

# PRELIMINARY FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in  
**CARTERET COUNTY, NORTH  
CAROLINA AND  
INCORPORATED AREAS**



Community Name	Community Number
CARTERET COUNTY	370043
TOWN OF ATLANTIC BEACH	370044
TOWN OF BEAUFORT	375346
TOWN OF BOGUE	370491
TOWN OF CAPE CARTERET	370046
TOWN OF CEDAR POINT	370465
TOWN OF EMERALD ISLE	370047
TOWN OF INDIAN BEACH	370433
TOWN OF MOREHEAD CITY	370048
TOWN OF NEWPORT	370049
TOWN OF PELETIER	370658
TOWN OF PINE KNOLL SHORES	370267



**PRELIMINARY: 6/30/2016**

**REVISED: 6/30/2016**

**Federal Emergency Management Agency**

**State of North Carolina**

**Flood Insurance Study Number**

**37031CV000**

**[www.fema.gov](http://www.fema.gov) and [www.ncfloodmaps.com](http://www.ncfloodmaps.com)**



# FOREWORD

This countywide Flood Insurance Study (FIS) Report was produced through a unique cooperative partnership between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long-term approach to floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map floodplain areas at the state level. As a part of this effort, the State of North Carolina has joined with FEMA in a Cooperating Technical State (CTS) agreement to produce and maintain this FIS Report and the accompanying digital Flood Insurance Rate Map (FIRM) for North Carolina.

## NOTICE TO FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

The following is a list of the publication dates of this Countywide FIS Report starting with the initial Report accompanying the North Carolina Statewide FIRM:

Date	Reason
7/16/2003	Initial Countywide FIS Report Effective Date

This FIS has been produced as part of the North Carolina Floodplain Mapping Program. Carteret County, North Carolina, falls under the administrative jurisdiction of Region IV of the Federal Emergency Management Agency (FEMA). Questions concerning this FIS may be directed to the North Carolina Floodplain Mapping Program at [www.ncfloodmaps.com](http://www.ncfloodmaps.com), the FEMA Map Assistance Center by calling the toll-free information line at 1-877-FEMA MAP (1-877-336-2627), or by contacting the FEMA Regional Office at the following address:

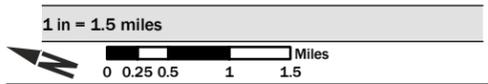
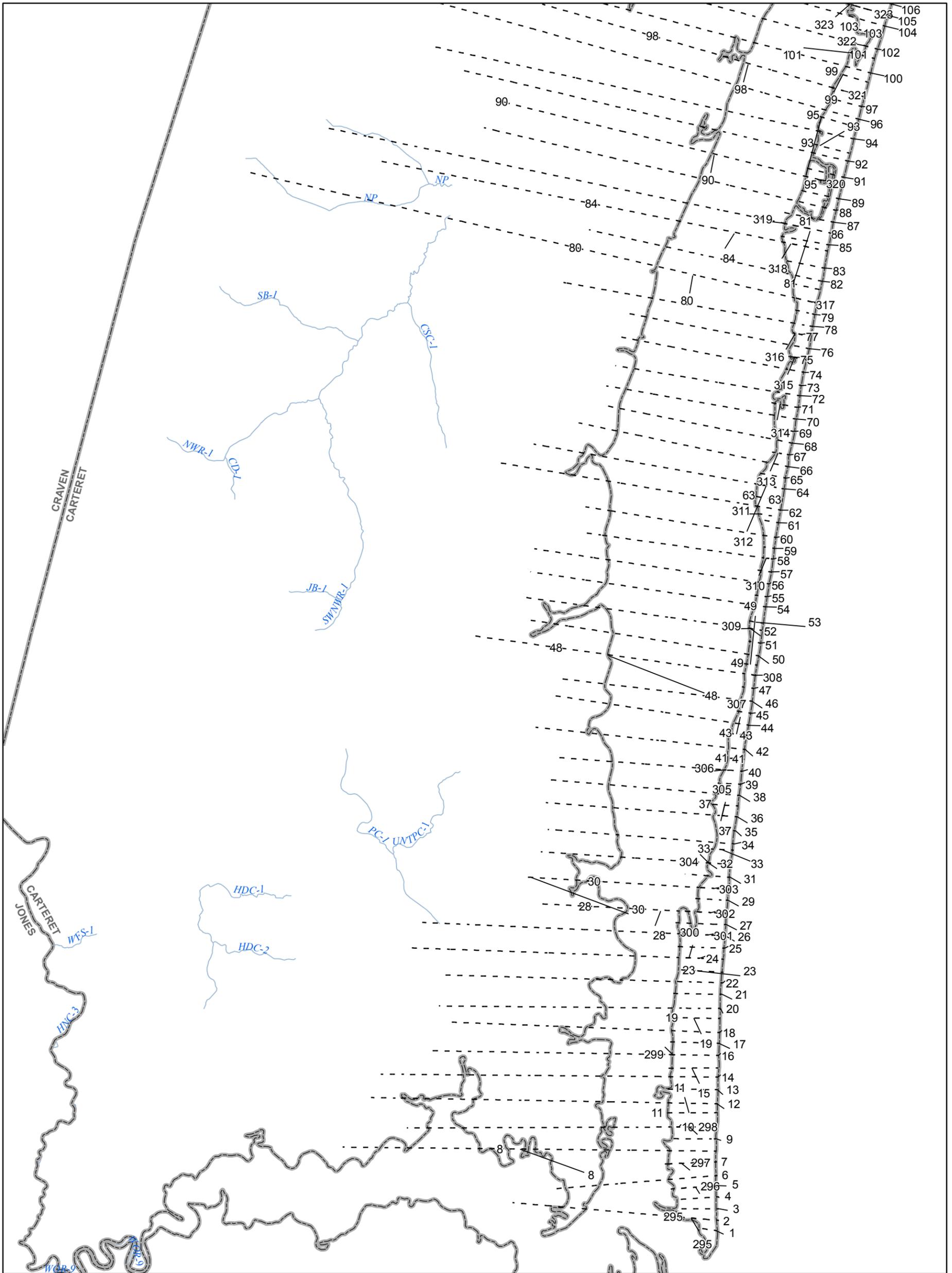
**FEMA, Federal Insurance and Mitigation Administration**  
**Koger Center - Rutgers Building**  
**3003 Chamblee Tucker Road**  
**Atlanta, Georgia 30341**  
**(770) 220-5400**

# Table of Contents

<b>Sections</b>	<b>Page</b>
<b>Section 1.0 Introduction</b>	<b>1</b>
1.1 The National Flood Insurance Program	1
1.2 Purpose of this Flood Insurance Study	1
1.3 FIS Components	2
1.4 Considerations for Using this Flood Insurance Study Report	2
<b>Section 2.0 Floodplain Management Applications</b>	<b>3</b>
2.1 Floodplains	3
2.2 Floodways	3
2.3 Base Flood Elevations	4
2.4 Watershed Characteristics	4
2.5 Coastal Flood Hazard Areas	5
<b>Section 3.0 Insurance Applications</b>	<b>8</b>
3.1 National Flood Insurance Program Insurance Zones	8
3.2 Coastal Barrier Resources System	9
<b>Section 4.0 Area Studied</b>	<b>10</b>
4.1 Basin Description	10
4.2 Principal Flood Problems	10
4.3 Historic Flood Elevations	10
4.4 Flood Protection Measures	12
4.5 Scope of Study	12
<b>Section 5.0 Engineering Methods</b>	<b>15</b>
5.1 Hydrologic Analyses	15
5.2 Hydraulic Analyses	17
5.3 Coastal Analyses	25
<b>Section 6.0 Mapping Methods</b>	<b>35</b>
6.1 Vertical and Horizontal Control	35
6.2 Base Map	37
6.3 Floodplain and Floodway Delineation	38
6.4 Coastal Flood Hazard Mapping	41
<b>Section 7.0 Revising the FIS</b>	<b>58</b>
7.1 Letters of Map Amendment and Letters of Map Revision - Based on Fill	58
7.2 Letters of Map Revision	59
7.3 Physical Map Revisions	59
7.4 Contracted Restudies	59
7.5 Map Revision History	60
<b>Section 8.0 Study Contracting and Community Coordination</b>	<b>60</b>
8.1 Authority and Acknowledgments	60
8.2 Consultation Coordination Officer's Meetings/Scoping Meetings	61
<b>Section 9.0 Guide to Additional Information</b>	<b>64</b>
9.1 Additional Information	64
<b>Section 10.0 Appendix</b>	<b>64</b>
10.1 Bibliography	64
 <b>Tables</b>	 <b>Page</b>
Jurisdictions	1
Flood Designations	9
Basin Description	10
Principal Flood Problems	10
Scope of Revisions: Revised or Newly Studied - Preliminary	13
Scope of Revisions : Limited Detailed - Preliminary	13

Flooding Sources Studied by Detailed Methods: Revised or Newly Studied . . . . .	14
Flooding Sources Studied by Detailed Methods: Limited Detailed . . . . .	14
Summary of Discharges . . . . .	15
Roughness Coefficients . . . . .	18
Limited Detailed Flood Hazard Data . . . . .	25
Summary of Coastal Analyses - Preliminary: Revised or Newly Studied . . . . .	26
Summary of Coastal Analyses . . . . .	27
Coastal Transect Parameters . . . . .	35
Datum Conversion Locations and Values . . . . .	36
Floodway Data Table . . . . .	41
Summary of Coastal Transect Mapping Considerations . . . . .	58
Map Revision History . . . . .	60
Authority and Acknowledgments . . . . .	61
Consultation Coordination Officer's Meetings . . . . .	61
Scoping Meetings . . . . .	62
Preliminary and Public Participation Meetings . . . . .	63
Map Repositories . . . . .	64
<b>Figures</b>	<b>Page</b>
Floodway Schematic . . . . .	4
North Carolina's State Plane Coordinate System . . . . .	38



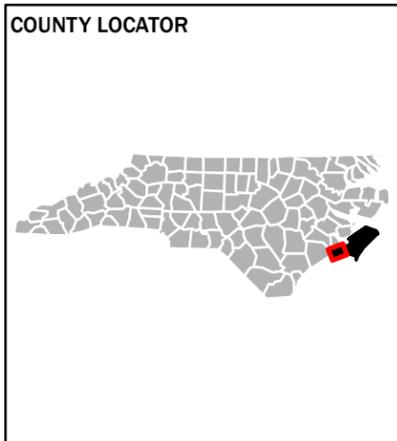


Map Projection:  
Lambert Conformal Conic  
North American Datum 1983

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

[HTTP://FRIS.NC.GOV/FRIS](http://FRIS.NC.GOV/FRIS)

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION



## NATIONAL FLOOD INSURANCE PROGRAM

### TRANSECT LOCATOR MAP

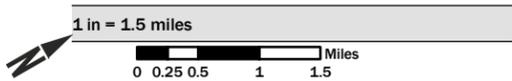
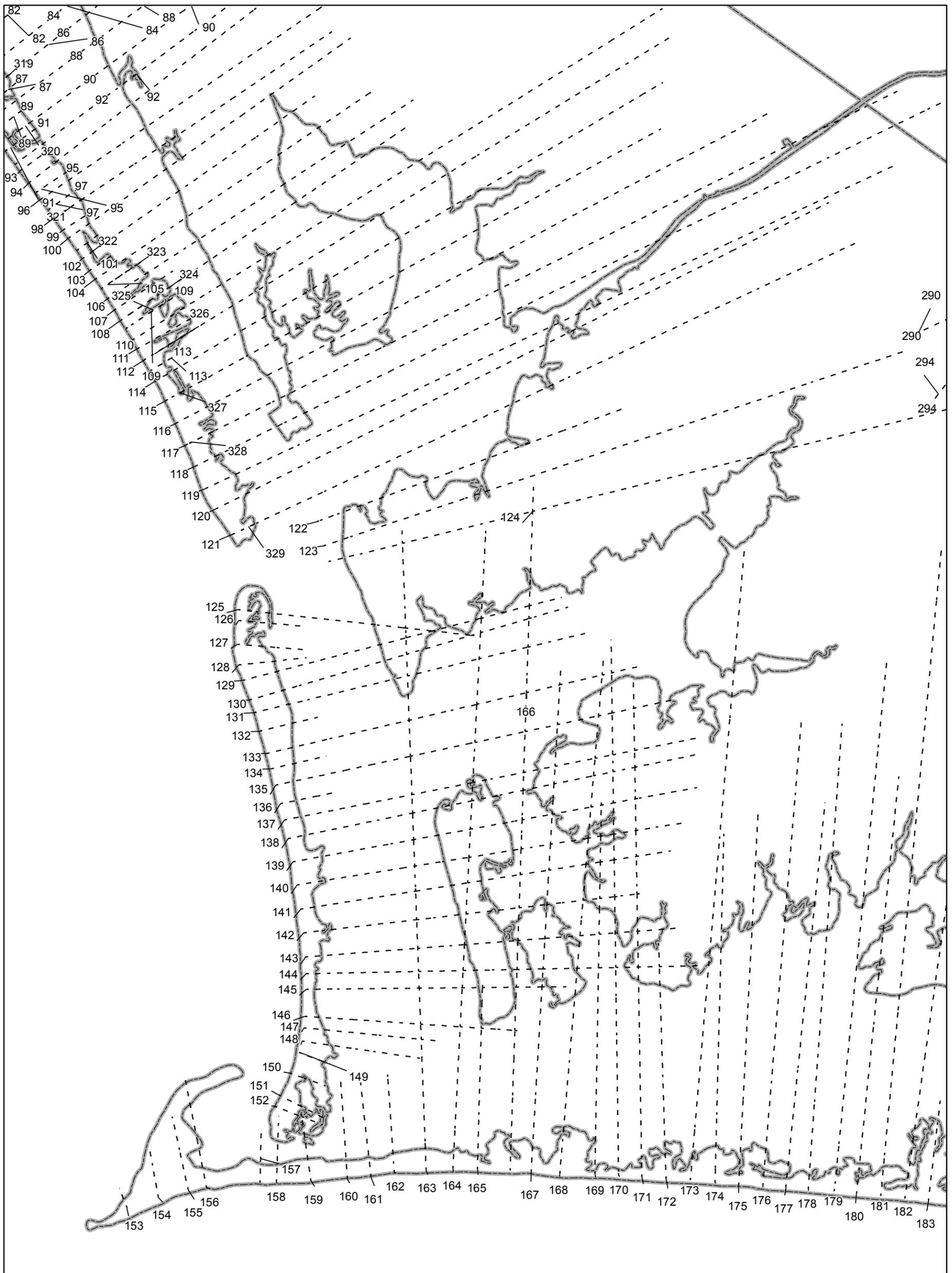
#### CARTERET COUNTY, NORTH CAROLINA

##### PANELS WITH TRANSECTS:

- 7482, 7492, 8402, 8412, 8422, 5366, 5386, 6306, 6347, 6357, 6367, 6377, 6387, 6397, 7331, 7341, 7408, 7448, 7468, 8479, 8489, 8499, 8468, 8478, 8488, 6486, 7426, 7446, 7466, 7486, 8407, 8426, 8457, 8467, 8477, 8406, 8446, 8456, 8466, 6484, 7404, 7424, 7444, 7464, 7485, 7495, 8405, 8415, 8425, 8435, 8445, 8455, 7484, 7494, 8404, 8414, 8424, 8434, 8444, 6482, 7402, 7422, 7442, 7462, 7483, 7493, 8403, 8413, 8423, 8433, 6440, 6460, 6480, 7400, 7420, 7440, 7460, 7481, 7491, 8401, 8411, 7480, 7490, 8400, 6349, 6368, 6388, 7308, 7328, 7348, 7368, 7389, 7399, 6348, 6358, 7388, 7307, 7317, 7327, 7337, 7346, 7367, 7377, 6326, 6336, 6346, 6356, 6366, 6376, 6386, 6396, 7306, 7316, 7326, 7336, 7366, 7376, 5365, 5375, 5385, 5395, 6305, 6315, 6325, 6335, 6345, 6355, 6365, 6375, 6385, 6395, 7305, 7315, 7325, 7335, 7345, 7355, 7365, 5364, 5374, 5384, 5394, 6304, 6314, 6324, 6334, 6344, 6354, 7304, 7314, 7324, 7334, 7344, 7354, 5363, 5373, 5383, 5393, 6303, 7323, 7333, 7343, 7353, 5362, 7332, 7342



FEMA



Map Projection:  
Lambert Conformal Conic  
North American Datum 1983

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

[HTTP://FRIS.NC.GOV/FRIS](http://FRIS.NC.GOV/FRIS)

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

TRANSECT LOCATOR MAP

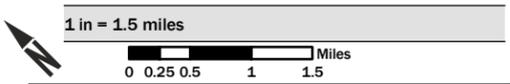
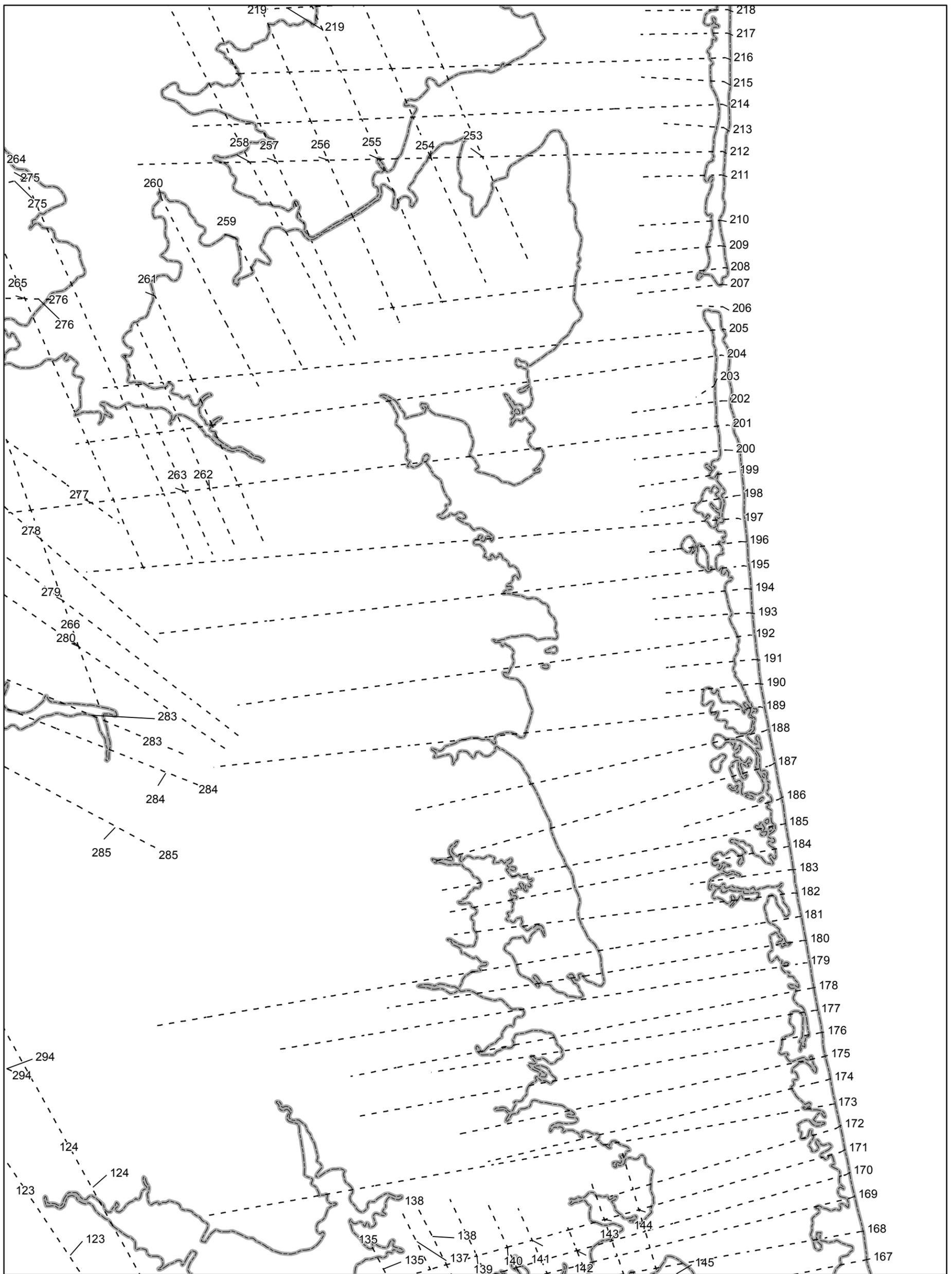
CARTERET COUNTY, NORTH CAROLINA

PANELS WITH TRANSECTS:

7482, 7492, 8402, 8412, 8422, 5366, 5386, 6306, 6347, 6357, 6367, 6377, 6387, 6397, 7331, 7341, 7408, 7448, 7468, 8479, 8489, 8499, 8468, 8478, 8488, 6486, 7426, 7446, 7466, 7486, 8407, 8426, 8457, 8467, 8477, 8406, 8446, 8456, 8466, 6484, 7404, 7424, 7444, 7464, 7485, 7495, 8405, 8415, 8425, 8435, 8445, 8455, 7484, 7494, 8404, 8414, 8424, 8434, 8444, 6482, 7402, 7422, 7442, 7462, 7483, 7493, 8403, 8413, 8423, 8433, 6440, 6460, 6480, 7400, 7420, 7440, 7460, 7481, 7491, 8401, 8411, 7480, 7490, 8400, 6349, 6368, 6388, 7308, 7328, 7348, 7368, 7389, 7399, 6348, 6358, 7388, 7307, 7317, 7327, 7337, 7346, 7367, 7377, 6326, 6336, 6346, 6356, 6366, 6376, 6386, 6396, 7306, 7316, 7326, 7336, 7366, 7376, 5365, 5375, 5385, 5395, 6305, 6315, 6325, 6335, 6345, 6355, 6365, 6375, 6385, 6395, 7305, 7315, 7325, 7335, 7345, 7355, 7365, 5364, 5374, 5384, 5394, 6304, 6314, 6324, 6334, 6344, 6354, 7304, 7314, 7324, 7334, 7344, 7354, 5363, 5373, 5383, 5393, 6303, 7323, 7333, 7343, 7353, 5362, 7332, 7342



FEMA



Map Projection:  
Lambert Conformal Conic  
North American Datum 1983

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

[HTTP://FRIS.NC.GOV/FRIS](http://FRIS.NC.GOV/FRIS)

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

TRANSECT LOCATOR MAP

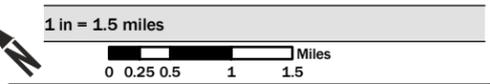
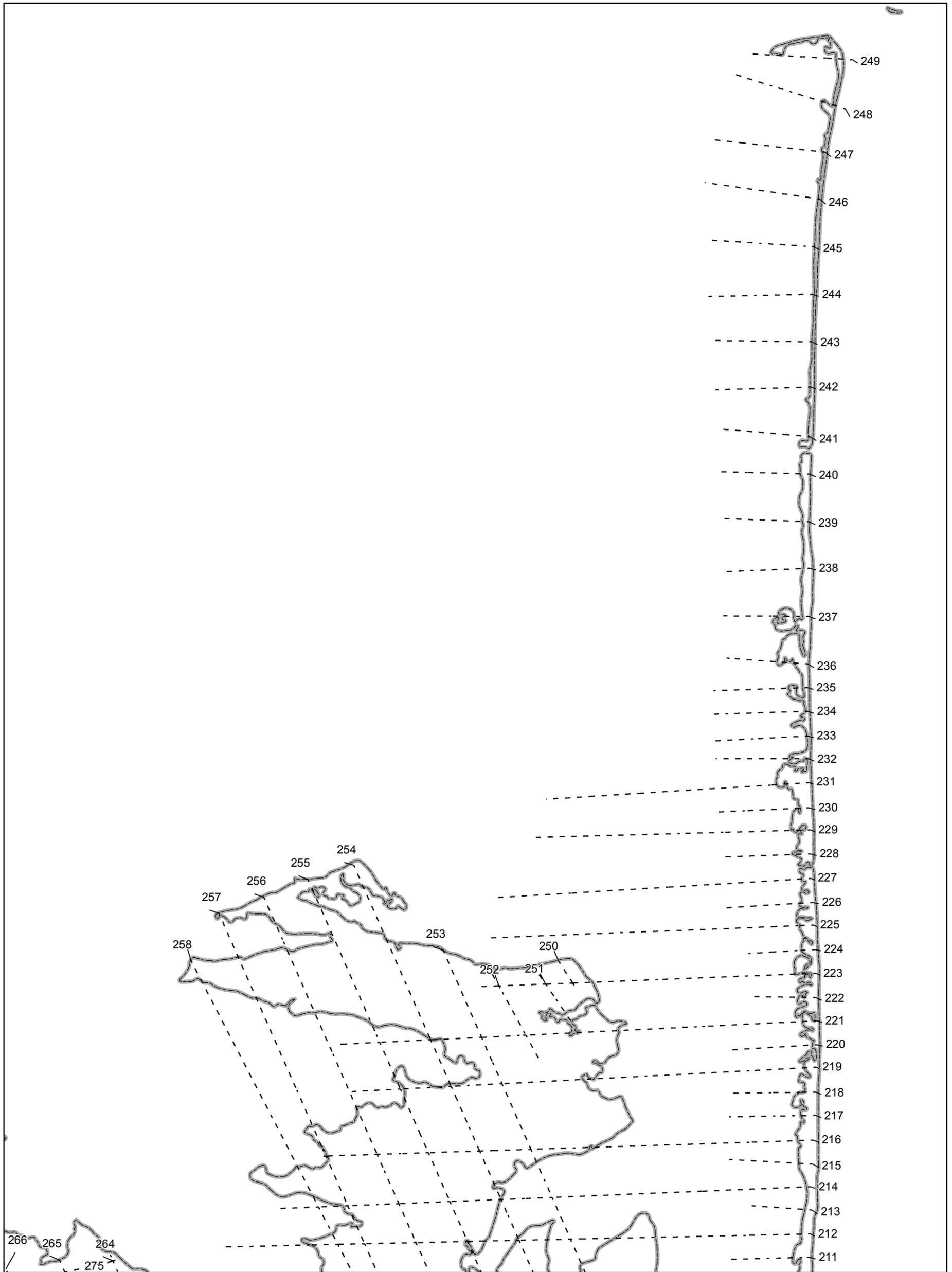
CARTERET COUNTY, NORTH CAROLINA

PANELS WITH TRANSECTS:

7482, 7492, 8402, 8412, 8422, 5366, 5386, 6306, 6347, 6357, 6367, 6377, 6387, 6397, 7331, 7341, 7408, 7448, 7468, 8479, 8489, 8499, 8468, 8478, 8488, 6486, 7426, 7446, 7466, 7486, 8407, 8426, 8457, 8467, 8477, 8406, 8446, 8456, 8466, 6484, 7404, 7424, 7444, 7464, 7485, 7495, 8405, 8415, 8425, 8435, 8445, 8455, 7484, 7494, 8404, 8414, 8424, 8434, 8444, 6482, 7402, 7422, 7442, 7462, 7483, 7493, 8403, 8413, 8423, 8433, 6440, 6460, 6480, 7400, 7420, 7440, 7460, 7481, 7491, 8401, 8411, 7480, 7490, 8400, 6349, 6368, 6388, 7308, 7328, 7348, 7368, 7389, 7399, 6348, 6358, 7388, 7307, 7317, 7327, 7337, 7346, 7367, 7377, 6326, 6336, 6346, 6356, 6366, 6376, 6386, 6396, 7306, 7316, 7326, 7336, 7366, 7376, 5365, 5375, 5385, 5395, 6305, 6315, 6325, 6335, 6345, 6355, 6365, 6375, 6385, 6395, 7305, 7315, 7325, 7335, 7345, 7355, 7365, 5364, 5374, 5384, 5394, 6304, 6314, 6324, 6334, 6344, 6354, 7304, 7314, 7324, 7334, 7344, 7354, 5363, 5373, 5383, 5393, 6303, 7323, 7333, 7343, 7353, 5362, 7332, 7342



FEMA



Map Projection:  
Lambert Conformal Conic  
North American Datum 1983

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

[HTTP://FRIS.NC.GOV/FRIS](http://FRIS.NC.GOV/FRIS)

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

TRANSECT LOCATOR MAP

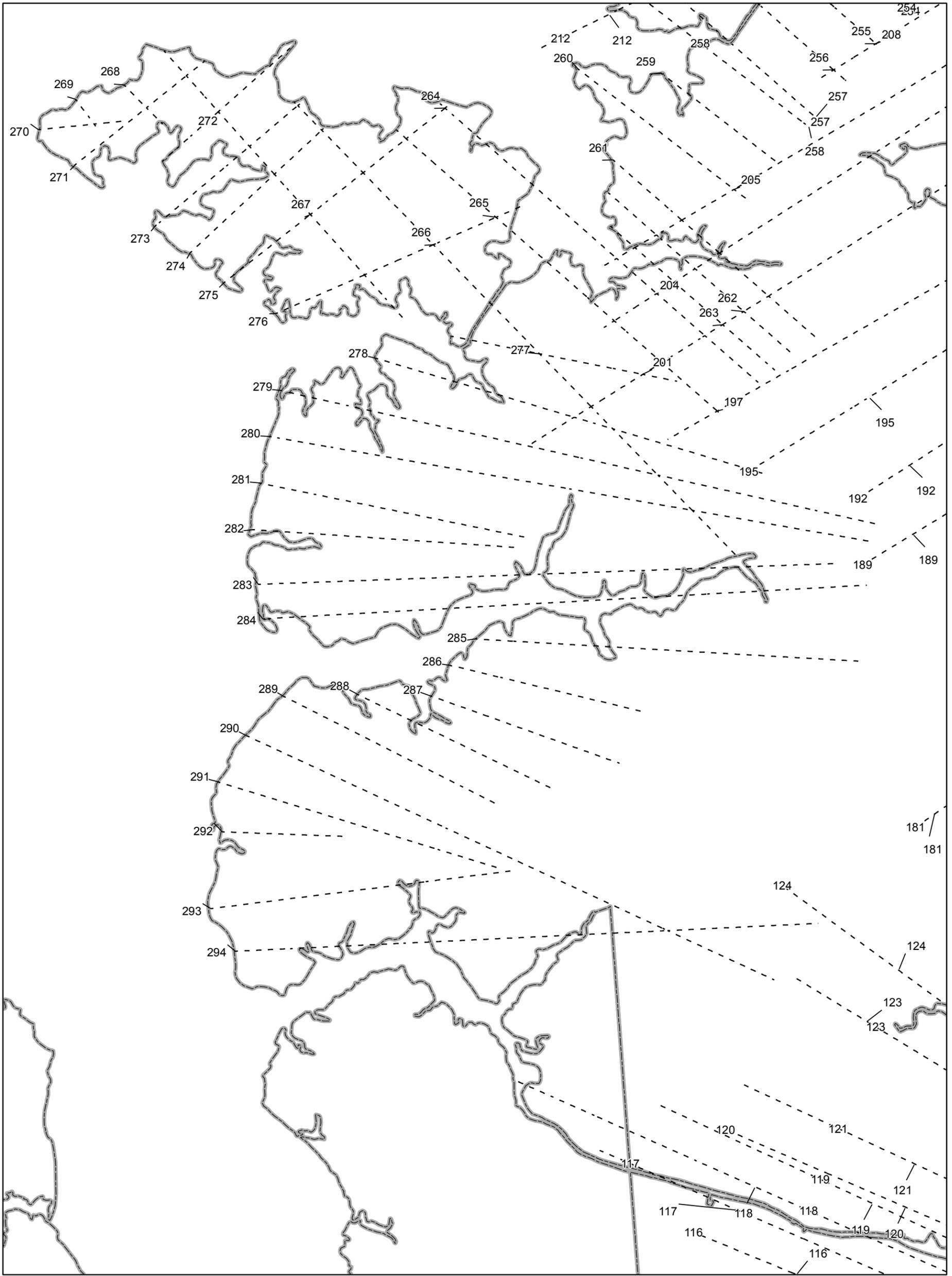
CARTERET COUNTY, NORTH CAROLINA

PANELS WITH TRANSECTS:

7482, 7492, 8402, 8412, 8422, 5366, 5386, 6306, 6347, 6357, 6367, 6377, 6387, 6397, 7331, 7341, 7408, 7448, 7468, 8479, 8489, 8499, 8468, 8478, 8488, 6486, 7426, 7446, 7466, 7486, 8407, 8426, 8457, 8467, 8477, 8406, 8446, 8456, 8466, 6484, 7404, 7424, 7444, 7464, 7485, 7495, 8405, 8415, 8425, 8435, 8445, 8455, 7484, 7494, 8404, 8414, 8424, 8434, 8444, 6482, 7402, 7422, 7442, 7462, 7483, 7493, 8403, 8413, 8423, 8433, 6440, 6460, 6480, 7400, 7420, 7440, 7460, 7481, 7491, 8401, 8411, 7480, 7490, 8400, 6349, 6368, 6388, 7308, 7328, 7348, 7368, 7389, 7399, 6348, 6358, 7388, 7307, 7317, 7327, 7337, 7346, 7367, 7377, 6326, 6336, 6346, 6356, 6366, 6376, 6386, 6396, 7306, 7316, 7326, 7336, 7366, 7376, 5365, 5375, 5385, 5395, 6305, 6315, 6325, 6335, 6345, 6355, 6365, 6375, 6385, 6395, 7305, 7315, 7325, 7335, 7345, 7355, 7365, 5364, 5374, 5384, 5394, 6304, 6314, 6324, 6334, 6344, 6354, 7304, 7314, 7324, 7334, 7344, 7354, 5363, 5373, 5383, 5393, 6303, 7323, 7333, 7343, 7353, 5362, 7332, 7342



FEMA



1 in = 1.5 miles



Map Projection:  
Lambert Conformal Conic  
North American Datum 1983

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

[HTTP://FRIS.NC.GOV/FRIS](http://FRIS.NC.GOV/FRIS)

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

COUNTY LOCATOR



**NATIONAL FLOOD INSURANCE PROGRAM**

TRANSECT LOCATOR MAP

**CARTERET COUNTY, NORTH CAROLINA**  
PANELS WITH TRANSECTS:

7482, 7492, 8402, 8412, 8422, 5366, 5386, 6306, 6347, 6357, 6367, 6377, 6387, 6397, 7331, 7341, 7408, 7448, 7468, 8479, 8489, 8499, 8468, 8478, 8488, 6486, 7426, 7446, 7466, 7486, 8407, 8426, 8457, 8467, 8477, 8406, 8446, 8456, 8466, 6484, 7404, 7424, 7444, 7464, 7485, 7495, 8405, 8415, 8425, 8435, 8445, 8455, 7484, 7494, 8404, 8414, 8424, 8434, 8444, 6482, 7402, 7422, 7442, 7462, 7483, 7493, 8403, 8413, 8423, 8433, 6440, 6460, 6480, 7400, 7420, 7440, 7460, 7481, 7491, 8401, 8411, 7480, 7490, 8400, 6349, 6368, 6388, 7308, 7328, 7348, 7368, 7389, 7399, 6348, 6358, 7388, 7307, 7317, 7327, 7337, 7346, 7367, 7377, 6326, 6336, 6346, 6356, 6366, 6376, 6386, 6396, 7306, 7316, 7326, 7336, 7366, 7376, 5365, 5375, 5385, 5395, 6305, 6315, 6325, 6335, 6345, 6355, 6365, 6375, 6385, 6395, 7305, 7315, 7325, 7335, 7345, 7355, 7365, 5364, 5374, 5384, 5394, 6304, 6314, 6324, 6334, 6344, 6354, 7304, 7314, 7324, 7334, 7344, 7354, 5363, 5373, 5383, 5393, 6303, 7323, 7333, 7343, 7353, 5362, 7332, 7342



FEMA

# 1.0 Introduction

## 1.1 The National Flood Insurance Program

In 1968, Congress created the National Flood Insurance Program (NFIP) in response to the rising cost of taxpayer-funded disaster relief for flood victims and the increasing amount of damage caused by floods. The NFIP makes federally backed flood insurance available in communities that agree to adopt and enforce floodplain management ordinances to reduce future flood damage. Federally backed flood insurance is available in more than 19,000 communities across the United States and its territories.

The NFIP is managed by the Federal Insurance and Mitigation Administration of the Federal Emergency Management Agency (FEMA). The Federal Insurance and Mitigation Administration manages the insurance component of the NFIP and oversees the flood hazard mapping and the floodplain management aspects of the program.

The NFIP, through involvement with communities, the insurance industry, and the lending industry, helps reduce flood damage by nearly \$800 million a year. Further, buildings constructed in compliance with NFIP building standards suffer approximately 80% less damage annually than those not built in compliance. In addition, every \$3 paid in flood insurance claims saves \$1 in disaster assistance payments. The NFIP is self-supporting for the average historical loss year, which means that operating expenses and flood insurance claims are not paid by the taxpayer, but through premiums collected for flood insurance policies.

Additional information of interest to homeowners, community officials, insurance companies, lenders, and study contractors is available in Section 9.0 of this FIS Report and on the NFIP Internet homepage at <http://www.fema.gov/business/nfip/>.

## 1.2 Purpose of this Flood Insurance Study

Flood Insurance Studies (FISs) are one of the primary means by which the NFIP administers the National Flood Insurance Act of 1968, the Flood Disaster Protection Act of 1973, and the National Flood Insurance Reform Act of 1994. FISs develop flood risk data that are used to establish actuarial flood insurance rates. The information in this FIS Report will also be used by Carteret County and the jurisdictions therein (hereinafter referred to collectively as Carteret County) to facilitate the adoption and maintenance of floodplain management ordinances, which form the basis of communities' continued participation in the NFIP. Minimum requirements for participation in the NFIP are set forth in Title 44, Part 60, Section 3 of the Code of Federal Regulations (44 CFR 60.3). In some States and/or communities, floodplain management criteria or regulations may exist that are more restrictive than the minimum Federal requirements. In such cases, the more restrictive criteria will take precedence, and the State and/or community (or other jurisdictional agency) will be able to explain them.

This FIS investigates the existence and severity of flood hazards in, or revises and updates previous FISs for, the geographic area of Carteret County, North Carolina, including the jurisdictions listed in Table 1.

**Table 1 - Jurisdictions in Carteret County**

Community	Included in this FIS	If Not Included, Location of Flood Hazard/Flood Insurance Rate Data
CARTERET COUNTY	Yes	*
TOWN OF ATLANTIC BEACH	Yes	*
TOWN OF BEAUFORT	Yes	*
TOWN OF BOGUE	Yes	*
TOWN OF CAPE CARTERET	Yes	*
TOWN OF CEDAR POINT	Yes	*
TOWN OF EMERALD ISLE	Yes	*
TOWN OF INDIAN BEACH	Yes	*
TOWN OF MOREHEAD CITY	Yes	*
TOWN OF NEWPORT	Yes	*

TOWN OF PELETIER	Yes	*
TOWN OF PINE KNOLL SHORES	Yes	*

## 1.3 FIS Components

A Flood Insurance Study (FIS) is an analysis of flood hazards, typically presented as a set of Flood Insurance Rate Map (FIRM) panels and the FIS Report, which includes a set of Flood Profiles and/or Water-surface elevation rasters.

### Flood Insurance Study Report

The FIS Report provides a context for the information shown on the FIRM, as well as a summary of the data upon which the analyses are based. It also includes an index of sources of additional information on the NFIP.

## 1.4 Considerations for Using this Flood Insurance Study Report

The NFIP encourages State and local governments to implement sound floodplain management programs. To assist in this endeavor, each FIS Report provides floodplain data, which may include a combination of the following: 10-, 4-, 2-, 1-, and 0.2-percent annual chance flood elevations (the 1% annual chance flood elevation is also referred to as the Base Flood Elevation (BFE)); delineations of the 1% annual chance and 0.2% annual chance floodplains; and 1% annual chance floodway. This information is presented on the FIRM and/or in many components of the FIS Report, including Flood Profiles, Floodway Data tables, Summary of Non-Coastal Stillwater Elevations tables, and Coastal Transect Parameters tables (not all components may be provided for a specific FIS).

It is, therefore, the responsibility of the user to consult with community officials by contacting the community repository to obtain the most current FIS Report components. Communities participating in the NFIP have established repositories of flood hazard data for floodplain management and flood insurance purposes. Community map repository addresses are provided in Table 27, "Map Repositories," within this FIS Report.

New FIS Reports are frequently developed for multiple communities, such as entire counties. A countywide FIS Report incorporates previous FIS Reports for individual communities and the unincorporated area of the county (if not jurisdictional) into a single document and supersedes those documents for the purposes of the NFIP.

The Initial Countywide FIS Report for Carteret became Effective on 7/16/2003. Refer to Table XX for information about subsequent revisions to FIRMs.

Selected FIRM panels for the community may contain information (such as floodways and cross sections) that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels. In addition, former flood hazard zone designations have been changed as follows:

Old Zone	New Zone
A1 through A30	AE
V1 through V30	VE
B	X (shaded)
C	X (unshaded)

FEMA does not impose floodplain management requirements or special insurance ratings based on Limit of Moderate Wave Action (LiMWA) delineations at this time. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. If the LiMWA is shown on the FIRM, it is being provided by FEMA as information only. For communities that do adopt Zone VE building standards in the area defined by the LiMWA, additional Community Rating System (CRS) credits are available. Refer to Section 2.5.4 for additional information about the LiMWA.

The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Visit the FEMA Web site at <http://www.fema.gov> or contact your appropriate FEMA Regional Office for more information about this program.

Previous FIS Reports and FIRMs may have included levees that were accredited as reducing the risk associated with the 1% annual chance flood based on the information available and the mapping standards of the NFIP at that time. For FEMA to continue to accredit the identified levees, the levees must meet the criteria of the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10), titled "Mapping of Areas Protected by Levee Systems.

Since the status of levees is subject to change at any time, the user should contact the appropriate agency for the latest information regarding levees presented in Table 9 of this FIS Report. For levees owned or operated by the U.S. Army Corps of Engineers (USACE), information may be obtained from the USACE national levee database. For all other levees, the user is encouraged to contact the appropriate local community.

FEMA has developed a Guide to Flood Maps (FEMA 258) and online tutorials to assist users in accessing the information contained on the FIRM. These include how to read panels and step-by-step instructions to obtain specific information. To obtain this guide and other assistance in using the FIRM, visit the FEMA Web site at <http://www.fema.gov>.

## 2.0 Floodplain Management Applications

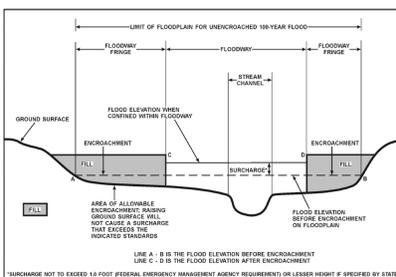
Flood events of a magnitude expected to occur with a 10%, 2%, 1%, or 0.2% annual chance have been selected as having special significance for developing sound floodplain management programs. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10%, 2%, 1%, and 0.2% chance, respectively, of being equaled in any given year. Therefore, FIS Reports typically determine water-surface elevations for floods with these probabilities. The FIRM delineates 1% and 0.2% annual chance floodplains and 1% annual chance floodway boundaries, and depicts 1% annual chance flood elevations, rounded to the nearest foot, to assist in developing floodplain management measures.

### 2.1 Floodplains

To provide a national standard without regional discrimination, the 1% annual chance flood has been adopted by FEMA as the base flood for floodplain management purposes. A 1% annual chance flood, or base flood, is defined as that having a 1% chance of being equaled or exceeded in any given year. The 1% annual chance floodplains shown on the FIRM identify areas that are expected to be inundated by the 1% annual chance flood. This 1% annual chance floodplain is also called a Special Flood Hazard Area (SFHA), where the NFIP's floodplain management regulations must be enforced by the community as a condition of participation in the NFIP. The 0.2% annual chance floodplain is employed to indicate additional areas of flood risk associated with exceptionally severe floods.

### 2.2 Floodways

Encroachment on floodplains such as that caused by placement of structures and fill reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, floodways are provided as a tool to assist local communities in this aspect of floodplain management. Under this concept, the 1% annual chance riverine floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights. Figure 1, "Floodway Schematic," illustrates this principle. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this FIS are presented to local agencies as a minimum standard that can be adopted directly or that can be used as a basis for additional encroachment studies.



**Figure 1- Floodway Schematic**

## **2.3 Base Flood Elevations**

The hydraulic characteristics of flooding sources were analyzed to provide estimates of the elevations of floods of the selected recurrence intervals. The Base Flood Elevation (BFE) is the elevation of the 1% annual chance flood. These BFEs are most commonly rounded to the whole foot, as shown on the FIRM, but in certain circumstances or locations they may be rounded to 0.1 foot. Cross section lines shown on the FIRM may also be labeled with the BFE rounded to 0.1 foot. Whole-foot BFEs derived from engineering analyses that apply to coastal areas, areas of ponding, or other static areas with little elevation change may also be shown at selected intervals on the FIRM. Cross sections with BFEs shown on the FIRM correspond to the cross sections shown in the Floodway Data table and Flood Profiles in this FIS Report. BFEs are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM.

Coastal flood elevations are provided in the Summary of Coastal Stillwater Elevations table in this report. If the elevation on the FIRM is higher than the elevation shown in this table, a wave height, wave runoff and/or wave setup component likely exists, in which case, the higher elevation should be used for construction and/or floodplain management purposes.

## **2.4 Watershed Characteristics**

Because a FIS is a probability analysis that may not account for some of the factors listed below, communities are strongly encouraged to consider adopting more restrictive or higher floodplain management criteria or ordinances than the minimum Federal requirements. Communities may also increase the validity of their flood hazard data by investing in continuous maintenance of river gages (see the Data Validity and Reliability paragraph below). If the U.S. Geological Survey (USGS) or other agencies do not maintain gages on the flooding sources of interest, partnerships with the USGS may be pursued, or local gages may be installed. For more information, see Section 9.0 of this report.

This flood hazard study represents an analysis of certain watershed characteristics, some of which are summarized as follows:

### **Drainage Area**

In general, streams that drain larger areas have greater flood hazards. FISs, in North Carolina, do not typically analyze flood hazards in places with rural drainage areas of less than one square mile and within urban drainage areas of less than ½ square mile.

### **Soil Permeability and Infiltration**

Differences in the types of soil and the amount of vegetation in a watershed have a significant effect on the amount of water that the soil can absorb; soils with a high sand content absorb much more water than soils with a high clay content. The presence of vegetation increases infiltration; the presence of pavement decreases infiltration and also speeds runoff to receiving waters. As soil permeability and infiltration decrease, the volume and rate of overland flow increases.

### **Soil Moisture Conditions**

In addition to soil permeability and infiltration, the level of the water table helps determine the saturation point, beyond which no water is absorbed. As rainfall duration increases, the height of the water table increases.

### **Channel and Floodplain Geometry**

The geometric contour of a streambed, termed channel geometry, and the geometric contour of a floodplain determine the volume of water that a channel can hold and partially determine the rate at which water flows through it.

### **Channel and Floodplain Roughness**

The roughness of a surface affects the characteristics of runoff whether the water is on the surface of the watershed or in the channel.

FIS Reports include analyses of how these factors will combine to produce overland flow patterns during floods that have a certain probability of occurring in any given year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at shorter intervals or even within the same year. The risk of experiencing a rare flood increases when longer periods are considered. For example, the risk of having a flood which equals or exceeds the 1% annual chance

flood (1% chance of annual exceedence) in any 50-year period is approximately 40% (4 in 10), but for any 90-year period, the risk increases to approximately 60% (6 in 10).

It is important to note that the 1% annual chance flood is used as the national standard to allow a consistent approach to floodplain management, flood hazard assessment, and flood hazard mapping. In any given community, a number of factors may result in flooding characteristics that do not conform to predicted conditions. Therefore, the determination that an area is not shown on the FIRM as being within a Special Flood Hazard Area is no guarantee that it will not flood during a 1% annual chance flood. Examples of these factors include Data Validity and Reliability; Developmental and Topographic Changes Over Time; Erosion, Deposition, and Debris Flow; and Meandering and Lateral Migration.

#### **Data Validity and Reliability**

Certain types of analysis methods yield more justifiable characterizations of flood hazards. For example, a gage analysis, to determine peak discharges, is based on actual measurements of watershed conditions over time and, therefore, is typically considered the most accurate method of hydrologic analysis. However, it is not feasible to install enough gages to gather data on every stream. In addition, for many of the gage sites that do exist, there are interruptions in the period of record. The usefulness of gage data for the purpose of predicting flooding behavior decreases with interruptions in the period of record; predicted flooding conditions over a 100-year period based on 20 years of measurements spread over a 35-year period are less valid than those based on 30 years of continuous measurements. A regression analysis is typically considered the best method in the absence of gage data, as it uses gage data from watersheds with similar characteristics to estimate flood frequency and magnitude in an ungaged watershed. Regression equations reflect average conditions for a region; therefore, the results will not exactly match the results of a gage analysis at a particular location. The standard errors of the North Carolina rural regression equations range from 44 to 51 percent for estimates of the 1% annual chance flood. That means the difference between the results of the regression equation and the gage analysis for approximately two-thirds of the locations that gage data exists are within 44 to 51 percent of the gage analysis results. A rainfall-runoff hydrologic analysis may be used for gaged or ungaged watersheds, and can estimate the effects of storage areas and flood control structures and measures. This method is most valid when calibrated against historical data.

#### **Developmental and Topographic Changes Over Time**

A FIRM is based on the best topographic and planimetric information available to FEMA and the State of North Carolina at the time the study is produced. In time, however, development and/or natural phenomena can alter the physical characteristics of a watershed and its drainage channels, resulting in changes in the flood hazards in those areas. For example, constructing a housing subdivision reduces the amount of soil that is available to absorb water; this in turn causes an increase in the volume of surface water that flows into the channel.

#### **Erosion, Deposition, and Debris Flow**

The flood hazards shown on a FIRM are based on the assumption of unobstructed flow. The FIRM does not reflect an analysis of areas that are subject to erosion caused by the increased water-surface elevations and velocities that occur during flooding. In addition to the risks of landslides or a weakening of the ground underneath roads or structures, any sediment that is removed from one location will be deposited in another; accumulated deposits may have a pronounced effect on flood hazards in those areas. Similarly, debris such as fallen trees or branches, litter, or other items may obstruct stream channels or hydraulic structures, increasing water-surface elevations, velocities, and floodplain width.

#### **Meandering and Lateral Migration**

FISs are based on the assumption that channel geometry will remain stable during normal drainage and during flood events. This assumption is valid for most streams, which flow over bedrock or between bedrock outcroppings that form non-alluvial channels. However, alluvial streams change the channel geometry with time, significantly so during flood events. Alluvial streams are subject to erosion and deposition, which may result in braided or meandering channels. Streams of this type may be characterized by lateral migration, or channel shifting, in which the stream may change course entirely during a flood. Whenever clear evidence is available, a FIRM will identify the alluvial nature of a studied flooding source and designate wider floodways to allow for potential migration. However, these floodways are based on qualitative assessments and not on quantitative geomorphic and engineering analyses.

## **2.5 Coastal Flood Hazard Areas**

For most areas along rivers, streams, and small lakes, BFEs and floodplain boundaries are based on the amount of water expected to

enter the area during a 1% annual chance flood and the geometry of the floodplain. Floods in these areas are typically caused by storm events. However, for areas on or near ocean coasts, large rivers, or large bodies of water, BFE and floodplain boundaries may need to be based on additional components, including storm surges and waves. Communities on or near ocean coasts face flood hazards caused by offshore seismic events as well as storm events.

Coastal flooding sources that are included in this Flood Risk Project are shown in Table XX.

### 2.5.1 Water Elevations and the Effects of Waves

Specific terminology is used in coastal analyses to indicate which components have been included in evaluating flood hazards.

The stillwater elevation (SWEL or still water level) is the surface of the water resulting from astronomical tides, storm surge, and freshwater inputs, but excluding wave setup contribution or the effects of waves.

- *Astronomical tides* are periodic rises and falls in large bodies of water caused by the rotation of the earth and by the gravitational forces exerted by the earth, moon and sun.
- *Storm surge* is the additional water depth that occurs during large storm events. These events can bring air pressure changes and strong winds that force water up against the shore.
- *Freshwater inputs* include rainfall that falls directly on the body of water, runoff from surfaces and overland flow, and inputs from rivers.

The 1% annual chance stillwater elevation is the stillwater elevation that has been calculated for a storm surge from a 1% annual chance storm. The 1% annual chance storm surge can be determined from analyses of tidal gage records, statistical study of regional historical storms, or other modeling approaches. Stillwater elevations for storms of other frequencies can be developed using similar approaches.

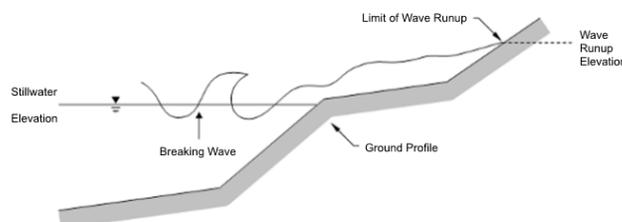
The total stillwater elevation (also referred to as the mean water level) is the stillwater elevation plus wave setup contribution but excluding the effects of waves.

- *Wave setup* is the increase in stillwater elevation at the shoreline caused by the reduction of waves in shallow water. It occurs as breaking wave momentum is transferred to the water column.

Like the stillwater elevation, the total stillwater elevation is based on a storm of a particular frequency, such as the 1% annual chance storm. Wave setup is typically estimated using standard engineering practices or calculated using models, since tidal gages are often sited in areas sheltered from wave action and do not capture this information.

Coastal analyses may examine the effects of overland waves by analyzing storm-induced erosion, overland wave propagation, wave runup, and/or wave overtopping.

- *Storm-induced erosion* is the modification of existing topography by erosion caused by a specific storm event, as opposed to general erosion that occurs at a more constant rate.
- *Overland wave propagation* describes the combined effects of variation in ground elevation, vegetation, and physical features on wave characteristics as waves move onshore.
- *Wave runup* is the uprush of water from wave action on a shore barrier. It is a function of the roughness and geometry of the shoreline at the point where the stillwater elevation intersects the land.
- *Wave overtopping* refers to wave runup that occurs when waves pass over the crest of a barrier.



## Figure 5: Wave Runup Transect Schematic

### 2.5.2 Floodplain Boundaries and BFEs for Coastal Areas

For coastal communities along the Atlantic and Pacific Oceans, the Gulf of Mexico, the Great Lakes, and the Caribbean Sea, flood hazards must take into account how storm surges, waves, and extreme tides interact with factors such as topography and vegetation. Storm surge and waves must also be considered in assessing flood risk for certain communities on rivers or large inland bodies of water.

Beyond areas that are affected by waves and tides, coastal communities can also have riverine floodplains with designated floodways, as described in previous sections.

#### Floodplain Boundaries

In many coastal areas, storm surge is the principle component of flooding. The extent of the 1% annual chance floodplain in these areas is derived from the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm. The methods that were used for calculation of total stillwater elevations for coastal areas are described in Section 5.3 of this FIS Report. Location of total stillwater elevations for coastal areas are shown in Figure 8, "1% Annual Chance Total Stillwater Levels for Coastal Areas."

In some areas, the 1% annual chance floodplain is determined based on the limit of wave runup or wave overtopping for the 1% annual chance storm surge. The methods that were used for calculation of wave hazards are described in Section 5.3 of this FIS Report.

Table 18 and 18P presents the types of coastal analyses that were used in mapping the 1% annual chance floodplain in coastal areas.

#### Coastal BFEs

Where they apply, coastal BFEs are calculated along transects extending from offshore to the limit of coastal flooding onshore. Results of these analyses are accurate until local topography, vegetation, or development type and density within the community undergoes major changes.

Parameters that were included in calculating coastal BFEs for each transect included in this FIS Report are presented in Table 20, "Coastal Transect Parameters." The locations of transects are shown in Figure 9, "Transect Location Map." More detailed information about the methods used in coastal analyses and the results of intermediate steps in the coastal analyses are presented in Section 5.3 of this FIS Report. Additional information on specific mapping methods is provided in Section 6.4 of this FIS Report.

### 2.5.3 Coastal High Hazard Areas

Certain areas along the open coast and other areas may have higher risk of experiencing structural damage caused by wave action and/or high-velocity water during the 1% annual chance flood. These areas will be identified on the FIRM as Coastal High Hazard Areas.

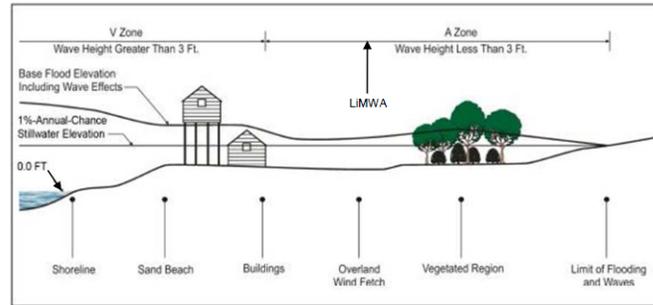
- *Coastal High Hazard Area (CHHA)* is a SFHA extending from offshore to the inland limit of the primary frontal dune (PFD) or any other area subject to damages caused by wave action and/or high-velocity water during the 1% annual chance flood.
- *Primary Frontal Dune (PFD)* is a continuous or nearly continuous mound or ridge of sand with relatively steep slopes immediately landward and adjacent to the beach. The PFD is subject to erosion and overtopping from high tides and waves during major coastal storms.

CHHAs are designated as "V" zones (for "velocity wave zones") and are subject to more stringent regulatory requirements and a different flood insurance rate structure. The areas of greatest risk are shown as VE on the FIRM. Zone VE is further subdivided into elevation zones and shown with BFEs on the FIRM.

The landward limit of the PFD occurs at a point where there is a distinct change from a relatively steep slope to a relatively mild slope; this point represents the landward extension of Zone VE. Areas of lower risk in the CHHA are designated with Zone V on the FIRM. More detailed information about the identification and designation of Zone VE is presented in Section 6.4 of this FIS Report.

Areas that are not within the CHHA but are SFHAs may still be impacted by coastal flooding and damaging waves; these areas are shown as "A" zones on the FIRM.

Figure 6, “Coastal Transect Schematic,” illustrates the relationship between the base flood elevation, the 1% annual chance stillwater elevation, and the ground profile as well as the location of the Zone VE and Zone AE areas in an area without a PFD subject to overland wave propagation. This figure also illustrates energy dissipation and regeneration of a wave as it moves inland.



**Figure 6: Coastal Transect Schematic**

Methods used in coastal analyses in this Flood Risk Project are presented in Section 5.3 and mapping methods are provided in Section 6.4 of this FIS Report.

Coastal floodplains are shown on the FIRM using the symbology described in Figure 3, “Map Legend for FIRM.” In many cases, the BFE on the FIRM is higher than the stillwater elevations shown in Table 17 due to the presence of wave effects. The higher elevation should be used for construction and/or floodplain management purposes.

### 2.5.4 Limit of Moderate Wave Action

Laboratory tests and field investigations have shown that wave heights as little as 1.5 feet can cause damage to and failure of typical Zone AE building construction. Wood-frame, light gage steel, or masonry walls on shallow footings or slabs are subject to damage when exposed to waves less than 3 feet in height. Other flood hazards associated with coastal waves (floating debris, high velocity flow, erosion, and scour) can also damage Zone AE construction.

Therefore, a LiMWA boundary may be shown on the FIRM as an informational layer to assist coastal communities in safe rebuilding practices. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The location of the LiMWA relative to Zone VE and Zone AE is shown in Figure 6.

The effects of wave hazards in Zone AE between Zone VE (or the shoreline where Zone VE is not identified) and the limit of the LiMWA boundary are similar to, but less severe than, those in Zone VE where 3-foot or greater breaking waves are projected to occur during the 1% annual chance flooding event. Communities are therefore encouraged to adopt and enforce more stringent floodplain management requirements than the minimum NFIP requirements in the LiMWA. The NFIP Community Rating System provides credits for these actions.

Where wave runup elevations dominate over wave heights, there is no evidence to date of significant damage to residential structures by runup depths less than 3 feet. Examples of these areas include areas with steeply sloped beaches, bluffs, or flood protection structures that lie parallel to the shore. In these areas, the FIRM shows the LiMWA immediately landward of the VE/AE boundary. Similarly, in areas where the zone VE designation is based on the presence of a primary frontal dune or wave overtopping, the LiMWA is delineated immediately landward of the Zone VE/AE boundary.

## 3.0 Insurance Applications

### 3.1 National Flood Insurance Program Insurance Zones

For flood insurance applications, the FIRM designates flood insurance rate zones and, in 1% annual chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use the zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies. Table 2, “Flood Zone Designations,” includes a description of each type of flood hazard zone.

**Table 2 - Flood Designations**

Zone	Description
A	Zone A is the flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined in the FIS Report by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no Base Flood Elevations or depths are shown within this zone.
AE	Zone AE is the flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined in the FIS Report by detailed methods. In most instances, whole-foot Base Flood Elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.
AH	Zone AH is the flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot Base Flood Elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.
AO	Zone AO is the flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.
AR	Zone AR is the flood insurance rate zone that corresponds to areas that were formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
A99	Zone A99 is the flood insurance rate zone that corresponds to areas of the 1% annual chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No Base Flood Elevations or depths are shown within this zone.
V	Zone V is the flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no Base Flood Elevations are shown within this zone.
VE	Zone VE is the flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Whole-foot Base Flood Elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.
X	Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2% annual chance floodplain, areas within the 0.2% annual chance floodplain, and to areas of 1% annual chance flooding where average depths are less than 1 foot, areas of 1% annual chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1% annual chance flood by levees. No Base Flood Elevations or depths are shown within this zone.
X (Future)	Zone X (Future Base Flood) is the flood insurance risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined based on future-conditions hydrology. No BFEs or base flood depths are shown within this zone.
D	Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

## 3.2 Coastal Barrier Resources System

### 3.2 Coastal Barrier Resources System

The Coastal Barrier Resources Act (CBRA) of 1982 was established by Congress to create areas along the Atlantic and Gulf coasts and the Great Lakes, where restrictions for Federal financial assistance including flood insurance are prohibited. In 1990, Congress passed the Coastal Barrier Improvement Act (CBIA), which increased the extent of areas established by the CBRA and added "Otherwise Protected Areas" (OPA) to the system. These areas are collectively referred to as the John. H Chafee Coastal Barrier Resources System (CBRS). The CBRS boundaries that have been identified in the project area are in Table 4: Coastal Barrier Resource System Information.

Table 4: "Coastal Barrier Resources System Information" is not applicable in Carteret County.

## 4.0 Area Studied

Carteret County is found in the Coastal Plain region of North Carolina. It is surrounded by Craven and Pamlico Counties to the north,

Jones and Onslow counties to the west, and the Atlantic Ocean to the east.

## 4.1 Basin Description

Table 3, "Basin Description" contains a description of the characteristics of the HUC-8 sub-basins within which each community falls. The table includes the main flooding sources within each basin, a brief description of the basin, and its area.

**Table 3 - Basin Description**

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description	HUC Area (square miles)
Lower Neuse	03020204	Neuse River	The Lower Neuse River Basin reaches up into Lenoir County, North Carolina and then drains east into the Pamlico Sound. The basin drains significant portions of Carteret, Craven, Jones, and Pamlico Counties.	1,583
Pamlico Sound	03020105	Pamlico Sound	The Pamlico Sound Basin includes coastal regions of Carteret, Dare, Hyde, and Pamlico Counties. The Neuse River and Pamlico River both end in the Pamlico Sound.	1,952
White Oak River	03020301	White Oak River	The White Oak River Basin drains southern portions of Jones and Craven Counties. The basin also includes coastal regions of Carteret and Onslow Counties.	932

## 4.2 Principal Flood Problems

Table 4, "Principal Flood Problems" contains a list of principal flooding problems in Carteret County.

**Table 4 - Principal Flood Problems**

Flooding Source	Problem
All Sources	The dominant source of flooding in Carteret County is wind-driven surge generated in the Atlantic Ocean by tropical storms and hurricanes. The surge propagates into Bogue Inlet, Bogue Sound, Back Sound, Core Sound, Goose Bay, the Intracoastal Waterway,

## 4.3 Historic Flood Elevations

### Hurricane Floyd (9/16/1999)

Hurricane Floyd made landfall near Wilmington with category two winds of 105 to 110 mph. Rainfall totals from Floyd were as high as 15 to 20 inches over portions of eastern North Carolina; with a record of 23.45 inches of rain falling in the month of September at Wilmington, NC. This breaks the previous record of 21.12 inches set in July 1886. These rains combined with saturated ground from previous rain events, including Hurricane Dennis, to produce an inland flood disaster. There were 74 deaths in the United States, including 52 in North Carolina, due to drowning from flood waters. This makes Floyd the deadliest U.S. hurricane since Agnes in 1972. Data from the USGS indicate that eleven of their stream gage monitoring sites in North Carolina (Ahoskie, Rocky Mount, Hilliardston, White Oak, Enfield, Tarboro, Lucama, Hookerton, Trenton, Chinquapin, and Freeland) exceeded 0.2% annual chance flood levels due to Floyd. Total losses in North Carolina approach \$5 billion with an estimated \$3.5 billion in damages to North Carolina homes, businesses, roads, and infrastructure. Floyd passed relatively close to the entire U.S. east coast, justifying hurricane warnings from Florida to Massachusetts and requiring an estimated two million people to evacuate. The last hurricane to require warnings for as large a stretch of coastline was Hurricane Donna in 1960.

### Hurricane Bonnie (8/26/1998)

The landfall location of Bonnie was in southern North Carolina near Cape Fear very close to landfall of both Hurricanes Bertha and Fran in 1996. Even though a powerful storm, damage from Bonnie was much less than Fran, which was also Category 3. Winds gusted up to 100 knots and storm tides of 5 to 8 feet above normal were reported mainly in eastern beaches of Brunswick County, while a storm surge of 6 feet was reported at Pasquotank and Camden Counties in the Albemarle Sound.

### Hurricane Fran (9/5/1996)

The landfall location of Fran near the city of Wilmington and its progression into the Raleigh-Durham area caused an estimated \$1.275 billion in damage in North Carolina alone. Fran hit with gusts up to 105 mph and a storm surge of approximately 16 feet. Over \$1 billion

in damage was reported in North Topsail Beach and Surf City and 23 people were killed.

### **Hurricane Bertha**

**(7/12/1996)**

1996 was a damaging year in the hurricane history of North Carolina. Tropical Storm Arthur, Hurricane Bertha, and Hurricane Fran all made direct landfall on the North Carolina coastline. It was the most active tropical cyclone season in the state since 1955, when Hurricanes Connie, Diane, and Ione all hit the coast. Bertha entered North Carolina in North Topsail Beach with 105 mph gust and a storm surge of approximately 5 feet.

### **Hurricane Gloria**

**(9/26/1985)**

The landfall location of Gloria was Cape Hatteras, with 90 knot winds and a storm surge of approximately 6-8 feet.

### **Hurricane Diana**

**(9/13/1984)**

The landfall location of Diana was 38 miles south of Wilmington with 90 mph winds at its closest approach to Wilmington. Diana had 115 mph sustained winds before landfall. Storm surge was approximately 5-6 feet.

### **Hurricane Donna**

**(8/29/1960)**

Hurricane Donna crossed the North Carolina coast between Wilmington and Morehead City of September 11, 1960. The center of the storm passed a few miles east of Wrightsville Beach, although Wilmington and Wrightsville Beach were each in the eye for about an hour. The lowest barometric pressure recorded during this storm was 962 mb at Wilmington. High tides, 6 to 8 feet above normal, together with high winds, caused severe damage at many points. Winds of hurricane force, up to 97 mph, were reported from Wilmington. During the night of September 11, the storm center moved northward, parallel, and slightly east of a line drawn between Wilmington and Norfolk. Wind gusts were in excess of 97 mph and tides were 4 to 8 feet above normal. High tides of 10.3 and 8.3 feet NGVD were reported at Atlantic Beach and Wrightsville Beach, respectively. Coastal communities from Wilmington to Nags Head suffered heavy structural damage and considerable beach erosion. Eight deaths and approximately 100 injuries were attributed to the storm. Damages were estimated at millions of dollars.

### **Hurricane Helene**

**(9/21/1958)**

Hurricane Helene was one of the most powerful storms of recent history. Fortunately for the people of North Carolina, the storm center was well out at sea as it moved north on September 26 and 27. Nevertheless, high winds were recorded at Wilmington, with the highest winds measured at 85 mph and peak gusts recorded at 135 mph. The lowest reported central pressure of the storm was 932 mb; this measurement was recorded south-southeast of Cape Fear early on the morning of September 27. There was some beach erosion due to seas and tides, but this erosion was minimized by the fact that the storm occurred at the time of low astronomical tides. High tides were estimated at 3 to 5 feet above normal; a high tide of 5.1 feet NGVD was reported at Wrightsville Beach. Tides were higher on the southern edge of Pamlico Sound, when the wind shift as the storm center passed brought the tides 7 to 8 feet above normal.

### **Hurricane Ione**

**(9/10/1955)**

Hurricane Ione moved up from the south and crossed the North Carolina coast near Salter Path, 10 miles west of Morehead City, at about 5 a.m. on September 19. It then slowly curved to the northeast and went out to sea near the Virginia border early on September 20. When Ione entered North Carolina, winds gusted to over 100 mph. Wind speeds of 75 mph with gusts to 107 mph were recorded at Cherry Point. The minimum barometric pressure recorded over North Carolina during this storm was 960 mb. Heavy rains also accompanied Ione. At the same time, prolonged easterly winds drove tidal water onto beaches and into sounds and estuaries to heights of 3 to 10 feet above normal. The result was the largest inundation of eastern North Carolina ever known to have occurred. At New Bern, the depth of the flood was the greatest ever recorded, about 10.5 feet above mean low water; forty city blocks were flooded, several hundred homes were washed away, and thousands more were flooded with up to 4 feet of water. A high tide of 6.9 feet NGVD was reported at Atlantic Beach, North Carolina, and an estimated 5.3 feet NGVD at Wrightsville Beach.

### **Hurricane Diane**

**(8/7/1955)**

Five days after Hurricane Connie, and before the damage from that storm could be estimated, Hurricane Diane struck the coast near Carolina Beach about 6 a.m. on August 17. The highest wind speed reported during this storm was 74 mph at Wilmington Airport. Storm tides ranged from 5 to 9 feet above mean low water on the beaches (6.8 feet NGVD at Wrightsville Beach), and in some areas of sounds and rivers emptying into sounds, estimated water levels were 5 to 9 feet above normal. Water was 3 feet above flood level in the business district of Belhaven and “waist deep” in parts of Washington and New Bern. Diane caused severe beach erosion along the North Carolina coast. The total damage caused in North Carolina by both Connie and Diane was estimated to be in excess of \$90 million. No deaths or injuries in North Carolina were attributed to either of the storms.

### **Hurricane Connie**

**(8/3/1955)**

Hurricane Connie entered North Carolina close to Cape Lookout at about 8:30 a.m. on August 12. The prolonged pounding of high waves against the coast caused tremendous beach erosion, probably worse than that caused by Hazel in 1954. Storm tides along the coast from Southport to Nags Head were reported to be about 7 feet NGVD (6.9 feet NGVD at Wrightsville Beach and 7.5 feet NGVD at Kure Beach). Water in sounds and near the mouths of rivers was 5 to 8 feet above normal. At Wilmington, winds were reported at 72 mph, gusting to 83 mph. At Fort Macon, winds of 75 mph, gusts of 100 mph, and barometric pressure of 962 mb were reported. The storm also brought torrential rains with the maximum rainfall, around 12 inches in 48 hours, occurring near Morehead City. Total damage throughout the state was estimated at \$50 million.

### **Hurricane Hazel**

**(10/5/1954)**

Hurricane Hazel was the most destructive storm in the history of North Carolina. The storm crossed the coast just north of Myrtle Beach, South Carolina, as hurricane winds hit the Atlantic coast between Georgetown, South Carolina, and Cape Lookout, North Carolina. Storm tides (i.e., hurricane surge) devastated the immediate ocean front of this stretch of coast. Every fishing pier along 170 miles of coast, from Myrtle Beach to Cedar Island, North Carolina, was destroyed. The waterfront between the South Carolina/North Carolina state boundary and Cape Fear was destroyed. Beach homes, which had been built in a continuous line five miles long behind and along grass-covered dunes (some of which were 20 feet high), simply disappeared – dunes, houses, and all. From Cape Fear to Cape Lookout, the degree of devastation was not as great, but oceanfront property was damaged an average of 50 percent along this entire stretch. To the north of Cape Lookout, the damage was relatively light. Storm surges of 16.6 feet above NGVD were observed at Holden Beach Bridge and Calabash, North Carolina. The highest tide of record was observed during Hurricane Hazel, when ocean tide levels reached approximately 10 feet NGVD at Wrightsville Beach and 11 feet NGVD at Carolina Beach. The lowest recorded barometric pressure of the storm was 938 millibars (mb), reported at Little River Inlet on the North Carolina/South Carolina border. Maximum wind speeds were 83 miles per hour (mph), with gusts recorded at 98 mph at Wilmington, North Carolina, 106 mph at Myrtle Beach, South Carolina, and an estimated 150 mph at Cape Fear. The storm continued inland through North Carolina, causing widespread damage due to high winds and record rainfalls. Nineteen people were killed and 200 injured during this storm.

Table 5, “Historic Flood Elevations” is not applicable in Carteret County.

## **4.4 Flood Protection Measures**

Flood protection measures may be structural (such as levees, dams, and reservoirs) or non-structural (such as land-use management ordinances, policies, or practices).

Table 6, “Non-Levee Flood Protection Measures” is not applicable in Carteret County.

Table 7, “Levees” is not applicable in Carteret County.

## **4.5 Scope of Study**

For this map maintenance revision, a scoping meeting was held in Carteret County to present the results of initial research to the county and communities within the county and to discuss their floodplain mapping needs. The county and communities were asked to provide input on proposed study priorities and analysis methods. These meetings resulted in the identification of flooding sources

having a floodplain mapping need. Map Maintenance Plans were developed based on the results of the scoping meetings and were both mailed to each jurisdiction within Carteret County and posted to the State's website at [www.ncfloodmaps.com](http://www.ncfloodmaps.com).

Draft basin plans were developed based on the results of the initial scoping meetings. Final scoping meetings were held by the State and FEMA to provide counties and communities an overview of the draft basin plans, including the proposed scope and schedule for the project, and to provide an opportunity for additional county and community input. After the final scoping meeting was held, the Final Basin Plans were produced.

This FIS covers the geographic area of Carteret County, North Carolina, and all jurisdictions therein. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction. Limits of detailed study are indicated on the Flood Profiles and/or Water-surface elevation rasters and/or the FIRM.

Table 8P, "Scope of Revisions: Revised or New Detailed Study -Preliminary", lists flooding sources that were newly studied by detailed methods or were previously studied by detailed methods and had a change in backwater elevation due to flooding effects from a newly studied flooding source.

**Table 8P - Scope of Revisions: Revised or New Detailed Study - Preliminary**

Source	Riverine Sources		Affected Communities
	From	To	
Deep Creek	The confluence with Newport River	Approximately 0.6 mile upstream of Newport Loop Road	Town Of Newport
Little Deep Creek	The confluence with Deep Creek	Approximately 2.1 miles upstream of the confluence with Deep Creek	Town Of Newport
Main Prong	The upstream end of Mill Pond	Approximately 2.4 miles upstream of Mill Pond	Carteret County
Newport River	At Bogue Sound	At U.S. Highway 70	Town Of Newport
Newport River <sup>1</sup>	At U.S. Highway 70	Approximately 1.4 miles upstream of confluence with Southwest Prong Newport River	Carteret County Town Of Newport
Pettiford Creek	The confluence with White Oak River	Approximately 3.4 miles upstream of U.S. Highway 58	Carteret County Town Of Cape Carteret Town Of Cedar Point Town Of Peletier
Southwest Prong Newport River <sup>1</sup>	The confluence with Newport River	Approximately 1,095 feet downstream of Nine Mile Road	Carteret County Town Of Newport

<sup>1</sup>Revised to reflect backwater effects from new detailed study

Table 9P, "Scope of Revisions: Redelineated - Preliminary" is not applicable in Carteret County.

Table 10P, "Scope of Revisions: Limited Detailed - Preliminary", lists flooding sources that were newly studied by limited detailed methods or were previously studied by limited detailed methods and had a change in backwater elevation due to flooding effects from a newly studied flooding source.

**Table 10P - Scope of Revisions: Limited Detailed - Preliminary**

Source	Riverine Sources		Affected Communities
	From	To	
Cales Creek	The confluence with White Oak River	Approximately 1,390 feet upstream of Forest Route No. 616	Carteret County
Cedar Swamp Creek <sup>1</sup>	The confluence with Newport River	Approximately 2,275 feet upstream of Roberts Road	Town Of Newport
Hadnot Creek <sup>1</sup>	Approximately 350 feet upstream of Old Church Road	Approximately 3,820 feet upstream of Old Church Road	Carteret County
Pettiford Creek <sup>1</sup>	Approximately 3.4 miles upstream of U.S. Highway 58	Approximately 165 feet downstream of Millis Road	Carteret County
Pettiford Creek Tributary <sup>1</sup>	The confluence with Pettiford Creek	Approximately 985 feet upstream of confluence with Pettiford Creek	Carteret County
Shoe Branch <sup>1</sup>	The confluence with Newport River	Approximately 2,575 feet upstream of Nine Foot Road	Carteret County Town Of Newport
White Oak River <sup>1</sup>	The confluence of Webb Creek	Approximately 12.2 miles upstream of the confluence of Webb Creek	Carteret County

<sup>1</sup>Revised to reflect backwater effects from new detailed study

Table 8, "Flooding Sources Studied by Detailed Methods", lists all flooding sources within the county that were studied by detailed methods for this FIS and previous FISs.

**Table 8 - Flooding Sources Studied by Detailed Methods: Revised or Newly Studied**

Source	Riverine Sources		Affected Communities
	From	To	
Deep Creek	The confluence with Newport River	Approximately 0.6 mile upstream of Newport Loop Road	Town Of Newport
Little Deep Creek	The confluence with Deep Creek	Approximately 2.1 miles upstream of the confluence with Deep Creek	Town Of Newport
Main Prong	The upstream end of Mill Pond	Approximately 2.4 miles upstream of Mill Pond	Carteret County
Newport River	At Bogue Sound	At U.S. Highway 70	Town Of Newport
Newport River	At U.S. Highway 70	Approximately 800 feet upstream of the confluence of Cypress Drain	Carteret County Town Of Newport
Pettiford Creek	The confluence with White Oak River	Approximately 3.4 miles upstream of U.S. Highway 58	Carteret County Town Of Cape Carteret Town Of Cedar Point Town Of Peletier
Southwest Prong Newport River	Confluence with Newport River	Approximately 2.0 miles upstream of confluence with Newport River	Carteret County Town Of Newport
Southwest Prong Newport River	The confluence with Newport River	Approximately 2.0 miles upstream of the confluence with Newport River	Carteret County Town Of Newport

Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated" is not applicable in Carteret County.

Table 10, "Flooding Sources Studied by Detailed Methods: Limited Detailed", lists all flooding sources within the county that were studied by limited detailed methods for either this FIS or previous FISs.

**Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed**

Source	Riverine Sources		Affected Communities
	From	To	
Cales Creek	The confluence with White Oak River	Approximately 1,390 feet upstream of Forest Route No. 616	Carteret County
Cedar Swamp Creek	The confluence with Newport River	Approximately 2.4 miles upstream of the confluence with Newport River	Town Of Newport
Cypress Drain	Confluence with Newport River	Approximately 0.7 mile upstream of confluence with Newport River	Carteret County
Hadnot Creek	Approximately 350 feet upstream of Old Church Road	Approximately 2.0 miles upstream of Forest Route No. 176	Carteret County
Hadnot Creek Tributary	Confluence with Hadnot Creek	Approximately 1.3 miles upstream of confluence with Hadnot Creek	Carteret County
Hunters Creek	The confluence with White Oak River	Approximately 750 feet upstream of confluence of Wolf Swamp	Carteret County
Juniper Branch	Confluence with Southwest Prong Newport River	Approximately 0.8 mile upstream of confluence with Southwest Prong Newport River	Carteret County
Pettiford Creek	Approximately 3.4 miles upstream of U.S. Highway 58	Approximately 2.1 miles upstream of Millis Road	Carteret County
Pettiford Creek Tributary 1	The confluence with Pettiford Creek	Approximately 1.8 miles upstream of the confluence with Pettiford Creek	Carteret County
Shoe Branch	The confluence with Newport River	Approximately 0.8 mile upstream of Tom Mann Road	Carteret County Town Of Newport
Southwest Prong Newport River	Approximately 2.0 miles upstream of confluence with Newport River	Approximately 0.6 mile upstream of confluence with Juniper Branch	Carteret County
White Oak River	The confluence of Webb Creek	Approximately 2.8 miles upstream of confluence with Chinkapin Branch	Carteret County
Wolf Swamp	Confluence with Hunters Creek	Approximately 0.8 mile upstream of confluence with Hunters Creek	Carteret County

Table 11, "Stream Name Changes" is not applicable in Carteret County.

Table 12, "Letters of Map Revision" is not applicable in Carteret County.

## 5.0 Engineering Methods

For the flooding sources in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded at least once on the average during any 10-, 25-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2% annual chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

## 5.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied. Hydrologic analyses are typically performed at the watershed level. Depending on factors such as watershed size and shape, land use and urbanization, and natural or man-made storage, various models or methodologies may be applied. For details on the county's hydrologic analyses, the hydrologic report is available by request.

A summary of the drainage area-peak discharge relationships for the flooding sources studied by detailed methods is shown in Table 13, "Summary of Discharges".

**Table 13 - Summary of Discharges**

Flooding Source		Discharges (cfs)			
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
<b>Caleb Branch (City Weeks Branch)</b>					
Approximately 1.2 miles downstream of N.C. Highway 58	1.18	255	568	761	1400
Approximately 3,200 feet downstream of N.C. Highway 58	1.00	230	515	692	1279
Approximately 370 feet upstream of N.C. Highway 58	0.47	144	331	449	849
<b>Cales Creek</b>					
At confluence with White Oak River	1.54	302	666	889	1623
Approximately 2,870 feet downstream of Wetherington Landing Road	1.17	254	566	758	1395
Approximately 270 feet upstream of Wetherington Landing Road	1.03	234	524	703	1299
Approximately 190 feet upstream of Forest Route #616 Road	0.45	140	324	440	833
<b>Cedar Swamp Creek</b>					
Confluence with Newport River	2.62	*	*	1200	*
Approximately 2.4 miles upstream of its confluence with Newport River	1.00	*	*	690	*
<b>Cypress Drain</b>					
Confluence with Newport River	6.12	*	*	1960	*
<b>Deep Creek</b>					
At confluence with Newport River	13.99	1189	2478	3247	5701
Confluence with Newport River	10.20	835	1630	2095	3550
Just upstream of the confluence with Little Deep Creek	8.63	883	1856	2438	4304
Approximately 3,050 feet upstream of the confluence with Little Deep Creek	8.20	855	1799	2365	4176
Approximately 300 feet downstream of Church Street	7.45	806	1698	2234	3949
Approximately 2,550 feet upstream of Church Street	6.62	749	1583	2083	3687
Approximately 3,350 feet downstream of Newport Loop Road	6.23	722	1526	2009	3558
Approximately 215 feet downstream of Newport Loop Road	4.31	575	1222	1613	2869
Approximately 2,035 feet upstream of Newport Loop Road	3.40	497	1061	1402	2501

**Table 13 - Summary of Discharges**

Flooding Source		Discharges (cfs)			
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
<b>Hadnot Creek</b>					
Approximately 1.1 miles upstream of N.C. 58	8.38	*	*	2340	*
Confluence of Hadnot Creek Tributary	4.13	*	*	1560	*
Approximately 2.6 miles upstream of the confluence of Hadnot Creek Tributary	1.15	*	*	750	*
<b>Hadnot Creek Tributary</b>					
Confluence with Hadnot Creek	2.38	*	*	1140	*
<b>Hunters Creek</b>					
Confluence with White Oak River	32.75	*	*	5120	*
Approximately 1.36 miles upstream of confluence with White Oak River	31.21	*	*	4980	*
Approximately 1.82 miles upstream of confluence with White Oak River	30.30	*	*	4890	*
Approximately 0.4 mile downstream of N.C. 58	29.33	*	*	4800	*
Approximately 0.64 mile upstream of Hunters Creek Road	27.43	*	*	4620	*
Approximately 1.98 miles upstream of Hunters Creek Road	25.50	*	*	4430	*
Approximately 2.76 miles upstream of Hunters Creek Road	24.54	*	*	4340	*
Approximately 1.2 miles downstream of the confluence of Wolf Swamp	23.61	*	*	4240	*
Approximately 0.70 mile downstream of confluence with Wolf Swamp	23.24	*	*	4200	*
Confluence of Wolf Swamp	16.86	*	*	3500	*
Approximately 0.6 mile downstream of Carteret-Craven County boundary	7.10	*	*	2130	*
<b>Juniper Branch</b>					
Confluence with Newport River	0.78	*	*	600	*
<b>Little Deep Creek</b>					
Approximately 125 feet upstream of the confluence with Deep Creek	5.03	633	1342	1769	3141
Approximately 1,715 feet upstream of the confluence with Deep Creek	4.61	600	1274	1681	2987
Approximately 3,580 feet downstream of Fannie Elliott Road	4.16	562	1196	1579	2809
Approximately 2,700 feet downstream of Fannie Elliott Road	3.26	484	1035	1368	2440
Approximately 210 feet downstream of Fannie Elliott Road	2.75	435	933	1235	2206
Approximately 2,265 feet upstream of Fannie Elliott Road	2.47	408	876	1160	2076
<b>Main Prong</b>					
Just upstream of the confluence with Ghouls Fork	2.72	432	927	1227	2193
Approximately 0.87 mile upstream of Mill Pond	2.30	390	838	1110	1988
Approximately 1.57 miles upstream of Mill Pond	1.62	314	679	902	1621
Approximately 1.75 miles upstream of Mill Pond	1.25	268	581	773	1394
Approximately 2.08 miles upstream of Mill Pond	0.76	197	431	574	1041
<b>Newport River</b>					
Approximately 40 feet upstream of the confluence with Deep Creek	48.72	2567	5240	6815	11801
Approximately 1,340 feet upstream of East Chatham Street	45.80	2471	5049	6569	11383
Confluence of Deep Creek	41.35	1890	3515	4455	7315
Confluence of Shoe Branch	37.99	2220	4350	5570	9270
Confluence of Southwest Prong Newport River	17.16	1350	2730	3530	6010
Confluence of Cypress Drain	8.18	852	1770	2310	4020
<b>Pettiford Creek</b>					
At Mouth	19.32	1455	2926	3781	6414
Approximately 5,000 feet downstream of N.C. Highway 58	16.85	1336	2701	3496	5955

**Table 13 - Summary of Discharges**

Flooding Source		Discharges (cfs)			
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Approximately 2,300 feet downstream of N.C. Highway 58	16.21	1305	2640	3420	5830
Approximately 2,950 feet upstream of N.C. Highway 58	14.38	1211	2461	3193	5463
Approximately 1.38 miles upstream of N.C. Highway 58	13.92	1186	2414	3133	5366
Approximately 2.75 miles upstream of N.C. Highway 58	12.95	1134	2314	3006	5159
Approximately 2.95 miles upstream of N.C. Highway 58	10.77	1011	2077	2705	4666
Approximately 3,980 feet downstream of the confluence with Pettiford Creek Tributary 1	9.88	958	1975	2574	4452
Confluence of Pettiford Creek Tributary 1	4.93	*	*	1730	*
Approximately 1.2 miles upstream of Millis Road	1.06	*	*	720	*
<b>Pettiford Creek Tributary 1</b>					
Confluence with Pettiford Creek	3.95	*	*	1520	*
Approximately 9,880 feet upstream of confluence with Pettiford Creek	1.32	*	*	813	*
<b>Shoe Branch</b>					
Confluence with Newport River	3.17	*	*	1340	*
At Tom Mann Road	1.00	*	*	690	*
<b>Southwest Prong Newport River</b>					
Confluence with Newport River	18.79	1430	2880	3720	6320
Confluence of Juniper Branch	9.64	*	*	2540	*
<b>White Oak River</b>					
Confluence with Webb Creek	207.65	*	*	14740	*
Approximately 4,140 feet upstream of confluence of Webb Creek	207.45	*	*	14700	*
Confluence of Hunters Creek	173.69	*	*	13310	*
<b>Wolf Swamp</b>					
Confluence of Hunters Creek	1.17	*	*	758	*

Table 14, "Summary of Stillwater Elevations" is not applicable in Carteret County.

Table 15, "Gage Information" is not applicable in Carteret County.

## 5.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the flood elevations for the selected recurrence intervals. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles and/or Water-surface elevation rasters. For stream segments for which BFEs were computed, selected cross-section locations are also shown on the FIRM. Flood Profiles and/or Water-surface elevation rasters were developed showing computed water-surface elevations for floods of the selected recurrence intervals.

Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles and/or Water-surface elevation rasters or in the Floodway Data tables in the FIS Report. For construction and/or floodplain management purposes, users are encouraged to use the flood elevation data presented in the FIS in conjunction with the data shown on the FIRM.

The hydraulic analyses for this FIS were based on unobstructed flow. The flood elevations shown on the Flood Profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

For details on the county's hydraulic analyses, the hydraulic report is available by request.

For the streams studied by detailed methods, water surface elevations of floods of the selected recurrence intervals were computed

through use of the Army Corps of Engineers' HEC RAS step backwater computer program . The hydraulic analyses were based on unobstructed flow. The flood elevations shown on the Profiles and/or Water-surface elevation rasters are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail. The computer models were calibrated using historic high water data collected during field investigations.

The cross section geometries were obtained from a combination of digital elevation data obtained by Light Detection and Ranging (LIDAR) and field surveys. All bridges, dams, and culverts were field surveyed to obtain elevation data and structural geometry. Natural floodplain cross sections were surveyed approximately every 4000 feet along the detail study reaches to obtain the channel geometry between bridges and culverts. Overbank cross section data for the backwater analyses were obtained from recently flown LIDAR data.

Channel roughness factors (Manning's "n") used in the hydraulic computations were made in the field by an engineer where stream access was possible, with orthophotos used to supplement areas that could not be accessed. The channel and overbank "n" values for all of the streams studied by detailed methods are shown in Table 16, "Roughness Coefficients".

**Table 16 - Roughness Coefficients**

Stream	Channel "n"	Overbank "n"
Cales Creek	0.040 to 0.048	0.080 to 0.150
Cedar Swamp Creek	0.035	0.150 to 0.200
Cypress Drain	0.032 to 0.033	0.110 to 0.140
Deep Creek	0.040 to 0.090	0.030 to 0.200
Hadnot Creek	0.048 to 0.050	0.128 to 0.150
Hunters Creek	0.043 to 0.045	0.120 to 0.150
Juniper Branch	0.048 to 0.050	0.140 to 0.150
Little Deep Creek	0.040 to 0.090	0.030 to 0.200
Main Prong	0.035 to 0.060	0.035 to 0.120
Newport River	0.030 to 0.090	0.030 to 0.200
Pettiford Creek	0.035 to 0.150	0.035 to 0.150
Pettiford Creek Tributary 1	0.050	0.140 to 0.200
Shoe Branch	0.027 to 0.050	0.090 to 0.230
Southwest Prong Newport River	0.045 to 0.055	0.100 to 0.200
White Oak River	0.040 to 0.045	0.120 to 0.150

For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained using digital elevation data obtained with LIDAR technology developed as part of the North Carolina Statewide Floodplain Mapping Program. The hydraulic model is prepared using this digital elevation data, without surveying bathymetric or structural data. Where bridge or culvert data are readily available, such as from the North Carolina Department of Transportation, these data have been reflected in the hydraulic model. If these structural data are not readily available, field measurements of these structures were made to approximate their geometry in the hydraulic models. In addition, this method does not include field surveys that determine specifics on channel and floodplain characteristics. A limited detailed study is a "buildable" product that can be upgraded to a fully detailed study at a later date by verifying stream channel characteristics, bridge and culvert opening geometry, and by analyzing multiple recurrence intervals.

The results of the HEC-RAS computations are tabulated for all cross sections (Table 17, "Limited Detailed Flood Hazard Data"). Flood Profiles have not been developed for streams studied by limited detailed methods. Water-surface elevation rasters were developed for streams studied by limited detailed methods. In addition, floodways for streams studied by limited detailed methods are not delineated on the FIRM. However, the 1% annual chance water-surface elevations, flood discharges, and non-encroachment widths from the limited detailed studies for every modeled cross section are given in Table 17. The non-encroachment widths given at modeled cross sections can be used by communities to enforce floodplain management ordinances that meet the requirement defined in 44 CFR 60.3(c)(10).

Between cross sections for streams studied by limited detailed methods, 1% annual chance water-surface elevations can be calculated by mathematical interpolation using the distance along the stream centerline. Non-encroachment widths and, therefore, the location of a non-encroachment area boundary between cross sections should be determined based on either 1) mathematical interpolation, or 2)

the non-encroachment width at the upstream or downstream cross section, whichever is larger. If the width determined by this second method is wider than the Special Flood Hazard Area (SFHA) or the 1% annual chance floodplain delineated on the FIRM for this location along the stream, the non-encroachment area shall be considered to be coincident with the SFHA. A full detailed study incorporating field survey data in the HEC-RAS hydraulic model may be submitted for a Letter of Map Revision (LOMR) request to map a regulatory floodway along a section of a stream in lieu of applying the non-encroachment widths listed in Table 17.

**Table 17 - Limited Detailed Flood Hazard Data**

Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water-Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline
<b>Cales Creek</b>				
085	8,537	703	11.8	15 / 67
087	8,669	703	13.0	68 / 40
088	8,822	440	13.2	15 / 54
091	9,091	440	13.6	19 / 8
093	9,320	440	15.0	11 / 45
096	9,576	440	15.8	18 / 9
098	9,826	440	17.9	27 / 29
<b>Cedar Swamp Creek</b>				
008	796	1,200	10.0 <sup>1</sup>	642 / 4
013	1,306	1,200	10.0 <sup>1</sup>	149 / 40
018	1,778	1,200	10.0 <sup>1</sup>	257 / 78
026	2,616	1,200	10.0 <sup>1</sup>	101 / 93
030	3,002	1,200	10.0 <sup>1</sup>	90 / 59
035	3,540	1,200	10.0 <sup>1</sup>	62 / 26
040	4,000	1,200	10.0 <sup>1</sup>	69 / 71
044	4,448	1,200	10.0 <sup>1</sup>	67 / 45
050	5,000	1,200	10.5	72 / 55
055	5,500	1,200	10.9	27 / 56
060	6,000	1,200	11.8	4 / 122
065	6,500	1,200	12.6	81 / 33
069	6,941	956	13.6	41 / 100
075	7,500	956	14.7	100 / 60
080	8,000	956	16.1	80 / 50
086	8,589	956	17.4	72 / 54
090	8,999	956	18.2	76 / 33
095	9,500	956	19.4	89 / 16
100	10,000	956	20.5	140 / 29
104	10,424	956	21.4	71 / 49
110	11,000	956	23.3	42 / 42
116	11,567	956	25.0	60 / 93
120	12,049	956	26.2	95 / 40
<b>Clubfoot Creek</b>				
446	44,602	535	10.5	12 / 105
<b>Cypress Drain</b>				
011	1,109	1,960	17.1 <sup>1</sup>	546 / 8
015	1,499	1,960	17.1 <sup>1</sup>	797 / 8
	2,055	1,960	19.0	110 / 255
	2,102	1,960	19.9	110 / 255
021	2,102	1,960	19.9	110 / 255

**Table 17 - Limited Detailed Flood Hazard Data**

Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water-Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline
025	2,500	1,960	20.1	96 / 169
030	3,000	1,960	20.5	8 / 370
035	3,500	1,960	20.7	15 / 398
<b>Hadnot Creek</b>				
250	25,005	2,140	11.5	141 / 269
255	25,505	2,140	12.0	263 / 81
260	26,005	2,140	12.8	156 / 119
264	26,394	2,140	13.6	56 / 160
270	27,000	1,560	14.5	51 / 161
275	27,500	1,560	14.9	104 / 159
280	28,000	1,560	15.4	152 / 185
285	28,500	1,560	16.5	64 / 115
290	29,000	1,560	17.3	47 / 98
295	29,500	1,530	18.0	121 / 71
301	30,125	1,530	19.0	36 / 62
305	30,452	1,530	20.2	176 / 14
305	30,502	1,530	21.9	176 / 14
310	31,002	1,530	22.1	99 / 60
315	31,502	1,530	22.4	40 / 214
320	32,002	1,530	22.9	45 / 56
325	32,549	1,530	24.4	112 / 34
331	33,055	1,530	25.6	83 / 21
335	33,502	1,530	26.7	65 / 62
340	33,988	1,530	27.6	78 / 93
343	34,334	1,530	28.0	203 / 70
347	34,693	750	28.3	10 / 173
350	35,002	750	28.6	72 / 11
355	35,501	750	29.6	38 / 142
359	35,937	750	30.1	2 / 260
365	36,500	750	30.5	106 / 267
370	37,000	750	30.9	79 / 146
375	37,534	750	31.4	331 / 31
380	38,012	750	31.6	26 / 236
387	38,691	750	32.0	2 / 282
391	39,078	750	32.2	301 / 20
395	39,500	750	32.3	250 / 185
400	40,000	750	32.5	109 / 204
405	40,501	750	32.7	987 / 2
410	41,000	750	33.2	480 / 2
<b>Hadnot Creek Tributary</b>				
005	500	1,140	14.1 <sup>1</sup>	58 / 183
010	1,001	1,140	14.8	164 / 40
015	1,501	1,140	15.8	5 / 155
020	2,000	1,140	17.4	93 / 66
025	2,454	1,140	18.5	69 / 127

**Table 17 - Limited Detailed Flood Hazard Data**

Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water-Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline
030	2,964	1,140	20.0	21 / 40
035	3,500	1,140	22.3	47 / 122
040	4,005	1,140	23.3	53 / 145
045	4,529	1,140	24.2	158 / 21
050	5,022	1,140	25.2	99 / 30
057	5,697	1,140	27.9	118 / 50
060	6,021	1,140	28.6	39 / 128
066	6,603	1,140	29.2	162 / 35
071	7,120	1,140	30.1	376 / 2
<b>Hunters Creek</b>				
227	22,720	4,800	11.3	384 / 119
234	23,445	4,800	11.7	266 / 92
243	24,308	4,800	12.5	122 / 291
249	24,854	4,800	12.8	213 / 289
254	25,371	4,720	13.1	424 / 131
259	25,902	4,720	13.3	242 / 632
270	26,990	4,620	13.5	1,094 / 67
279	27,948	4,620	13.8	350 / 460
285	28,473	4,620	14.2	284 / 194
294	29,364	4,620	14.8	598 / 138
302	30,229	4,620	15.3	168 / 216
308	30,752	4,570	15.6	209 / 301
313	31,316	4,570	15.9	162 / 408
323	32,280	4,470	16.3	164 / 342
329	32,950	4,470	16.8	380 / 31
333	33,315	4,430	17.0	211 / 376
340	33,956	4,430	17.3	187 / 416
344	34,425	4,430	17.6	394 / 26
349	34,903	4,430	17.8	388 / 275
353	35,300	4,430	17.9	80 / 430
356	35,620	4,430	18.0	205 / 392
359	35,903	4,430	18.1	210 / 401
365	36,498	4,430	18.4	181 / 348
369	36,922	4,430	18.6	237 / 420
373	37,349	4,430	18.8	426 / 169
378	37,798	4,430	19.0	320 / 200
382	38,216	4,430	19.3	332 / 386
386	38,645	4,340	19.5	515 / 248
394	39,355	4,340	19.8	212 / 303
400	39,967	4,240	20.2	253 / 243
407	40,738	4,240	20.6	387 / 320
413	41,271	4,240	20.8	353 / 382
420	42,026	4,240	21.1	334 / 247
427	42,742	4,240	21.4	328 / 268
434	43,437	4,200	21.7	286 / 506

**Table 17 - Limited Detailed Flood Hazard Data**

Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water-Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline
441	44,088	4,200	21.9	322 / 356
447	44,673	4,200	22.2	261 / 296
454	45,430	4,200	22.5	274 / 444
460	45,968	4,200	22.8	208 / 301
467	46,668	3,500	23.3	353 / 224
472	47,173	3,500	23.7	416 / 152
<b>Juniper Branch</b>				
005	500	601	22.7 <sup>1</sup>	22 / 214
010	1,000	601	22.7 <sup>1</sup>	141 / 37
	1,950	601	24.3	23 / 75
	2,005	601	24.6	23 / 75
024	2,448	601	26.1	67 / 92
029	2,945	601	28.0	23 / 68
035	3,493	601	29.4	99 / 155
041	4,111	601	30.1	143 / 123
<b>Pettiford Creek</b>				
330	33,000	2,690	10.2	303 / 291
335	33,500	2,690	10.3	393 / 146
340	34,000	2,690	10.3	229 / 289
345	34,498	2,690	10.4	132 / 258
350	35,000	2,690	10.5	196 / 162
354	35,422	2,690	10.6	200 / 182
359	35,860	2,690	10.7	91 / 204
365	36,501	2,570	11.1	189 / 87
370	37,000	2,570	11.4	129 / 195
375	37,500	2,570	11.7	164 / 133
381	38,060	2,570	11.9	132 / 258
385	38,500	2,570	12.1	130 / 198
391	39,059	2,570	12.4	100 / 292
395	39,500	2,570	12.7	60 / 212
400	40,000	2,570	13.1	142 / 270
405	40,510	1,730	13.5	149 / 100
410	41,012	1,730	14.0	151 / 91
415	41,498	1,730	14.8	151 / 67
420	41,998	1,730	16.0	71 / 109
422	42,249	1,730	16.6	31 / 35
429	42,855	1,560	18.4	62 / 111
433	43,326	1,560	18.9	147 / 7
440	44,016	1,000	19.5	3 / 213
444	44,408	1,000	19.7	51 / 157
449	44,875	1,000	20.1	3 / 230
455	45,498	1,000	21.0	85 / 24
459	45,871	1,000	22.2	115 / 19
465	46,498	1,000	23.8	83 / 87
471	47,053	1,000	25.8	72 / 79

**Table 17 - Limited Detailed Flood Hazard Data**

Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water-Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline
475	47,499	1,000	26.9	27 / 128
480	47,999	1,000	28.1	41 / 91
485	48,499	1,000	29.6	65 / 53
490	48,998	718	30.6	20 / 136
498	49,835	718	32.3	176 / 146
523	52,250	718	34.7	293 / 90
530	53,000	718	35.3	378 / 2
<b>Pettiford Creek Tributary 1</b>				
005	540	1,520	13.3 <sup>1</sup>	227 / 92
010	1,001	1,520	13.3 <sup>1</sup>	143 / 108
015	1,500	1,520	13.6	95 / 112
019	1,861	1,520	14.1	125 / 87
025	2,500	1,520	14.9	118 / 122
030	2,999	1,520	15.7	142 / 101
035	3,498	1,520	16.6	84 / 111
040	3,998	1,520	17.2	168 / 69
045	4,497	1,520	17.7	115 / 135
049	4,885	1,520	18.0	295 / 91
055	5,495	1,520	18.6	137 / 76
060	5,995	1,520	19.7	135 / 6
065	6,495	1,520	20.6	132 / 40
070	6,995	1,350	21.3	79 / 56
076	7,598	1,350	22.3	9 / 149
081	8,130	1,350	23.0	83 / 86
085	8,496	1,350	23.4	64 / 134
090	8,996	1,350	24.1	148 / 4
095	9,496	1,350	25.5	35 / 49
<b>Shoe Branch</b>				
010	1,031	1,340	10.5 <sup>1</sup>	115 / 160
015	1,499	1,340	10.5 <sup>1</sup>	163 / 28
019	1,909	1,340	10.5 <sup>1</sup>	163 / 28
020	1,954	1,340	10.5 <sup>1</sup>	19 / 77
020	1,954	1,340	10.5 <sup>1</sup>	163 / 28
025	2,500	1,340	10.5 <sup>1</sup>	106 / 103
030	3,000	1,340	10.5 <sup>1</sup>	140 / 93
036	3,620	1,340	10.5 <sup>1</sup>	22 / 85
040	4,000	1,340	11.0	95 / 9
045	4,501	1,340	11.8	72 / 89
051	5,060	1,340	12.2	32 / 27
055	5,502	1,340	13.8	15 / 78
058	5,778	1,340	14.4	38 / 51
061	6,081	1,340	15.2	10 / 119
061	6,136	1,340	15.2	10 / 119
065	6,502	1,340	15.8	6 / 188
070	7,002	1,020	16.3	75 / 13

**Table 17 - Limited Detailed Flood Hazard Data**

Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water-Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline
075	7,503	1,020	17.0	15 / 109
080	8,002	1,020	18.0	21 / 81
086	8,622	1,020	20.0	38 / 28
091	9,071	1,020	21.8	50 / 65
091	9,141	1,020	23.3	50 / 65
097	9,654	1,020	24.0	4 / 558
102	10,230	693	24.4	361 / 195
108	10,847	693	24.5	314 / 804
115	11,505	693	24.8	4 / 247
120	12,004	693	25.7	224 / 244
125	12,548	693	26.3	176 / 559
133	13,333	693	27.1	187 / 163
<b>Southwest Prong Newport River</b>				
109	10,938	3,258	16.9	61 / 83
115	11,548	3,258	17.2	251 / 103
120	11,975	3,258	17.4	448 / 231
125	12,474	3,258	17.5	450 / 193
132	13,185	3,258	17.8	199 / 489
136	13,646	3,258	18.1	40 / 411
142	14,234	3,258	18.4	178 / 292
148	14,830	3,258	18.8	403 / 127
154	15,426	3,258	19.2	495 / 42
159	15,903	3,258	19.4	389 / 119
165	16,463	3,258	19.7	516 / 47
169	16,928	3,258	20.0	422 / 163
175	17,516	3,258	20.5	414 / 13
181	18,061	3,258	21.2	652 / 111
187	18,681	3,258	21.7	373 / 35
193	19,325	3,258	22.4	534 / 13
203	20,331	2,543	23.2	662 / 10
211	21,078	2,543	23.9	508 / 10
216	21,615	2,543	24.4	404 / 181
222	22,211	2,543	24.7	475 / 204
226	22,604	2,543	25.0	554 / 22
231	23,086	2,543	25.6	479 / 125
<b>Wolf Swamp</b>				
003	313	757	23.1 <sup>1</sup>	47 / 175
006	643	757	23.1 <sup>1</sup>	101 / 71
	860	757	23.1 <sup>1</sup>	80 / 91
	915	757	23.1 <sup>1</sup>	80 / 91
014	1,364	757	23.1 <sup>1</sup>	27 / 122
017	1,699	757	23.1 <sup>1</sup>	96 / 117
020	2,003	757	23.8	28 / 135
025	2,477	757	25.5	106 / 45
029	2,939	757	26.6	126 / 31

**Table 17 - Limited Detailed Flood Hazard Data**

Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water-Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline
033	3,298	697	27.3	181 / 13
037	3,666	697	28.1	5 / 252
	3,933	697	28.8	25 / 31
	3,978	697	33.3	25 / 31
044	4,390	697	33.5	50 / 40

<sup>1</sup>Elevation includes backwater effects

## 5.3 Coastal Analyses

For the areas of Carteret County that are impacted by coastal flooding processes, coastal flood hazard analyses were performed to provide estimates of coastal BFEs. Coastal BFEs reflect the increase in water levels during a flood event due to extreme tides and storm surge as well as overland wave effects.

The following subsections provide summaries of how each coastal process was considered for the FIS Report. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation. Table 15 summarizes the methods and/or models used for each of the coastal analyses. Refer to Section 2.5.1 for descriptions of the terms used in this section.

Table 18P, "Summary of Coastal Analyses - Preliminary: Revised or Newly Studied"

**Table 18P - Summary of Coastal Analyses - Preliminary: Revised or Newly Studied**

Flooding Source	Study Limits From	Study Limits To	Hazard Evaluated	Model or Method Used	Date Analysis Was Completed	Study Type
Atlantic Ocean	Atlantic Ocean coastline	End of coastal influence on White Oak/ Newport Rivers	*	removal/ retreat	12/10/2014	DETAILED STUDY
Atlantic Ocean	Atlantic Ocean coastline	End of coastal influence on White Oak/ Newport Rivers	*	WHAFIS 4.0	12/10/2014	DETAILED STUDY
Atlantic Ocean	Entire Onslow County shoreline along Atlantic Ocean	End of coastal influence up New River	*	CHAMP / RUNUP 2.0 (2007)	12/9/2013	DETAILED STUDY
Atlantic Ocean	Atlantic Ocean coastline	Atlantic Ocean coastline	*	removal/ retreat	12/10/2014	DETAILED STUDY
Atlantic Ocean	Atlantic Ocean coastline	Pungo River Canal	*	removal/ retreat	1/14/2014	DETAILED STUDY
Atlantic Ocean	Entire Onslow County shoreline along Atlantic Ocean	End of coastal influence up New River	*	ADCIRC	1/22/2013	DETAILED STUDY
Atlantic Ocean	Entire Onslow County shoreline along Atlantic Ocean	End of coastal influence up New River	*	CHAMP 2.0	12/9/2013	DETAILED STUDY
Atlantic Ocean	Atlantic Ocean coastline	Atlantic Ocean coastline	*	ADCIRC	1/22/2013	DETAILED STUDY
Atlantic Ocean	Atlantic Ocean coastline	Atlantic Ocean coastline	*	CHAMP 2.0	12/10/2014	DETAILED STUDY
Atlantic Ocean	Atlantic Ocean coastline	End of coastal influence on White Oak/ Newport Rivers	*	ADCIRC	1/22/2013	DETAILED STUDY
Atlantic Ocean	Atlantic Ocean coastline	End of coastal influence on White Oak/ Newport Rivers	*	CHAMP 2.0	12/10/2014	DETAILED STUDY
Atlantic Ocean	Atlantic Ocean coastline	Pungo River Canal	*	ADCIRC	1/22/2013	DETAILED STUDY
Atlantic Ocean	Atlantic Ocean coastline	Pungo River Canal	*	CHAMP 2.0	1/14/2014	DETAILED STUDY
Atlantic Ocean	Entire Onslow County shoreline along Atlantic Ocean	End of coastal influence up New River	*	WHAFIS 4.0	12/9/2013	DETAILED STUDY
Atlantic Ocean	Atlantic Ocean coastline	Atlantic Ocean coastline	*	CHAMP / RUNUP 2.0 (2007)	12/10/2014	DETAILED STUDY
Atlantic Ocean	Atlantic Ocean coastline	Atlantic Ocean coastline	*	WHAFIS 4.0	12/10/2014	DETAILED STUDY
Atlantic Ocean	Atlantic Ocean coastline	End of coastal influence on White Oak/ Newport Rivers	*	CHAMP / RUNUP 2.0 (2007)	12/10/2014	DETAILED STUDY

**Table 18P - Summary of Coastal Analyses - Preliminary: Revised or Newly Studied**

Atlantic Ocean	Atlantic Ocean coastline	Pungo River Canal	*	CHAMP / RUNUP 2.0 (2007)	1/14/2014	DETAILED STUDY
Atlantic Ocean	Atlantic Ocean coastline	Pungo River Canal	*	WHAFIS 4.0	1/14/2014	DETAILED STUDY
Atlantic Ocean	Entire Onslow County shoreline along Atlantic Ocean	End of coastal influence up New River	*	Removal/ Retreat	12/9/2013	DETAILED STUDY
Neuse River	The confluences of South River and Neuse River	Approximately 1.1 miles upstream of the confluence with Swift Creek	*	ADCIRC	1/22/2013	DETAILED STUDY
Neuse River	The confluences of South River and Neuse River	Approximately 1.1 miles upstream of the confluence with Swift Creek	*	CHAMP / RUNUP 2.0 (2007)	1/24/2014	DETAILED STUDY
Neuse River	The confluences of South River and Neuse River	Approximately 1.1 miles upstream of the confluence with Swift Creek	*	WHAFIS 4.0	1/24/2014	DETAILED STUDY
Neuse River	The confluences of South River and Neuse River	Approximately 1.1 miles upstream of the confluence with Swift Creek	*	CHAMP 2.0	1/24/2014	DETAILED STUDY
Pungo River	Confluence with the Pamlico Sound	Approximately 5.1 miles upstream of US Highway 264	*	CHAMP / RUNUP 2.0 (2007)	1/14/2014	DETAILED STUDY
Pungo River	Confluence with the Pamlico Sound	Approximately 5.1 miles upstream of US Highway 264	*	ADCIRC	1/22/2013	DETAILED STUDY
Pungo River	Confluence with the Pamlico Sound	Approximately 5.1 miles upstream of US Highway 264	*	CHAMP 2.0	1/14/2014	DETAILED STUDY
Pungo River	Confluence with the Pamlico Sound	Approximately 5.1 miles upstream of US Highway 264	*	removal/ retreat	1/14/2014	DETAILED STUDY
Pungo River	Confluence with the Pamlico Sound	Approximately 5.1 miles upstream of US Highway 264	*	WHAFIS 4.0	1/14/2014	DETAILED STUDY

Table 18, "Summary of Coastal Analyses"

**Table 18 - Summary of Coastal Analyses**

Flooding Source	Study Limits From	Study Limits To	Hazard Evaluated	Model or Method Used	Date Analysis Was Completed
Atlantic Ocean	Atlantic Ocean coastline	End of coastal influence on White Oak/ Newport Rivers	*	removal/ retreat	12/10/2014
Atlantic Ocean	Atlantic Ocean coastline	End of coastal influence on White Oak/ Newport Rivers	*	WHAFIS 4.0	12/10/2014
Atlantic Ocean	Entire Onslow County shoreline along Atlantic Ocean	End of coastal influence up New River	*	CHAMP / RUNUP 2.0 (2007)	12/9/2013
Atlantic Ocean	Atlantic Ocean coastline	Atlantic Ocean coastline	*	removal/ retreat	12/10/2014
Atlantic Ocean	Atlantic Ocean coastline	Pungo River Canal	*	removal/ retreat	1/14/2014
Atlantic Ocean	Entire Onslow County shoreline along Atlantic Ocean	End of coastal influence up New River	*	ADCIRC	1/22/2013
Atlantic Ocean	Entire Onslow County shoreline along Atlantic Ocean	End of coastal influence up New River	*	CHAMP 2.0	12/9/2013
Atlantic Ocean	Atlantic Ocean coastline	Atlantic Ocean coastline	*	ADCIRC	1/22/2013
Atlantic Ocean	Atlantic Ocean coastline	Atlantic Ocean coastline	*	CHAMP 2.0	12/10/2014
Atlantic Ocean	Atlantic Ocean coastline	End of coastal influence on White Oak/ Newport Rivers	*	ADCIRC	1/22/2013
Atlantic Ocean	Atlantic Ocean coastline	End of coastal influence on White Oak/ Newport Rivers	*	CHAMP 2.0	12/10/2014
Atlantic Ocean	Atlantic Ocean coastline	Pungo River Canal	*	ADCIRC	1/22/2013
Atlantic Ocean	Atlantic Ocean coastline	Pungo River Canal	*	CHAMP 2.0	1/14/2014
Atlantic Ocean	Entire Onslow County shoreline along Atlantic Ocean	End of coastal influence up New River	*	WHAFIS 4.0	12/9/2013
Atlantic Ocean	Atlantic Ocean coastline	Atlantic Ocean coastline	*	CHAMP / RUNUP 2.0 (2007)	12/10/2014
Atlantic Ocean	Atlantic Ocean coastline	Atlantic Ocean coastline	*	WHAFIS 4.0	12/10/2014
Atlantic Ocean	Atlantic Ocean coastline	End of coastal influence on White Oak/ Newport Rivers	*	CHAMP / RUNUP 2.0 (2007)	12/10/2014

**Table 18 - Summary of Coastal Analyses**

Atlantic Ocean	Atlantic Ocean coastline	Pungo River Canal	*	CHAMP / RUNUP 2.0 (2007)	1/14/2014
Atlantic Ocean	Atlantic Ocean coastline	Pungo River Canal	*	WHAFIS 4.0	1/14/2014
Atlantic Ocean	Entire Onslow County shoreline along Atlantic Ocean	End of coastal influence up New River	*	Removal/ Retreat	12/9/2013
Neuse River	The confluences of South River and Neuse River	Approximately 1.1 miles upstream of the confluence with Swift Creek	*	ADCIRC	1/22/2013
Neuse River	The confluences of South River and Neuse River	Approximately 1.1 miles upstream of the confluence with Swift Creek	*	CHAMP / RUNUP 2.0 (2007)	1/24/2014
Neuse River	The confluences of South River and Neuse River	Approximately 1.1 miles upstream of the confluence with Swift Creek	*	WHAFIS 4.0	1/24/2014
Neuse River	The confluences of South River and Neuse River	Approximately 1.1 miles upstream of the confluence with Swift Creek	*	CHAMP 2.0	1/24/2014
Pungo River	Confluence with the Pamlico Sound	Approximately 5.1 miles upstream of US Highway 264	*	CHAMP / RUNUP 2.0 (2007)	1/14/2014
Pungo River	Confluence with the Pamlico Sound	Approximately 5.1 miles upstream of US Highway 264	*	ADCIRC	1/22/2013
Pungo River	Confluence with the Pamlico Sound	Approximately 5.1 miles upstream of US Highway 264	*	CHAMP 2.0	1/14/2014
Pungo River	Confluence with the Pamlico Sound	Approximately 5.1 miles upstream of US Highway 264	*	removal/ retreat	1/14/2014
Pungo River	Confluence with the Pamlico Sound	Approximately 5.1 miles upstream of US Highway 264	*	WHAFIS 4.0	1/14/2014

**5.3.1 Total Stillwater Elevations**

The total stillwater elevations (stillwater including storm surge plus wave setup) for the 1% annual chance flood were determined for areas subject to coastal flooding. The models and methods that were used to determine storm surge and wave setup are listed in Table 15. The stillwater elevation that was used for each transect in coastal analyses is shown in Table 20, "Coastal Transect Parameters."

**Astronomical Tide**

Astronomical tidal statistics were generated directly from local tidal constituents by sampling the predicted tide at random times throughout the tidal epoch.

**Storm Surge Statistics**

Storm surge is modeled based on characteristics of actual storms responsible for significant coastal flooding. The characteristics of these storms are typically determined by statistical study of the regional historical record of storms or by statistical study of tidal gages.

When historic records are used to calculate storm surge, characteristics such as the strength, size, track, etc., of storms are identified by site. Storm data was used in conjunction with numerical hydrodynamic models to determine the corresponding storm surge levels. An extreme value analysis was performed on the storm surge modeling results to determine a stillwater elevation for the 1% annual chance event.

Tidal gages can be used instead of historic records of storms when the available tidal gage record for the area represents both the astronomical tide component and the storm surge component. Table 16 provides the gage name, managing agency, gage type, gage identifier, start date, end date, and statistical methodology applied to each gage used to determine the stillwater elevations. For areas between gages, peak stillwater elevations for selected recurrence intervals were estimated by combining interpolation between gages and observed high water marks during major storms. A regionalized statistical approach was applied to the gage data so that stillwater elevations in areas between gages could be identified.

Table 19, "Tide Gage Analysis Specifics" is not applicable in Carteret County.

**Combined Riverine and Tidal Effects**

Riverine and surge rates for the lower reaches of the Inundation River were combined by developing curves for rate of occurrence vs.

flood level for each flood source.

### Wave Setup Analysis

Wave setup was computed during the storm surge modeling through the methods and models listed in Table 15 and included in the frequency analysis for the determination of the total stillwater elevations. The oscillating component of wave setup, dynamic wave setup, was calculated for areas subject to wave runup hazards.

### 5.3.2 Waves

A coastal wave model (Coastal State University 2007) was used to calculate the nearshore wave fields required for the addition of wave setup effects. Three nested grids were used to obtain sufficient nearshore resolution to represent the radiation stress gradients required as ADCIRC inputs. Radiation stress fields output from the inner grids are used by ADCIRC to estimate the contribution of breaking waves (wave setup effects) to the total stillwater elevation.

### 5.3.3 Coastal Erosion

A single storm episode can cause extensive erosion in coastal areas. Storm-induced erosion was evaluated to determine the modification to existing topography that is expected to be associated with flooding events. Erosion was evaluated using the methods listed in Table 15. The post-event eroded profile was used for the subsequent transect-based onshore wave hazard analyses.

### 5.3.4 Wave Hazard Analyses

Overland wave hazards were evaluated to determine the combined effects of ground elevation, vegetation, and physical features on overland wave propagation and wave runup. These analyses were performed at representative transects along all shorelines for which waves were expected to be present during the floods of the selected recurrence intervals. The results of these analyses were used to determine elevations for the 1% annual chance flood.

Transect locations were chosen with consideration given to the physical land characteristics as well as development type and density so that they would closely represent conditions in their locality. Additional consideration was given to changes in the total stillwater elevation. Transects were spaced close together in areas of complex topography and dense development or where total stillwater elevations varied. In areas having more uniform characteristics, transects were spaced at larger intervals. Transects shown in Figure 9, "Transect Location Map," are also depicted on the FIRM. Table 17 provides the location, stillwater elevations, and starting wave conditions for each transect evaluated for overland wave hazards. In this table, "starting" indicates the parameter value at the beginning of the transect.

### Wave Height Analysis

Wave height analyses were performed to determine wave heights and corresponding wave crest elevations for the areas inundated by coastal flooding and subject to overland wave propagation hazards. Refer to Figure 6 for a schematic of a coastal transect evaluated for overland wave propagation hazards.

Wave heights and wave crest elevations were modeled using the methods and models listed in Table 18, "Summary of Coastal Analyses".

### Wave Runup Analysis

Wave runup analyses were performed to determine the height and extent of runup beyond the limit of stillwater inundation for the 1% annual chance flood. Wave runup elevations were modeled using the methods and models listed in Table 15.

Table 20, "Coastal Transect Parameters"

**Table 20: Coastal Transect Parameters**

Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
	Significant Wave Height Hs (ft)	Peak Wave Period Tp (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	.2% Annual Chance
Atlantic Ocean	From Atlantic Ocean coastline				To End of coastal influence on White Oak River and Newport River		

**Table 20: Coastal Transect Parameters**

Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
	Significant Wave Height Hs (ft)	Peak Wave Period Tp (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	.2% Annual Chance
1	22.5	15.3	*	*	*	10.4	13.8
			*	*	*	10.0 - 10.4	13.3 - 13.8
3	22.5	15.3	*	*	*	10.4	13.9
			*	*	*	9.7 - 10.4	12.8 - 13.9
5	22.5	15.3	*	*	*	10.3	13.8
			*	*	*	9.4 - 10.3	12.5 - 13.8
7	22.5	15.3	*	*	*	10.2	13.7
			*	*	*	9.3 - 10.2	12.3 - 13.7
9	22.5	15.3	*	*	*	10.2	13.7
			*	*	*	9.0 - 10.2	11.8 - 13.7
11	22.5	15.3	*	*	*	10.2	13.6
			*	*	*	8.8 - 10.2	11.5 - 13.6
13	22.5	15.3	*	*	*	*	13.6
			*	*	*	10.2 - 10.2	*
14	22.5	15.3	*	*	*	10.1	13.6
			*	*	*	8.6 - 10.1	11.3 - 13.6
16	22.5	15.3	*	*	*	*	13.6
			*	*	*	10.1 - 10.1	*
17	22.5	15.3	*	*	*	10.0	13.5
			*	*	*	7.2 - 10.0	9.3 - 13.5
19	22.5	15.3	*	*	*	10.1	13.5
			*	*	*	7.3 - 10.1	9.4 - 13.5
21	22.5	15.3	*	*	*	10.0	13.4
			*	*	*	7.2 - 10.0	9.3 - 13.4
23	22.5	15.3	*	*	*	10.0	13.5
			*	*	*	7.2 - 10.0	9.3 - 13.5
24	22.5	15.3	*	*	*	10.0	*
			*	*	*	7.2 - 10.0	9.3 - 13.4
26	22.5	15.3	*	*	*	*	13.3
			*	*	*	9.9 - 9.9	*
27	22.5	15.3	*	*	*	9.9	13.3
			*	*	*	7.2 - 9.9	9.2 - 13.3
29	22.5	15.3	*	*	*	9.9	13.3
			*	*	*	7.1 - 9.9	9.0 - 13.3
31	22.5	15.3	*	*	*	9.9	13.3
			*	*	*	6.9 - 9.9	8.8 - 13.3
33	22.5	15.3	*	*	*	9.9	13.3
			*	*	*	6.8 - 9.9	8.6 - 13.3
35	22.5	15.3	*	*	*	9.9	13.3
			*	*	*	6.8 - 9.9	8.6 - 13.3
37	22.5	15.3	*	*	*	9.9	13.3
			*	*	*	6.5 - 9.9	8.3 - 13.3
39	22.5	15.3	*	*	*	9.9	13.2
			*	*	*	6.5 - 9.9	8.3 - 13.2
41	22.5	15.3	*	*	*	9.8	13.2
			*	*	*	6.4 - 9.8	8.2 - 13.2
43	22.5	15.3	*	*	*	9.8	13.1
			*	*	*	6.3 - 9.8	8.2 - 13.1
45	22.5	15.3	*	*	*	9.7	13.1
			*	*	*	6.3 - 9.8	8.1 - 13.1
47	22.5	15.3	*	*	*	9.7	13.1
			*	*	*	6.2 - 9.7	8.2 - 13.1
49	22.5	15.3	*	*	*	9.8	12.8
			*	*	*	6.2 - 9.8	8.2 - 13.1
51	22.5	15.3	*	*	*	9.8	13.1
			*	*	*	6.2 - 9.8	8.2 - 13.1
53	22.5	15.3	*	*	*	9.8	13.1
			*	*	*	6.2 - 9.8	8.2 - 13.1
55	22.5	15.3	*	*	*	9.7	13.0

**Table 20: Coastal Transect Parameters**

Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
	Significant Wave Height Hs (ft)	Peak Wave Period Tp (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	.2% Annual Chance
			*	*	*	6.2 - 9.7	8.2 - 13.0
57	22.5	15.3	*	*	*	9.7	13.0
			*	*	*	6.2 - 9.7	8.3 - 13.0
59	22.5	15.3	*	*	*	9.6	12.9
			*	*	*	6.2 - 9.6	8.3 - 12.9
60	22.5	15.3	*	*	*	9.7	*
			*	*	*	6.3 - 9.7	8.4 - 12.9
61	22.5	15.3	*	*	*	9.7	*
			*	*	*	6.3 - 9.7	8.4 - 13.0
62	22.5	15.3	*	*	*	9.7	*
			*	*	*	6.3 - 9.7	8.4 - 12.9
63	22.5	15.3	*	*	*	9.6	*
			*	*	*	6.3 - 9.6	8.4 - 12.9
64	22.5	15.3	*	*	*	9.6	*
			*	*	*	6.3 - 9.6	8.5 - 12.9
65	22.5	15.3	*	*	*	9.6	*
			*	*	*	6.3 - 9.6	8.5 - 12.9
66	22.5	15.3	*	*	*	9.6	*
			*	*	*	6.3 - 9.6	8.5 - 12.9
67	22.5	15.3	*	*	*	9.6	*
			*	*	*	6.3 - 9.6	8.5 - 12.8
69	22.5	15.3	*	*	*	9.6	*
			*	*	*	6.4 - 9.6	8.6 - 8.6
70	22.5	15.3	*	*	*	9.5	*
			*	*	*	6.4 - 9.5	8.6 - 12.7
71	22.5	15.3	*	*	*	9.5	*
			*	*	*	6.4 - 9.5	8.6 - 12.7
72	22.5	15.3	*	*	*	9.5	*
			*	*	*	6.4 - 9.5	8.6 - 12.7
73	22.5	15.3	*	*	*	9.5	*
			*	*	*	6.4 - 9.5	8.6 - 12.7
74	22.5	15.3	*	*	*	9.5	*
			*	*	*	6.4 - 9.5	8.6 - 12.8
75	22.5	15.3	*	*	*	9.5	*
			*	*	*	6.4 - 9.6	8.7 - 12.7
76	22.5	15.3	*	*	*	9.5	*
			*	*	*	6.5 - 9.5	8.7 - 12.7
77	22.5	15.3	*	*	*	9.5	*
			*	*	*	6.5 - 9.5	8.7 - 12.7
78	22.5	15.3	*	*	*	9.5	*
			*	*	*	6.5 - 9.5	8.7 - 12.7
79	22.5	15.3	*	*	*	9.6	*
			*	*	*	6.5 - 9.6	8.8 - 12.7
81	22.5	15.3	*	*	*	9.4	12.7
			*	*	*	6.5 - 9.4	8.8 - 12.7
83	22.5	15.3	*	*	*	9.4	12.6
			*	*	*	6.6 - 9.4	8.9 - 12.6
84	22.5	15.3	*	*	*	9.4	*
			*	*	*	6.6 - 9.4	8.9 - 12.6
85	22.5	15.3	*	*	*	9.4	*
			*	*	*	6.6 - 9.4	8.9 - 12.5
86	22.5	15.3	*	*	*	9.4	*
			*	*	*	6.6 - 9.4	8.9 - 12.5
87	22.5	15.3	*	*	*	9.4	*
			*	*	*	6.6 - 9.4	8.9 - 12.5
88	22.5	15.3	*	*	*	9.4	*
			*	*	*	6.6 - 9.4	8.8 - 12.5
89	22.5	15.3	*	*	*	9.4	*
			*	*	*	6.6 - 9.4	8.8 - 12.6

**Table 20: Coastal Transect Parameters**

Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
	Significant Wave Height Hs (ft)	Peak Wave Period Tp (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	.2% Annual Chance
90	22.5	15.3	*	*	*	9.4	*
			*	*	*	6.6 - 9.4	8.8 - 12.5
92	22.5	15.3	*	*	*	9.4	12.5
			*	*	*	6.6 - 9.4	8.8 - 12.5
94	22.5	15.3	*	*	*	9.3	12.4
			*	*	*	6.6 - 9.3	8.8 - 12.4
96	22.5	15.3	*	*	*	9.4	12.4
			*	*	*	6.6 - 9.4	8.8 - 12.4
98	22.5	15.3	*	*	*	9.4	12.4
			*	*	*	6.6 - 9.4	8.7 - 12.4
100	22.5	15.3	*	*	*	9.3	12.4
			*	*	*	6.5 - 9.3	8.6 - 12.4
102	22.5	15.3	*	*	*	9.3	12.3
			*	*	*	6.4 - 9.3	8.6 - 12.3
103	22.5	15.3	*	*	*	9.3	*
			*	*	*	6.4 - 9.4	8.6 - 12.4
104	22.5	15.3	*	*	*	9.3	*
			*	*	*	6.5 - 9.4	8.6 - 12.3
105	22.5	15.3	*	*	*	9.3	*
			*	*	*	6.5 - 9.3	8.6 - 12.3
107	22.5	15.3	*	*	*	9.2	12.2
			*	*	*	6.4 - 9.2	8.5 - 12.2
109	22.5	15.3	*	*	*	9.2	12.2
			*	*	*	6.4 - 9.2	8.5 - 12.2
111	22.5	15.3	*	*	*	9.1	12.1
			*	*	*	6.6 - 9.2	8.5 - 12.1
113	22.5	15.3	*	*	*	9.2	12.2
			*	*	*	6.6 - 9.3	8.4 - 12.2
114	22.5	15.3	*	*	*	9.2	*
			*	*	*	6.6 - 9.6	8.4 - 12.1
116	22.5	15.3	*	*	*	9.0	11.9
			*	*	*	6.9 - 9.5	8.8 - 11.9
118	22.5	15.3	*	*	*	8.9	11.8
			*	*	*	6.7 - 9.4	8.1 - 11.8
120	22.5	15.3	*	*	*	8.8	11.7
			*	*	*	7.2 - 9.4	9.2 - 11.7
122	22.5	15.3	*	*	*	7.3	9.6
			*	*	*	7.3 - 9.0	9.4 - 11.3
124	22.5	15.3	*	*	*	7.7	10.3
			*	*	*	7.2 - 7.7	9.2 - 10.5
126	22.5	15.3	*	*	*	8.0	11.3
			*	*	*	7.4 - 8.4	9.9 - 11.4
128	22.5	15.3	*	*	*	8.7	11.4
			*	*	*	6.9 - 8.7	9.3 - 11.4
130	22.5	15.3	*	*	*	8.6	11.4
			*	*	*	6.5 - 8.6	8.5 - 11.4
132	22.5	15.3	*	*	*	8.6	11.3
			*	*	*	6.1 - 8.6	8.3 - 11.3
134	22.5	15.3	*	*	*	8.5	11.2
			*	*	*	5.8 - 8.5	8.0 - 11.3
136	22.5	15.3	*	*	*	8.4	11.1
			*	*	*	5.6 - 8.4	7.6 - 11.1
138	22.5	15.3	*	*	*	8.4	11.0
			*	*	*	5.4 - 8.4	7.5 - 11.0
140	22.5	15.3	*	*	*	8.2	10.7
			*	*	*	5.1 - 8.2	7.5 - 10.8
142	22.5	15.3	*	*	*	8.1	10.7
			*	*	*	5.0 - 8.1	7.3 - 10.7
144	22.5	15.3	*	*	*	7.8	10.4

**Table 20: Coastal Transect Parameters**

Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
	Significant Wave Height Hs (ft)	Peak Wave Period Tp (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	.2% Annual Chance
			*	*	*	5.1 - 7.9	7.3 - 10.4
146	22.5	15.3	*	*	*	7.7	10.3
			*	*	*	5.0 - 7.7	7.4 - 10.3
148	22.5	15.3	*	*	*	7.5	10.0
			*	*	*	4.9 - 7.5	7.1 - 10.0
150	22.5	15.3	*	*	*	7.3	9.7
			*	*	*	5.4 - 7.3	7.3 - 9.7
152	22.5	15.3	*	*	*	6.9	9.2
			*	*	*	5.2 - 6.9	7.1 - 9.2
154	22.5	15.3	*	*	*	*	10.4
			*	*	*	8.2 - 8.2	*
155	22.5	15.3	*	*	*	8.3	10.6
			*	*	*	6.4 - 8.3	8.5 - 10.6
157	22.5	15.3	*	*	*	8.2	10.6
			*	*	*	6.2 - 8.3	8.2 - 10.6
159	22.5	15.3	*	*	*	8.2	10.7
			*	*	*	5.3 - 8.3	7.2 - 10.7
161	22.5	15.3	*	*	*	8.2	10.6
			*	*	*	5.1 - 8.2	6.8 - 10.6
163	22.5	15.3	*	*	*	8.2	10.6
			*	*	*	5.1 - 8.2	7.0 - 10.6
165	22.5	15.3	*	*	*	8.3	10.6
			*	*	*	5.1 - 8.3	7.2 - 10.6
167	22.5	15.3	*	*	*	8.2	10.5
			*	*	*	5.1 - 8.2	7.1 - 10.5
169	22.3	13.9	*	*	*	8.2	10.5
			*	*	*	5.2 - 8.2	7.3 - 10.5
171	22.5	15.3	*	*	*	8.2	10.5
			*	*	*	5.3 - 8.2	7.4 - 10.5
173	22.5	15.3	*	*	*	8.2	10.6
			*	*	*	5.3 - 8.2	7.4 - 10.6
175	22.5	15.3	*	*	*	8.4	10.7
			*	*	*	5.3 - 8.4	7.4 - 10.7
177	22.5	15.3	*	*	*	8.3	10.7
			*	*	*	5.4 - 8.3	7.5 - 10.7
179	22.5	15.3	*	*	*	8.3	10.6
			*	*	*	5.4 - 8.3	7.5 - 10.6
181	22.5	15.3	*	*	*	8.2	10.5
			*	*	*	5.3 - 8.2	7.5 - 10.5
183	24.5	15.6	*	*	*	8.3	10.5
			*	*	*	5.3 - 8.3	7.4 - 10.5
185	24.5	15.6	*	*	*	8.2	10.5
			*	*	*	5.3 - 8.2	7.4 - 10.5
187	24.5	15.6	*	*	*	8.2	10.4
			*	*	*	5.3 - 8.2	7.2 - 10.4
189	24.5	15.6	*	*	*	8.2	10.4
			*	*	*	5.3 - 8.2	7.2 - 10.4
191	24.5	15.6	*	*	*	8.3	10.5
			*	*	*	5.2 - 8.3	7.4 - 10.5
193	24.5	15.6	*	*	*	8.2	10.4
			*	*	*	5.3 - 8.2	7.3 - 10.4
195	24.5	15.6	*	*	*	8.1	10.4
			*	*	*	5.3 - 8.1	6.7 - 10.4
197	24.5	15.6	*	*	*	8.1	10.3
			*	*	*	5.4 - 8.1	6.3 - 10.3
199	24.5	15.6	*	*	*	8.2	10.4
			*	*	*	5.7 - 8.2	8.3 - 10.4
201	24.5	15.6	*	*	*	8.1	10.2
			*	*	*	4.5 - 8.1	5.7 - 10.2

**Table 20: Coastal Transect Parameters**

Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
	Significant Wave Height Hs (ft)	Peak Wave Period Tp (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	.2% Annual Chance
203	24.5	15.6	*	*	*	6.1	8.6
			*	*	*	5.9 - 6.1	8.3 - 8.6
205	24.5	15.6	*	*	*	8.0	10.1
			*	*	*	4.5 - 8.0	5.7 - 10.1
207	24.5	15.6	*	*	*	8.1	10.4
			*	*	*	6.2 - 8.1	8.4 - 10.4
209	24.5	15.6	*	*	*	8.3	10.5
			*	*	*	5.3 - 8.3	7.8 - 10.5
211	24.5	15.6	*	*	*	6.9	10.1
			*	*	*	5.1 - 8.1	7.4 - 10.2
213	24.5	15.6	*	*	*	7.7	9.8
			*	*	*	5.0 - 7.7	6.9 - 9.8
215	24.5	15.6	*	*	*	8.0	10.2
			*	*	*	4.3 - 8.0	5.7 - 10.2
217	24.5	15.6	*	*	*	7.9	10.0
			*	*	*	4.2 - 7.9	5.7 - 10.0
219	24.5	15.6	*	*	*	8.1	10.2
			*	*	*	4.0 - 8.1	5.1 - 10.2
221	24.5	15.6	*	*	*	8.2	10.3
			*	*	*	4.0 - 8.2	5.1 - 10.3
223	24.5	12.0	*	*	*	8.1	10.1
			*	*	*	3.8 - 8.1	5.0 - 10.1
225	24.5	12.0	*	*	*	8.1	10.2
			*	*	*	4.1 - 8.1	5.6 - 10.2
227	24.5	12.0	*	*	*	8.1	10.2
			*	*	*	4.1 - 8.1	5.5 - 10.2
229	23.9	15.3	*	*	*	8.0	10.1
			*	*	*	3.7 - 8.0	4.7 - 10.1
231	23.9	15.3	*	*	*	8.0	10.0
			*	*	*	3.7 - 8.0	4.7 - 10.0
233	23.9	15.3	*	*	*	8.2	10.2
			*	*	*	4.1 - 8.2	5.4 - 10.2
235	23.9	15.3	*	*	*	8.1	10.0
			*	*	*	4.0 - 8.1	5.3 - 10.0
237	23.9	15.3	*	*	*	8.1	10.1
			*	*	*	3.9 - 8.1	5.3 - 10.1
239	23.9	15.3	*	*	*	8.0	9.9
			*	*	*	3.8 - 8.0	5.1 - 9.9
241	23.9	15.3	*	*	*	8.0	9.9
			*	*	*	3.9 - 8.0	5.0 - 9.9
243	23.9	15.3	*	*	*	7.9	9.8
			*	*	*	4.1 - 7.9	5.3 - 9.8
245	23.9	15.3	*	*	*	8.1	9.9
			*	*	*	4.1 - 8.1	5.4 - 9.9
247	23.9	15.3	*	*	*	8.1	9.9
			*	*	*	3.7 - 8.1	4.8 - 9.9
249	23.9	15.3	*	*	*	7.9	9.8
			*	*	*	4.1 - 8.0	5.3 - 9.9
251	7.1	5.5	*	*	*	3.7	4.8
			*	*	*	3.7 - 4.0	4.8 - 5.2
253	7.1	5.5	*	*	*	3.7	4.7
			*	*	*	3.7 - 4.3	4.7 - 5.6
255	7.1	5.5	*	*	*	3.7	4.7
			*	*	*	3.7 - 4.2	4.7 - 5.3
257	7.1	5.5	*	*	*	3.7	4.7
			*	*	*	3.7 - 4.2	4.7 - 5.3
259	7.1	5.5	*	*	*	4.2	5.3
			*	*	*	4.2 - 4.7	5.3 - 6.1
261	7.1	5.5	*	*	*	4.3	5.4

**Table 20: Coastal Transect Parameters**

Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
	Significant Wave Height Hs (ft)	Peak Wave Period Tp (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	.2% Annual Chance
			*	*	*	4.3 - 5.7	5.4 - 7.6
263	7.1	5.5	*	*	*	4.4	5.6
			*	*	*	4.4 - 5.5	5.6 - 7.3
265	7.1	5.5	*	*	*	4.1	5.2
			*	*	*	4.1 - 4.5	5.2 - 5.7
267	7.1	5.5	*	*	*	3.8	4.9
			*	*	*	3.8 - 4.3	4.9 - 5.5
269	7.1	5.5	*	*	*	3.8	4.8
			*	*	*	3.8 - 3.9	4.8 - 4.9
271	7.1	5.5	*	*	*	3.9	5.0
			*	*	*	3.8 - 3.9	4.9 - 5.0
273	7.1	5.5	*	*	*	4.1	5.2
			*	*	*	4.0 - 4.1	5.1 - 5.2
275	7.1	5.5	*	*	*	4.2	5.3
			*	*	*	4.1 - 4.2	5.2 - 5.3
277	7.1	5.5	*	*	*	4.4	5.6
			*	*	*	4.4 - 4.5	5.6 - 5.8
279	7.1	5.5	*	*	*	4.4	5.6
			*	*	*	4.4 - 5.4	5.6 - 6.7
281	7.1	5.5	*	*	*	4.6	5.8
			*	*	*	4.6 - 5.1	5.8 - 6.3
283	7.1	5.5	*	*	*	4.8	6.0
			*	*	*	4.7 - 5.4	5.9 - 6.7
285	7.1	5.5	*	*	*	5.1	6.3
			*	*	*	5.1 - 5.4	6.3 - 6.7
287	7.1	5.5	*	*	*	5.1	6.3
			*	*	*	5.1 - 5.3	6.3 - 6.5
289	7.1	5.5	*	*	*	5.0	6.3
			*	*	*	5.0 - 5.1	6.3 - 6.3
291	7.1	5.5	*	*	*	5.2	6.6
			*	*	*	5.2 - 6.5	6.5 - 7.8
293	7.1	5.5	*	*	*	5.6	7.0
			*	*	*	5.6 - 6.5	6.8 - 7.9
295	3.3	7.6	*	*	*	9.8	12.9
			*	*	*	9.8 - 9.9	12.9 - 13.2
297	2.4	2.9	*	*	*	9.3	12.3
			*	*	*	9.3 - 9.3	12.3 - 12.3
299	2.4	2.9	*	*	*	8.4	11.1
			*	*	*	8.4 - 8.4	11.1 - 11.1
301	2.4	2.9	*	*	*	7.4	9.6
			*	*	*	7.2 - 7.4	9.3 - 9.6
303	2.4	2.9	*	*	*	7.0	8.9
			*	*	*	7.0 - 7.0	8.9 - 8.9
305	2.4	2.9	*	*	*	6.9	8.9
			*	*	*	6.9 - 7.4	8.9 - 9.9
307	2.4	2.9	*	*	*	6.3	8.2
			*	*	*	6.3 - 6.3	8.2 - 8.2
309	2.4	2.9	*	*	*	6.2	8.2
			*	*	*	6.2 - 6.2	8.2 - 8.2
311	2.4	2.9	*	*	*	6.3	8.4
			*	*	*	6.3 - 6.3	8.4 - 8.4
313	2.4	2.9	*	*	*	6.3	8.5
			*	*	*	6.3 - 6.3	8.5 - 8.5
315	2.4	2.9	*	*	*	6.4	8.7
			*	*	*	6.4 - 6.4	8.7 - 8.7
317	2.4	2.9	*	*	*	6.6	8.8
			*	*	*	6.6 - 6.6	8.8 - 8.8
319	2.4	2.9	*	*	*	6.6	8.9
			*	*	*	6.6 - 6.6	8.9 - 8.9

**Table 20: Coastal Transect Parameters**

Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
	Significant Wave Height Hs (ft)	Peak Wave Period Tp (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	.2% Annual Chance
321	2.4	2.9	*	*	*	6.6	8.7
			*	*	*	6.6 - 6.6	8.7 - 8.7
323	2.4	2.9	*	*	*	6.5	8.6
			*	*	*	6.5 - 6.5	8.6 - 8.6
325	2.4	2.9	*	*	*	6.7	8.7
			*	*	*	6.4 - 6.7	8.5 - 8.8
327	2.4	2.9	*	*	*	6.8	8.7
			*	*	*	6.8 - 6.8	8.6 - 8.7
329	5.0	11.9	*	*	*	7.8	10.2
			*	*	*	7.7 - 7.8	10.0 - 10.2
<b>Atlantic Ocean</b>		<b>From Atlantic Ocean coastline</b>			<b>To Pungo River Canal</b>		
<b>Atlantic Ocean</b>		<b>From Entire Onslow County shoreline along Atlantic Ocean</b>			<b>To End of coastal influence on New River</b>		
<b>Neuse River</b>		<b>From The confluences of South River and Neuse River</b>			<b>To Approximately 1.1 miles upstream of the confluence with Swift Creek</b>		
1	5.4	4.2	*	*	*	6.2	7.7
			*	*	*	6.2 - 6.7	7.7 - 8.1
3	5.4	4.2	*	*	*	6.1	7.7
			*	*	*	6.1 - 7.3	7.7 - 8.8
6	5.4	4.2	*	*	*	6.5	8.2
			*	*	*	6.5 - 7.8	8.1 - 9.5
11	5.4	4.2	*	*	*	6.9	8.7
			*	*	*	6.9 - 7.4	8.7 - 9.3

## 6.0 Mapping Methods

### 6.1 Vertical and Horizontal Control

#### Vertical Datum

All FISs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. With the finalization of the North American Vertical Datum of 1988 (NAVD 88), all North Carolina FISs have been prepared using NAVD 88 as the referenced vertical datum.

All flood elevations shown on the FIRM for Carteret County are referenced to NAVD 88. Structure and ground elevations in the county must, therefore, be referenced to NAVD 88. It is important to note that FISs for adjacent communities in neighboring states may be referenced to NGVD 29. This may result in BFE differences across political boundaries between the communities.

As noted above, the elevations shown in this FIS are referenced to NAVD 88. Ground, structure, and flood elevations may be compared and/or referenced to NGVD 29 by applying a standard conversion factor. The conversion factor for Carteret County is # feet. The locations used to establish the conversion factor were USGS quadrangle corners that fell within the county, as well as those that were within 2.5 miles outside the county. The benchmarks are referenced to NAVD 88. Table 21, "Datum Conversion Locations and Values," is shown below.

Table 21, "Datum Conversion Locations and Values."

**Table 21 - Datum Conversion Locations and Values**

Latitude	Longitude	Conversion from NGVD29 to NAVD88 (feet)
35.00	-76.63	-1.00
35.00	-76.50	-0.98
35.00	-76.37	-0.98
35.00	-76.25	-1.04
35.12	-76.12	-1.03

**Table 21 - Datum Conversion Locations and Values**

Latitude	Longitude	Conversion from NGVD29 to NAVD88 (feet)
35.00	-76.13	-1.12
34.87	-76.63	-0.96
34.87	-76.50	-0.96
34.87	-76.38	-1.01
34.88	-76.25	-1.13
34.75	-77.12	-1.06
34.75	-77.00	-1.05
34.75	-76.87	-1.06
34.75	-76.75	-1.04
34.75	-76.62	-0.97
34.75	-76.50	-1.01
34.75	-76.38	-1.14
34.62	-77.00	-1.06
34.62	-76.50	-1.13
Average conversion in Carteret County from NGVD 29 to NAVD 88 = -1.04 feet		

The vertical datum conversion factor for all flooding sources which run along a county boundary are in accordance with the conversion factor used in those contiguous counties.

BFEs shown on the FIRM represent whole-foot rounded values. For example, a 1% annual chance water-surface elevation of 102.4 feet will appear as 102 on the FIRM and 102.6 feet will appear as 103. Therefore, users who wish to convert the elevations in this FIS to NGVD 29 should apply the stated conversion factor(s) to elevations shown on the Flood Profiles and/or Water-surface elevation rasters and supporting data tables in the FIS Report, which are shown, at a minimum, to the nearest 0.1 foot.

For more information on NAVD 88, see *Converting the National Flood Insurance Program to the North American Vertical Datum of 1988*, or contact the Vertical Network Branch, National Geodetic Survey, Coast and Geodetic Survey, National Oceanic and Atmospheric Administration, Rockville, Maryland 20910 (<http://www.ngs.noaa.gov>).

**Vertical Control Monuments**

Qualifying bench marks within Carteret County that are cataloged by the National Geodetic Survey (NGS) and entered into the National Spatial Reference System (NSRS) as First or Second Order Vertical, with a vertical stability classification of A, B, or C, are shown and labeled on the FIRM with their 6-character NSRS Permanent Identifier (PID).

The National Geodetic Survey establishes precisely located monuments on the North Carolina Grid System and Bench Marks referenced to a vertical datum (NGVD 1929 and NAVD 1988).

Bench marks cataloged by the NGS and entered into the NSRS vary widely in vertical stability classification. NSRS vertical stability classifications are as follows:

- Stability A: Monuments of the most reliable nature, expected to hold position/elevation well (e.g., mounted in bedrock)
- Stability B: Monuments which generally hold their position/elevation well (e.g., concrete bridge abutment)
- Stability C: Monuments which may be affected by surface ground movements (e.g., concrete monument below frost line)
- Stability D: Mark of questionable or unknown vertical stability (e.g., concrete monument above frost line, or steel witness post)

Monuments with a Stability D classification may be used as Elevation Reference Marks (ERMs) when a Stability C or better monument is not an option. These ERMs must be approved by NCGS and can be set and used as elevation bench marks to establish vertical control and produce NC DFIRMs. Including such ERMs will greatly augment North Carolina’s useable vertical control network.

In addition, when local jurisdictions have established their own vertical monument network, these monuments may also be shown on the FIRM with the appropriate designations. Local monuments will be placed on the FIRM if the community has requested that they be

included and if the monuments meet the aforementioned criteria.

North Carolina Geodetic Survey (NCGS) and contractor surveyed vertical control monuments will be shown on the FIRM panels. Those cataloged by NCGS meet similar requirements to the NGS monuments as described above. Most monuments that have been cataloged by NCGS have been established to NGS standards, but have not been submitted to NGS for inclusion into the NSRS. The qualifying criteria for depicting bench marks established by the State's contractors on the new digital FIRM panels include:

- GPS surveying of permanent 3-D survey monuments to 5-centimeter or better local network accuracy guidelines, in accordance with NOAA Technical Memorandum NOS NGS-58 "Guidelines for Establishing GPS-Derived Ellipsoid Heights (Standards: 2 cm and 5 cm)," and conversion to NAVD 88 orthometric heights using NGS' latest geoid mode;
- Requiring a stability classification of "C" or better; and
- Submitting GPS files and station descriptions to NCGS.

To obtain current information for cataloging local bench marks in the NSRS, please visit the Data Sheet page of the NGS website at <http://www.ngs.noaa.gov/cgi-bin/datasheet.prl>, or contact the NGS Information Services Branch at:

**NGS Information Services  
NOAA, N/NGS12  
National Geodetic Survey  
SSMC-3, #9202  
1315 East-West Highway  
Silver Spring, Maryland 20910-32822  
(301) 713-3242**

Information regarding the NCGS or State contractor bench marks can be obtained through the NCGS website at [www.ncgs.state.nc.us](http://www.ncgs.state.nc.us), or by phone at (919) 733-3836.

It is important to note that temporary vertical monuments, sometimes called Elevation Reference Marks, are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, interested individuals may contact FEMA to access this information.

#### **Horizontal Datum and Control**

The digital files that comprise the FIRM are georeferenced to an established coordinate system. The coordinate system used for the production of this FIRM is North Carolina State Plane (FIPZONE 3200) referenced to the North American Datum of 1983 (NAD83), GRS80 ellipsoid.

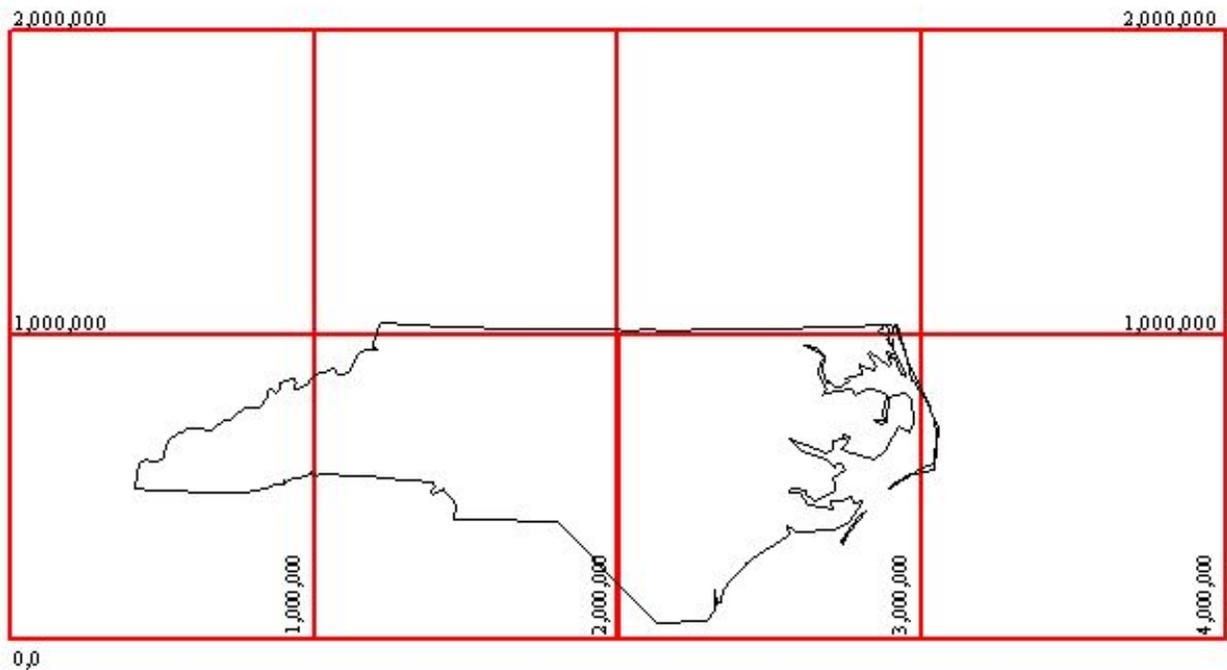
## **6.2 Base Map**

The FIRMs and FIS Report for this project have been produced in a digital format. The flood hazard information was converted to a Geographic Information System (GIS) format that meets FEMA's FIRM database specifications and geographic information standards. This information is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community. The FIRM Database includes most of the tabular information contained in the FIS Report in such a way that the data can be associated with pertinent spatial features.

The projection used in the preparation of this map was the North Carolina State Plane Coordinate System. The horizontal datum was NAD83, GRS80 spheroid. Differences in datum, spheroid, or projection used in the production of FIRMs for adjacent states may result in slight positional differences in map features across the state boundary. These differences do not affect the accuracy of this FIRM.

As part of the North Carolina CTS Initiative, North Carolina digital FIRM panel numbers are consistent with the North Carolina Land Records Management Program (LRMP).

The 11-digit digital FIRM panel numbering system for North Carolina is: SS MM LLLL PP X, where SS = State Federal Information Processing Code (37); MM = Easting-Northing (EN) 1,000,000-foot coordinates; LLLL = LRMP map numbers to include the EN 100,000-foot coordinates, and the EN 10,000-foot coordinates; PP = place holders for additional EN 1,000-foot coordinates; and X = suffix ("J" for the initial edition). North Carolina's State Plane Coordinate System origin is outside the State boundary to the southwest (in Georgia), the eastings range from approximately 0,404,000 (Tennessee border) to 3,040,000 (Atlantic Ocean); and the northings range from approximately 0,045,000 (South Carolina border) to 1,043,000 (Virginia border). Digital FIRM panels were compiled at either 1"=1,000', covering an area of 20,000 feet x 20,000 feet (20" x 20" panels); or at 1"=500', covering an area of 10,000 feet x 10,000 feet (20" x 20" panels). An additional 2 digits (both zeros) are held in reserve as a "place holder" in the event that future FIRMs are printed at a larger scale; e.g., 1"=250', covering an area of 5,000 feet x 5,000 feet for which the 1,000-foot coordinates would either be 0 or 5.



**Figure 3 - North Carolina's State Plane Coordinate System**

## 6.3 Floodplain and Floodway Delineation

### Floodplain Boundaries

For streams restudied by detailed and limited detailed methods, the 1% and 0.2% annual chance floodplains were delineated using flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic data acquired using airborne Light Detection and Ranging (LIDAR). This LIDAR data was acquired during the (insert date from basin plan and update for map maintenance, if necessary) flying season.

The topographic data satisfies a vertical root-mean-square error (RMSE) accuracy standard of 20 cm (1.3 feet accuracy at the 95% confidence limit) for the Outer Banks and 25 cm (1.6 feet accuracy at the 95% confidence limit) for those portions of the basin lying west of the Outer Banks. These data could be contoured at roughly a 2-foot vertical contour interval. All elevations were referenced to the NAVD 88 and reflect orthometric heights. Variably spaced, bare-earth digital topographic data in ASCII point file format were combined with imagery (either flown concurrently with the LIDAR data or using existing digital orthophotos) to establish a Triangulated Irregular Network (TIN) of digital elevation points, which include selected breaklines to be used for hydraulic modeling. Furthermore, a uniformly spaced sampling of the TIN resulted in uniformly spaced Digital Elevation Models (DEMs), with 20 ft x 20 ft post spacing, which was generated in multiple file formats.

For coastal floodplains, after analyzing wave heights along each transect, wave elevations were interpolated between transects. Various source data were used in the interpolation, including topographic data described above. Controlling features affecting the elevations were identified and considered in relation to their positions at particular transect and their variation between transects. •

The 1% annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones VE, AO, AH, A99, AR, A, and AE), and the 0.2% annual chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundaries have been shown.

### Floodway Delineation

The floodways presented in this FIS were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 22, "Floodway Data"). The computed floodway is shown on the FIRM. In cases where the floodway and 1% annual chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown. In areas where the top of the bridge or road is higher than the 1.0-percent annual chance (100-year) flood, the FIRM will show the flood discharge as contained within the structure for emergency management purposes. It is important to note that FEMA and community floodway regulations still apply in and around those areas.

**Table 22 - Floodway Data**

Floodway Source		Floodway			Water Surface Elevation			
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	Without Floodway	With Floodway	Increase
<b>Deep Creek</b>								
114	11,382	340	2,064	1.1	9.2	9.2	9.4	0.2
126	12,643	313	1,990	1.1	9.5	9.5	9.7	0.2
138	13,822	280	2,041	1.0	9.7	9.7	9.9	0.3
150	14,988	370	1,859	1.1	9.8	9.8	10.1	0.4
161	16,077	223	996	2.0	9.9	9.9	10.5	0.5
172	17,198	209	805	2.5	10.6	10.6	11.3	0.7
186	18,639	163	814	2.5	11.8	11.8	12.6	0.9
192	19,229	308	1,617	1.0	12.8	12.8	13.7	0.9
203	20,331	293	1,416	1.1	12.9	12.9	13.9	0.9
221	22,089	69	538	2.6	13.7	13.7	14.4	0.8
<b>Little Deep Creek</b>								
048	4,758	225	1,138	1.4	9.1	9.1	8.4	-0.6
060	6,004	194	743	1.8	9.3	9.3	9.1	-0.2
070	7,001	175	675	2.0	9.5	9.5	9.7	0.2
077	7,661	106	438	2.8	10.0	10.0	10.4	0.4
084	8,450	94	411	3.0	10.7	10.7	11.1	0.5
093	9,295	99	382	3.2	11.6	11.6	12.0	0.4
099	9,897	94	367	3.2	12.4	12.4	12.8	0.4
105	10,519	94	376	3.1	13.1	13.1	13.4	0.3
111	11,125	82	391	3.0	13.7	13.7	14.0	0.3
<b>Main Prong</b>								
001	116	240	743	1.6	9.3	9.3	9.4	0.0
009	862	190	558	2.2	9.9	9.9	10.3	0.4
016	1,642	170	651	1.9	11.2	11.2	11.9	0.7
026	2,613	240	1,244	1.0	11.8	11.8	12.6	0.8
033	3,266	240	1,309	0.8	12.0	12.0	12.9	0.9
038	3,845	240	1,339	0.8	12.2	12.2	13.1	0.9
044	4,416	240	1,176	0.9	12.4	12.4	13.3	0.9
050	5,031	200	988	1.1	13.0	13.0	13.8	0.9
056	5,640	200	818	1.4	13.6	13.6	14.5	1.0
061	6,130	200	714	1.6	14.4	14.4	15.4	1.0

**Table 22 - Floodway Data**

Floodway Source		Floodway			Water Surface Elevation			
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	Without Floodway	With Floodway	Increase
065	6,510	140	551	2.0	17.0	17.0	17.8	0.8
068	6,802	260	1,025	0.9	17.4	17.4	18.4	1.0
073	7,321	200	650	1.4	18.1	18.1	19.0	0.9
080	7,990	250	594	1.3	19.7	19.7	20.5	0.8
088	8,798	290	754	1.0	21.2	21.2	22.0	0.8
096	9,596	374	1,053	0.6	21.6	21.6	22.5	1.0
104	10,353	370	1,091	0.5	21.9	21.9	22.9	1.0
114	11,419	320	810	0.7	22.8	22.8	23.7	0.9
125	12,541	320	693	0.8	24.0	24.0	25.0	1.0
131	13,103	320	765	0.8	24.6	24.6	25.5	1.0
<b>Newport River</b>								
1035	103,457	980	7,705	0.9	9.4	9.4	8.7	-0.7
1050	105,046	600	5,369	1.3	9.6	9.6	8.9	-0.6
1055	105,464	600	5,627	1.2	9.6	9.6	9.0	-0.6
1062	106,229	660	5,795	1.1	9.6	9.6	9.1	-0.5
1071	107,083	684	6,382	1.0	9.6	9.6	9.2	-0.4
1081	108,050	500	4,894	1.3	9.6	9.6	9.3	-0.4
1097	109,716	272	3,136	2.0	9.7	9.7	9.5	-0.2
1109	110,864	850	8,320	0.7	9.9	9.9	10.2	0.3
1130	112,999	1,285	10,823	0.6	10.1	10.1	10.5	0.4
1145	114,500	1,338	12,106	0.5	10.2	10.2	10.6	0.4
1160	116,000	1,105	9,973	0.6	10.3	10.3	10.8	0.5
1185	118,506	1,369	11,936	0.5	10.5	10.5	11.1	0.5
1200	120,000	1,052	9,097	0.6	10.8	10.8	11.3	0.5
1210	121,001	870	7,730	0.7	10.9	10.9	11.4	0.6
1219	121,920	1,039	8,880	0.6	11.0	11.0	11.6	0.6
1235	123,500	994	8,142	0.7	11.2	11.2	11.9	0.6
1250	125,000	680	5,075	0.7	11.5	11.5	12.2	0.7
1260	125,999	*	*	*	12.3	12.3	*	*
1267	126,710	645	4,844	0.7	13.2	13.2	14.0	0.9
1279	127,910	625	4,406	0.8	13.8	13.8	14.7	0.8
1295	129,497	600	4,088	0.9	14.6	14.6	15.5	0.9
1305	130,497	585	3,952	0.8	15.1	15.1	16.0	0.9
1315	131,497	560	3,956	0.8	15.7	15.7	16.6	0.9
1320	131,998	820	5,340	0.6	15.9	15.9	16.9	1.0
1327	132,678	665	4,250	0.8	16.2	16.2	17.1	0.9
1332	133,172	755	4,702	0.7	16.5	16.5	17.4	0.9
1340	134,017	775	4,438	0.8	16.9	16.9	17.8	1.0
1351	135,122	728	3,471	1.0	17.8	17.8	18.7	1.0
<b>Pettiford Creek</b>								
128	12,833	570	1,862	1.8	10.0 <sup>1</sup>	9.9	2.9	-7.0
136	13,566	696	1,797	1.9	10.0 <sup>1</sup>	9.9	3.4	-6.5
147	14,738	332	1,536	2.2	10.0 <sup>1</sup>	9.9	4.7	-5.3
173	17,283	663	3,339	1.0	10.0 <sup>1</sup>	9.9	5.6	-4.4
198	19,763	790	3,517	0.9	10.0 <sup>1</sup>	10.0	6.1	-3.8

**Table 22 - Floodway Data**

Floodway Source		Floodway			Water Surface Elevation			
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	Without Floodway	With Floodway	Increase
223	22,268	802	4,536	0.7	10.0 <sup>1</sup>	10.0	6.6	-3.4
256	25,560	522	3,013	1.0	10.0	10.0	7.5	-2.6
276	27,596	527	3,640	0.8	10.1	10.1	7.9	-2.1
291	29,060	575	4,150	0.6	10.1	10.1	8.2	-1.9
302	30,212	459	3,327	0.8	10.2	10.2	8.4	-1.7
<b>Southwest Prong Newport River</b>								
010	1,000	613	3,740	1.0	11.4 <sup>1</sup>	10.5	11.0	0.5
020	2,000	500	3,356	1.1	11.4 <sup>1</sup>	11.1	11.8	0.7
030	2,999	400	2,786	1.3	11.7	11.7	12.5	0.8
040	3,999	544	3,804	1.0	12.3	12.3	13.1	0.8
052	5,178	544	3,246	1.1	12.9	12.9	13.7	0.9
060	6,000	438	2,748	1.3	13.4	13.4	14.4	0.9
070	7,000	640	3,807	0.9	14.2	14.2	15.1	0.9
080	8,000	773	4,692	0.8	14.6	14.6	15.6	1.0
085	8,500	385	2,527	1.4	14.9	14.9	15.8	1.0
104	10,385	325	2,566	1.4	16.7	16.7	17.7	1.0

<sup>1</sup>Elevation includes backwater effects

\* Values not computed for this station

## 6.4 Coastal Flood Hazard Mapping

Flood insurance zones and BFEs including the wave effects were identified on each transect based on the results from the onshore wave hazard analyses. Between transects, elevations were interpolated using topographic maps, land-use and land-cover data, and knowledge of coastal flood processes to determine the aerial extent of flooding. Sources for topographic data are shown in Table 23.

Zone VE is subdivided into elevation zones and BFEs are provided on the FIRM.

The limit of Zone VE shown on the FIRM is defined as the farthest inland extent of any of these criteria (determined for the 1% annual chance flood condition):

- *The primary frontal dune zone* is defined in 44 CFR Section 59.1 of the NFIP regulations. The primary frontal dune represents a continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes that occur immediately landward and adjacent to the beach. The primary frontal dune zone is subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune zone occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope.
- *The wave runup zone* occurs where the (eroded) ground profile is 3.0 feet or more below the 2-percent wave runup elevation.
- *The wave overtopping splash zone* is the area landward of the crest of an overtopped barrier, in cases where the potential 2-percent wave runup exceeds the barrier crest elevation by 3.0 feet or more.
- *The breaking wave height zone* occurs where 3-foot or greater wave heights could occur (this is the area where the wave crest profile is 2.1 feet or more above the total stillwater elevation).
- *The high-velocity flow zone* is landward of the overtopping splash zone (or area on a sloping beach or other shore type),

where the product of depth of flow times the flow velocity squared (hv<sup>2</sup>) is greater than or equal to 200 ft<sup>3</sup>/sec<sup>2</sup>. This zone may only be used on the Pacific Coast.

The SFHA boundary indicates the limit of SFHAs shown on the FIRM as either “V” zones or “A” zones.

**Table 23: Summary of Coastal Transect Mapping Considerations**

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
Adams Creek	1	*	*	AE 0-5 VE 3-5	WHAFIS	SWEL
	2	*	*	AE 4 VE 3-5	WHAFIS	SWEL
	3	*	*	AE 4 VE 2-5	WHAFIS	SWEL
Atlantic Ocean	1	X	*	AE 2-5 VE 1-11	PFD	PFD
	2	X	*	AE 0-5 VE 0-11	PFD	PFD
	3	X	*	AE 3 VE 11	PFD	PFD
	4	X	*	VE 11	PFD	PFD
	5	X	*	AE 1 VE 10	PFD	PFD
	6	X	*	AE 3 VE 11	PFD	PFD
	7	X	*	AE 2 VE 10	PFD	PFD
	8	X	*	AE 4 VE 10	PFD	PFD
	9	X	*	AE 3 VE 10	PFD	PFD
	10	X	*	AE 4 VE 0-10	PFD	PFD
	11	X	*	VE 10	PFD	PFD
	12	X	*	AE 4 VE 10	PFD	PFD
	13	X	*	VE 11	PFD	PFD
	14	X	*	AE 4 VE 9	PFD	PFD
	15	X	*	AE 2 VE 0-10	PFD	PFD
	16	X	*	AE 4 VE 10	PFD	PFD

**Table 23: Summary of Coastal Transect Mapping Considerations**

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	17	X	*	AE 0 VE 0-9	PFD	PFD
	18	X	*	AE 4 VE 0-10	PFD	PFD
	19	X	*	VE 10	PFD	PFD
	20	X	*	AE 5 VE 10	PFD	PFD
	21	X	*	VE 10	PFD	PFD
	22	X	*	AE 5 VE 10	PFD	PFD
	23	X	*	AE 1 VE 10	PFD	PFD
	24	X	*	AE 3 VE 11	PFD	PFD
	25	X	*	AE 1 AO 1 VE 10	PFD	PFD
	26	X	*	AE 4 VE 11	PFD	PFD
	27	X	*	AE 2 AO 0-2 VE 10	PFD	PFD
	28	X	*	AE 4 VE 10	PFD	PFD
	29	X	*	AE 1 VE 0-10	PFD	PFD
	30	X	*	AE 5 VE 0-10	PFD	PFD
	31	X	*	AE 2 VE 10	PFD	PFD
	32	X	*	AE 4 VE 10	PFD	PFD
	33	X	*	AE 3 VE 10	PFD	PFD
	34	X	*	AE 4 VE 8	PFD	PFD
	35	X	*	AE 3 VE 10	PFD	PFD
	36	X	*	AE 4 VE 0-10	PFD	PFD

**Table 23: Summary of Coastal Transect Mapping Considerations**

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	37	X	*	AE 3 VE 10	PFD	PFD
	38	X	*	AE 4 VE 10	PFD	PFD
	39	X	*	AE 2 VE 10	PFD	PFD
	40	X	*	AE 4 VE 0-10	PFD	PFD
	41	X	*	AE 2 VE 10	PFD	PFD
	42	X	*	AE 4 VE 10	PFD	PFD
	43	X	*	AE 1 VE 0-10	PFD	PFD
	44	X	*	AE 4 VE 10	PFD	PFD
	45	X	*	AE 3 VE 0-10	PFD	PFD
	46	X	*	AE 4 VE 10	PFD	PFD
	47	X	*	AE 0 VE 0-10	PFD	PFD
	48	X	*	AE 6 VE 0-10	PFD	PFD
	49	X	*	VE 0-10	PFD	PFD
	50	X	*	AE 4 VE 10	PFD	PFD
	51	X	*	AE 1-2 VE 8	PFD	PFD
	52	X	*	AE 4 VE 9	PFD	PFD
	53	X	*	AE 4 VE 10	PFD	PFD
	54	X	*	AE 3 VE 10	PFD	PFD
	55	X	*	AE 4 VE 9	PFD	PFD
	56	X	*	AE 0-3 VE 10	PFD	PFD
	57	X	*	AE 0 VE 0-10	PFD	PFD

**Table 23: Summary of Coastal Transect Mapping Considerations**

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	58	X	*	AE 4 VE 9	PFD	PFD
	59	X	*	AE 0 VE 0-10	PFD	PFD
	60	X	*	AE 5 VE 15	PFD	PFD
	61	X	*	VE 10	PFD	PFD
	62	X	*	AE 2 VE 10	PFD	PFD
	63	X	*	AE 1-2 VE 0-10	PFD	PFD
	64	X	*	AE 6 VE 0-10	PFD	PFD
	65	X	*	AE 1 VE 0-10	PFD	PFD
	66	X	*	AE 3 VE 0-10	PFD	PFD
	67	X	*	AE 1 VE 0-16	PFD	PFD
	68	X	*	AE 0-4 VE 0-11	PFD	PFD
	69	X	*	VE 7	PFD	PFD
	70	X	*	AE 1 VE 0-10	PFD	PFD
	71	X	*	AE 1 VE 10	PFD	PFD
	72	X	*	AE 4 VE 10	PFD	PFD
	73	X	*	VE 10	PFD	PFD
	74	X	*	AE 4 VE 10	PFD	PFD
	75	X	*	VE 10	PFD	PFD
	76	X	*	AE 0 VE 10	PFD	PFD
	77	X	*	AE 0 VE 0-10	PFD	PFD
	78	X	*	AE 1 VE 0-10	PFD	PFD
	79	X	*	VE 10	PFD	PFD

**Table 23: Summary of Coastal Transect Mapping Considerations**

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	80	X	*	AE 3 VE 10	PFD	PFD
	81	X	*	AE 1 VE 10	PFD	PFD
	82	X	*	AE 1 VE 0-10	PFD	PFD
	83	X	*	AE 1 VE 0-10	PFD	PFD
	84	X	*	AE 2 AO 0 VE 0-10	PFD	PFD
	85	X	*	AE 1 VE 0-10	PFD	PFD
	86	X	*	AE 4 VE 0-10	PFD	PFD
	87	X	*	AE 1 VE 0-10	PFD	PFD
	88	X	*	AE 3 VE 10	PFD	PFD
	89	X	*	AE 0 VE 10	PFD	PFD
	90	X	*	AE 3 VE 10	PFD	PFD
	91	X	*	AE 0 VE 0-10	PFD	PFD
	92	X	*	AE 4 VE 10	PFD	PFD
	93	X	*	AE 1 VE 10	PFD	PFD
	94	X	*	AE 4 VE 9	PFD	PFD
	95	X	*	AE 1 VE 0-10	PFD	PFD
	96	X	*	AE 4 VE 0-10	PFD	PFD
	97	X	*	AE 0-1 VE 0-10	PFD	PFD
	98	X	*	AE 4 AO 0-0 VE 0-10	PFD	PFD
	99	X	*	VE 10	PFD	PFD

**Table 23: Summary of Coastal Transect Mapping Considerations**

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	100	X	*	AE 4 VE 10	PFD	PFD
	101	X	*	AE 2 VE 10	PFD	PFD
	102	X	*	AE 4 VE 0-10	PFD	PFD
	103	X	*	AE 2 VE 1-10	PFD	PFD
	104	X	*	AE 4 VE 1-10	PFD	PFD
	105	X	*	AE 1 VE 0-9	PFD	PFD
	106	X	*	AE 4 VE 0-9	PFD	PFD
	107	X	*	AE 1 VE 0-9	PFD	PFD
	108	X	*	AE 4 VE 1-9	PFD	PFD
	109	X	*	AE 2 VE 0-9	PFD	PFD
	110	X	*	AE 5 VE 2-10	PFD	PFD
	111	X	*	AE 3 VE 0-9	PFD	PFD
	112	X	*	AE 5 VE 0-9	PFD	PFD
	113	X	*	AE 0-1 VE 0-9	PFD	PFD
	114	X	*	AE 4 VE 1-11	PFD	PFD
	115	X	*	AE 4 VE 0-9	PFD	PFD
	116	X	*	AE 7 VE 0-7	PFD	PFD
	117	X	*	AE 4 VE 0-9	PFD	PFD
	118	X	*	AE 4 VE 8	PFD	PFD
	119	X	*	AE 4 VE 8	PFD	PFD

**Table 23: Summary of Coastal Transect Mapping Considerations**

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	120	X	*	AE 4 VE 8	PFD	PFD
	121	X	*	AE 5 VE 7	PFD	PFD
	122	*	*	AE 5 VE 4-7	WHAFIS	WHAFIS
	123	*	*	AE 5 VE 3-8	WHAFIS	WHAFIS
	124	*	*	AE 5 VE 3-8	WHAFIS	WHAFIS
	125	X	*	AE 5 VE 1-9	PFD	PFD
	126	X	*	AE 1-5 VE 0-9	PFD	PFD
	127	X	*	AE 4 VE 1-9	PFD	PFD
	128	X	*	AE 4 VE 9	PFD	PFD
	129	X	*	AE 3 VE 1-9	PFD	PFD
	130	X	*	AE 4 VE 0-9	PFD	PFD
	131	X	*	AE 4 VE 0-9	PFD	PFD
	132	X	*	AE 4 VE 0-9	PFD	PFD
	133	X	*	AE 1 VE 1-9	PFD	PFD
	134	X	*	AE 3 VE 1-9	PFD	PFD
	135	X	*	AE 4 VE 1-8	PFD	PFD
	136	X	*	AE 4 VE 4-8	PFD	PFD
	137	X	*	AE 4 VE 0-8	PFD	PFD
	138	X	*	AE 4 VE 8	PFD	PFD
	139	X	*	AE 4 VE 0-8	PFD	PFD

**Table 23: Summary of Coastal Transect Mapping Considerations**

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	140	X	*	AE 5 VE 0-8	PFD	PFD
	141	X	*	AE 4 VE 0-8	PFD	PFD
	142	X	*	AE 6 VE 0-8	PFD	PFD
	143	X	*	AE 5 VE 1-8	PFD	PFD
	144	X	*	AE 5 VE 0-8	PFD	PFD
	145	X	*	AE 3 VE 0-8	PFD	PFD
	146	X	*	AE 3 VE 2-8	PFD	PFD
	147	X	*	AE 4 VE 3-8	PFD	PFD
	148	X	*	AE 1-4 VE 2-8	PFD	PFD
	149	X	*	AE 3 VE 8	PFD	PFD
	150	X	*	AE 3 VE 0-7	PFD	PFD
	151	X	*	AE 3 VE 0-7	PFD	PFD
	152	X	*	AE 4 VE 2-7	PFD	PFD
	153	*	*	VE 8	WHAFIS	WHAFIS
	154	X	*	AE 3 VE 8	PFD	PFD
	155	X	*	AE 4 VE 2-8	PFD	PFD
	156	X	*	AE 6 VE 8	PFD	PFD
	157	X	*	AE 3 VE 8	PFD	PFD
	158	X	*	AE 4 VE 8	PFD	PFD
	159	X	*	AE 6 VE 1-8	PFD	PFD
	160	X	*	AE 4 VE 0-8	PFD	PFD

**Table 23: Summary of Coastal Transect Mapping Considerations**

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	161	X	*	AE 3 VE 8	PFD	PFD
	162	X	*	AE 3 VE 8	PFD	PFD
	163	X	*	AE 3 VE 0-8	PFD	PFD
	164	X	*	AE 5 VE 6	PFD	PFD
	165	X	*	AE 5 VE 6	PFD	PFD
	166	X	*	AE 6 VE 0-8	PFD	PFD
	167	X	*	AE 5 VE 0-8	PFD	PFD
	168	X	*	AE 6 VE 0-8	PFD	PFD
	169	X	*	AE 6 VE 0-8	PFD	PFD
	170	X	*	AE 4 VE 0-8	PFD	PFD
	171	X	*	AE 4 VE 0-8	PFD	PFD
	172	X	*	AE 5 VE 0-8	PFD	PFD
	173	X	*	AE 4 VE 0-8	PFD	PFD
	174	X	*	AE 4 VE 8	PFD	PFD
	175	X	*	AE 5 VE 8	PFD	PFD
	176	X	*	AE 5 VE 0-8	PFD	PFD
	177	X	*	AE 5 VE 8	PFD	PFD
	178	X	*	AE 5 VE 0-8	PFD	PFD
	179	X	*	AE 4 VE 7	PFD	PFD
	180	X	*	AE 5 VE 0-8	PFD	PFD

**Table 23: Summary of Coastal Transect Mapping Considerations**

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	181	X	*	AE 4 VE 8	PFD	PFD
	182	X	*	AE 5 VE 1-8	PFD	PFD
	183	X	*	AE 4 VE 0-8	PFD	PFD
	184	X	*	AE 5 VE 8	PFD	PFD
	185	X	*	AE 0-4 VE 1-8	PFD	PFD
	186	X	*	AE 3 VE 2-8	PFD	PFD
	187	X	*	AE 5 VE 0-8	PFD	PFD
	188	X	*	AE 4 VE 8	PFD	PFD
	189	X	*	AE 5 VE 0-8	PFD	PFD
	190	X	*	AE 2 VE 8	PFD	PFD
	191	X	*	AE 2 VE 0-8	PFD	PFD
	192	X	*	AE 5 VE 7	PFD	PFD
	193	X	*	AE 2 VE 1-8	PFD	PFD
	194	X	*	AE 2 VE 0-8	PFD	PFD
	195	X	*	AE 5 VE 8	PFD	PFD
	196	X	*	AE 4 VE 8	PFD	PFD
	197	X	*	AE 4 VE 1-8	PFD	PFD
	198	X	*	AE 0-5 VE 8	PFD	PFD
	199	X	*	AE 1-5 VE 1-8	PFD	PFD
	200	X	*	AE 2-5 VE 6	PFD	PFD

**Table 23: Summary of Coastal Transect Mapping Considerations**

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	201	*	*	AE 4 VE 3-8	WHAFIS	WHAFIS
	202	*	*	VE 1-7	WHAFIS	WHAFIS
	203	*	*	VE 6	WHAFIS	WHAFIS
	204	*	*	AE 5 VE 8	WHAFIS	WHAFIS
	205	*	*	AE 6 VE 2-8	WHAFIS	WHAFIS
	206	X	*	VE 2-8	PFD	PFD
	207	X	*	AE 3-5 VE 7	PFD	PFD
	208	X	*	AE 5 VE 8	PFD	PFD
	209	X	*	AE 0-4 VE 8	PFD	PFD
	210	X	*	AE 3 VE 0-8	PFD	PFD
	211	*	*	AE 0-4 VE 0-8	WHAFIS	WHAFIS
	212	X	*	AE 5 VE 0-8	PFD	PFD
	213	*	*	AE 1-4 VE 3-8	WHAFIS	WHAFIS
	214	*	*	AE 0-2 VE 2-7	WHAFIS	WHAFIS
	215	X	*	AE 2 VE 8	PFD	PFD
	216	X	*	AE 3 VE 1-8	PFD	PFD
	217	X	*	AE 1 VE 7	PFD	PFD
	218	X	*	AE 2 VE 0-8	PFD	PFD
	219	X	*	AE 4 VE 0-8	PFD	PFD
	220	X	*	AE 2 VE 0-8	PFD	PFD
	221	X	*	AE 4 VE 1-8	PFD	PFD

**Table 23: Summary of Coastal Transect Mapping Considerations**

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	222	X	*	AE 2 VE 0-8	PFD	PFD
	223	X	*	AE 3 VE 8	PFD	PFD
	224	X	*	AE 2 VE 1-8	PFD	PFD
	225	X	*	AE 1 VE 0-8	PFD	PFD
	226	X	*	AE 2 VE 0-8	PFD	PFD
	227	X	*	AE 2 VE 0-8	PFD	PFD
	228	X	*	AE 2 VE 0-8	PFD	PFD
	229	X	*	AE 3 VE 0-8	PFD	PFD
	230	X	*	AE 1 VE 0-8	PFD	PFD
	231	X	*	AE 4 VE 0-8	PFD	PFD
	232	X	*	AE 2 VE 0-8	PFD	PFD
	233	X	*	AE 2 VE 0-8	PFD	PFD
	234	X	*	AE 3 VE 0-8	PFD	PFD
	235	X	*	AE 2 VE 7	PFD	PFD
	236	X	*	AE 2 VE 1-8	PFD	PFD
	237	X	*	AE 2 VE 0-8	PFD	PFD
	238	X	*	AE 2 VE 0-8	PFD	PFD
	239	X	*	AE 2 VE 0-8	PFD	PFD
	240	X	*	AE 3 VE 0-8	PFD	PFD
	241	X	*	AE 2 VE 0-8	PFD	PFD

**Table 23: Summary of Coastal Transect Mapping Considerations**

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	242	*	*	AE 1-4 VE 2-8	WHAFIS	WHAFIS
	243	*	*	AE 3 VE 8	WHAFIS	WHAFIS
	244	*	*	AE 3 VE 7	WHAFIS	WHAFIS
	245	*	*	AE 4 VE 2-8	WHAFIS	WHAFIS
	246	*	*	AE 1-4 VE 3-8	WHAFIS	WHAFIS
	247	*	*	AE 1-4 VE 7	WHAFIS	WHAFIS
	248	*	*	AE 3 VE 8	WHAFIS	WHAFIS
	249	*	*	AE 0-4 VE 3-8	WHAFIS	WHAFIS
	250	*	*	AE 0-4	WHAFIS	SWEL
	251	*	*	AE 4	WHAFIS	SWEL
	252	*	*	AE 4	WHAFIS	SWEL
	253	*	*	AE 4 VE 1-4	WHAFIS	SWEL
	254	*	*	AE 4 VE 1-4	WHAFIS	SWEL
	255	*	*	AE 4	WHAFIS	SWEL
	256	*	*	AE 4	WHAFIS	SWEL
	257	*	*	AE 4 VE 2-4	WHAFIS	SWEL
	258	*	*	AE 1-4 VE 2-4	WHAFIS	SWEL
	259	*	*	AE 2 VE 2-4	WHAFIS	SWEL
	260	*	*	AE 2 VE 3	WHAFIS	SWEL
	261	*	*	AE 4 VE 3-4	WHAFIS	SWEL
	262	*	*	AE 3 VE 2-4	WHAFIS	SWEL
	263	*	*	AE 0-3 VE 2-4	WHAFIS	SWEL

**Table 23: Summary of Coastal Transect Mapping Considerations**

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	264	*	*	AE 3 VE 3-4	WHAFIS	SWEL
	265	*	*	AE 3 VE 4	WHAFIS	SWEL
	266	*	*	AE 4	WHAFIS	SWEL
	267	*	*	AE 3 VE 1-1	WHAFIS	SWEL
	268	*	*	AE 1-4	WHAFIS	SWEL
	269	*	*	AE 1-4	WHAFIS	SWEL
	270	*	*	AE 3	WHAFIS	SWEL
	271	*	*	AE 1-4	WHAFIS	SWEL
	272	*	*	AE 0-4 VE 1-2	WHAFIS	SWEL
	273	*	*	AE 0-4 VE 3-4	WHAFIS	SWEL
	274	*	*	AE 0-3 VE 1-4	WHAFIS	SWEL
	275	*	*	AE 4 VE 1-4	WHAFIS	SWEL
	276	*	*	AE 1-3 VE 2-4	WHAFIS	SWEL
	277	*	*	AE 3 VE 3-4	WHAFIS	SWEL
	278	*	*	AE 4 VE 3-4	WHAFIS	SWEL
	279	*	*	AE 4 VE 3-4	WHAFIS	SWEL
	280	*	*	AE 3 VE 3	WHAFIS	SWEL
	281	*	*	AE 2 VE 3-4	WHAFIS	SWEL
	282	*	*	AE 3 VE 4	WHAFIS	SWEL
	283	*	*	AE 4 VE 1-4	WHAFIS	SWEL
	284	*	*	AE 4 VE 5	WHAFIS	SWEL
	285	*	*	AE 4 VE 3-5	WHAFIS	SWEL

**Table 23: Summary of Coastal Transect Mapping Considerations**

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	286	*	*	AE 3 VE 4-5	WHAFIS	SWEL
	287	*	*	AE 4 VE 4-8	WHAFIS	SWEL
	288	*	*	AE 4 VE 3-5	WHAFIS	SWEL
	289	*	*	AE 0 VE 4	WHAFIS	SWEL
	290	*	*	AE 4 VE 4-7	WHAFIS	SWEL
	291	*	*	AE 4 VE 4-5	WHAFIS	SWEL
	292	*	*	AE 4 VE 4	WHAFIS	SWEL
	293	*	*	AE 3 VE 4	WHAFIS	SWEL
	294	*	*	AE 4 VE 4	WHAFIS	SWEL
Bogue Sound	295	*	*	AE 0-3 VE 3-6	WHAFIS	WHAFIS
	296	*	*	AE 5 VE 3-5	WHAFIS	WHAFIS
	297	*	*	AE 2 VE 4-5	WHAFIS	WHAFIS
	298	*	*	AE 1-4 VE 4-4	WHAFIS	WHAFIS
	299	*	*	AE 3-4 VE 4-4	WHAFIS	WHAFIS
	300	*	*	VE 3-4	WHAFIS	WHAFIS
	301	*	*	AE 3 VE 4-4	WHAFIS	WHAFIS
	302	*	*	AE 3 VE 2-4	WHAFIS	WHAFIS
	303	*	*	AE 1-3 VE 3-4	WHAFIS	WHAFIS
	304	*	*	AE 3 VE 3-4	WHAFIS	WHAFIS
	305	*	*	AE 1-3 VE 4-4	WHAFIS	WHAFIS
	306	*	*	AE 0-4 VE 3-4	WHAFIS	WHAFIS

**Table 23: Summary of Coastal Transect Mapping Considerations**

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	307	*	*	AE 0-2 VE 4-4	WHAFIS	WHAFIS
	308	X	*	AE 2-3 VE 3-4	PFD	PFD
	309	*	*	AE 0-3 VE 4-4	WHAFIS	WHAFIS
	310	*	*	AE 1-3 VE 4-4	WHAFIS	WHAFIS
	311	*	*	AE 1-3 VE 3-4	WHAFIS	WHAFIS
	312	*	*	AE 0-4	WHAFIS	WHAFIS
	313	*	*	AE 4 VE 4-4	WHAFIS	WHAFIS
	314	*	*	AE 4 VE 3-4	WHAFIS	WHAFIS
	315	*	*	AE 0-4 VE 4-4	WHAFIS	WHAFIS
	316	*	*	AE 2-4 VE 3-4	WHAFIS	WHAFIS
	317	*	*	AE 3 VE 0-4	WHAFIS	WHAFIS
	318	*	*	AE 4 VE 3-4	WHAFIS	WHAFIS
	319	*	*	AE 4 VE 3-4	WHAFIS	WHAFIS
	320	*	*	VE 3-4	WHAFIS	WHAFIS
	321	*	*	AE 1-4 VE 4-4	WHAFIS	WHAFIS
	322	*	*	AE 1-2 VE 3-4	WHAFIS	WHAFIS
	323	*	*	AE 1-3 VE 2-4	WHAFIS	WHAFIS
	324	*	*	AE 0-4 VE 3-5	WHAFIS	WHAFIS
	325	*	*	AE 0-4	WHAFIS	WHAFIS
	326	*	*	AE 1-4 VE 3-4	WHAFIS	WHAFIS
	327	*	*	AE 0-4 VE 3-4	WHAFIS	WHAFIS

**Table 23: Summary of Coastal Transect Mapping Considerations**

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	328	*	*	AE 1-3 VE 3-4	WHAFIS	WHAFIS
	329	*	*	AE 1-5 VE 3-8	WHAFIS	WHAFIS
Neuse River	5	*	*	AE 2 VE 4-6	WHAFIS	SWEL
	6	*	*	AE 3 VE 4-6	WHAFIS	SWEL
	10	*	*	AE 4 VE 5-6	WHAFIS	SWEL
	11	*	*	AE 4 VE 5-6	WHAFIS	SWEL

A LiMWA boundary has also been added in coastal areas subject to wave action for use by local communities in safe rebuilding practices. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. In areas where the Zone VE designation is based on the presence of a primary frontal dune the LiMWA was not delineated.

## 7.0 Revising the FIS

### 7.1 Letters of Map Amendment and Letters of Map Revision - Based on Fill

LOMAs and LOMR-Fs are documents issued by FEMA that officially remove a property and/or a structure from a Special Flood Hazard Area (SFHA), if data supporting the removal are submitted. LOMAs and LOMR-Fs are generally determinations regarding areas that are too small to be shown on a FIRM panel; consequently, the changes they describe become official without revising the FIRM or the FIS Report.

NFIP regulations require that the lowest adjacent grade (the lowest ground touching the structure) be at or above the 1% annual chance flood elevation for a LOMA to be issued. Currently, there is no fee for FEMA’s review of a LOMA request, but the requester of a LOMA is responsible for providing all the information needed for the review, which may include structure and/or property elevations certified by a licensed land surveyor or professional engineer. Therefore, LOMA requesters may need to retain the services of a land surveyor or engineer.

A LOMA cannot be used for property on which fill has been placed. For those situations, a LOMR-F must be used. As a participant in the NFIP, a local government must adopt ordinances that meet the minimum Federal floodplain management standards, which are outlined in Section 60.3 of the NFIP regulations. For a number of reasons, these ordinances generally vary from community to community. Nonetheless, because the placement of fill within the floodplain can affect flood hazards in the surrounding area, additional information is needed before FEMA can process a LOMR-F request. Among the data required for a LOMR-F is the community acknowledgment form. This form is FEMA’s assurance that all appropriate Federal, State, and local floodplain management requirements have been met. Furthermore, NFIP regulations require that the lowest adjacent grade (the lowest ground touching the structure) be at or above the 1% annual chance flood elevation for a LOMR-F to be issued removing the structure from the floodplain. Because LOMR-F requests are the result of changed physical conditions rather than limitations of scale or topographic definition, FEMA charges a fee for the review of a LOMR-F request. As with the LOMA, the requester of a LOMR-F is responsible for providing all supporting information, including structure and/or property elevation data.

In cases where property owners plan to add fill in the SFHA, NFIP regulations require plans and technical information to be submitted for review by FEMA before construction takes place. FEMA will issue a conditional LOMR-F stating how flood hazards would change and what portions of the property, if any, would remain in the SFHA if the project were built according to the submitted plans.

The issuance of a LOMA or LOMR-F ends the property owner's obligation to purchase flood insurance as a condition of Federal or federally backed financing. However, the property owner's mortgage company maintains the prerogative to require flood insurance as a condition of providing financing. Before attempting to obtain a LOMA or LOMR-F, property owners are advised to consult their mortgage companies regarding this policy. Even if the mortgage company indicates that it will require flood insurance if a LOMA or LOMR-F is issued, it may be advantageous for property owners to request a LOMA or LOMR-F because flood insurance premiums are lower for properties removed from the SFHA than for properties that remain within the SFHA.

For additional information regarding LOMAs, LOMR-Fs, conditional LOMR-Fs, or current application fees, please call the FEMA Map Information eXchange (FMIX) toll-free information line at 1-877-FEMA MAP (1-877-336-2627).

## 7.2 Letters of Map Revision

A Letter of Map Revision (LOMR) is a document issued by FEMA and the NCFMP that revises an FIS Report and/or FIRM. A LOMR is used to change flood risk zones, floodplain and/or floodway delineations, flood elevations, or planimetric features such as road systems or corporate limits. A LOMR provides FEMA and the NCFMP with a cost-effective means of revising the FIS information without physically changing and reprinting the map or report itself. A portion of the FIRM panel or FIS Report showing the revised information is issued with the LOMR. The LOMR is sent to all affected communities and is archived in the communities' NFIP map repository for public reference.

In cases where a proposed project (such as construction in the 1% annual chance floodplain) would result in a significant rise in 1% annual chance water-surface elevations, NFIP regulations require the community to submit plans and technical information for review by FEMA and the NCFMP before construction takes place. This assures communities participating in the NFIP that proposed projects meet minimum NFIP requirements. The result of FEMA and the NCFMP reviews is documented in a conditional LOMR.

For additional information regarding LOMRs, conditional LOMRs, or current application fees, please call the FEMA Map Assistance Center toll-free information line at 1-877-FEMA MAP (1-877-336-2627) or the NCFMP at 919-715-5711.

## 7.3 Physical Map Revisions

Physical Map Revisions (PMRs) are processed to incorporate information concerning conditions present in the community that are not reflected in the FIS, and involve distributing republished FISs that supersede the most current NFIP data in the community repository. PMRs may be initiated by a request from a community resident or agency, or FEMA may initiate a PMR to incorporate one or more LOMRs, to reflect significant changes in corporate limits, to correct errors, or to update flood hazards to match new information from an adjacent community's FIS. Due to the costs associated with updating and distributing FISs, map revisions will be processed as LOMRs rather than PMRs whenever possible. For more information regarding PMRs, please contact the FEMA Map Information eXchange (FMIX) toll-free information line at 1-877-FEMA MAP (1-877-336-2627), the FEMA Regional Office at the address listed on the Notice to Flood Insurance Study Users page at the front of this report, or the NCFMP at 919-715-5711.

## 7.4 Contracted Restudies

The NFIP provides for a periodic review and restudy of flood hazards in a given community. FEMA accomplishes this through a national mapping needs assessment process that assigns priorities and allocates funds to sponsor or subsidize new flood hazard analyses used to update FIS Reports. For map maintenance restudies within the state of North Carolina, scoping will be performed by county approximately 2.5-3.5 years after the previous effective date. Scoping will focus on streams with restudy needs within those previously effective counties rather than on full countywide restudies. A restudy refers specifically to updating or reevaluating engineering analyses that were performed for a flood mapping project that directly impact BFEs and/or flood hazard boundary extents

or analysis of previously unstudied flood prone areas. Restudy project evaluation triggers and prioritization values are an essential component of the map maintenance program. For more information regarding NCFMP-contracted restudies, please contact the NCFMP at 919-715-5711 or at [www.ncfloodmaps.com](http://www.ncfloodmaps.com). For more information regarding FEMA-contracted restudies, please contact the FEMA Map Information eXchange (FMIX) toll-free information line at 1-877-FEMA MAP(1-877-336-2627) or the FEMA Regional Office at the address listed on the Notice to Flood Insurance Study Users page at the front of this report.

## 7.5 Map Revision History

The current FIRM is a subset of the Statewide FIRM, showing flood hazard information for the entire geographic area of Carteret County. Previously, separate Flood Hazard Boundary Maps (FHBMs), Flood Boundary and Floodway Maps (FBFMs), and/or FIRMs were prepared for each identified flood prone jurisdiction within the county. Historical data relating to the NFIP maps prepared for each community prior to and including the 7/16/2003 North Carolina Statewide FIRM, which includes Carteret County, are presented in Table 24, "Map Revision History."

Information pertaining to revised and unrevised flood hazards for each jurisdiction within Carteret County has been compiled into this FIS. Therefore, this FIS supersedes all previously printed FIS Reports, FHBMs, FIRMs, and/or FBFMs for all of the incorporated and unincorporated jurisdictions within Carteret County.

**Table 24 - Map Revision History**

Community	Initial Identification Date	Initial FIRM Effective Date	FIS Revision Date
CARTERET COUNTY	2/14/1975	5/15/1980	07/16/2003
TOWN OF ATLANTIC BEACH	6/28/1974	3/15/1977	07/16/2003
TOWN OF BEAUFORT	12/1/1972	12/1/1972	07/16/2003
TOWN OF BOGUE	2/14/1975	5/15/1980	07/16/2003
TOWN OF CAPE CARTERET	5/24/1974	4/1/1977	07/16/2003
TOWN OF CEDAR POINT	2/14/1975	5/15/1980	07/16/2003
TOWN OF EMERALD ISLE	6/7/1974	4/1/1977	07/16/2003
TOWN OF INDIAN BEACH	3/4/1985	3/4/1985	07/16/2003
TOWN OF MOREHEAD CITY	2/22/1974	2/16/1977	07/16/2003
TOWN OF NEWPORT	3/1/1974	5/15/1978	07/16/2003
TOWN OF PELETIER	7/16/2003	7/16/2003	07/16/2003
TOWN OF PINE KNOLL SHORES	7/11/1975	9/28/1979	07/16/2003

## 8.0 Study Contracting and Community Coordination

### 8.1 Authority and Acknowledgments

The sources of authority for this FIS are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

This FIS revises and updates the previous countywide FIS for the geographic area of Carteret County and Incorporated Areas. Table 25, "Authority and Acknowledgments," includes information for the previous countywide FIS and for this revision. This table also includes information for the single-jurisdiction FISs published for each community included in this countywide FIS (if available) as compiled from their previously printed FIS Reports

**Table 25 — Authority and Acknowledgments**

Community	FIS Dated	Study Contracted By	Data Source	Contract or IAA Number	Work Completed In
CARTERET COUNTY	7/16/2003	NCFMP	NCFMP	286-000022	4/3/2015
CARTERET COUNTY	7/16/2003	NCFMP	NCFMP	286-0000-23	8/8/8888
TOWN OF ATLANTIC BEACH	7/16/2003	NCFMP	NCFMP	286-000022	4/3/2015
TOWN OF ATLANTIC BEACH	7/16/2003	NCFMP	NCFMP	286-0000-23	8/8/8888
TOWN OF BEAUFORT	7/16/2003	NCFMP	NCFMP	286-000022	4/3/2015
TOWN OF BEAUFORT	7/16/2003	NCFMP	NCFMP	286-0000-23	8/8/8888
TOWN OF BOGUE	7/16/2003	NCFMP	NCFMP	286-000022	4/3/2015
TOWN OF BOGUE	7/16/2003	NCFMP	NCFMP	286-0000-23	8/8/8888

**Table 25 — Authority and Acknowledgments**

Community	FIS Dated	Study Contracted By	Data Source	Contract or IAA Number	Work Completed In
TOWN OF CAPE CARTERET	7/16/2003	NCFMP	NCFMP	286-000022	4/3/2015
TOWN OF CAPE CARTERET	7/16/2003	NCFMP	NCFMP	286-0000-23	8/8/8888
TOWN OF CEDAR POINT	7/16/2003	NCFMP	NCFMP	286-000022	4/3/2015
TOWN OF CEDAR POINT	7/16/2003	NCFMP	NCFMP	286-0000-23	8/8/8888
TOWN OF EMERALD ISLE	7/16/2003	NCFMP	NCFMP	286-000022	4/3/2015
TOWN OF EMERALD ISLE	7/16/2003	NCFMP	NCFMP	286-0000-23	8/8/8888
TOWN OF INDIAN BEACH	7/16/2003	NCFMP	NCFMP	286-000022	4/3/2015
TOWN OF INDIAN BEACH	7/16/2003	NCFMP	NCFMP	286-0000-23	8/8/8888
TOWN OF MOREHEAD CITY	7/16/2003	NCFMP	NCFMP	286-000022	4/3/2015
TOWN OF MOREHEAD CITY	7/16/2003	NCFMP	NCFMP	286-0000-23	8/8/8888
TOWN OF NEWPORT	7/16/2003	NCFMP	NCFMP	286-000022	4/3/2015
TOWN OF NEWPORT	7/16/2003	NCFMP	NCFMP	286-0000-23	8/8/8888
TOWN OF PELETIER	7/16/2003	NCFMP	NCFMP	286-000022	4/3/2015
TOWN OF PELETIER	7/16/2003	NCFMP	NCFMP	286-0000-23	8/8/8888
TOWN OF PINE KNOLL SHORES	7/16/2003	NCFMP	NCFMP	286-000022	4/3/2015
TOWN OF PINE KNOLL SHORES	7/16/2003	NCFMP	NCFMP	286-0000-23	8/8/8888

This FIS Report was produced through a unique cooperative partnership between the State of North Carolina and FEMA. The State of North Carolina, through FEMA’s Cooperating Technical Partner (CTP) Initiative, has become the first Cooperating Technical State (CTS) and will assume primary ownership of the NFIP FIRM panels for all North Carolina communities. This role has traditionally been fulfilled by FEMA. The North Carolina Floodplain Mapping Program is conducting flood hazard analyses and producing updated, digital FIRM panels. The hydrologic and hydraulic analyses and the FIRM panels for the initial statewide mapping for Carteret County were produced by NCFMP under contract with the State of North Carolina and issued on effective 6/30/2016. For this revision, the hydrologic and hydraulic analyses and the FIRM panels were produced by NCFMP, under contract with the State of North Carolina.

## 8.2 Consultation Coordination Officer's Meetings/Scoping Meetings

In general, for each FIS an initial Consultation Coordination Officer’s (CCO) meeting is held with representatives from FEMA, the communities, and the study contractors to explain the nature and purpose of the FIS and to identify the streams to be studied by detailed methods. A final CCO meeting is held with representatives from FEMA, the communities, and the study contractors to review the results of the study

The dates of the initial and final CCO meetings held for Carteret County and Incorporated Areas were compiled from the previous countywide FIS Report and are shown in Table 26, “Consultation Coordination Officer’s Meetings

**Table 26 — Consultation Coordination Officer’s Meetings**

Community	For FIS Dated	Initial CCO Date	Attended By	Final CCO Date	Attended By
TOWN OF ATLANTIC BEACH	9/1/1976	5/1/1974	Town of Atlantic Beach	10/23/1975	FIA, Town of Atlantic Beach

For each FIS produced during the initial phase of statewide, an Initial Scoping Meeting was held with representatives from FEMA, the county, the incorporated communities, and the State of North Carolina. A Final Scoping meeting was held to review the Draft Basin Plan and finalize the streams to be studied by detailed methods. This information was then used to create the Final Basin Plan.

For map maintenance revisions, only one scoping meeting was held to identify the streams to be newly studied by detailed methods, redelineated, or to be studied by limited detailed methods. This information was then used to create the Map Maintenance Plan.

The historical dates of the Initial and Final Scoping Meetings held during the first round of statewide mapping for Carteret County are shown in Table 28, “Scoping Meetings.” Meetings held for the map maintenance revision are also included below for Carteret County.

**Table 28 — Scoping Meetings**

Community	Riverbasin	Initial Scoping Date	Attended By	Final Scoping Date	Attended By
CARTERET COUNTY	WHITE OAK	10/25/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC	12/19/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC
TOWN OF ATLANTIC BEACH	WHITE OAK	10/27/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC	12/19/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC
TOWN OF BEAUFORT	WHITE OAK	10/27/2000	Community official and North Carolina Department of Emergency Management	12/19/2000	NP
TOWN OF BEAUFORT ETJ	WHITE OAK	10/27/2000	Community official and North Carolina Department of Emergency Management	12/19/2000	NP
TOWN OF BOGUE	WHITE OAK	10/27/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC	12/19/2000	NP
TOWN OF CAPE CARTERET	WHITE OAK	10/26/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC	12/19/2000	NP
TOWN OF CAPE CARTERET ETJ	WHITE OAK	10/26/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC	12/19/2000	NP
TOWN OF CEDAR POINT	WHITE OAK	10/26/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC	12/19/2000	NP
TOWN OF CEDAR POINT ETJ	WHITE OAK	10/26/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC	12/19/2000	NP
TOWN OF EMERALD ISLE	WHITE OAK	10/26/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC	12/19/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC
TOWN OF INDIAN BEACH	WHITE OAK	10/26/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC	12/19/2000	NP
TOWN OF MOREHEAD CITY	WHITE OAK	10/26/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC	12/19/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC
TOWN OF MOREHEAD CITY ETJ	WHITE OAK	10/26/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC	12/19/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC
TOWN OF NEWPORT	WHITE OAK	10/26/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC	12/19/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC
TOWN OF NEWPORT ETJ	WHITE OAK	10/26/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC	12/19/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC
TOWN OF PELETIER	WHITE OAK	10/27/2000	NP	12/19/2000	NP
TOWN OF PELETIER ETJ	WHITE OAK	10/27/2000	NP	12/19/2000	NP
TOWN OF PINE KNOLL SHORES	WHITE OAK	10/27/2000	FEMA, community officials, North Carolina Department of Emergency Management, Dewberry & Davis LLC	12/19/2000	NP

Preliminary Meetings are held in each county to disseminate and review the FIS Report and FIRM panels. This meeting is required by FEMA. Public Participation Meetings are not required by FEMA, but provide an opportunity to review and discuss the FIS Report and

FIRM panels for each jurisdiction in a public setting. The dates for the preliminary and public participation meetings are shown in Table 30, "Preliminary and Public Participation Meetings."

**Table 30 — Preliminary and Public Participation Meetings**

Community	For FIS Dated	Meeting Location	Preliminary Meeting Date	Attended By	Public Meeting Date	Attended By
TOWN OF MOREHEAD CITY	7/2/2004	Town of Morehead City	3/5/2002	Officials from Carteret County, NCDEM, FEMA, Dewberry and Watershed Concepts	4/17/2002	The Public
TOWN OF MOREHEAD CITY	7/2/2004	Town of Morehead City	3/5/2002	Officials from Carteret County, NCDEM, FEMA, Dewberry and Watershed Concepts	5/5/2002	The Public
TOWN OF MOREHEAD CITY	7/2/2004	Town of Morehead City	3/5/2002	Officials from Carteret County, NCDEM, FEMA, Dewberry and Watershed Concepts	8/18/2003	NP
TOWN OF MOREHEAD CITY	7/2/2004	Town of Morehead City	3/5/2002	Officials from Carteret County, NCDEM, FEMA, Dewberry and Watershed Concepts	10/28/2003	NP
TOWN OF MOREHEAD CITY ETJ	7/2/2004	Town of Morehead City	3/5/2002	Officials from Carteret County, NCDEM, FEMA, Dewberry and Watershed Concepts	4/17/2002	The Public
TOWN OF MOREHEAD CITY ETJ	7/2/2004	Town of Morehead City	3/5/2002	Officials from Carteret County, NCDEM, FEMA, Dewberry and Watershed Concepts	5/5/2002	The Public
TOWN OF MOREHEAD CITY ETJ	7/2/2004	Town of Morehead City	3/5/2002	Officials from Carteret County, NCDEM, FEMA, Dewberry and Watershed Concepts	8/18/2003	NP
TOWN OF MOREHEAD CITY ETJ	7/2/2004	Town of Morehead City	3/5/2002	Officials from Carteret County, NCDEM, FEMA, Dewberry and Watershed Concepts	10/28/2003	NP

## 9.0 Guide to Additional Information

Information concerning the pertinent data used in the preparation of this FIS Report can be obtained by submitting an order with any required payment to the FEMA Engineering Library. For more information on this process, see <http://www.fema.gov>.

The Map Repositories table below lists locations where FIRMs for Carteret County can be viewed. Please note that the maps at these locations are for reference only and are not for distribution. Also, please note that only the maps for the community listed in the table are available at that particular repository. A user may need to visit another repository to view maps from an adjacent community.

**Table 27 — Map Repositories**

Community	Address	City	State	Zip Code
Carteret County	Carteret County Planning and Inspections Dept, 402 Broad Street	Beaufort	NC	28516
Town of Atlantic Beach	Atlantic Beach Town Hall, 125 West Fort Macon Road	Atlantic Beach	NC	28512
Town of Beaufort	Town of Beaufort Town Hall, 701 Front Street	Beaufort	NC	28516
Town of Bogue	Town of Bogue Town Hall, 121 Chimney Branch Road	Newport	NC	28570
Town of Cape Carteret	Cape Carteret Town Hall, 102 Dolphin Street	Cape Carteret	NC	28584
Town of Peletier	Town of Peletier Town Hall, 1603 Highway 58,	Peletier	NC	28584
Town of Pine Knoll Shores	Town of Pine Knoll Shores, 100 Municipal Circle	Pine Knoll Shores	NC	28512
Town of Cedar Point	Town of Cedar Point Town Hall, 427 Sherwood Avenue	Cedar Point	NC	28584
Town of Emerald Isle	Town of Emerald Isle Town Hall, 7500 Emerald Drive	Emerald Isle	NC	28594
Town of Indian Beach	Town of Indian Beach Town Hall, 1400 Salter Path Road	Salter Path	NC	28512

**Table 27 — Map Repositories**

Town of Morehead City	Morehead City Municipal Building, 706 Arendell Street	Morehead City	NC	28557
Town of Newport	Town of Newport Town Hall, 200 Howard Boulevard	Newport	NC	28570

## 9.1 Additional Information

All FIRM panels created for the State of North Carolina are produced in a seamless statewide format; however, FIS Reports are produced for individual counties.

Copies of FIRM panels are available for a nominal fee. To obtain a copy of the current flood map for a specific community, contact the FEMA Map Service Center at 1-800-358-9616. To facilitate the processing of your request, please review the current flood map on file at your local community repository and obtain the panel number in which you are interested. If necessary, users may also order a FIRM Index from the Map Service Center to determine the appropriate panel numbers. The Map Service Center also accepts orders for the Community Status Book and the Flood Insurance Manual. The FIS Report, FIRM panels, and digital data used to produce the FIRM panels are available online at [www.ncfloodmaps.com](http://www.ncfloodmaps.com).

Information concerning the data used in the preparation of this FIS, contained in an Engineering Study Data Package, may be obtained by contacting the FEMA Regional Office at the address listed on the Notice to Flood Insurance Study Users page at the front of this report.

Table 29, “Additional Information” is not applicable in Carteret County.

## 10.0 Appendix

### 10.1 Bibliography

All bibliography and reference information associated within this Flood Insurance Study are maintained and accessible within the geodatabase structure and associated metadata. Users requiring more specific information should contact the North Carolina Floodplain Mapping Program (NCFMP) at [www.ncfloodmaps.com](http://www.ncfloodmaps.com) under the Contacts menu