort Bragg.

Falls Lake before impoundment

The first environmental impact statement for the Falls project, only about 15 pages long, was completed in 1971. In compiling the second EIS, the District went for overkill. When completed, the second document totaled over 2,000 pages in five separate volumes and covered all foreseeable environmental changes to be brought about by the project. The District submitted the EIS on 1 May 1974. The sheer bulk of the report must have impressed the Neuse Valley Association, because only three weeks before the trial the association requested that its suit be dismissed with prejudice, which meant a victory for the Corps of Engineers.[38]

The District began work on the dam and road relocations during 1978. With the demolition of four highway bridges by the paratroopers of the 307th Engineer Battalion, 82nd Airborne Division, the District completed the road relocation work in 1982. During the construction work, the District uncovered an old stone dam and an earlier wooden dam built in the 1820s or 1830s to supply power to a local mill. The contractor halted work for two weeks to allow the District to excavate and study the structure. Both had been built on the center line of the current dam.

The Wilmington District did not have to stop work because of the litigation over the Falls project, but was slowed by the low level of annual appropriations. The District assumed some of the same kinds of work on the Falls project that the Savannah District had performed for the Jordan Dam and Lake, which were designed by Savannah. Wilmington designed all of the Falls project, except for the dam. By the 1970s, the District was beginning to resume its pre-1961 civil works design functions.[39]

The real victim of the delays in completing Falls Dam and Lake was the city of Raleigh. Raleigh officials had believed the Corps of Engineers when it said the project could be completed by 1971. In 1967, the city spent $7.6 million for the construction of intake facilities to obtain a reliable source of water from the Neuse River. The water supply shortage became so acute for the city that it built a $2.5 million reservoir to act as an interim water supply until the completion of the Falls project.

Falls Lake partially impounded

By 1981, even the temporary reservoir could not help the city meet its water supply needs. By that time, the dam and outlet works were completed, so the Wilmington District responded to Raleigh's request and partially impounded the lake. Throughout the dry summer months, Falls supplied Raleigh with 30 million gallons of water per day. The District again partially filled the lake in 1982 to supply Raleigh with water. By early 1983, the District had impounded Falls Lake to full conservation pool level.

The *Raleigh News and Observer* carried an editorial expressing the paper's views. "The U.S. Army Corps of Engineers," said the editor, "deserves the thanks of the people of Raleigh and those in neighboring towns that depend on Raleigh's water supply. The often-criticized corps has bent over backwards to help protect local water consumers against drought this summer. . . . It has become most fashionable to criticize the Corps of Engineers. . . . But it's good to see the corps doing such an obviously good public service."[40] When completed, Falls should greatly reduce the water supply problems of Raleigh.

In 1980, the Wilmington District continued on its course to becoming a full-fledged civil works district. Following a reevaluation of the district boundaries in the South Atlantic Division, Division Engineer General Kenneth E. McIntyre adjusted the Wilmington-Charleston district boundary. He transferred all North Carolina territory under Charleston to the Wilmington District. Included in the transfer was the W. Kerr Scott Dam and Reservoir on the Yadkin River, six miles above Wilkesboro. Authorized by Congress in the Flood Control Act of 1946, the dam and reservoir were put in operation for flood-control and water-storage purposes in February 1963.

In 1982, the Wilmington District supervised three multipurpose projects, but still awaited the completion of Jordan and Falls reservoirs and the chance to supervise a project conceived and constructed solely by the Wilmington District."[41]

W. Kerr Scott Dam and Reservoir

CHAPTER XII

I See Jobs In The Lake

We secure our friends not by accepting favors but by doing them.

—Thucydides

On a warm first day of May 1982, hundreds of North Carolina residents gathered near Moncure, North Carolina, for the official dedication of B. Everett Jordan Dam and Lake. Surrounded by manicured grounds, sharply graded banks of evergreens, and water glistening in the Chatham County sun, the crowd came to honor the memory of the late North Carolina senator for whom the facility is named, enjoy the weather, and listen to speeches by local and national dignitaries.

Lieutenant General Joseph K. Bratton, Chief of Engineers, outlined the project's benefits in his remarks to the crowd. Downstream flood control was the primary purpose of the dam and lake from the outset of the planning. Bratton predicted that a storm, such as the one that hit the area in 1945, would cause virtually no downstream flooding because of the Jordan Dam. He estimated that the project would reduce annual flood damages below the dam by 66 percent, permitting more productive use of the river's flood plain. The dam's outlet structure can mix water from different levels in the lake to produce a discharge with water temperature, dissolved oxygen content, and chemical composition best suited to downstream needs. Jordan Lake will provide surrounding communities with up to 100 million gallons of drinking water per day.[1]

Governor James B. Hunt gave the main address. In his speech, Hunt looked to the future of the state and the role Jordan Dam and Lake would play. The lake made the state better prepared to meet anticipated needs for water, flood control, outdoor recreation, and wildlife conservation. As he gazed over the lake, Hunt proclaimed, "I see jobs in the lake, and that is literally true. . . . There will be thousands and thousands of jobs associated with recreation here." The opening of the project would mean a boon for the local economy.[2]

Dedication of B. Everett Jordan Dam and Lake, May 1982

The dedication of Jordan Dam and Lake, a significant event for North Carolina, was the culmination of over 50 years of work by the Wilmington District. It represented the maturation of the District from an old-line rivers and harbors district to an organization capable of all types of water resources management.

Since the 1820s, the Army Corps of Engineers has aided the commercial development of North Carolina by dredging rivers, ocean bars, and inlets; clearing rivers of debris; and building locks and dams. Fayetteville, at one time a community with a dream of a waterway to the Atlantic, is now a city connected to the Atlantic Intracoastal Waterway and the ocean by an eight-foot channel on the Cape Fear River. Morehead City, once merely a small cluster of houses and docks, is now a busy, deep-water port with modern terminal facilities. Wilmington, a city that could receive ships drawing only nine feet in the 1820s, is now one of the major ports on the South Atlantic Coast. Wrightsville and Carolina beaches, once susceptible to damage from storms that destroyed homes and washed away precious sand, are now among the most popular beach areas in the state. Raleigh, a fast-growing but water-scarce city, will have an adequate supply for the future. The Wilmington District has played an important part in all of those developments.

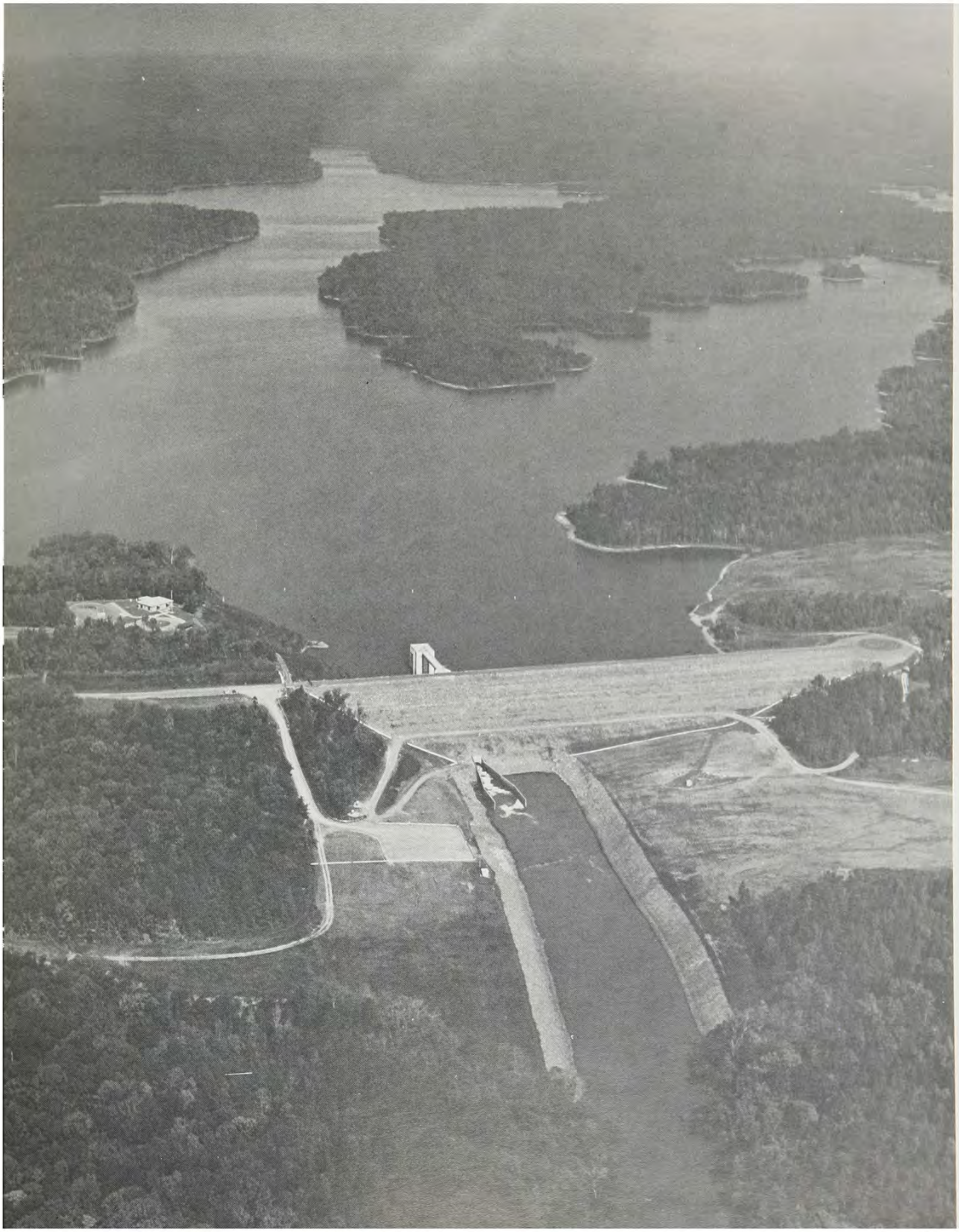
The Army Corps of Engineers has built in North Carolina several structures historically significant for their function, design, or construction. Fort Caswell, over 150 years old, remains a well-preserved example of the Endicott era of coastal defenses. Although the fort saw little actual combat, it protected Wilmington for nearly a century. Fort Macon, built simultaneously with Fort Caswell, stands as a model of coastal fortification design of the 1820s. Today, Fort Macon is part of North Carolina's most popular state park.

The outstanding project built by the Corps of Engineers in North Carolina, in terms of design, construction, and function, is the Rocks. By literally parting the Atlantic Ocean and Cape Fear River with the stone structure, the engineers were later able to deepen the river to its present depth of 38 feet and 40 feet on the bar. The engineering complexity of the project was remarkable for the 19th century. The stability of the dams for a century is testimony to the skill applied to the project's design and construction. The Rocks has played as important a part in the economic development of Wilmington as any other single work of man.

Examples of the Wilmington District's work can be found throughout eastern North Carolina. But dams or jetties are not the Wilmington District. The Wilmington District is people. It is the District Engineer and Deputy District Engineer, who come and go every few years. It is also the civilians who remain for a number of years and provide continuity for the District's program.

The nature of their job has changed over the decades and will continue to change as the regional economy develops. But the personnel of the District are not now merely experts on dredging and snagging; they represent a broader spectrum of occupations and scientific and engineering disciplines than ever before. The Wilmington District is prepared to meet the future needs of the people within its boundaries, as it has done in the past.

"Personnel of the Wilmington District are experts on dredging and snagging. . . ."



Jordan Dam and Lake is a multipurpose project providing water supply, flood control, water quality control, recreation and conservation of natural resources.

Courtyard of the Federal building. This building became headquarters of the Wilmington District shortly after it was built in 1916.

APPENDIX A

Freight Traffic at Morehead City and Wilmington Harbors

MOREHEAD CITY HARBOR

Year	Tons	Year	Tons
1924	20,530	1952	455,742
1925	17,948	1953	536,685
1926	15,723	1954	504,205
1927	17,092	1955	446,655
1928	14,626	1956	479,320
1929	14,131	1957	453,794
1930	10,181	1958	506,616
1931	8,592	1959	574,706
1932	6,940	1960	678,986
1933	7,649	1961	541,656
1934	7,787	1962	540,416
1935	9,718	1963	561,571
1936	62,509	1964	624,868
1937	122,919	1965	693,343
1938	120,958	1966	655,808
1939	111,268	1967	674,667
1940	105,963	1968	902,718
1941	29,328	1969	1,177,410
1942	38,805	1970	1,364,454
1943	19,356	1971	1,289,768
1944	9,774	1972	1,422,933
1945	7,671	1973	1,160,988
1946	67,849	1974	1,512,883
1947	147,096	1975	1,522,208
1948	254,080	1976	2,503,675
1949	214,924	1977	2,874,828
1950	333,506	1978	3,343,434
1951	343,850	1979	3,568,907

WILMINGTON HARBOR

Year	Tons	Year	Tons
1869	220,000	1925	1,027,653
1872	294,060	1930	1,258,147
1877	205,340	1935	1,388,756
1880	218,320	1940	2,582,785
1884	212,464	1945	1,169,111
1890	346,557	1950	4,021,777
1895	618,054	1955	4,693,306
1900	699,356	1960	5,168,062
1905	871,106	1965	4,742,108
1910	944,657	1970	6,316,640
1915	709,570	1975	7,939,207
1920	582,681	1979	10,293,376

APPENDIX B

District Boundaries

The boundaries of the Wilmington District have changed several times to include parts of Virginia, North Carolina, and South Carolina during the nearly 100 years since the District's establishment. Taken from *Annual Reports of the Chief of Engineers* and cited below are descriptions of the Wilmington District or a listing of projects within the District which represents a change in the District's boundaries.

From 1885 until 1921 boundaries are delineated by projects. Beginning in 1921 boundaries are described primarily in geographic terms.

For clarity, additions to the District for each period listed below are set in boldface; reductions are itemized.

1885

In charge of Captain William H. Bixby, Corps of Engineers—

Contentnea Creek, NC; Trent River, NC; Neuse River, NC; Inland navigation from New Bern to Beaufort Harbor, via Clubfoot, Harlowe, and Newport rivers, NC; harbor at Beaufort, NC; New River, NC; Cape Fear River, above Wilmington, NC; Cape Fear River, below Wilmington, NC; Great Pee Dee River, SC; Waccamaw River, SC; harbor at Georgetown, SC; Santee River, SC; Wateree River, SC.

1887

In charge of Captain William H. Bixby, Corps of Engineers—

Pamlico and Tar rivers, NC; Contentnea Creek, NC; Trent River, NC; Neuse River, NC; inland waterway between New Bern and Beaufort, NC; harbor at Beaufort, NC; **inland waterway between Beaufort Harbor and New River, NC, through Bogue Sound**; New River, NC; **Black River, NC**; Cape Fear River, NC; **Yadkin River, NC**; Waccamaw River, SC; Great Pee Dee River, SC; harbor at Georgetown, SC; **Winyah Bay, SC**; Santee River, SC; Wateree River, SC; **Congaree River, SC**.

1889

In charge of Captain William H. Bixby, Corps of Engineers—

Roanoke River, NC and VA; Pamlico and Tar rivers, NC; Contentnea Creek, NC; Trent River, NC; Neuse River, NC; inland waterway between New Bern and Beaufort, NC; harbor at Beaufort, NC; inland waterway between Beaufort Harbor and New River, NC, through Bogue Sound; New River, NC; Black River, NC; Cape Fear River above Wilmington, NC; Cape Fear River at and below Wilmington, NC; Yadkin River, NC; harbor at Georgetown, SC; Winyah Bay, SC.

REMOVED from 1887 boundaries: Great Pee Dee, Santee, Wateree, Congaree, and Waccamaw rivers, all in SC.

1891

Report of Major W. S. Stanton, Corps of Engineers—

Staunton River, VA; Roanoke River, NC; **Pasquotank River, NC; Mackeys Creek, NC; Ocracoke Inlet, NC; Fishing Creek, NC**; Pamlico and Tar rivers, NC; Contentnea Creek, NC; Trent River, NC; Neuse River, NC; inland waterway between New Bern and Beaufort, NC; harbor at Beaufort, NC; inland waterway between Beaufort and New River, NC; **inland waterway between New River and Swansboro, NC**; New River, NC; **Northeast (Cape Fear) River, NC**; Black River, NC; Cape Fear River above Wilmington, NC; Cape Fear River at and below Wilmington, NC; **Lockwoods Folly River, NC**; Yadkin River, NC; Georgetown Harbor, SC; Winyah Bay, SC.

REMOVED from 1889 boundaries: Roanoke River, VA, portion.

1895

Report of Major W. S. Stanton, Corps of Engineers—

Ocracoke Inlet, NC; Fishing Creek, NC; Pamlico and Tar rivers, NC; Contentnea Creek, NC; Trent River, NC; Neuse River, NC; inland waterway between New Bern and Beaufort, NC; harbor at Beaufort, NC; inland waterway between Beaufort Harbor and New River, NC; inland waterway between New River and Swansboro, NC; New River, NC; Northeast (Cape Fear) River, NC; Black River, NC; Cape Fear River above Wilmington, NC; Cape Fear River at and below Wilmington, NC; Lockwoods Folly River, NC; Georgetown Harbor, SC; Winyah Bay, SC.

REMOVED from 1891 boundaries: Staunton River, VA; Roanoke, Yadkin, and Pasquotank rivers, NC; Mackeys Creek, NC.

1900

Report of Captain E. W. Van C. Lucas, Corps of Engineers—

Ocracoke Inlet, NC; Fishing Creek, NC; Pamlico and Tar rivers, NC; Contentnea Creek, NC; Trent River, NC; Neuse River, NC; inland waterway between New Bern and Beaufort, NC; harbor at Beaufort, NC; inland waterway between Beaufort Harbor and New River, NC; New River, NC; Black River, NC; Northeast (Cape Fear) River, NC; Cape Fear River, NC, above Wilmington; Cape Fear River, NC, at and below Wilmington; **Town Creek, Brunswick County, NC**.

REMOVED from 1895 boundaries: inland waterway between New River and Swansboro; Lockwoods Folly River, NC; Georgetown Harbor and Winyah Bay, SC.

1921

Improvement of rivers and harbors in the Wilmington, NC, District—

This district includes river and harbor improvements in central and eastern North Carolina from the mouth of Roanoke River, Albemarle Sound, to Little River, SC, near the state line, embracing the watersheds of all rivers in North Carolina which empty into the sounds thereof or the Atlantic Ocean within the limits stated.

AIWW REMOVED.

1924

Improvements of rivers and harbors in the Wilmington, NC, District—

This district includes river and harbor improvements in central and eastern North Carolina from Pamlico River to Shallotte River, NC, near the state line, embracing the watersheds of all rivers in North Carolina within the limits stated.

AREA REDUCED: north boundary—Pamlico rather than Roanoke River; south boundary—Shallotte rather than Little River.

1935

Improvements of rivers and harbors in the Wilmington, NC, District—

This district includes river and harbor improvements in central and eastern North Carolina from Pamlico River to Shallotte River, NC, near the state line, embracing the watersheds of all rivers in North Carolina within the limits stated **and that portion of the intracoastal waterway between Norfolk, VA, and Beaufort Inlet, NC, south of and including the crossing of the New Holland, Higginsport & Mount Vernon Railroad in Hyde County, NC, as well as the portion of the intracoastal waterway from Cape Fear River, NC, to Winyah Bay, SC, north of Little River, SC.**

1939

Improvement of rivers and harbors in the Wilmington, NC, District—

This district includes all river and harbor improvements in central and eastern North Carolina from **the Virginia state line** to Shallotte River, NC, near the South Carolina state line excepting that part of the waterway from Norfolk, VA, to the sounds of North Carolina north of Albemarle Sound. This includes the watersheds of all rivers in North Carolina within the limits stated except as follows: That part of the Roanoke River Basin above Weldon, NC; that part of the Meherrin River Basin above Murfreesboro, NC; the Chowan River Basin above the confluence of the Nottaway and Blackwater rivers. The district also includes that portion of the intracoastal waterway from the Cape Fear River, NC, to Winyah Bay, SC, north of Little River, SC.

REMOVED from 1935 boundaries: AIWW from Norfolk, VA, to the sounds of North Carolina north of Albemarle Sound; some river basins.

1962

Improvement of rivers and harbors in the Wilmington, NC, District—

This district comprises central and eastern North Carolina **and a portion of south central Virginia, embraced in the drainage basins tributary to the Atlantic Ocean from the southern boundary of Virginia** to Shallotte River, inclusive, with the exception of the Meherrin River Basin above Murfreesboro, NC, the Chowan River Basin above the confluence of the Nottaway and Blackwater rivers, and the Pasquotank River and its tributaries for navigation only. It includes the portion of the Atlantic Intracoastal Waterway from the northern boundary of North Carolina to Little River, SC, **and the portion of the waterway from Norfolk, VA, to the sounds of North Carolina, south of the north shore of Albemarle Sound.**

1981

Improvement of rivers and harbors in the Wilmington, NC, District—

This district comprises central and eastern North Carolina and a portion of south central Virginia, embraced in the drainage basins tributary to the Atlantic Ocean from the southern boundary of Virginia **to the South Carolina state line,** inclusive, with the exception of the Meherrin River Basin above Murfreesboro, NC, the Chowan River Basin above the confluence of the Nottaway and Blackwater rivers, and the Pasquotank River and its tributaries for navigation only. It includes a portion of the Atlantic Intracoastal Waterway from the northern boundary of North Carolina to Little River, SC, and a portion of the waterway from Norfolk, VA, to the sounds of North Carolina, south of the north shore of Albemarle Sound.

APPENDIX C

District Engineers

Many notable officers of the Corps of Engineers have in the past been stationed at Wilmington. Among the 40 men who have served the Wilmington District as District Engineer since 1884, nine have attained the rank of general. Major General C. S. Ridley, District Engineer from 1915 to 1916, was governor of the Panama Canal. Three District Engineers later served as Chief of Engineers. The first District Engineer, Captain William H. Bixby, was Chief from 1910 to 1913. During World War II, Lieutenant General Eugene Reybold directed the largest Corps ever recruited. He became the first officer to rank as lieutenant general while Chief of Engineers. Reybold's predecessor in Wilmington, Major Raymond A. Wheeler, was his successor as Chief of Engineers. Wheeler served with distinction in India and Burma during World War II as Deputy Supreme Commander of Southeast Asia. He served as Chief from 1945 to 1949.

Three officers served as District Engineer twice: Captain E. Eveleth Winslow, Colonel Earl I. Brown, and Colonel George Gillette. Colonels Beverly C. Snow and Beverly C. Snow, Jr., father and son, were both District Engineers. Robert C. Merritt, the Wilmington District's only civilian District Engineer, served in that position during World War I.

DISTRICT ENGINEERS

Captain William H. Bixby	Nov 1884 - Nov 1891
Major W. S. Stanton	Dec 1891 - Oct 1895
Lieutenant Colonel David Porter Heap	Oct 1895 - Mar 1897
Captain W. E. Craighill	Mar 1897 - Mar 1899
Major E. W. Van C. Lucas	Mar 1899 - Nov 1902
Captain E. Eveleth Winslow	Nov 1902 - Sep 1903
Captain R. P. Johnston	Sep 1903 - Sep 1906
Captain E. Eveleth Winslow	Sep 1906 - Nov 1906
Major Joseph E. Kuhn	Nov 1906 - May 1907
Captain Earl I. Brown	May 1907 - Jul 1911
Captain Lewis H. Rand	Jul 1911 - Dec 1911
Major H. W. Stickle	Dec 1911 - Jul 1915
Captain C. S. Ridley	Jul 1915 - Sep 1916
Major A. E. Waldron	Sep 1916 - Sep 1917
Robert C. Merritt (civilian)	Sep 1917 - Mar 1919
Major J. R. D. Matheson	Mar 1919 - Jul 1921
Major Milo P. Fox	Jul 1921 - Aug 1922
Major Oscar O. Kuentz	Aug 1922 - Jun 1926
Major W. A. Snow	Jun 1926 - Oct 1930
Major Raymond A. Wheeler	Oct 1930 - Sep 1933
Lieutenant Colonel Eugene Reybold	Sep 1933 - May 1935
Colonel Ernest D. Peek	May 1935 - Jul 1935
Major Ralph Millis	Jul 1935 - Sep 1938
Major George W. Gillette	Sep 1938 - Oct 1940
Colonel Earl I. Brown	Oct 1940 - Feb 1942
Lieutenant Colonel R. A. Sharrer	Feb 1942 - May 1942
Colonel Wayne S. Moore	May 1942 - May 1943
Lieutenant Colonel John T. Knight, Jr.	May 1943 - Apr 1944
Colonel Ellis E. Haring	Apr 1944 - Dec 1945
Colonel George W. Gillette	Dec 1945 - Nov 1946
Colonel Beverly C. Snow	Nov 1946 - Aug 1947
Colonel Heston R. Cole	Aug 1947 - Jun 1950
Colonel Roland C. Brown	Jun 1950 - Jul 1953
Colonel Raymond L. Hill	Jul 1953 - Jul 1956
Colonel Henry C. Rowland	Jul 1956 - Aug 1959
Colonel Richard P. Davidson	Aug 1959 - Jun 1962
Colonel Joseph S. Grygiel	Jun 1962 - Jun 1965

Colonel Beverly C. Snow, Jr.	Jun 1965 - Jun 1968
Colonel Paul S. Denison	Jun 1968 - Jul 1971
Colonel Albert C. Costanzo	Jul 1971 - Jul 1974
Colonel Homer Johnstone	Jul 1974 - Jul 1977
Colonel Adolph A. Hight	Jul 1977 - Jul 1980
Colonel Robert K. Hughes	Jul 1980 - May 1983
Colonel Wayne A. Hanson	May 1983 -

APPENDIX D

How Corps of Engineers Projects are Initiated, Authorized, and Constructed

The Corps of Engineers never initiates a project. Actually, local interests initiate, Congress authorizes, and the Corps of Engineers constructs federal navigation, flood control, shore protection, and other related projects under its civil works program. The major steps in initiating and processing Corps of Engineers projects are briefly outlined as follows:

1. When local interests feel that a need exists for any type of flood control, navigation, or other improvement, it will be most profitable for them to consult at the outset with the District Engineer of the U.S. Army Engineer District embracing their locality. He will provide full information as to what might be done to solve their particular problem, the authorities under which it might be accomplished, and the procedures necessary to initiate the action desired.

2. Local interests inform their senator or representative in Congress of a navigation, flood control, or related water-resource problem they desire solved and request that solution of the problem be investigated by the federal government.

Two courses of action are open to the senator or representative. If a previous report has been made for the area, he may request a review of previous reports to determine whether any modifications in such reports would be advisable.

If a review report is appropriate, the committee adopts a resolution authorizing the Board of Engineers for Rivers and Harbors to make the review and refers the resolution to the Chief of Engineers for necessary action. If the committee is convinced of the need for an original report, the authorization for investigation will be included in an authorization bill for consideration by Congress. When passed, the bill becomes a directive for the study.

Comprehensive investigations of projects or other solutions are made to determine their economic and engineering feasibility and necessity. In making these surveys the Corps of Engineers cooperates fully with all other federal agencies concerned, as well as with the state and local authorities.

3. When the investigation is authorized, the Chief of Engineers will assign it to an appropriate reporting officer, usually the Division Engineer in whose territory the area is located. The Division Engineer refers the survey to the proper District Engineer for actual accomplishment. Following receipt of the directive requesting an investigation, and upon receipt of funds for the studies, the District Engineer, in close cooperation with local authorities and other federal agencies, begins the necessary engineering and economic investigations.

Public meetings are held to ascertain the views and desires of local people as to the extent and character of the solution desired and on the need for implementation. After careful consideration of the view of the local people, as expressed during the public meetings or otherwise, and after thorough analysis of data obtained through field and office studies, the District Engineer develops a plan of improvement believed to be best suited to the problems under consideration and the area in question. Estimates of benefits and costs are prepared and the requirements of local cooperation decided upon. All these data, together with the recommendations of the District Engineer as to whether the improvement should be authorized, are included in the report on the investigation. A favorable recommendation by the District Engineer is largely dependent upon acceptance and support of the proposed project or other type of solution by the local people and upon environmental considerations and economic justification of the improvement.

4. The report is submitted to the Division Engineer who reviews and approves the report and transmits it to the Chief of Engineers and the Board of Engineers for Rivers and Harbors for review. All interested parties receive a public notice, which sets forth the findings and recommendations of the District and Division Engineers and informs them that they may present their views on the matter to the Board of Engineers for Rivers and Harbors.

5. The board reviews the reports of the District and Division Engineers and carefully considers any additional information from interested parties. Finally, the board prepares its report, including its recommendations, and transmits it to the Chief of Engineers. The Chief of Engineers reviews the reports and all other data and then prepares the report he will submit to Congress. The report is sent to the governors of the states affected and to other interested federal agencies in order to obtain their views and recommendations on the improvements discussed in the report. After full consideration of the comments received, the Chief of Engineers submits the report to the Secretary of the Army. The Secretary of the Army obtains the views of the Office of Management and Budget and transmits the report to Congress.

6. The Committees on Public Works and Transportation of the House and Environment and Public Works of the Senate may hold hearings on the report with a view toward formulating a bill including authorization of projects recommended. If the project is included in an authorization bill, enactment of this bill constitutes authorization of the project.

Section 201 of Public Law 89-298, 89th Congress (1965 Authorization Act), authorized the Secretary of the Army, acting through the Chief of Engineers, to construct and operate projects of less than $20 million federal cost without specific congressional authorization, if approved by resolutions of these committees of the Senate and House of Representatives on the basis of reports submitted to Congress.

Funds for undertaking authorized projects are not provided by the authorization act, but are supplied by a later appropriation. After funding, projects are designed and built in accordance with the authorizing acts and such other general laws as may be applicable, at a rate determined by appropriation of funds.

In addition to the above procedures, Congress has provided several special continuing authorities which give the Secretary of the Army authority to construct small projects without specific authority of Congress. The selection and funding is delegated by the Secretary of the Army to the Chief of Engineers.

To be eligible for work under special continuing authorities, federal assistance must be requested by responsible local bodies. The special continuing authorities are not to be applied for construction of a specifically authorized project, a portion thereof, or an alternate therefor. A special continuing-authority project is to be complete in itself, not requiring additional work to alleviate the problem or to insure successful operation of another project.

The legislation for each type of special continuing authority specifies a cost limitation which is the federal cost ceiling including federal planning, supervision, and administration. Local interests must assume responsibility, in cash usually, for costs which exceed that ceiling in addition to required local costs such as lands and relocations. When a project is approved, construction funds are allotted as available provided local cooperation requirements are met.

7. Often, the completed project is turned over to the local people for operation and maintenance. In any case, the project, which came into being on the initiative of local governments, is available for the public to reap the benefits of the navigation, flood control, shore protection, or related water-resource purposes in their area. The Corps civil works program has great impact on the economy of the community and the nation, providing economic and defense benefits through integrated waterways for waterborne commerce; generation of hydroelectric power; an adequate water supply for municipalities, industries, and agriculture; streamflow regulation for such purposes as water-quality improvement, pollution abatement, and benefit of navigation; fish and wildlife enhancement; and water-based recreation for the general public.

NOTES

Chapter I

1. The following geographical description is derived from several sources, in particular Nevin M. Fenneman, *Physiography of the Eastern United States* (New York: McGraw-Hill, 1938); and Cordelia Camp, *The Influence of Geography upon Early North Carolina* (Raleigh: Carolina Charter Tercentenary Commission, 1963).

2. Fenneman, *Physiography*, p. 13.

3. Hamilton Basso, "If Tortugas Let You Pass," *American Heritage* 7 (February 1956): 46; Gary S. Dunbar, *Historical Geography of the North Carolina Outer Banks* (Baton Rouge: Louisiana State University Press, 1958), pp. 1-3, 215-217; David Stick, *Graveyard of the Atlantic* (Chapel Hill: University of North Carolina Press, 1952). Stick describes the perils of navigation in the waters off the North Carolina coast.

4. Camp, *Influence of Geography*, pp. 11-13.

5. Hugh T. Lefler and Albert R. Newsome, *North Carolina: The History of a Southern State* (Chapel Hill: University of North Carolina Press, 1973), p. 27. This is one of a number of good textbook surveys of the state's history. Another good summary is William S. Powell, *North Carolina: A Bicentennial History* (New York: W. W. Norton, 1977).

6. Lefler and Newsome, *North Carolina*, ch. 3; Camp, *Influence of Geography*, pp. 6-7, 18-21; Charles Christopher Crittenden, "Inland Navigation in North Carolina, 1763-1789," *North Carolina Historical Review* (hereafter *NCHR*) 8 (April 1931): 154; John S. Bassett, "The Influence of Coast Line and Rivers on North Carolina," *Annual Report of the American Historical Association* 1 (1909): 59-61.

7. The map of North and South Carolina is a constant reminder of the eight original proprietors: Edward Hyde; the Duke of Albemarle; William, Earl of Craven; John, Lord Berkeley; Sir William Berkeley; Sir George Carteret; Anthony Ashley Cooper, Earl of Shaftesbury; Sir John Colleton.

8. Lawrence Lee, *New Hanover County: A Brief History* (Raleigh: State Department of Archives and History, 1971), p. 5; Malcolm Ross, *The Cape Fear* (New York: Holt, Rinehart and Winston, 1965), p. 11.

9. R. D. W. Connor, "The Settlement of the Cape Fear," *South Atlantic Quarterly* 6 (July 1907): 272-275.

10. George Davis, former attorney general of the Confederacy, 1879, quoted in ibid., pp. 272-273.

11. Lee, *New Hanover County*, p. 6; Lefler and Newsome, *North Carolina*, pp. 68-71.

12. Duncan P. Randall, "Wilmington, North Carolina: The Historical Development of a Port City," *Annals of the Association of American Geographers* 58 (September 1968): 444.

13. Henry M. Payne, "Naval Stores, 1610-1932," *Military Engineer* 25 (January-February 1933): 13.

14. Camp, *Influence of Geography*, pp. 11-13.

Chapter II

1. Charles C. Weaver, *Internal Improvements in North Carolina Previous to 1860*, Johns Hopkins University Series in Historical and Political Science, series XXI, nos. 3-4 (Baltimore: Johns Hopkins University Press, 1903): 30.

2. Lefler and Newsome, *North Carolina*, p. 322; Crittenden, "Inland Navigation," p. 152. As Mahan expressed a truism of history in 1890, "Notwithstanding all the familiar and unfamiliar dangers of the sea, both travel and traffic by water have always been easier and cheaper than by land. The commercial greatness of Holland was due not only to her shipping at sea, but also to the numerous tranquil water-ways which gave such cheap and easy access to her own interior and to that of Germany. This advantage of carriage by water over that by

land was yet more marked in a period when roads were few and very bad, wars frequent and society unsettled. . . . Sea traffic then went in peril of robbers, but was nevertheless safer and quicker than that by land." Alfred Thayer Mahan, *The Influence of Sea Power Upon History, 1660-1783* (Boston: Little, Brown, 1890, 1918), p. 25.

3. Crittenden, "Inland Navigation," p. 145.

4. Charles Christopher Crittenden, "The Seacoast in North Carolina History, 1763-1789," *NCHR* 7 (October 1930): 441.

5. Crittenden, "Inland Navigation," p. 153.

6. Weaver, *Internal Improvements*, pp. 50-53.

7. Ross, *Cape Fear*, pp. 164, 194-197; C. R. Hinshaw, Jr., "North Carolina Canals Before 1860," *NCHR* 25 (January 1948): 6.

8. Weaver, *Internal Improvements*, pp. 50-54.

9. Ibid., pp. 55-57; Wade H. Hadley, Jr., *The Story of the Cape Fear and Deep River Navigation Company, 1849-1873* (Chatham County Historical Society, 1980), p. viii-ix; D. G. McDuffie to president of Cape Fear and Deep River Navigation Co., 2 January 1856, and McDuffie to president of company, 23 May 1856, File 9, H. A. London Collection, The Southern Historical Collection, Chapel Hill, NC.

10. Weaver, *Internal Improvements*, pp. 57-67.

11. Lefler and Newsome, *North Carolina*, ch. 21.

12. Ibid., pp. 328-333; Weaver, *Internal Improvements,* pp. 12-15; Hamilton Fulton, *Report of Sundry Surveys Made by Hamilton Fulton* (Raleigh: Thomas Henderson, 1819), pp. 1-5.

13. U.S. Army, Corps of Engineers, *Annual Report of the Chief of Engineers* (hereafter *ARCE*), 1876, p. 322; *The Observer* (Raleigh), 11 May 1879. *The Observer* ran a series of articles in May 1879 concerning the Cape Fear River improvements. An 1833 report by Hinton James, who worked on the river, 1823-1833, to Governor David L. Swain was reprinted as part of the series.

14. Clark's Island was a small island 3.5 miles below Wilmington. Fulton closed the channel flowing on the western side of the island between Clark's and Eagle islands. As the channel filled, Clark's Island became part of Eagle Island.

15. *Observer*, 11 May 1879.

16. Ibid.

17. Ibid. Fulton was under constant criticism because of his foreign extraction, his exorbitant salary (1200 pounds sterling, more than the governor got), and his unwillingness to promote purely local projects. Lefler and Newsome, *North Carolina*, p. 332.

18. *Observer*, 14 and 15 May 1879.

19. Quoted in Lefler and Newsome, *North Carolina*, p. 314.

Chapter III

1. *The Geneses of the United States Army Corps of Engineers* (Washington: Department of the Army, 1978); Stephen E. Ambrose, *Duty, Honor, Country: A History of West Point* (Baltimore: Johns Hopkins University Press, 1966), pp. 21-23; *History and Traditions of the Corps of Engineers* (Fort Belvoir, VA: The Engineer School, 1953), pp. 1-11.

2. *Register of Debates in Congress*, vol. 2 (Washington, 1826): xxv; *Petition of Inhabitants of Wilmington, North Carolina*, Senate Document (Sen. Doc.) 49, 19th Cong., 2d sess.

3. Macomb to Bache, 6 September 1826, Letters Sent by the Office of the Chief of Engineers Relating to Internal Improvements 1824-1830, Records of the Office of the Chief of Engineers, Record Group 77, National Archives (hereafter RG77), National Archives Microfilm M65, Roll 1.

4. George W. Cullum, *Biographical Register of the Officers and Graduates of the U.S. Military Academy at West Point, N.Y.*, vol. 1 (Boston: Houghton Mifflin, 1891): 202-205.

5. The following summary of Bache's survey report is taken from *Cape Fear River*, House Document (H. Doc.) 127, 20th Cong., 1st sess.

6. *ARCE, 1829*, p. 50; *Observer*, 14 May 1879.

7. *Observer*, 14 May 1879.

8. Ibid.; Blaney to Gratiot, 5 January 1830, Letters Received 1826-1866, RG77, National Archives, Washington, DC (hereafter NA).

9. Cullum, *Biographical*, p. 448.

10. H. Doc. 127, 20th Cong., 1st sess., p. 5; *ARCE, 1886*, p. 1006.

11. *ARCE, 1834*, p. 410; *ARCE, 1839*, p. 223.

12. The following summary of the commission's report is taken from *ARCE, 1853*, pp. 418-435.

13. Woodbury to Totten, 6 March 1854, and Bache to Totten, 13 March 1854, Letters Received 1826-1866, RG77, NA.

14. Woodbury to Totten, 23 January 1854, Letters Received 1826-1866, RG77, NA; *ARCE, 1876*, p. 324.

15. *ARCE, 1876*, p. 324.

16. Ibid.

17. Ibid.; *ARCE, 1853*, pp. 424-425.

18. Quoted in *Swash in Pamlico Sound*, H. Doc. 69, 20th Cong., 1st sess., pp. 5-6.

19. Macomb to Bache, 30 August 1826, RG77, NA Microfilm M65, Roll 1.

20. H. Doc. 69, 20th Cong., 1st sess., p. 6.

21. Ibid., p. 9. Camels imparted additional buoyancy to vessels, enabling them to cross shoals. They were usually two or more watertight chests equipped with plugs and pumps. Water was admitted to sink the chests in position, and they were then attached to the sides of the vessels. When the water was pumped out the camels rose, lifting the vessel. They had been used successfully in Holland.

22. *Register of Debates*, vol. 4, p. xxiv.

23. Dutton to Gratiot, 16 April 1830, Letters Received, Ocracoke 1892, Wilmington District files (hereafter WDF), RG77, Atlanta Regional Archives Branch, Atlanta, Georgia (hereafter ARAB).

24. Carney to Eliason, 29 August 1829, Letters Received, Ocracoke 1892, WDF, ARAB.

25. Dutton to Gratiot, 16 April 1830, Letters Received, Ocracoke 1892, WDF, ARAB.

26. Ibid.

27. Ibid.

28. Dutton to Gratiot, 16 August 1830, Letters Received 1826-1866, RG77, NA.

29. David F. Bastian, "Dredges of the 1830's Deepened Passages to North Carolina," *World Dredging*, October 1975, p. 14; *ARCE, 1830*, in *Register of Debates*, vols. 7, 27.

30. *ARCE, 1832*, in *Register of Debates*, vols. 9, 29.

31. *ARCE, 1834*, p. 408.

32. Ibid.

33. Ibid., p. 409.

34. Ibid.

35. *ARCE, 1835*, pp. 686-687.

36. *ARCE, 1836*, p. 853.

37. Swift to Gratiot, 20 October 1837, Letters Received 1826-1866, RG77, NA.

38. Woodbury to Totten, 3 February 1853, and Woodbury to Totten, 9 February 1853, Letters Received 1826-1866, RG77, NA; *ARCE, 1839*, pp. 222-223.

Chapter IV

1. Lawrence Lee, *The History of Brunswick County, North Carolina* (Southport: Brunswick County, 1978), pp. 45-46, 71-75; Bruce Grant, *American Forts: Yesterday and Today* (New York: E. P. Dutton, 1965), p. 147.

2. Robert Arthur, "Early Coast Fortification," *Military Engineer* 354 (August 1961): 279-280.

3. Report of Lt. Col. Jonathan Williams, 28 May 1803, Document 37, Reel 1, Buell Collection of Historical Documents Relating to the Corps of Engineers (hereafter Buell Collection), RG77, NA Microfilm M417.

4. Ibid.; *Geneses of the U.S. Army Corps of Engineers.*

5. Cullum, *Biographical*, pp. 51-56; Joseph Gardner Swift, *The Memoirs of General Joseph Gardner Swift, 1800-1865* (privately printed, 1890), p. 51. Southport was known as Smithville until 1886.

6. Swift, *Memoirs*, p. 54.

7. Williams to Secretary of War, 29 February 1808, Doc. 143, Reel 1, Buell Collection, RG77, NA Microfilm M417. Macomb served as Chief, 1821-1828; Gratiot served as Chief, 1828-1838.

8. Macomb to Secretary of War, 10 August 1808, Doc. 177, Reel 1, Buell Collection, RG77, NA Microfilm M417.

9. Macomb to Secretary of War, 6 October 1809, Doc. 22; Secretary of War to Gratiot, 26 October 1809, Doc. 224; Macomb to Secretary of War, 30 October 1809, Doc. 226; all in Reel 1, Buell Collection, RG77, NA Microfilm M417.

10. Swift to Secretary of War, 7 February 1810, Doc. 242, Reel 1, Buell Collection, RG77, NA Microfilm M417.

11. Ibid.; Secretary of War to Swift, 9 April 1810, Doc. 247; Swift to Secretary of War, 26 August 1811, Doc. 277; all in Reel 1, Buell Collection, RG77, NA Microfilm M417.

12. Swift to General Pinckney, 3 July 1812, Doc. 328; Armistead to Secretary of War, 15 May 1815, Doc. 557; both in Reel 2, Buell Collection, RG77, NA Microfilm M417.

13. Arthur, "Early Fortifications," p. 281.

14. Lee, *Brunswick County*, pp. 96-97; Lewis P. Hall, *Land of the Golden River* (Wilmington: Wilmington Printing, 1975), pp. 237-239.

15. *ARCE, 1826, Register of Debates*, vol. 3, p. 1567; *ARCE, 1832, Register of Debates*, vol. 9, p. 26.

16. Swift to Gratiot, 27 August 1837, Letters Received 1826-1866, RG77, NA.

17. Blaney to Gratiot, 3 August 1833; Swift to Totten, 7 November 1839; both Letters Received 1826-1866, RG77, NA.

18. Foster to Totten, 18 May 1861, Letters Received 1826-1866, RG77, NA.

19. Dutton to Gratiot, 20 November 1834, Letters Received 1826-1866, RG77, NA; Richard S. Barry, "Fort Macon: Its History," *NCHR* 27 (April 1950): 153-158.

20. Ames W. Williams, "Fort Macon—152 Years Old," *Periodical Journal of the Council on Abandoned Military Posts* 10 (Spring 1978): 46-50; Willard Robinson, *American Forts: Architectural Form and Function* (Urbana: University of Illinois Press, 1977), p. 104; State of North Carolina, Department of Conservation and Development, Division of State Parks, "A Guide and Brief History of Fort Macon" (July 1965).

21. Kingman to Mackenzie, 7 December 1907, General Correspondence 1894-1923, RG77, NA.

22. Kirby to Macomb, 16 January 1835, Letters Received 1826-1866, RG77, NA.

23. Williams, "Fort Macon," pp. 46-50; State of North Carolina, "Brief History of Fort Macon," p. 2.

24. Lee Report, 22 January 1841, Letters Received 1826-1866, RG77, NA.

25. Woodbury to Totten, 15 October 1846; Cullum to Thayer, 24 February 1858; both Letters Received 1826-1866, RG77, NA.

26. Charles B. Robbins, "Fort Caswell: Batteries to Baptists," *Periodical Journal of the Council on Abandoned Military Posts* 9 (Winter 1977-1978): 17-21; State of North Carolina, "Brief History of Fort Macon."

Chapter V

1. Harold Kanarek, *The Mid-Atlantic Engineers: A History of the Baltimore District, U.S. Army Corps of Engineers, 1774-1974* (Washington: Government Printing Office, 1976), pp. 45-46; *Geneses of the U.S. Army Corps of Engineers.*

2. John Parke to Phillips, 13 September 1878, Letters Sent 1871-1886, RG77, NA.

3. Allan Nevins, *The War for the Union: The Organized War to Victory, 1864-1865* (New York: Charles Scribner's Sons, 1971), pp. 189-193. See also

Richard Wood, "Port Town at War: Wilmington, North Carolina, 1860-1965," Ph.D. dissertation, Florida State University, 1979.

4. Ibid.; Shelby Foote, *The Civil War: A Narrative, Red River to Appomattox* (New York: Random House, 1974), pp. 740-747.

5. Henry Nutt Scrapbook, Henry Nutt Collection, The Southern Historical Collection, Chapel Hill, North Carolina, p. 68; William McKee Evans, *Ballots and Fence Rails: Reconstruction on the Lower Cape Fear* (New York: Norton, 1974), pp. 106-109; Dan and Inez Morris, *Who Was Who in American Politics* (New York: Hawthorn Books, 1974), pp. 1-2.

6. *ARCE, 1870*, p. 421.

7. Ibid., p. 70.

8. *ARCE, 1873*, p. 789; *ARCE, 1874*, p. 71; *ARCE, 1877*, p. 333.

9. *ARCE, 1873*, pp. 799-803.

10. *ARCE, 1875*, p. 100; *ARCE, 1874*, p. 72; *ARCE, 1872*, p. 748.

11. *ARCE, 1876*, pp. 328-329.

12. Frederick C. Scheffauer, ed., *The Hopper Dredge: Its History, Development, and Operation* (Washington: Government Printing Office, 1954), p. 5.

13. *ARCE, 1876*, pp. 328-329.

14. Ibid.

15. *ARCE, 1873*, pp. 799-803.

16. *ARCE, 1874*, p. 72.

17. *ARCE, 1875*, pp. 98-99.

18. *ARCE, 1876*, pp. 314-315.

19. Ibid.

20. Henry Bacon Diary, Henry Bacon Collection, The Southern Historical Collection, Chapel Hill, North Carolina, Introduction. Bacon was the father of Henry Bacon, Jr., designer of the Lincoln Memorial.

21. *ARCE, 1877*, p. 335.

22. *ARCE, 1878*, pp. 477-478.

23. Ibid., p. 493.

24. Evans, *Ballots*, p. 182; Nutt Scrapbook, p. 70; *ARCE, 1879*, p. 556.

25. *ARCE, 1879*, p. 559.

26. *ARCE, 1880*, p. 699.

27. *ARCE, 1881*, p. 922.

28. Nutt Scrapbook, p. 67.

29. Bacon Diary, 23 February 1881.

30. Ibid., 26 and 27 August 1881; *ARCE, 1882*, p. 938.

31. *ARCE, 1882*, p. 939.

32. *ARCE, 1883*, p. 720; Lynn M. Alperin, *Custodians of the Coast: History of the United States Army Engineers at Galveston* (Galveston: Galveston District, U.S. Army Corps of Engineers, 1977), pp. 42-45.

33. Instead of stone, the original owner of Gander Hall had visions of supplying the Wilmington area with featherbeds. To acquire a source of supply, he purchased a flock of geese. Plucking went well for the first year but for some unaccountable reason the flock did not increase. The geese were not laying eggs. The master investigated and found that all his geese were ganders. From that day on, the plantation was known as Gander Hall.

34. *ARCE, 1884*, pp. 940-941.

35. The award citation is on display in the District office.

Chapter VI

1. Newton to Bixby, 11 July 1884, 1884 vol. 2, Letters Sent 1871-1886, RG77, NA.

2. Herbert Deakyne, "Memoir of William Herbert Bixby," *Transactions of the American Society of Civil Engineers*, 1929, pp. 1768-71; *Geneses of the U.S. Army Corps of Engineers*; Bixby to Newton, 15 September 1884, 1884 vol. 2, Letters Sent 1871-1886, RG77, NA.

3. *ARCE, 1885*, p. 395; Newton to Bixby, 7 August 1884, 1884 vol. 2, and Newton to Bixby, 10 January 1885, 1885 vol. 1, Letters Sent 1871-1886, RG77, NA.

4. Heap to Humphreys, 26 November 1895, Correspondence Received, Cape Fear Below Wilmington, 1893-1897, WDF, RG77, ARAB.

5. William P. Craighill, "Memoir of Charles Humphreys,' *Transactions of the American Society of Civil Engineers*, June 1907, pp. 534-537; Mrs. Robert Ransom to Stanton, 15 January 1892, Miscellaneous Letters Sent 1892-1894, WDF, RG77, ARAB; Chadbourn citation as a member of the Wilmington District's Hall of Fame. The Hall of Fame is a recognition of distinguished former employees. The picture with a short biography of each member of the Hall of Fame hangs on the wall outside the District Engineer's office on the third floor of the Federal Building. Members of the Hall of Fame are Henry Bacon, Charles Humphreys, William Hobbs Chadbourn, Jr., James C. Lodor, Robert C. Merritt, Harry Thomas Paterson, Carl Jonathan Josenhans, Horace Vincent Conly, Thomas J. Hewitt, Paul M. Snell, Leon C. McDuffie, Jr., Nels C. Magnuson, Hamilton Hicks, Earle Merrill, Maurice Wester, and William Sanderson.

6. Matheson to Division Engineer, 6 October 1919, no. 55, General Administrative files, 1907-1952, WDF, RG77, ARAB.

7. Interview, author with Hamilton Hicks, Wilmington, 10 February 1982; John Wessell, "Engineer Enters 48th Year of Service," *Wilmington Sunday Star-News Magazine*, 21 February 1932.

8. Stanton to Thompson, 31 October 1893, and Stanton to Casey, 31 October 1893, Letters Sent, Cape Fear Below Wilmington, 1892-1894, WDF, RG77, ARAB.

9. Edward I. Pross, "A History of Rivers and Harbors Appropriation Bills, 1866-1933," Ph.D. dissertation, Ohio State University, pp. 49, 56, 84, 95.

10. *ARCE, 1881*, pp. 1013-15; *ARCE, 1882*, p. 1095; *Surveys of Certain Rivers in North Carolina*, H. Ex. Doc. 78, 46th Cong., 3d sess.

11. Evans, *Ballots*, pp. 80, 101-103.

12. *ARCE, 1885*, p. 768; *ARCE, 1886*, pp. 989-990.

13. *Beaufort Harbor, N.C.*, H. Doc. 511, 61st Cong., 2d sess.; *Bogue Sound, N.C.*, H. Doc. 649, 61st Cong., 2d sess.; *ARCE, 1910*, p. 344.

14. *ARCE, 1873*, p. 855; *ARCE, 1876*, pp. 361-362; *ARCE, 1877*, p. 1366; *ARCE, 1878*, p. 540.

15. *ARCE, 1881*, p. 1003; *ARCE, 1884*, p. 1037.

16. *ARCE, 1884*, p. 168.

17. *ARCE, 1913*, p. 468; *ARCE, 1932*, pp. 534-535; *Tar River, N.C.*, H. Doc. 5, 55th Cong., 1st sess.; Stanton to Casey, 2 June 1893, Letters Sent, Pamlico-Tar Rivers, 1892-1894, WDF, RG77, ARAB.

18. *ARCE, 1879*, p. 93.

19. *ARCE, 1886*, p. 979; Stanton to Chadbourn, 14 July 1892, Letters Sent, Neuse River, 1892-1895, WDF, RG77, ARAB.

20. *ARCE, 1881*, p. 1004; *ARCE, 1882*, p. 1086.

21. "Waterways within the State of North Carolina," no. 122, General Administrative files 1907-1952, WDF, RG77, ARAB.

22. Total appropriations for the following rivers, in the period 1870-1912, were Trent River, $133, 750; Roanoke River, $246,000; New River, $92,200; and Contentnea Creek, $81,000.

23. *ARCE, 1893*, p. 1359.

24. Lt. Lucas later served as District Engineer in Wilmington, 1899-1902; *ARCE, 1893*, p. 1361.

25. Stanton to Casey, 15 May 1893, Letters Sent, Ocracoke Inlet, 1892-1904, WDF, RG77, ARAB.

26. Ibid.

27. Branch to Casey, 23 June 1894, Reports Sent 1895, WDF, RG77, ARAB; Stanton to Hains, 8 June 1895, Letters Sent, Ocracoke Inlet, 1893-1905, WDF, RG77, ARAB.

28. *ARCE, 1896*, p. 1098; *ARCE, 1897*, p. 1386.

29. *ARCE, 1898*, p. 1238; *ARCE, 1903*, p. 227; *ARCE, 1904*, p. 230.

30. *ARCE, 1888*, pp. 903-904; *ARCE, 1890*, p. 1157.

31. Craighill to Bacon, 23 December 1884, Correspondence Received, Cape Fear Below Wilmington, 1884-1893, WDF, RG77, ARAB.

32. Craighill to Bacon, 10 January 1885, Correspondence Received, Cape Fear Below Wilmington, 1884-1893, WDF, RG77, ARAB.

33. Burgwyn to Lamont, 3 June 1895, Letters Received, Cape Fear Below Wilmington, 1894–1895, WDF, RG77, ARAB.

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GLOSSARY

APRON	A concrete, planking, or brushwood structure along the bank of a river, along a seawall or below a dam (to prevent scour).
BAR	A submerged or partly submerged bank of material along a shore or in a river formed by currents and often obstructing navigation.
BATTERY	A group of guns or other weapons set up in a certain area.
BERM	A low, almost horizontal, narrow terrace on the backshore of a beach.
BREACH	A gap, as in a wall, made by battering.
BREAKWATER	An offshore structure used to protect a harbor or beach from the force of waves.
CANAL	An artificial waterway used for navigation.
CARRIAGE	The mobile or fixed support for a cannon.
CASEMATE	A bombproof enclosure with openings, used as a gun emplacement.
CHANNEL	The deeper part of a river or harbor which carries the main current.
CUT	A channel made by dredging.
DRAFT	The depth of water a ship draws.
DREDGE	A machine or vessel used to remove material from a waterway. To deepen a waterway by removing material.
DUNE	A mound of sand.
EMBANKMENT	A raised structure, usually earthen, to hold back water.
ESTUARY	A water passage where the tide meets a river current.
FORESHORE	The part of a seashore between high-water and low-water marks.
FRESHET	A great rise or overflowing of a stream caused by heavy rains or melting snow.
GRILLAGE	A system of timber or steel beams used to spread a load over a comparatively large area, generally used for temporary construction.
GROIN	A rigid structure built out from a shore to protect the shore from erosion, to trap sand, or to direct a current for scouring a channel.
INLET	A narrow water passage between peninsulas or through a barrier island leading to a bay or lagoon.
JETTY	A structure extended into a sea, lake, or river to influence the current or tide or to protect a harbor.
LIGHTERAGE	The unloading of a ship's cargo to reduce the draft of the ship.

LITTORAL DRIFT	The movement of sedimentary material such as sand along an ocean shore, influenced by waves and current.
LOCK	An enclosure with gates at each end used in raising or lowering boats as they pass from level to level of a watercourse.
MATTRESS	A mass of interwoven brush and poles serving as a foundation in soft ground.
RIPRAP	Odd-sized stones used to build a foundation or sustaining wall, especially to prevent erosion of an embankment or shoreline.
SCANTLING	A small piece of lumber.
SCOUR	To clear or remove by the current of a river or by waves.
SHOAL	Shallow. A sandbank that makes water shallow.
SLUICE	A channel through which water passes. May be an artificial channel, especially a temporary wooden channel to control water level.
SLURRY	A watery mixture of insoluble matter such as mud.
SNAG	A tree or branch embedded in a lake or stream bed, constituting a hazard to navigation. To clear a river of obstructions.
SWASH	A narrow channel of water lying within a sand bank or between a sand bank and the shore; may be dry at low tide.
WEIR	A partition or breakwater having in its top edge an opening or openings of fixed dimensions through which water can flow.

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