Preliminary Analysis of the South Carolina Coastal Zone Boundary

Report to the South Carolina General Assembly

South Carolina Department of Health and Environmental Control
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Executive Summary

The following is a summary of the preliminary analysis conducted by the S.C. Department of Health and Environmental Control (DHEC) of the S.C. Coastal Zone boundary. DHEC makes no recommendations based on this analysis regarding the modification to the inland extent or area of the Coastal Zone.

Background of the South Carolina Coastal Management Program

South Carolina's Coastal Management Program was adopted by the S.C. General Assembly in 1977 under the Coastal Tidelands and Wetlands Act (CTWA), S.C. Code of Laws Ann. § 48-39-10 et seq., with the goal of achieving balance between the appropriate use, development, and conservation of coastal resources in the best interest of all citizens of the state. The S.C. Coastal Management Program was established under the guidelines of the federal Coastal Zone Management Act (1972) as a state-federal partnership to effectively manage coastal resources. The CTWA enumerates the significant economic, social and biological value of coastal resources and defines policies to promote their protection and enhancement for current and future generations.

DHEC's Office of Ocean and Coastal Resource Management (OCRM) implements the state's Coastal Management Program through an integrated framework of planning, direct regulatory permitting within defined Critical Areas (coastal waters, tidelands, beaches and beach/dune system) and indirect Coastal Zone Consistency (CZC) certification of federal and state permits within the eight-county Coastal Zone. The CZC review process ensures that activities that may have a direct or significant impact on coastal resources do not contravene the enforceable policies of the Coastal Management Program. The certification process also provides a coordinated and efficient mechanism for state resource agencies to review and comment on individual project applications that may have a direct and significant impact on resources within the Coastal Zone, including unique and fragile biological, cultural and historical resources.

South Carolina uses a geopolitical (*i.e.* county) boundary to establish the inland extent of the state's Coastal Zone. In consideration of federal Coastal Zone boundary requirements, the South Carolina Coastal Zone is defined in the CTWA as "all coastal waters and submerged lands seaward to the State's jurisdictional limits and all lands and waters in the counties of the State which contain any one or more of the critical areas. These counties are Beaufort, Berkeley, Charleston, Colleton, Dorchester, Horry, Jasper and Georgetown." In 1992, a federal review of South Carolina's Coastal Zone Management Program determined that the eight-coastal county Coastal Zone Boundary was sufficient for the protection of coastal waters and resources.

Purpose of Study

DHEC-OCRM has conducted a preliminary, science-based analysis of the South Carolina Coastal Zone boundary pursuant to Proviso 34.55 of the 2016-2017 Appropriation Act. The purpose of this analysis was to identify a geographic area in coastal South Carolina that is inclusive of the variables identified in federal Coastal Zone Management regulations as inland boundary requirements (15 C.F.R. § 923.31). With the time and resources available for this preliminary analysis, DHEC was not able to fully evaluate all variables listed in these federal regulations. Priority areas of analysis included:
1) areas with the presence of significant and uniquely coastal resources, including estuarine and marine waters and wetlands and tidally influenced areas; 2) watersheds that have direct and significant impact on those resources; and 3) areas subject to marine-based hazards, specifically storm surge inundation.

Methodology

This Geographic Information System (GIS)-based analysis investigates an alternative, watershed-based methodology for delineating the Coastal Zone boundary. The analysis was conducted at the U.S. Geological Survey's "Watershed" level, as defined by 10-digit Hydrologic Unit Codes (HUCs). This approach identifies areas with a direct, hydrological connection to coastal resources. A number of datasets were acquired for this analysis including: county boundaries, hydrologic unit boundaries, estuarine and coastal drainage areas, estuarine and marine waters and wetlands, tidal influence, and storm surge.

The analysis began with the identification of a study area based on NOAA's Coastal Assessment Framework watershed drainage classifications, which includes estuarine, coastal and fluvial drainage areas. All 10-digit HUCs identified as

having estuarine or coastal drainage were included in the study area, while 10-digit HUCs identified as having fluvial drainage were excluded from the study area. All areas outside of the study area were excluded from further analysis.

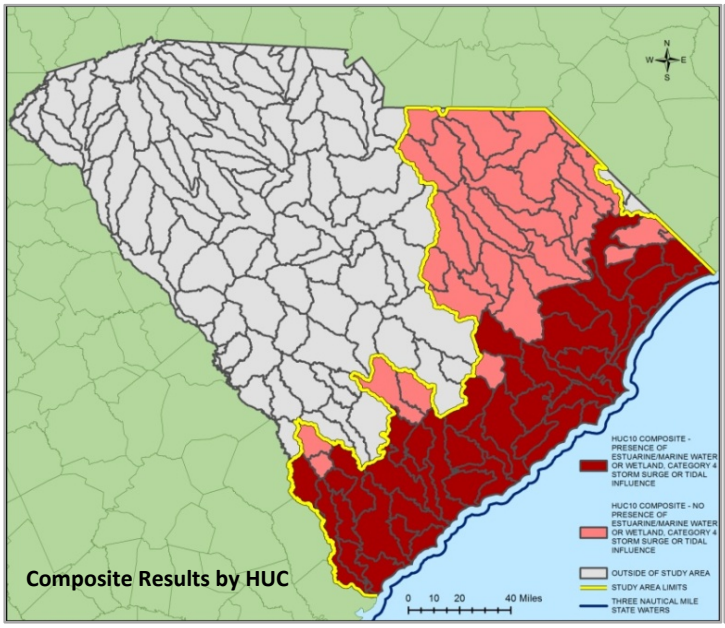
The analysis proceeded with application of three questions, associated with three primary data layers, to each 10-digit HUC within the study area. The purpose of each question was to determine the presence or absence of each data layer within the HUC. If a HUC included any part of a data layer, it was selected. If a data layer was absent from the HUC, the HUC was not selected. The three analysis questions are listed below; associated primary data layers are shown in bold text.

1. Does the HUC include the presence of **Estuarine and Marine Waters and Wetlands**?
2. Does the HUC include the presence of **Tidal Influence**?
3. Does the HUC include the presence of **Category 4 Storm Surge Inundation**?

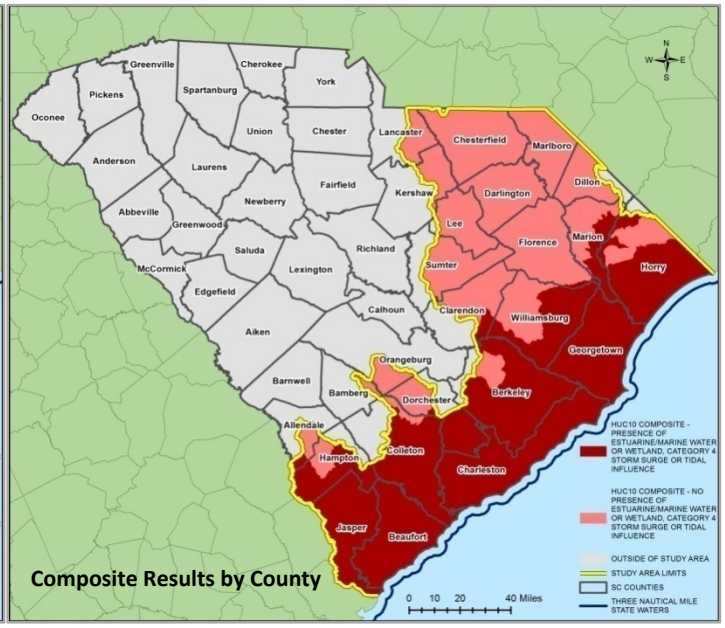
The individual results associated with the questions above were then composited to identify all 10-digit HUCs within the study area that answered "yes" to one or more of the three analysis questions.

Overview of Findings

Delineation of the study area, based on estuarine and coastal drainage classifications, resulted in the inclusion of 79 HUCs. This study area is 13,812 square miles and represents approximately 44% of the state's land and water area and includes all or part of 24 counties. Composite results of the analysis questions include a total of 42 HUCs. This area is 7,544 square miles, and represents about 24% of the state's land and water area. The composite results include all or part of 14 counties: Allendale (7%), Beaufort (100%), Berkeley (82%), Charleston (100%), Clarendon (9%), Colleton (70%), Dorchester (46%), Florence (3%), Georgetown (100%), Hampton (62%), Horry (74%), Jasper (100%), Marion (39%), and Williamsburg (59%).[1] In total, this 7,544-square mile area is approximately 35 square miles, or 0.5%, larger than the current South Carolina Coastal Zone. Composite results are illustrated below, by HUC and by County.



Composite Results by HUC



Composite Results by County

[1] The current South Carolina Coastal Zone is 7,509 square miles and includes all of the following eight counties: Beaufort, Berkeley, Charleston, Colleton, Dorchester, Georgetown, Horry and Jasper.

Summary Discussion

The interaction of land with tidal, estuarine and coastal waters provides dynamic and valuable natural systems that yield a myriad of benefits to the citizens of South Carolina. Healthy coastal ecosystems afford opportunities for recreation, support commercial and recreational fisheries and bolster domestic and international tourism, thus underpinning major engines of the state's economy. Fundamentally, the purpose of the Coastal Zone is to provide an adequate geographic region in which an integrated planning, regulatory permitting and indirect permit review authority may be applied to manage activities that have a direct and significant impact on the quality of coastal resources and coastal waters. As illustrated by this analysis, South Carolina's current eight-county Coastal Zone does not include all surface waters that have a direct connection with and influence on coastal waters and resources. Similarly, the current Coastal Zone extends beyond the composite results in some areas. However, the two areas are similar in size, with the composite results of this study yielding an area that is 0.5% larger than the current Coastal Zone.

The analysis contained in the full report is preliminary, utilizing available data and applying a watershed-based approach. DHEC makes no recommendations based on this analysis regarding the modification to the inland extent or area of the Coastal Zone. A revision of the South Carolina Coastal Zone boundary would require an extensive analytical process, significant time and effort among DHEC program areas, the active contribution among federal and state agencies, academia and non-governmental organizations in addition to opportunities for public participation. Further, the revision process would require adherence to federal Coastal Zone Management Act procedural guidelines. Subsequently, amendments to the S.C. Code of Laws, S.C. Code of Regulations and the South Carolina Coastal Program Document would be required to ensure consistency across decision-making processes and eliminate ambiguity in jurisdictional authority resulting from the proposed boundary change.

Introduction

The following document is a preliminary analysis that has been conducted by the S.C. Department of Health and Environmental Control (DHEC), Office of Ocean and Coastal Resource Management (OCRM) pursuant to Proviso 34.55 of the 2016-2017 Appropriation Act, which states:

> 34.55. (DHEC: Coastal Zone Boundary) Of the funds appropriated, the Department of Health and Environmental Control shall report to the General Assembly by January 1, 2017, with an initial recommendation to revise the coastal zone boundary, if any, and the study shall begin with Dorchester County.

In the proviso, the term "coastal zone boundary" is a reference to the eight-county South Carolina Coastal Zone, which is defined in S.C. Code of Laws, § 48-39-10; S.C Code of Regulations, Chapter 30; and the S.C. Coastal Program Document. Within this jurisdictional boundary, DHEC-OCRM administers the South Carolina Coastal Management Program (S.C. CMP). The S.C. CMP is a coordinated framework of direct and indirect regulatory authorities, planning assistance, funding assistance and inter-governmental coordination.

This document provides a summary of the major features of the S.C. CMP, a brief description of how Coastal Zone boundaries are established, documentation of the methodology used to analyze the South Carolina Coastal Zone, and general reference maps for South Carolina and Dorchester County. This analysis investigates an alternative, watershed-based methodology for delineating the Coastal Zone boundary. DHEC makes no recommendations based on this preliminary analysis regarding the modification to the inland extent or area of the Coastal Zone.

History of the Coastal Zone Management Program

The federal Coastal Zone Management Act of 1972 (CZMA), as amended, encourages states to develop coastal management programs that identify key coastal resources and the policies necessary to effectively and consistently manage those resources. The National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management (OCM) administers the Coastal Zone Management Program as a partnership between the federal government and coastal states.

In August 1973, South Carolina Governor John West created the Coastal Zone Planning and Management Council to develop a state coastal management plan that would provide guidelines for the protection of South Carolina's public trust resources in light of the growing pressures and complexities within the coastal region. Based on the efforts of the Coastal Zone Planning and Management Council, the South Carolina Coastal Tidelands and Wetlands Act (CTWA) was signed into law in 1977 and became the state's Coastal Zone Management Act.[2]

The **South Carolina Coastal Tidelands and Wetlands Act** has been modified numerous times since its inception, most notably in the area of beachfront management. Other changes through the years have addressed state government restructuring, which placed the South Carolina Coastal Council as a Division within DHEC. Administration of the state's Coastal Management Program has since been implemented by DHEC's Office of Ocean and Coastal Resource Management.

The CTWA identifies the eight-county Coastal Zone and details the legislative findings and state policies for the use and protection of South Carolina's coastal resources. The General Assembly found that South Carolina had a rich and wide variety of natural and man-made resources that added great value to the entire state. Important features of the Coastal Zone were acknowledged and documented in order to help better manage them for future generations. The CTWA also established the South Carolina Coastal Council as the original administrative body for the state's Coastal Management Program. Subsequent to the passage of the CTWA, the Coastal Council developed and promulgated regulations for the alteration, use and protection of coastal resources through a regulatory permitting program. Concurrent with this effort, the Coastal Council also completed a federally-required Environmental Impact Statement and developed the South Carolina Coastal Program Document, which contains the enforceable policies of the program. In 1979, the Coastal Program Document was approved by the S.C. General Assembly, Governor Riley and the U.S. Department of Commerce.[3]

The state's policies, as set forth by the CTWA and Coastal Program Document, promote a comprehensive framework of coastal management working with all levels of government and the public to ensure that sensitive and fragile areas are protected, while also affording and promoting responsible economic development opportunities throughout the Coastal Zone. Further, the CTWA seeks to restore and enhance coastal resources for current and future generations by formulating a comprehensive tidelands and beach erosion and protection program.

With the passage of the CTWA, the Coastal Council was directed to develop a comprehensive coastal management plan in accordance with statute:[4]

> The department shall develop a comprehensive coastal management program, and thereafter have the responsibility for enforcing and administering the program in accordance with the provisions of this chapter and any rules and regulations promulgated under this chapter. In developing the program the department shall:

[2] S.C. Code of Laws Ann., § 48-39-10
[3] DHEC. (2003). *Coastal Management in South Carolina: Past, Present, & Future*.
[4] S.C. Code of Laws Ann., § 48-39-80

(A) Provide a regulatory system which the department shall use in providing for the orderly and beneficial use of the Critical Areas.

(B) In devising the management program the department shall consider all lands and waters in the Coastal Zone for planning purposes. In addition, the department shall:

(1) Identify present land uses and coastal resources.

(2) Evaluate these resources in terms of their quality, quantity and capability for use both now and in the future.

(3) Determine the present and potential uses and the present and potential conflicts in uses of each coastal resource.

(4) Inventory and designate areas of critical state concern within the Coastal Zone, such as port areas, significant natural and environmental, industrial and recreational areas.

(5) Establish broad guidelines on priority of uses in Critical Areas.

(6) Provide for adequate consideration of the local, regional, state and national interest involved in the siting of facilities for the development, generation, transmission and distribution of energy, adequate transportation facilities and other public services necessary to meet requirements which are other than local in nature.

(7) Provide for consideration of whether a proposed activity of an applicant for a federal license or permit complies with the State's Coastal Zone Program and for the issuance of notice to any concerned federal agency as to whether the State concurs with or objects to the proposed activity.

(8) Provide for a review process of the management plan and alterations thereof that involves local, regional, state and federal agencies.

(9) Conduct other studies and surveys as may be required, including the beach erosion control policy as outlined in this chapter.

(10) Devise a method by which the permitting process shall be streamlined and simplified so as to avoid duplication.

(11) Develop a system whereby the department shall have the authority to review all state and federal permit applications in the Coastal Zone, and to certify that these do not contravene the management plan.

(C) Provide for a review process of the management program and alterations that involve interested citizens as well as local, regional, state and federal agencies.

(D) Consider the planning and review of existing water quality standards and classifications in the Coastal Zone.

(E) Provide consideration for nature-related uses of Critical Areas, such as aquaculture, mariculture, waterfowl and wading bird management, game and nongame habitat protection projects and endangered flora and fauna.

Generally, the CTWA provides the state with the statutory authority to develop and implement a comprehensive Coastal Management Plan. This Plan is commonly referred to as the Coastal Program Document. Both the state and federal CZMA define parameters for a federally-approved state coastal management program. An approved management program must include each of the following elements: [5]

(A) An identification of the boundaries of the Coastal Zone subject to the management program.

[5] 16 U.S.C. § 1455 (d)

(B) A definition of what shall constitute permissible land uses and water uses within the Coastal Zone which have a direct and significant impact on the coastal waters.

(C) An inventory and designation of areas of particular concern within the Coastal Zone.

(D) An identification of the means by which the State proposes to exert control over the land uses and water uses referred to in subparagraph (B), including a list of relevant State constitutional provisions, laws, regulations, and judicial decisions.

(E) Broad guidelines on priorities of uses in particular areas, including specifically those uses of lowest priority.

(F) A description of the organizational structure proposed to implement such management program, including the responsibilities and interrelationships of local, area wide, State, regional, and interstate agencies in the management process.

(G) A definition of the term "beach" and a planning process for the protection of, and access to, public beaches and other public coastal areas of environmental, recreational, historical, esthetic, ecological, or cultural value.

(H) A planning process for energy facilities likely to be located in, or which may significantly affect, the Coastal Zone, including a process for anticipating the management of the impacts resulting from such facilities.

(I) A planning process for assessing the effects of, and studying and evaluating ways to control, or lessen the impact of, shoreline erosion, and to restore areas adversely affected by such erosion.

BOX 1. Validity of the South Carolina Coastal Management Program Document and Enforceable Policies Upheld
Spectre, LLC v. S.C. DHEC

In 2006, the validity and enforceability of the South Carolina Coastal Management Program were challenged in Spectre, LLC v. S.C. DHEC. The case was ultimately decided by the South Carolina Supreme Court (Court) in 2010. In its decision, the Court upheld both the validity of the Coastal Management Program (CMP) and DHEC's application of the program when reviewing projects in the Coastal Zone.

The Court found that the CMP was enacted in accordance with the specific procedures set forth by the South Carolina General Assembly and, consequently, is a valid and enforceable document. Further, the Court determined that the policies contained within the CMP were applicable to the Spectre site. It concluded that DHEC properly exercised its authority when it denied a permit to fill isolated freshwater wetlands at the site.

South Carolina's CMP does not entirely prohibit the filling of isolated or other wetlands for development. In this particular case, DHEC denied the permit application because the applicant did not attempt to avoid or minimize impacts to the isolated wetlands on the property.

Based on the requirements of the federal CZMA as well as the state's enabling legislation contained in the CTWA, broad policies addressing coastal resource management were developed and adopted and have been employed for the past 37 years. These resource policies address residential development, transportation activities, tourism, marine related facilities, wildlife and fisheries management, dredging activities, public infrastructure and related services, erosion control, energy related facilities and areas of special resource significance. A complete list of policy goals and objectives of the S.C. CMP can be found in Appendix 1. The validity and enforceability of the S.C. CMP were challenged in 2006 but ultimately upheld by a state Supreme Court decision in 2010 (see Box 1).

Establishment of the Coastal Zone Boundary

As participants of the federal Coastal Zone Management Program, states must include the identification of a Coastal Zone boundary subject to the management frameworks and provisions. According to federal regulations,[6] the inland boundary of a State's Coastal Zone **must** include:

> (1) Those areas the management of which is necessary to control uses which have direct and significant impacts on coastal waters, or are likely to be affected by or vulnerable to sea level rise, pursuant to § 923.11;
>
> (2) Those special management areas identified pursuant to § 923.21;
>
> (3) Waters under saline influence - Waters containing a significant quantity of seawater, as defined by and uniformly applied by the State;
>
> (4) Salt marshes and wetlands - Areas subject to regular inundation of tidal salt (or Great Lakes) waters which contain marsh flora typical of the region;
>
> (5) Beaches - The area affected by wave action directly from the sea. Examples are sandy beaches and rocky areas usually to the vegetation line;
>
> (6) Transitional and intertidal areas - Areas subject to coastal storm surge, and areas containing vegetation that is salt tolerant and survives because of conditions associated with proximity to coastal waters. Transitional and intertidal areas also include dunes and rocky shores to the point of upland vegetation;
>
> (7) Islands - Bodies of land surrounded by water on all sides. Islands must be included in their entirety, except when uses of interior portions of islands do not cause direct and significant impacts.
>
> (8) The inland boundary must be presented in a manner that is clear and exact enough to permit determination of whether property or an activity is located within the management area. States must be able to advise interested parties whether they are subject to the terms of the management program within, at a maximum, 30 days of receipt of an inquiry. An inland Coastal Zone boundary defined in terms of political jurisdiction (*e.g.*, county, township or municipal lines) cultural features (*e.g.*, highways, railroads), planning areas (*e.g.*, regional agency jurisdictions, census enumeration districts), or a uniform setback line is acceptable so long as it includes the areas indentified.

Furthermore, the inland boundary of a state's Coastal Zone **may** include:

> (1) Watersheds - A state may determine some uses within entire watersheds which have direct and significant impact on coastal waters or are likely to be affected by or vulnerable to sea level rise. In such cases it may be appropriate to define the Coastal Zone as including these watersheds.
>
> (2) Areas of tidal influence that extend further inland than waters under saline influence; particularly in estuaries, deltas and rivers where uses inland could have direct and significant impacts on coastal waters or areas that are likely to be affected by or vulnerable to sea level rise.
>
> (3) Indian lands not held in trust by the Federal Government.

[6] 15 C.F.R. § 923.31

Currently, 34 states and territories participate in the national Coastal Zone Management Program. A summary of federally-approved state Coastal Zone boundaries is provided in Appendix 2. While techniques used to define the inland extent of Coastal Zone boundaries vary, delineation is typically associated with the following: county or municipal boundaries; physical or biophysical features such as waterways, roads, and bridges; a distance-based setback (*e.g.*, from mean high water); watersheds; a defined continuous contour line; or the entire state or territory is included in the Coastal Zone. The most common technique is the use of geopolitical boundaries, such as county, municipal, state, or territory boundaries. The county-based Coastal Zone boundaries of Virginia, North Carolina, South Carolina, Georgia, and Florida are shown in Figure 1. A summary of boundary delineation techniques, by region, is provided in Box 2.[7]

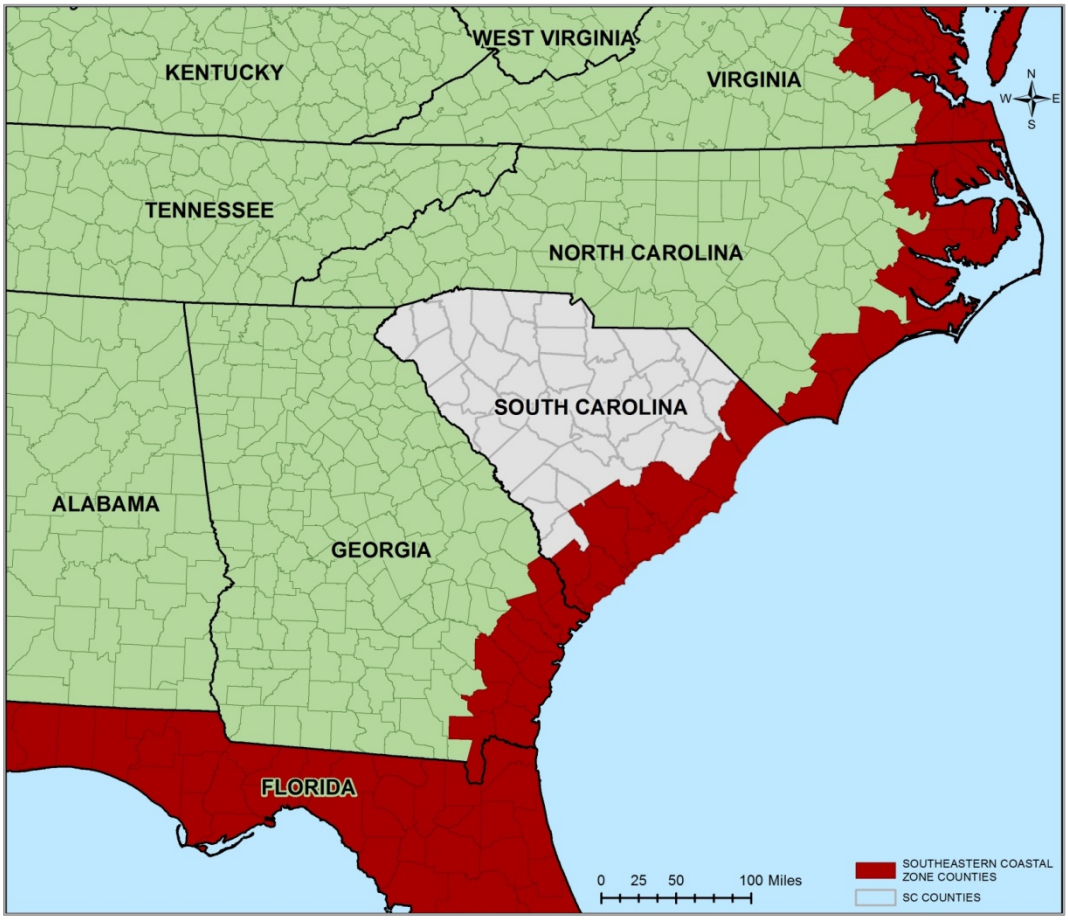


Figure 1: Coastal Zone boundaries in the southeastern United States.

BOX 2. Regional Summary of Coastal Zone Boundary Delineation Techniques

In the South Atlantic, county boundaries are used to establish the inland extent of the Coastal Zone. Along the Gulf Coast, Mississippi uses county boundaries, Alabama uses a continuous contour line, and Louisiana and Texas use physical or biophysical features such as roads and waterways. In the Mid-Atlantic, Virginia and Maryland use county boundaries to establish the inland extent of the Coastal Zone. In the northeast, county or municipal boundaries are used in Connecticut, Maine, and New Hampshire, while Massachusetts, New York, and Pennsylvania use a distance-based setback for delineation. A distance-based setback is also used in California, Michigan, and Puerto Rico. Most states in the Great Lakes, with the exception of Wisconsin (which uses county boundaries), use watersheds and/or physical or biophysical features to establish inland boundaries. Most territories including American Samoa, Guam, Northern Mariana Islands, and the U.S. Virgin Islands are entirely within the Coastal Zone. Delaware, Florida, Hawaii, and Rhode Island include the entire state in the Coastal Zone.

[7] NOAA Office for Coastal Management. *State Coastal Zone Boundaries*. (2012, February 9). Retrieved June 2016 from https://coast.noaa.gov/czm/media/StateCZBoundaries.pdf

Like many states participating in the national Coastal Zone Management Program, South Carolina used a geopolitical boundary to establish the inland extent of the state's Coastal Zone. In consideration of federal Coastal Zone boundary requirements, the South Carolina Coastal Zone (Figure 2) is defined in statute as "all coastal waters and submerged lands seaward to the State's jurisdictional limits and all lands and waters in the counties of the State which contain any one or more of the critical areas. These counties are Beaufort, Berkeley, Charleston, Colleton, Dorchester, Horry, Jasper and Georgetown."[8] The Coastal Zone is 8,224 square miles including state waters (7,509 square miles excluding state waters), and about 24% of the state's land and water area.

The Coastal Zone boundary establishes a two-tiered approach to coastal management in the state. DHEC exercises direct permitting authority within designated Critical Areas and a broader management authority to review and certify other state and federal permits in the remainder of the Coastal Zone. This concurrent authority ensures that all permitted activities within the Coastal Zone are consistent with the goals and enforceable policies of the Program Document. In 1992, the Coastal Zone underwent federal review and was deemed sufficient to protect coastal waters (Box 3).[9]

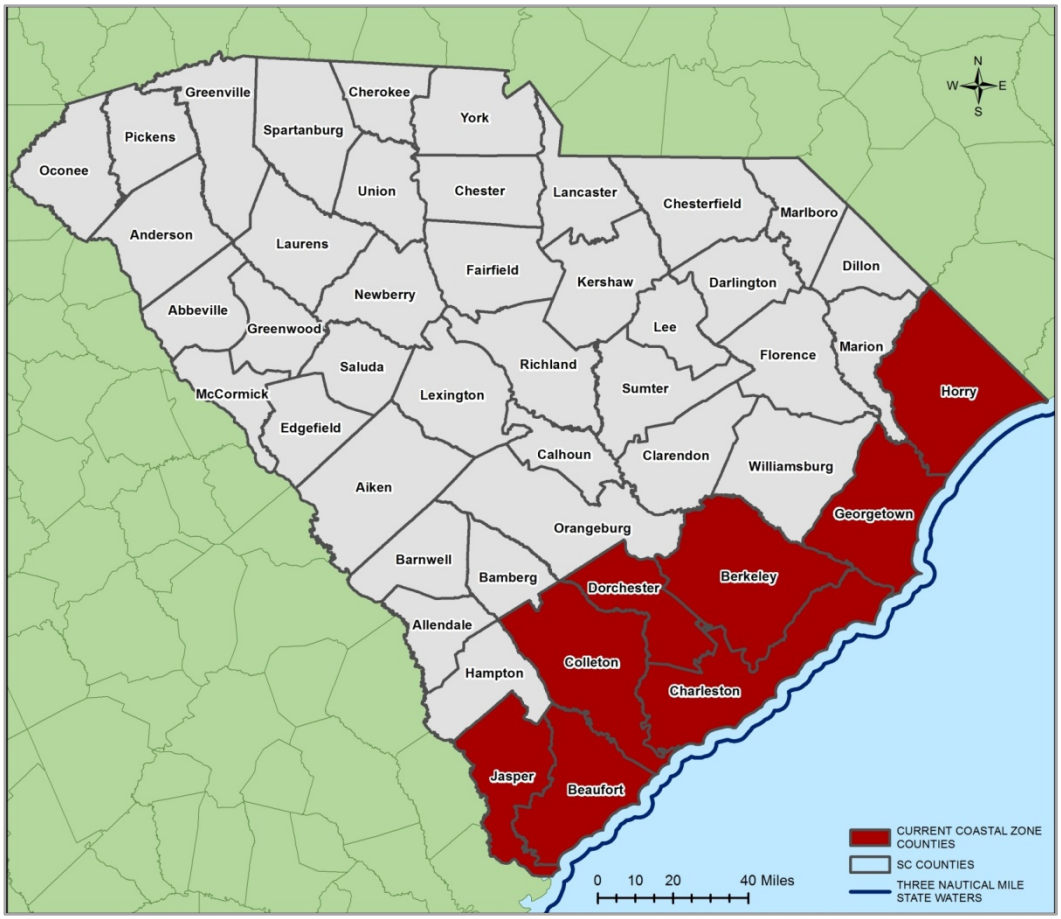


Figure 2: South Carolina Coastal Zone.

BOX 3. NOAA finds South Carolina Coastal Zone Boundary Sufficient to Protect Coastal Waters

In 1992, South Carolina's Coastal Zone boundary was reviewed by NOAA in consultation with the U.S. Environmental Protection Agency (EPA) pursuant to the Coastal Zone Act Reauthorization Amendments of 1990. This evaluation compared the Coastal Zone boundary with a watershed boundary to determine whether the inland extent of the Coastal Zone was sufficient to manage land and water uses significantly impacting the state's coastal waters. In the findings, NOAA confirmed that South Carolina's Coastal Zone boundary was sufficient to protect coastal waters, and this boundary subsequently defined the management area for the Coastal Nonpoint Pollution Control Program.

[8] S.C. Code of Laws Ann. § 48-39-10

[9] NOAA. (1992). *Coastal Zone Boundary Review - Amended Draft, National Summary: State Characterization Reports*. National Oceanic and Atmospheric Administration. Washington, DC.

Federal Requirements for Amending the State's Coastal Zone Management Program

Pursuant to the CZMA of 1972, as amended, a coastal state with an approved management program may amend or modify the program subject to certain conditions and approval from NOAA. CZMA regulations define two types of program changes: amendments and routine program changes (RPC). Amendments are defined as substantial changes in one or more of the following five program areas: 1) Uses Subject to Management; 2) Special Management Areas; 3) Boundaries; 4) Authorities and Organization; and 5) Coordination, Public Involvement and National Interest.[10] RPCs are the further detailing of a state program that does not result in a substantial change to one or more of the five program areas. All program change requests are reviewed by NOAA, and determination of whether a proposed program change is substantial is decided on a case-by-case basis. Indicators of a substantial change identified by NOAA include: 1) New or revised enforceable policies that address coastal uses or resources not previously managed (or major changes in the way a state program manages coastal uses or resources); 2) The extent to which the proposed change impacts the national interest reflected in the CZMA; and 3) The extent to which the proposed change is similar to past program change requests (by any state) that were treated as amendments. Two instances of state requests for Coastal Zone boundary changes are discussed below.

> In February 2003, the New Hampshire Coastal Program submitted an amendment of its inland boundary to NOAA for approval. The amendment expanded the inland boundary to encompass the total area of the 17 tidal coastal municipalities. NOAA approved this amendment on December 16, 2003, and it became effective with notice in the Federal Register on February 12, 2004.[11]
>
> In July 2012, the Louisiana Department of Natural Resources' Office of Coastal Resource Management submitted a request to NOAA for an RPC to modify the inland boundary of the Louisiana Coastal Zone.[12] The boundary changes were based on the recommendations of a science-based study conducted by the Department in response to Senate Concurrent Resolution 60 of the 2009 Legislative Session of the Louisiana General Assembly.[13] This Resolution charged the Department to study whether environmental changes including sea-level rise, regional subsidence, and wetland loss, had altered the coastline such that the original Coastal Zone boundary was no longer adequate for current and future Coastal Zone management needs. As a result of the study, the inland boundary was modified in 10 of the 20 coastal parishes. However, parishes were neither added nor removed from the Coastal Zone in their entirety. The boundary modification expanded the Coastal Zone in eight parishes and reduced the Coastal Zone in two parishes, resulting in a net increase of approximately 1,900 square miles in Coastal Zone area.[14, 15] Formal federal recognition of the revised Louisiana Coastal Zone boundary was announced in September 2012.[16]

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[10] 15 C.F.R. § 923

[11] New Hampshire Dept. of Environmental Services. *Program Changes*. Retrieved November 2016 from http://des.nh.gov/organization/divisions/water/wmb/coastal/program_changes.htm

[12] Louisiana Dept. of Natural Resources. (2012). *Request for Routine Program Change to Modify the Inland Boundary of the Louisiana Coastal Zone to the Louisiana Coastal Resources Program*. Retrieved November 2016 from http://dnr.louisiana.gov/assets/OCM/CoastalZoneBoundary/CZB2012/RPC_Document.pdf

[13] Louisiana Dept. of Natural Resources. (2010). *Defining Louisiana's Coastal Zone: A Science-based Evaluation of the Louisiana Coastal Zone Inland Boundary*. Retrieved June 2016 from http://dnr.louisiana.gov/assets/OCM/CoastalZoneBoundary/CZB_Study_Report_October_2010_Final.pdf

[14] Louisiana Dept. of Natural Resources. *Coastal Zone Boundary*. Retrieved August 2016 from http://dnr.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&pid=928

[15] Louisiana Dept. of Natural Resources. (2010). *Defining Louisiana's Coastal Zone: A Science-based Evaluation of the Louisiana Coastal Zone Inland Boundary*. Retrieved June 2016 from http://dnr.louisiana.gov/assets/OCM/CoastalZoneBoundary/CZB_Study_Report_October_2010_Final.pdf

[16] Louisiana Dept. of Natural Resources. (2012). *DNR Achieves Formal Federal Recognition of Coastal Zone Boundary Revisions*. Retrieved August 2016 from http://dnr.louisiana.gov/index.cfm?md=newsroom&tmp=detail&aid=974

If a proposed change to a state's Coastal Zone boundary is deemed substantial, the amendment submittal requirements and federal review process apply. Program amendment requests must be submitted to NOAA by the Governor of a coastal state or by the head of the designated state 306 program agency, if the governor has delegated this responsibility and the delegation is part of the approved coastal management program. Pending the program change or approval, NOAA may choose to suspend all or part of any grant award to the state.[17] A full list of statutory requirements and details on the federal review process for both RPCs and amendments can be found in NOAA's *Program Change Guidance, The Coastal Zone Management Act and Changes to State and Territory Coastal Management Programs, July 1996.*[18]

Regulatory Authorities within the Coastal Zone

Direct Permitting Authority in Critical Areas

DHEC administers direct permitting authority over the Critical Areas pursuant to the CTWA and Coastal Division Regulations.[19] Critical Areas include coastal waters, tidelands, beach/dune systems and beaches. Each of these specific areas is defined in the Coastal Division Regulations. Any person or entity wishing to alter a Critical Area must receive a permit from DHEC prior to the initiation of activities. Typical activities include the construction of docks, bulkheads, boat ramps, marinas or other activities such as filling, dredging and renourishment. The inland extent of the Critical Area (Figure 3) is defined according to the following criteria:[20]

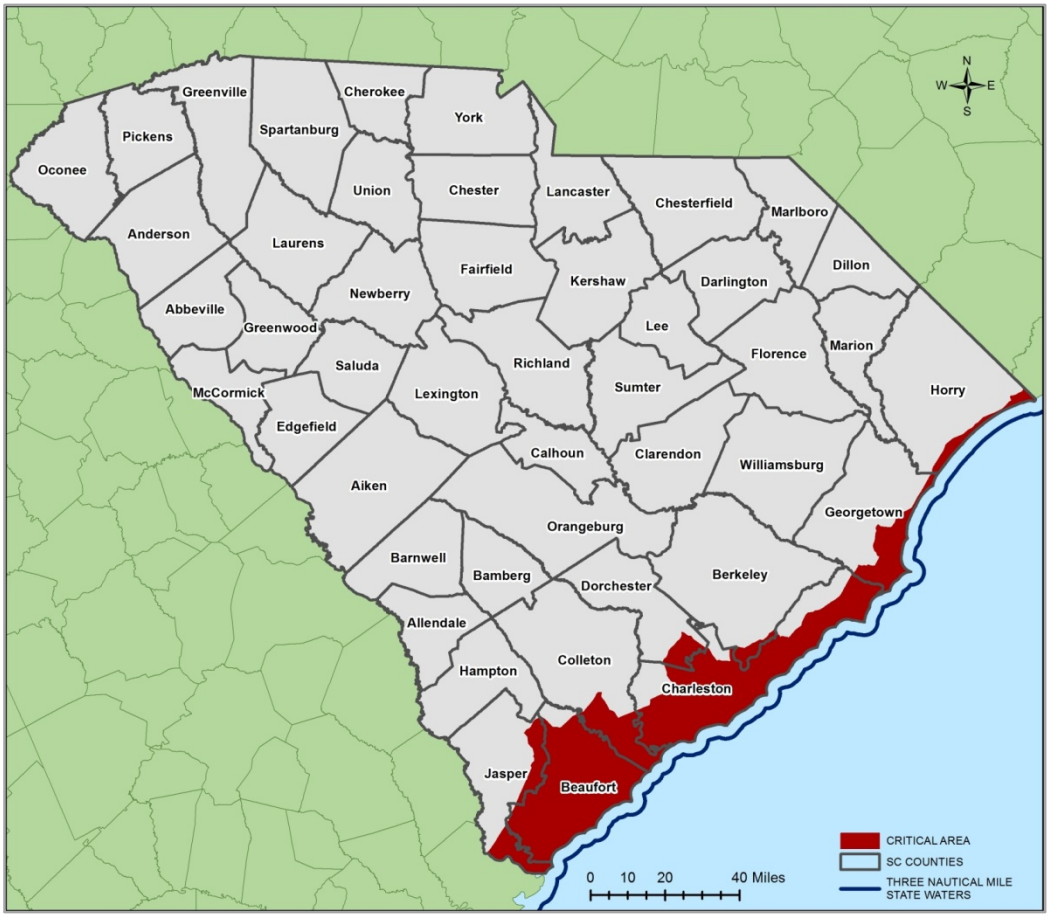

Figure 3: South Carolina Critical Area.

> Using biological field surveys and aerial photography, the Department has found the point on the upper reaches of the estuarine systems where tideland vegetation changes from predominately brackish to

[17] 16 C.F.R. § 1455

[18] NOAA. (1996). *Program Change Guidance: The Coastal Zone Management Act and Changes to State and Territory Coastal Management Programs*. National Oceanic and Atmospheric Administration. Washington, DC.

[19] S.C. Code of Laws Ann. § 48-39-10, et. seq, and S.C. Code of Regulations Ann. 30-1

[20] S.C Code of Regulations Ann. 30-10(A)(2)

predominately fresh and has established a boundary using the nearest recognizable physical features within this area.

A detailed geographic description of the jurisdictional Critical Area boundary is provided in the Coastal Division Regulations.[21] Including state territorial waters, the Critical Area is approximately 2,952 square miles in area (2,237 square miles excluding state waters). This area represents about 30% of the South Carolina Coastal Zone and about 7% of the state's land and water area.

Indirect Authority and Enforceable Policies

Enforceable Policies of the Coastal Zone Management Program

In addition to regulating activities in the Critical Areas and preserving and protecting the priority use(s) of Special Management Areas, a comprehensive Coastal Management Program includes policies for management of the full range of activities that have a "direct and significant impact" on coastal waters. The need for this form of resource management was recognized in the Congressional findings of the federal CZMA of 1972, as amended, which describe the value of our coastal resources and the pressures for development from often competing uses. To achieve the national goals of this Act, participating states must develop and implement an acceptable management program and are encouraged to exercise their responsibility and authority over lands and waters within the coastal zone, giving full consideration to ecological, cultural, historic, and esthetic values as well as the needs for compatible economic development.[22] In addition, states must prepare an acceptable management program.

The federal CZMA requires states to develop policies and procedures by which uses, determined to be subject to the management program, will be allowed, conditioned, modified, encouraged or prohibited.[23] This refers to the federal requirement that each state first identify the coastal activities considered significant enough to warrant management, and then identify the policies and legal authority or review process which will govern the activities. Box 4 includes a list of activities and areas of special resource significance which

BOX 4. Activities and Areas Determined to Have Potential Direct and Significant Impact on Coastal Waters

- Residential development
- Transportation: ports, roads and highways, airports, railways, parking facilities
- Coastal industries: agriculture, forestry (silviculture), mineral extraction, manufacturing, fish and seafood processing, aquaculture (mariculture)
- Commercial development
- Recreation and tourism: parks, commercial recreation
- Marine related facilities: marinas, boat ramps, docks and piers
- Wildlife and fisheries management: wildlife and fisheries management areas, artificial reefs, impoundments
- Dredging: dredging, dredged material disposal, underwater salvage
- Public services and facilities: sewage treatment, solid waste disposal, public/quasi-public buildings and structures, dams and reservoirs, water supply
- Erosion control
- Energy and energy related facilities
- Activities in areas of special resource significance: barrier Islands, dune areas, navigation channels, public recreation areas, wetlands (other than Critical Areas)
- Stormwater management guidelines: stormwater runoff storage requirements, project size, bridge runoff, golf courses adjacent to receiving water bodies, mines and sandfills, notice of approval
- Mitigation guidelines: types of wetland impacts for mitigation, types of requirements for mitigation, monitoring and compliance, notice of approval

[21] S.C. Code of Regulations Ann. 30-10(A)(2)
[22] 16 U.S.C. § 1452 (303)(2)
[23] 15 C.F.R. § 923.11

were determined to meet the definition for having a potential for "direct and significant impact" on coastal waters.

The South Carolina coastal program utilizes the performance standards approach which contemplates the impacts of an activity on coastal resources rather than the proposed activity itself. This is an indirect method of managing activities in the Coastal Zone by assessing the impacts of a proposed action on coastal resources. With this approach, policies were developed for those activities which would have direct and significant coastal impacts. Evaluation of projects and proposals takes into consideration the individual merit of each application while also considering the resulting effects on the marine and estuarine environment.

Areas of Particular Concern

While recognizing that the entire Coastal Zone of each state is an important and vital resource, the federal CZMA of 1972, also declares that certain areas are of special significance and warrant particular attention to their preservation and development. The Act requires, in Section 306(d)(2)(c), that each state inventory and designate the "Areas of Particular Concern" within its Coastal Zone as part of the state's program. Special Management Areas include: Geographic Areas of Particular Concern (GAPCs), Energy Facility Planning Process, Erosion Control Program, Beach and Shoreline Access, and Special Area Management Plans.

Coastal Zone Consistency

Before any project can be authorized by a state permit or federal permit or action, DHEC must ensure impacts to coastal resources located within the Coastal Zone are consistent with the applicable enforceable policies of the Coastal Management Program. This process is referred to as state and federal Coastal Zone Consistency (CZC) certification.

State Coastal Zone Consistency

The state's permitting programs, or authorities that currently operate in the Coastal Zone, consist of DHEC's Bureau of Air (BOA), Bureau of Land and Waste Management (BLWM), Bureau of Water (BOW), as well as the Office of Ocean and Coastal Resource Management (OCRM). The remaining state permitting authority that operates in the Coastal Zone is the Office of Regulatory Staff (ORS). The general timeframe for OCRM staff to complete CZC reviews is

GAPC (Geographic Areas of Particular Concern) - areas within South Carolina's coastal zone which have been identified in the State's Coastal Management Program as being of such importance as to merit special consideration during the Department review of permit applications. GAPC's consist of: (1) areas of unique natural resource value; (2) areas where activities, development, or facilities depend on proximity to coastal waters, in terms of use or access; and (3) areas of special historical, archeological or cultural significance. - *S.C. Code of Regulations Chapter 30(D)(24)*

BOX 5. State Agency Permit Programs

S.C. DHEC Environmental Affairs:

BAQ: Asbestos Removal, Conditional Major, Expedited Review, Minor New Source (NSR), Synthetic Minor Source, Title V

BLWM: Certificate to Explore for Minerals; Hazardous Waste Facility; Infectious Waste Facility; Mining and Reclamation; Radiological Waste Facility; Radioactive Waste Facility; Solid Waste Landfills; Solid Waste Handling Facilities; Terminal Facility Registration; Oil and Gas Exploration, Drilling, Transportation, and Production; Underground Storage Tank (UST)

BOW: Agricultural Animal Facilities, Dams and Reservoirs Safety, Drinking Water Construction, Construction in Navigable Waters, Groundwater Use, Interbasin Transfer Permitting Program, Land Application, Recreational Waters Construction, Satellite Sewer Systems, Septic Tanks, Shellfish Sanitation, Storm Water NPDES, Surface Water, Private Wells, Public Water System Construction, Underground Injection Control, Wastewater Discharge (NPDES)

OCRM: Critical Area

S.C. Office of Regulatory Staff:

Major Public Utility Facilities

within 30 business days. As shown in Box 5, the majority of state agency permit programs that operate in the Coastal Zone are housed within DHEC.

Federal Coastal Zone Consistency

The federal CZMA was enacted to encourage coastal states, Great Lake States and United States territories and commonwealths (collectively referred to as coastal states) to develop comprehensive programs to manage and balance competing uses of, and impacts to, coastal resources. The federal CZMA emphasizes the primacy of state decision-making regarding the Coastal Zone. Section 307 of the federal CZMA requires the federal government to comply with a state's Coastal Management Program when taking actions that are likely to affect coastal resources.[24] This federal consistency provision provides a major incentive for states to join the national Coastal Management Program as it allows state programs to manage coastal activities and resources and to facilitate cooperation and coordination with federal agencies. The timeframe for federal consistency reviews, or concurrences, ranges from 15 days to 6 months. A general list of federal consistency programs that operate in and outside of the Coastal Zone can be found in Appendix 3.

Coastal Management Program Document Refinements

Since its initial approval in August 1979, there have been two revisions to the Coastal Management Program Document. The first substantive change was made in 1993. These refinements were added to the existing Program Document to address wetland master planning, wetland mitigation, dock master planning, storm water management guidelines, Special Area Management Plans (SAMPs) and the appeals process for Coastal Zone Consistency certifications.[25] The second revision was in 1995 following state government restructuring. The 1995 amendments modified the Program Document to reflect the new administrative nomenclature subsequent to restructuring of state agencies by the S.C. General Assembly. No substantive or technical policy changes resulted from the 1995 update.

The 1993 Refinements to the Program Document provided more detailed policies for wetlands management, dock permitting and storm water management. These refinements also provided more specific policies and guidelines for the SAMP process. A summary of these policy refinements is provided below.

> Policies regarding wetlands were modified to provide a process for wetland master planning and more comprehensive guidance for wetland impact avoidance, minimization and mitigation. The wetland policies provide greater specificity regarding how mitigation would be approached in the Coastal Zone while recognizing existing approaches of other regulatory agencies. This guidance provides consistency among agencies with regulatory authority, reducing procedural conflicts.
>
> Dock Master Planning policies provide two approaches for projects subject to consistency review. One approach available to the applicant is to apply for a comprehensive permit for the entire subdivision. This approach allows for the applicant, the public and OCRM to evaluate the potential impact from the entire project comprehensively. If the permit is issued, there is more certainty for the developer and future property owners. The second approach is for the developer to provide a more general plan that shows the proposed development with the lots and extended property lines that represent the potential dock corridors for future dock permitting.
>
> Stormwater management guidelines address additional measures which are applied to projects based on the size of the project and their proximity to receiving water bodies. The refinements also addresses specific types of development projects such as golf courses, mines and landfills. Some of these policies have been overtaken by

[24] 16 C.F.R. § 1456

[25] *S.C. Coastal Zone Management Program, Program Refinements*. (1993). Retrieved October 2016 from http://www.DHEC.gov/HomeAndEnvironment/Docs/CZMP_1993_Refinements.pdf

subsequent changes to DHEC's stormwater program, specifically several changes to the NPDES program that is administered by DHEC's Bureau of Water.

The SAMP process is established by the federal CZMA. The SAMP process allows coastal programs to develop comprehensive plans addressing coastal resource management needs with specific policies usually targeting a specific geographic area. Because of the focus on targeting of specific geographic areas, these plans often take into consideration the local government's role as well as the state's interest in these resource management initiatives. To date, DHEC has undertaken approximately 13 SAMP initiatives in the Coastal Zone. Some of these initiatives have resulted in changes to the local as well as state government's approach to managing these special resource areas. Many of these focused on the land-water interface in the specified geographic area under review.

Finally, the 1993 refinements to the Program Document addressed the appeals process as it relates to CZC certifications for federal and state permits. The policies in this section describe the notice, review and appeals process for consistency certifications. Some of these policies have been overcome by subsequent changes to state law related to state government restructuring in 1994. Furthermore, additional significant changes to the appeals process for the state of South Carolina came into effect with the passage of Act 387 in 2006.

Science-Based Analysis of the South Carolina Coastal Zone

The purpose of this science-based analysis was to identify a potential alternative geographic area in coastal South Carolina that provides adequate coastal resource protection and includes the variables identified in federal regulations as inland boundary requirements.[26] These variables are listed in detail in the section of this report titled Establishment of the Coastal Zone Boundary, and are summarized below.

- Areas that have direct and significant impact on coastal waters including areas vulnerable to sea level rise,
- Special management areas,
- Waters under saline influence,
- Salt marshes and wetlands,
- Beaches,
- Transitional and intertidal areas including areas subject to storm surge,
- Islands,
- Watersheds,
- Tidal Influence, and
- Indian lands not held in trust by the Federal Government.

With the time and resources available for this preliminary analysis, not all variables listed above were fully evaluated. Priority areas of analysis included: 1) areas with the presence of significant and uniquely coastal resources, including estuarine and marine waters and wetlands and tidally influenced areas; 2) watersheds that have direct and significant impact on those resources; and 3) areas subject to marine-based hazards, specifically storm surge inundation. Sea level rise data were consulted but not included in this analysis. Additionally, time did not allow for a full inventory of special management areas as defined in federal regulations.[27] A change in the South Carolina Coastal Zone boundary would require detailed evaluation, along the entire coast, of additional data and resources not examined in this analysis. Some of this information has been gathered and is presented in the section of this report titled Profile: Dorchester County. The following sections describe acquired data, methodology, and results of the preliminary analysis.

Acquired Datasets and Data Descriptions

Six primary datasets were acquired for this analysis. These datasets include county boundaries, hydrologic unit boundaries, estuarine and coastal drainage areas, estuarine and marine waters and wetlands, tidal influence, and storm surge. These datasets were collected from a number of federal agencies including the U.S. Geological Survey (USGS), NOAA, and the U.S. Army Corps of Engineers (USACE). Table 1 includes a full list of acquired datasets and associated sources. Brief descriptions of these datasets and any required pre-processing steps are included in the sections below.

Table 1: Acquired datasets and associated sources.

Dataset	Source	Date Published	Date Acquired	Link
County Boundaries	USGS National Boundary Dataset (NBD) for South Carolina 20160317 State or Territory Shapefile	3/17/2016	7/19/16	https://catalog.data.gov/dataset/usgs-national-boundary-dataset-nbd-for-south-carolina-20140401-state-or-territory-shapefile
Hydrologic Unit Boundaries	USGS National Hydrography Dataset (NHD)	4/13/2016	7/22/16	https://www.sciencebase.gov/catalog/item/56d6921ae4b015c306f27f2e

[26] 15 C.F.R. § 923.31
[27] 15 C.F.R. § 923.21

Dataset	Source	Date Published	Date Acquired	Link
Estuarine and Coastal Drainage	NOAA Coastal Assessment Framework	7/2010	9/28/16	Data received via mail
Estuarine and Marine Water and Wetland	USFWS National Wetlands Inventory (NWI)	5/1/2016	7/19/16	https://www.fws.gov/wetlands/index.html
Tidal Influence	USACE 1977 Navigability Study of South Carolina	1977	9/13/2016	• http://www.sac.usace.army.mil/Portals/43/docs/regulatory/Summary.pdf • http://www.sac.usace.army.mil/Portals/43/docs/regulatory/Report_1CooswhatchieRiverBasin.pdf • http://www.sac.usace.army.mil/Portals/43/docs/regulatory/Report2CombaheeRiverArea.pdf • http://www.sac.usace.army.mil/Portals/43/docs/regulatory/Report3EdistoRiverArea.pdf • http://www.sac.usace.army.mil/Portals/43/docs/regulatory/Report4CooperRiverArea.pdf • http://www.sac.usace.army.mil/Portals/43/docs/regulatory/Report5SanteeRiverBasin.pdf • http://www.sac.usace.army.mil/Portals/43/docs/regulatory/Report%206%20BlackRiverArea.pdf • http://www.sac.usace.army.mil/Portals/43/docs/regulatory/Report7WaccamawRiverBasin.pdf • http://www.sac.usace.army.mil/Portals/43/docs/regulatory/Report11GreatPeeDeeRiverBasin.pdf
	USACE Savannah Harbor Expansion Project (SHEP) Final EIS, Section 4 Affected Environment	2012	9/14/2016	http://www.sas.usace.army.mil/Portals/61/docs/SHEP/Reports/EIS/Section%204%20SHEP%20FINAL%20EIS.pdf
Storm Surge	NOAA National Hurricane Center - Category 4 Storm Surge Inundation (SLOSH Maximum of Maximums)	5/27/2016	11/7/2016	http://www.arcgis.com/home/item.html?id=3838c1e97617467884a5d2c88b34308f

County Boundaries

The USGS National Boundaries Dataset (NBD) was used in this analysis to represent South Carolina county boundaries. This dataset includes major civil areas for the Nation, including States or Territories, counties (or equivalents), Federal and Native American areas, congressional districts, minor civil divisions, incorporated places (such as cities and towns), and unincorporated places. Boundaries data are useful for understanding the extent of jurisdictional or administrative areas for a wide range of applications, including mapping or managing resources, and responding to natural disasters. Boundaries data also include extents of forest, grassland, park, wilderness, wildlife, and other reserve areas useful for recreational activities, such as hiking and backpacking. Boundaries data are acquired from a variety of government sources. The data represents the source data with minimal editing or review by USGS.[28]

[28] USGS. *National Boundary Dataset*. Retrieved October 2016 from https://www.sciencebase.gov/catalog/item/4f70b219e4b058caae3f8e19

Hydrologic Unit Boundaries

Hydrologic unit boundaries, in the USGS Watershed Boundary Dataset (WBD), were used in this analysis to represent watershed boundaries. Hydrologic unit boundaries define the areal extent of surface water drainage to a point. These boundaries are determined solely upon science-based hydrologic principles, not favoring administrative boundaries or special projects. More specifically, boundaries are defined by hydrographic and topographic criteria that delineate an area of land upstream from a specific point on a river, stream or similar surface waters. A hydrologic unit can accept surface water directly from upstream drainage areas, and indirectly from associated surface areas such as remnant, non-contributing, and diversions to form a drainage area with single or multiple outlet points.[29] Hydrologic unit areas are delineated to nest in a multi-level, hierarchical drainage system. At this time nationally, each hydrologic unit is identified by a 2- to 12-digit hydrologic unit code (HUC), though some states and local entities have established 14- and 16-digit HUCs. The HUC numbering system establishes the relationship between the larger "parent" hydrologic units and the smaller units within them. For instance, the 10-digit "Watershed" represented by HUC 0304020112 indicates this unit falls within the larger 2-digit "Region" 03, the 4-digit "Subregion" 0304, the 6-digit "Basin" 030402, and the 8-digit "Subbasin" 03040201 (Table 2). Hydrologic units are not necessarily identical to classic topographic watersheds, but the two strongly correlate and hydrologic units are commonly used in watershed management and analysis activities. South Carolina HUCs at the 6-digit (Basin), 8-digit (Subbasin), and 10-digit (Watershed) level are geographically represented in Figure 4.[30]

Table 2: Example of the USGS hierarchical, HUC numbering system representing hydrologic units at various levels.

HUC	Name	Level	Example
2-Digit	Region	1st	03
4-Digit	Subregion	2nd	0304
6-Digit	Basin / Accounting Unit	3rd	030402
8-Digit	Subbasin / Cataloging Unit	4th	03040201
10-Digit	Watershed	5th	0304020112
12-Digit	Subwatershed	6th	030402011201

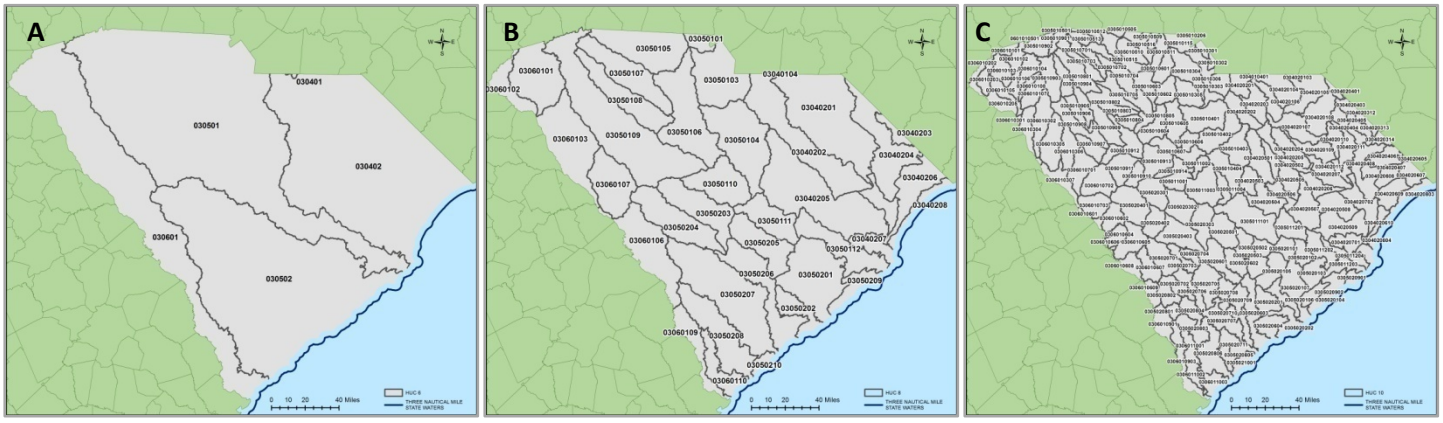

Figure 4: South Carolina HUCs at the A) 6-digit level, B) 8-digit level, and C) 10-digit level.[31]

[29] USGS. *Watershed Boundary Dataset*. Retrieved October 2016 from http://nhd.usgs.gov/wbd.html
[30] Ibid.
[31] Ibid.

Estuarine and Coastal Drainage

NOAA's Coastal Assessment Framework (CAF) was used to identify a study area defined by watersheds that drain directly to estuarine or coastal areas in South Carolina. The CAF is a digital spatial framework, developed using geographic information system (GIS) technology, which provides a consistently derived, watershed-based, digital, spatial framework for managers and analysts to organize and present information on the Nation's coastal, near-ocean, and Great Lakes' resources. The Framework is composed of Estuarine and Sub-estuarine Drainage Areas (EDAs), Coastal Drainage Areas (CDAs), and Fluvial Drainage Areas (FDAs) within the contiguous United States. An EDA is defined as that part of an estuary's entire watershed that empties directly into the estuary and, for each river in the estuary's watershed, includes the downstream-most USGS cataloging unit in which the head-of-tide is found. CDAs are generally defined as that component of an entire watershed that meets the following three criteria: 1) it is not part of any one of the 102 EDAs or their corresponding FDAs; 2) it drains directly into an ocean, an estuary, or the Great Lakes; and 3) it is composed only of the downstream-most HUC in which the head-of-tide is found. An FDA is that component of an estuary's entire watershed upstream of the EDA boundary.[32]

Estuarine and Marine Water and Wetland

USFWS National Wetlands Inventory (NWI) data was used to map estuarine and marine waters and wetlands. USFWS is the principal federal agency that provides information to the public on the extent and status of the Nation's wetlands. The NWI was established by USFWS in 1974 to conduct a nationwide inventory of U.S. wetlands to provide its biologists and others with information on the distribution of wetlands to aid in wetland conservation efforts. To do this, the NWI developed a wetland classification system[33] that is now the official USFWS wetland classification system and the federal standard for wetland classification. The NWI also developed techniques for mapping and recording the inventory findings. The NWI relies on trained image analysts to identify and classify wetlands and deepwater habitats from aerial imagery.[34]

Tidal Influence

Extent of tidal influence was obtained from two USACE sources, detailed in subsections below. Maps were extracted from these sources and georeferenced to delineate the inland extent of tidal influence. Once georeferenced, tidal influence areas indicated on the maps were recreated using NWI riverine and marine water features and DHEC Water Classification data.[35] A third source of tidal influence data, NOAA's National Estuarine Inventory Data Atlas, was consulted but not used in this analysis due to the limited information on the methodology used to delineate head-of-tide.[36]

USACE 1977 Navigability Study of South Carolina

In 1977, a navigability study was commissioned by the USACE Charleston District. Information pertaining to the study is compiled into individual reports, by river basin. In the summary report, USACE describes the methodology developed to approximate the upstream extent of tidal influence on affected navigable rivers in the study area: "the upstream extent of tidal influence is defined as the river mile location where the horizontal plane of mean high tide intersects the

[32] NOAA. *Coastal Assessment Framework Metadata*. Retrieved October 2016 from: http://geostac.tamu.edu/metadata/oceanresourcesconservationassessment.htm

[33] Cowardin, L. M., Carter, V., Golet, F. C., & LaRoe, E. T. (1979). Classification of wetlands and deepwater habitats of the United States. *US Fish and Wildlife Service FWS/OBS*, *79*(31), 131.

[34] USFWS. *NWI Overview*. Retrieved October 2016 from https://www.fws.gov/wetlands/nwi/Overview.html

[35] DHEC. *Watershed Atlas, Water Classification*. Retreived November 2016 from https://gis.dhec.sc.gov/watersheds/

[36] NOAA. (1985). *National Estuarine Inventory Data Atlas. Volume 1: Physical and Hydrologic Characteristics*.

established mean water surface profile of any particular stream." The summary report indicates that tidal influence limits are estimates only and may vary appreciably from actual field conditions.[37]

USACE Savannah Harbor Expansion Project Final EIS

Tidal extent of the Savannah River was not included in the USACE 1977 Navigability Study. In 2012, the Final Environmental Impact Statement (EIS) for the Savannah Harbor Expansion Project was released, which included an approximation of the upstream extent of tidal influence for the Savannah River.[38]

Storm Surge Inundation

Data outputs from the Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model were acquired for this analysis. The SLOSH model is a numerical model used by NOAA's National Weather Service to compute storm surge. Storm surge is defined as the abnormal rise of water generated by a storm, over and above the predicted astronomical tides. Flooding from storm surge depends on many factors, such as the track, intensity, size, and forward speed of the hurricane and the characteristics of the coastline where it comes ashore or passes nearby. SLOSH simulates the storm surge hazard within gridded areas along the U.S. Gulf and East Coasts. Two near worst-case-scenario planning products are available from the National Hurricane Center based on hypothetical storm tracks: Maximum Envelopes of Water (MEOWs) and Maximum of Maximums (MOMs). MEOWs are created by computing the maximum storm surge resulting from roughly 10,000 to 60,000 hypothetical storms simulated through the SLOSH grid of varying forward speed, radius of maximum wind, intensity (Categories 1-5), landfall location, initial water level, and storm direction. A MEOW product is created for each combination of category, forward speed, storm direction, and initial water level. For each storm combination, parallel storms make landfall in 5 to 10 mile increments along the coast within the SLOSH grid, and the maximum storm surge footprint from each simulation is composited, retaining the maximum height of storm surge in a given basin grid cell. No single hurricane will produce the regional flooding depicted in the MEOWs. SLOSH model MOMs are an ensemble product of maximum storm surge heights. MOMs are created for each SLOSH basin by compositing all the MEOWs, separated by category and initial water level, and selecting maximum storm surge value for each grid cell regardless of the forward speed, storm trajectory, or landfall location. MOMs represent the worst-case-scenario for a given category of storm and initial water level under ideal storm conditions.[39]

For this study, the storm surge inundation data layer is represented by the MOMs product for a Category 4 hurricane at high tide. This data layer represents a worst-case-scenario for inundation from a Category 4 hurricane for the entire South Carolina coast. The selected storm intensity for this study was determined by consulting the National Hurricane Center's Historical Hurricane Tracks database. Since 1950, nine hurricanes have made landfall in South Carolina. Of these, three (or 33%) made landfall as Category 4 storms. The most recent of these storms was Hurricane Hugo in 1989. Storm surge from Hugo inundated the South Carolina coast from Charleston to Myrtle Beach, with maximum storm tides of 20 feet observed in the Cape Romain-Bulls Bay area. High winds associated with Hugo extended far inland, with Shaw Air Force Base (just east of Columbia), reporting 67 mph sustained winds with gusts to 110 mph. In 1954, Hurricane Hazel made landfall near Little River. Reported storm surge from Hazel was up to 18 feet and winds were estimated at

[37] USACE, Charleston District. (1977). *Navigability Study 1977*. Charleston, South Carolina. Retrieved November 2016 from http://www.sac.usace.army.mil/Portals/43/docs/regulatory/Summary.pdf

[38] USACE. (2012). *Savannah Harbor Expansion Project Final EIS, Section 4 Affected Environment*. Retrieved November 2016 from http://www.sas.usace.army.mil/Portals/61/docs/SHEP/Reports/EIS/Section%204%20SHEP%20FINAL%20EIS.pdf

[39] NOAA, National Weather Service. *Storm Surge Inundation*. Retrieved October 2016 from http://noaa.maps.arcgis.com/apps/StorytellingTextLegend/index.html?appid=b1a20ab5eec149058bafc059635a82ee

130-150 mph along the coast between Myrtle Beach and Cape Fear, North Carolina.[40] In 1959, Hurricane Gracie, also a Category 4 storm, made landfall on St. Helena Island with 130 mph winds.[41]

Methodology

This GIS-based analysis was conducted at the USGS "Watershed" level, as defined by 10-digit HUCs. This approach allows for the identification of areas with a direct, hydrological connection to coastal resources. Analysis at the 10-digit HUC level maintains operational consistency with other Bureaus within DHEC, specifically the Bureau of Water, as well as other state agencies. There are a total of 189 10-digit HUCs within, or partially within, the state of South Carolina (Figure 4 C). On average, these 10-digit HUCs are approximately 200 square miles in area.

Study Area

This analysis began with geographically defining a "coastal" study area within South Carolina. All areas outside of the study area were excluded from further analysis. The study area was determined based on NOAA's Coastal Assessment Framework (CAF) watershed drainage classifications, which include estuarine, coastal, and fluvial drainage areas (classifications defined above in Estuarine and Coastal Drainage section). All 10-digit HUCs identified as having estuarine or coastal drainage were included in the study area, while 10-digit HUCs identified as having fluvial drainage were excluded from the study area. A total of 79 10-digit HUCs are classified as estuarine or coastal drainage areas. This study area is 13,812 square miles (Figure 5) and represents approximately 44% of the state's land and water area. It includes all or part of 24 counties, which are listed in Table 3, on the following page.

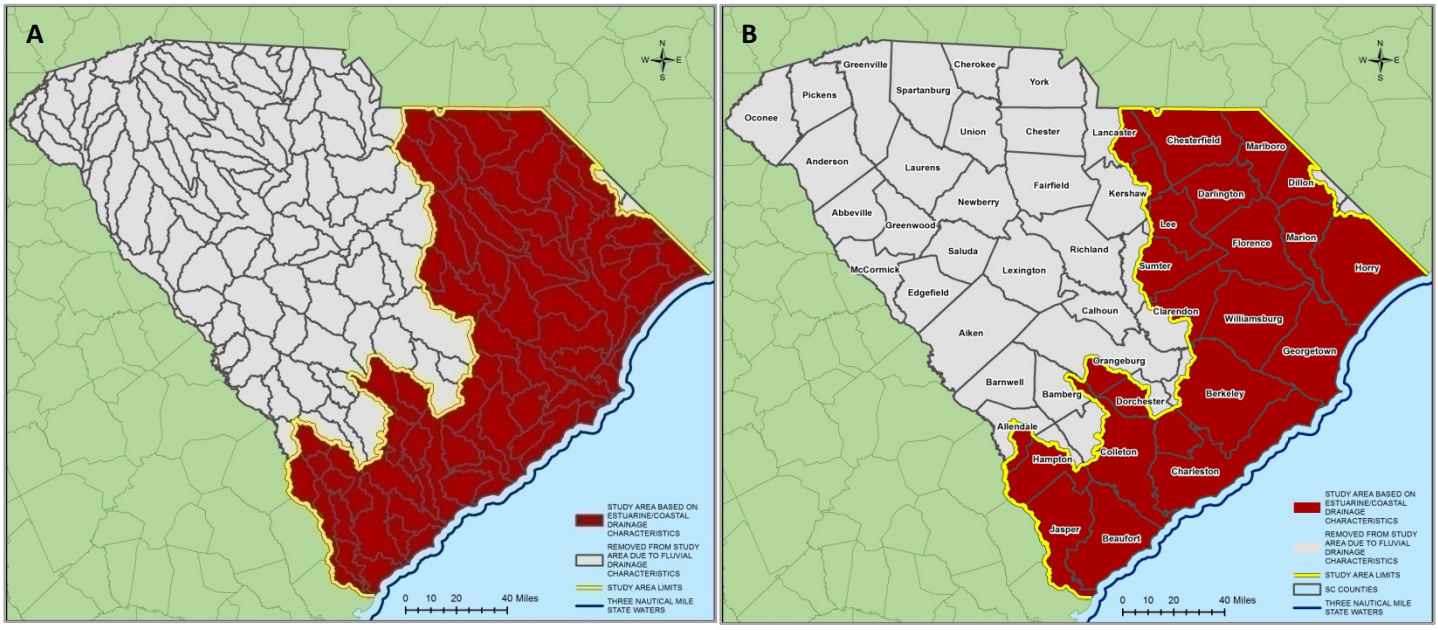

Figure 5: A) Study area represented by 10-digit HUCs identified as having estuarine or coastal drainage. B) Study area with county overlay.

[40] NOAA, National Hurricane Center. *Hurricanes in History*. Retrieved November 2016 from http://www.nhc.noaa.gov/outreach/history/

[41] SCDNR. *South Carolina Hurricane Climatology*. Retrieved November 2016 from http://www.dnr.sc.gov/climate/sco/Tropics/hurricanes_affecting_sc.php

Table 3: List of 24 counties entirely or partially within the study area

County Name	Currently in Coastal Zone	County Size (mi^2)	County Area within Study Area (mi^2)	Percent of County in Study Area
Allendale	No	412.4	111.8	27%
Bamberg	No	395.6	40.9	10%
Beaufort	Yes	790.1	790.1	100%
Berkeley	Yes	1,229.3	1,128.6	92%
Charleston	Yes	1,097.9	1,097.9	100%
Chesterfield	No	805.7	798.0	99%
Clarendon	No	695.7	436.8	63%
Colleton	Yes	1,101.1	824.0	75%
Darlington	No	566.8	566.8	100%
Dillon	No	406.6	338.3	83%
Dorchester	Yes	575.8	446.8	78%
Florence	No	803.7	803.7	100%
Georgetown	Yes	880.6	880.6	100%
Hampton	No	562.7	455.1	81%
Horry	Yes	1,147.5	1,101.6	96%
Jasper	Yes	686.4	686.4	100%
Kershaw	No	740.3	217.8	29%
Lancaster	No	555.1	193.7	35%
Lee	No	411.2	392.0	95%
Marion	No	494.1	486.6	98%
Marlboro	No	485.3	485.3	100%
Orangeburg	No	1,127.9	146.1	13%
Sumter	No	682.1	446.7	66%
Williamsburg	No	937.0	937.0	100%

Primary Datasets and Analysis Questions

This analysis involved applying three questions, associated with three primary data layers, to each 10-digit HUC within the study area. The purpose of each question was to determine the presence or absence of each data layer within the HUC. If a HUC included any part of a data layer, it was selected. If a data layer was absent from the HUC, the HUC was not selected. The three primary data layers, illustrated in Figure 6 on the following page, include: 1) Estuarine and marine waters and wetlands, 2) Tidal influence, and 3) Category 4 storm surge inundation. The three questions asked of each HUC within the study area are outlined in the following sections.

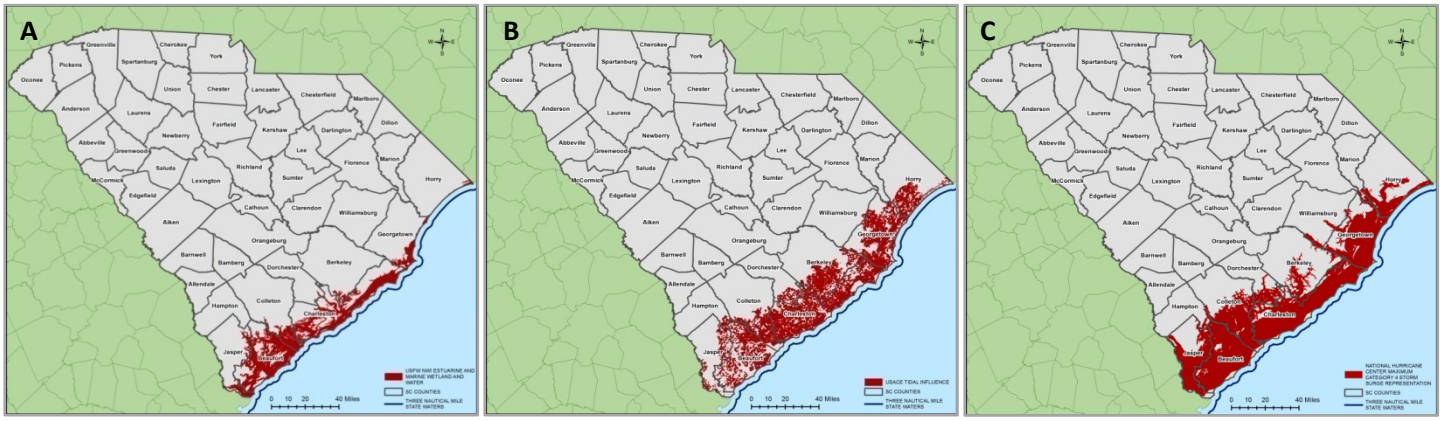

Figure 6: Three primary datasets used in the analysis, with county overlay. Data coverage is displayed in red. A) Estuarine and marine waters and wetlands, B) Tidal influence, C) Category 4 storm surge inundation.

Question 1: Does the HUC include the presence of Estuarine and Marine Waters and Wetlands?

The first question was asked to determine the presence of estuarine and marine waters and wetlands within HUCs. Estuarine and marine waters and wetlands represent significant and uniquely coastal resources, the protection of which is the underlying basis of the state's Coastal Management Program. Figure 7 illustrates (A) estuarine and marine waters and wetlands in South Carolina and (B) 10-digit HUCs within the study area that include estuarine and marine waters and wetlands.

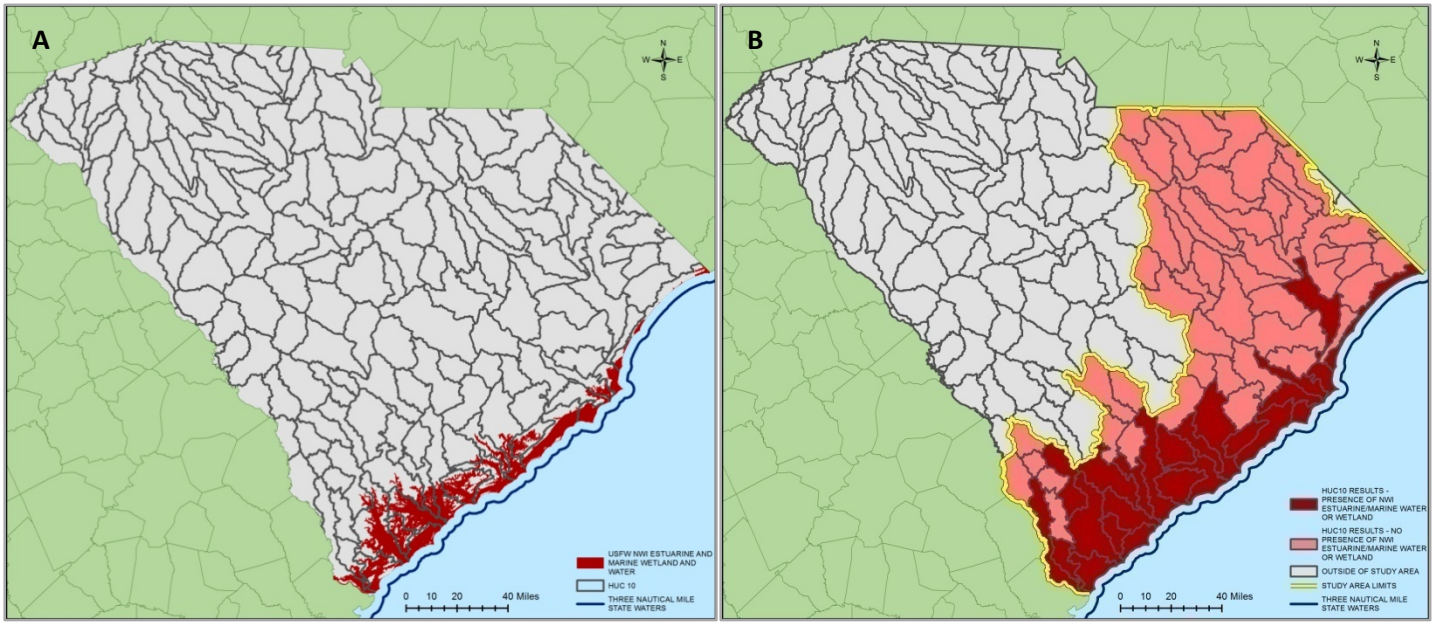

Figure 7: A) Estuarine and marine waters and wetlands in South Carolina. B) 10-digit HUCs within the study area that include estuarine and marine waters and wetlands.

Question 2: Does the HUC include the presence of Tidal Influence?

The second question was asked to determine the presence of tidal influence within HUCs. Tidally influenced areas represent the inland extent of tidal exchange along the coast. Tides play an important role in the transfer of water, nutrients, and sediment between marine and upland environments. Figure 8, on the following page, depicts (A) tidal influence in South Carolina and B) 10-digit HUCs within the study area that include tidal influence.

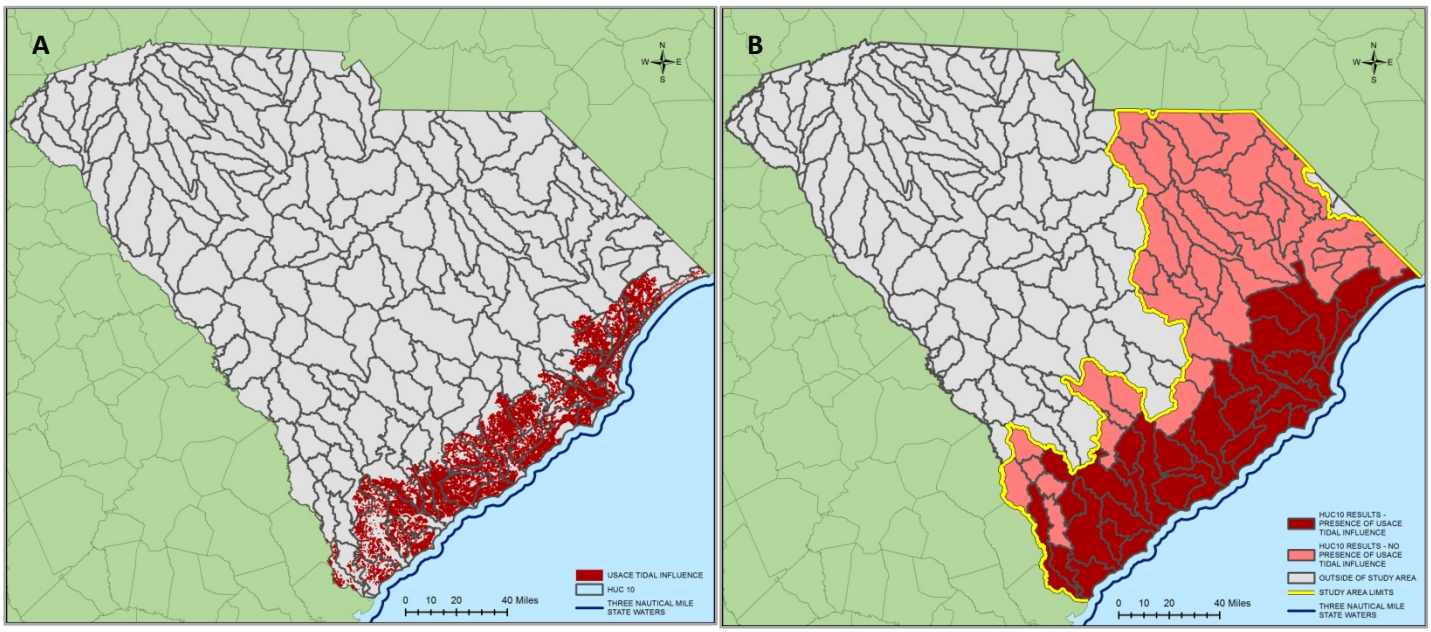

Figure 8: A) Tidal influence in South Carolina. B) 10-digit HUCs within the study area that include tidal influence.

Question 3: Does the HUC include the presence of Category 4 Storm Surge Inundation?

The third question was asked to determine the presence of Category 4 storm surge inundation within HUCs. This data layer represents a worst-case-scenario for storm surge-related flooding from a Category 4 hurricane for the entire South Carolina coast. Figure 9 shows (A) Category 4 storm surge inundation in South Carolina and B) 10-digit HUCs within the study area that include Category 4 storm surge inundation.

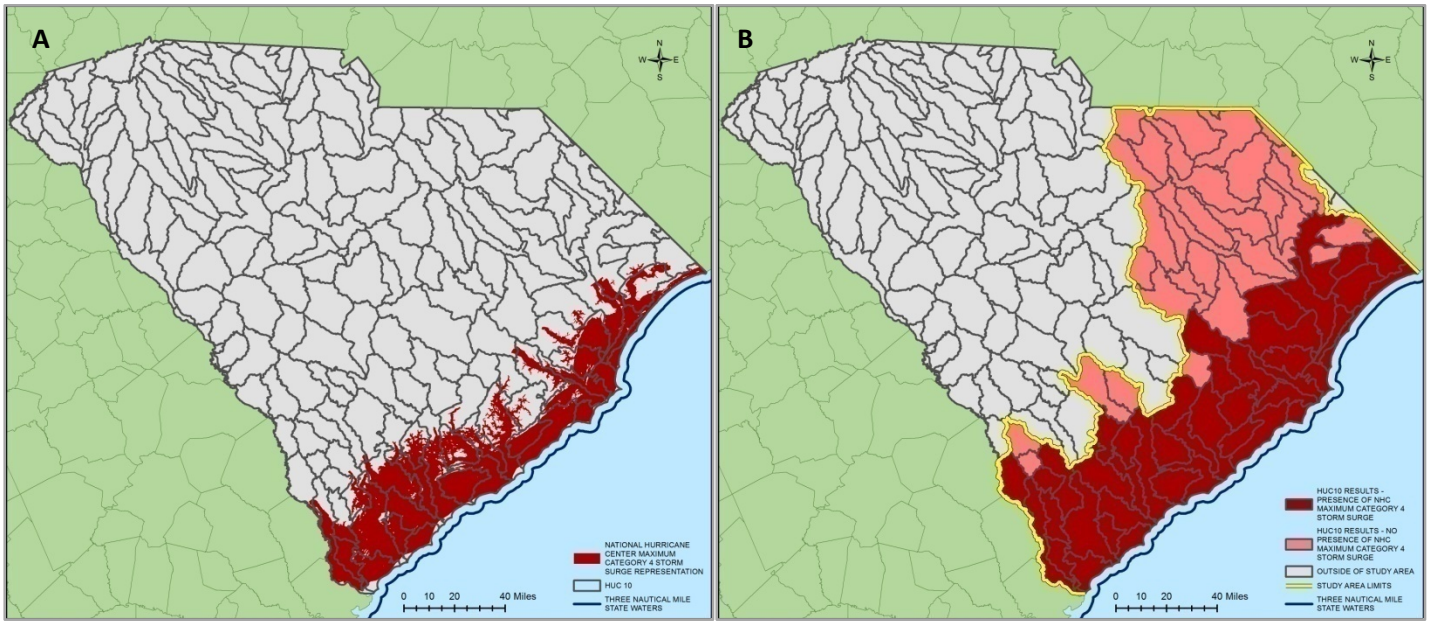

Figure 9: A) Category 4 storm surge inundation in South Carolina. B) 10-digit HUCs within the study area that include Category 4 storm surge inundation.

Results for Coastal South Carolina

Results were composited to identify 10-digit HUCs within the study area that answered "yes" to one or more of the three analysis questions representing the occurrence of estuarine and marine waters and wetlands, tidal influence, or Category 4 storm surge inundation. Figure 10 shows in red (A) the HUCs that answered "yes" to one or more of the analysis questions and (B) the same area with county overlay. A total of 42 10-digit HUCs answered "yes" to one or more of the three analysis questions. This area is 7,544 square miles, which represents approximately 24% of the state's land and water area and includes all or part of 14 counties. In total, this area is about 35 square miles larger (0.5%) than the existing Coastal Zone. Table 4 includes a list of these 14 counties, as well as the percentage of the county that is within the red shaded area.

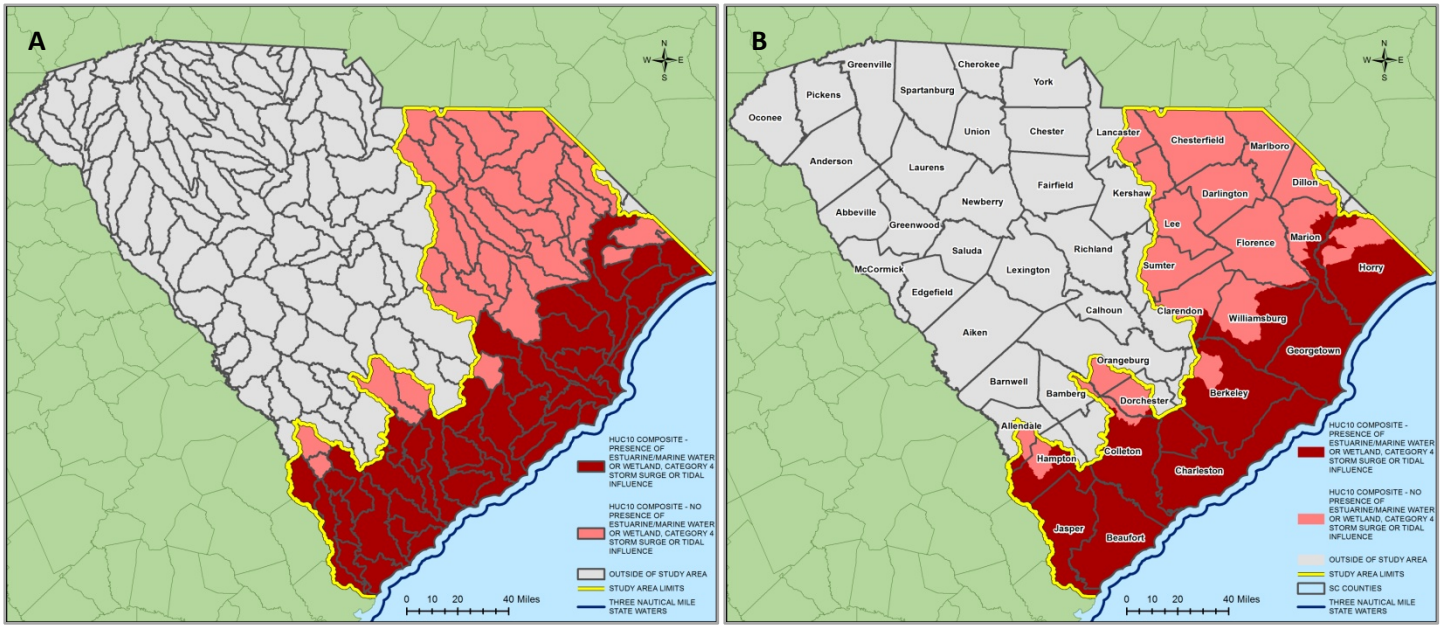

Figure 10: A) HUCs within the study area that answered "yes" to one or more of the three questions. B) HUC-based results with county overlay.

Table 4: List of 14 counties entirely or partially within the red shaded area representing analysis results from the three questions.

County Name	Currently in Coastal Zone	County Size (mi^2)	Estimated Red Shaded Area (mi^2)	Percentage of County Shaded
Allendale	No	412.4	27.6	7%
Beaufort	Yes	790.1	790.1	100%
Berkeley	Yes	1,229.3	1005.8	82%
Charleston	Yes	1,097.9	1097.9	100%
Clarendon	No	695.7	59.9	9%
Colleton	Yes	1,101.1	770.5	70%
Dorchester	Yes	575.8	262.5	46%
Florence	No	803.7	22.5	3%
Georgetown	Yes	880.6	880.6	100%
Hampton	No	562.7	350.3	62%
Horry	Yes	1147.5	844.5	74%
Jasper	Yes	686.4	686.4	100%
Marion	No	494.1	190.2	39%
Williamsburg	No	937.0	555.6	59%

Results for Dorchester County

The methods and results above are shown in relation to all of coastal South Carolina. The following figures highlight the results for Dorchester County. Figure 11 shows in red the portion of Dorchester County within the study area. Approximately 447 square miles, or 78% of Dorchester County is classified as having estuarine or coastal drainage and was therefore analyzed as part of the study area. Figure 12 illustrates A) estuarine and marine waters and wetlands in Dorchester County, and B) this data layer analyzed at the 10-digit HUC level.

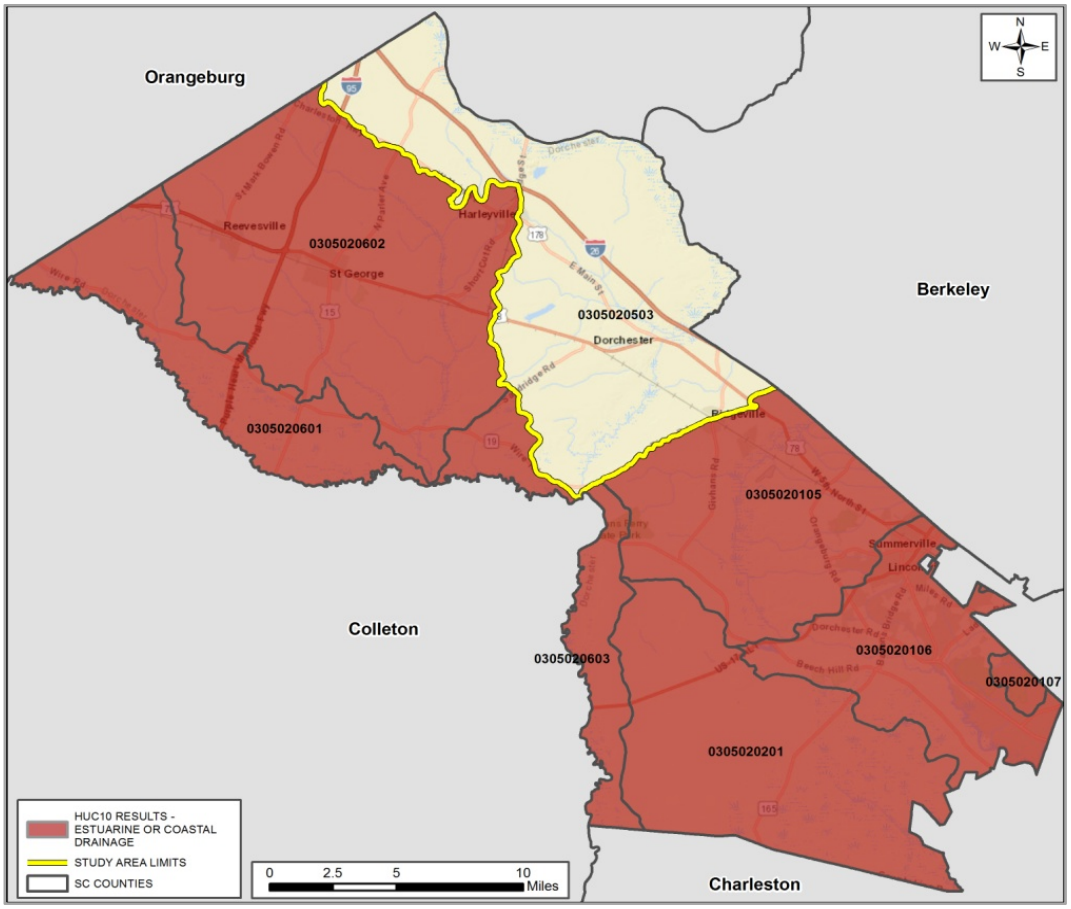

Figure 11: Portion of Dorchester County within the study area.

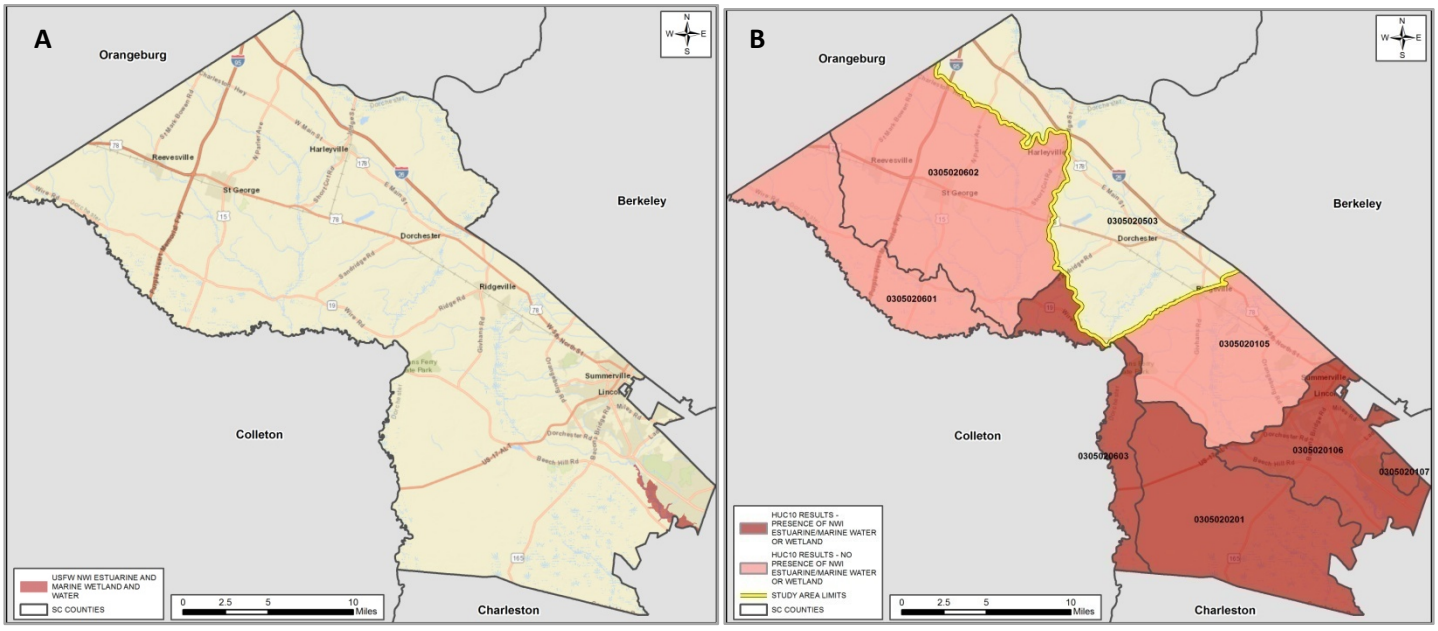

Figure 12: A) Estuarine and Marine Waters and Wetlands in Dorchester County. B) Analysis of this data layer at 10-digit HUC level.

Figure 13 illustrates A) tidal influence in Dorchester County, and B) this data layer analyzed at the 10-digit HUC level.
Figure 14 illustrates A) Category 4 storm surge inundation and B) this data layer analyzed at the 10-digit HUC level.

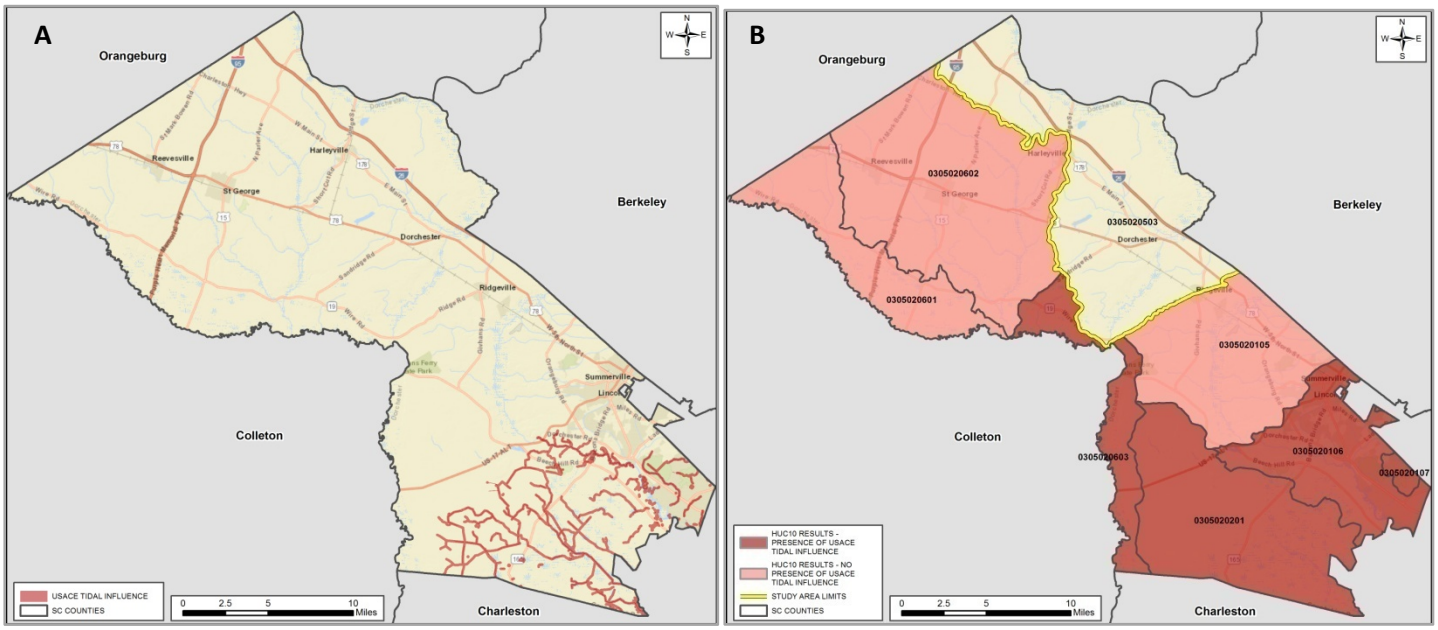

Figure 13: A) Tidal Influence in Dorchester County. B) Analysis of this data layer at 10-digit HUC level.

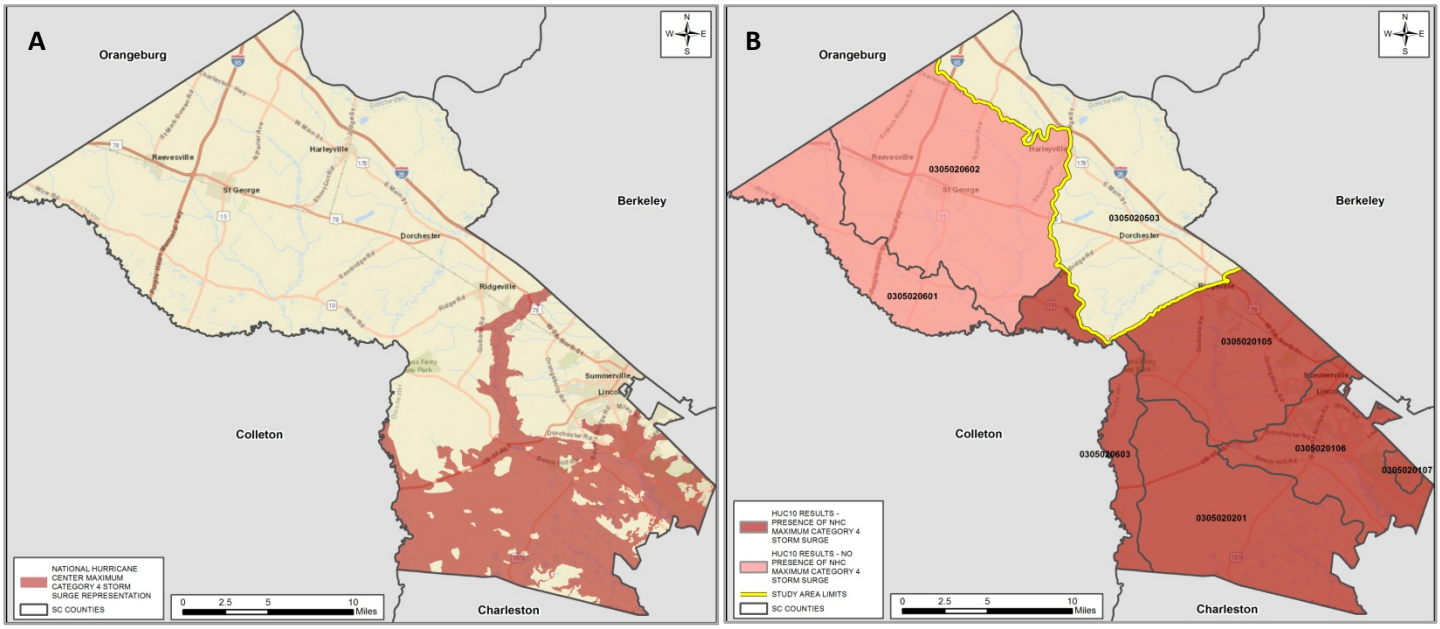

Figure 14: A) Category 4 Storm Surge Inundation. B) Analysis of this data layer at 10-digit HUC level.

Figure 15 shows the composited results, which identify all 10-digit HUCs within the study area that answered “yes” to one or more of the three analysis questions. This area, in dark red, is approximately 262 square miles, or 46% of Dorchester County.

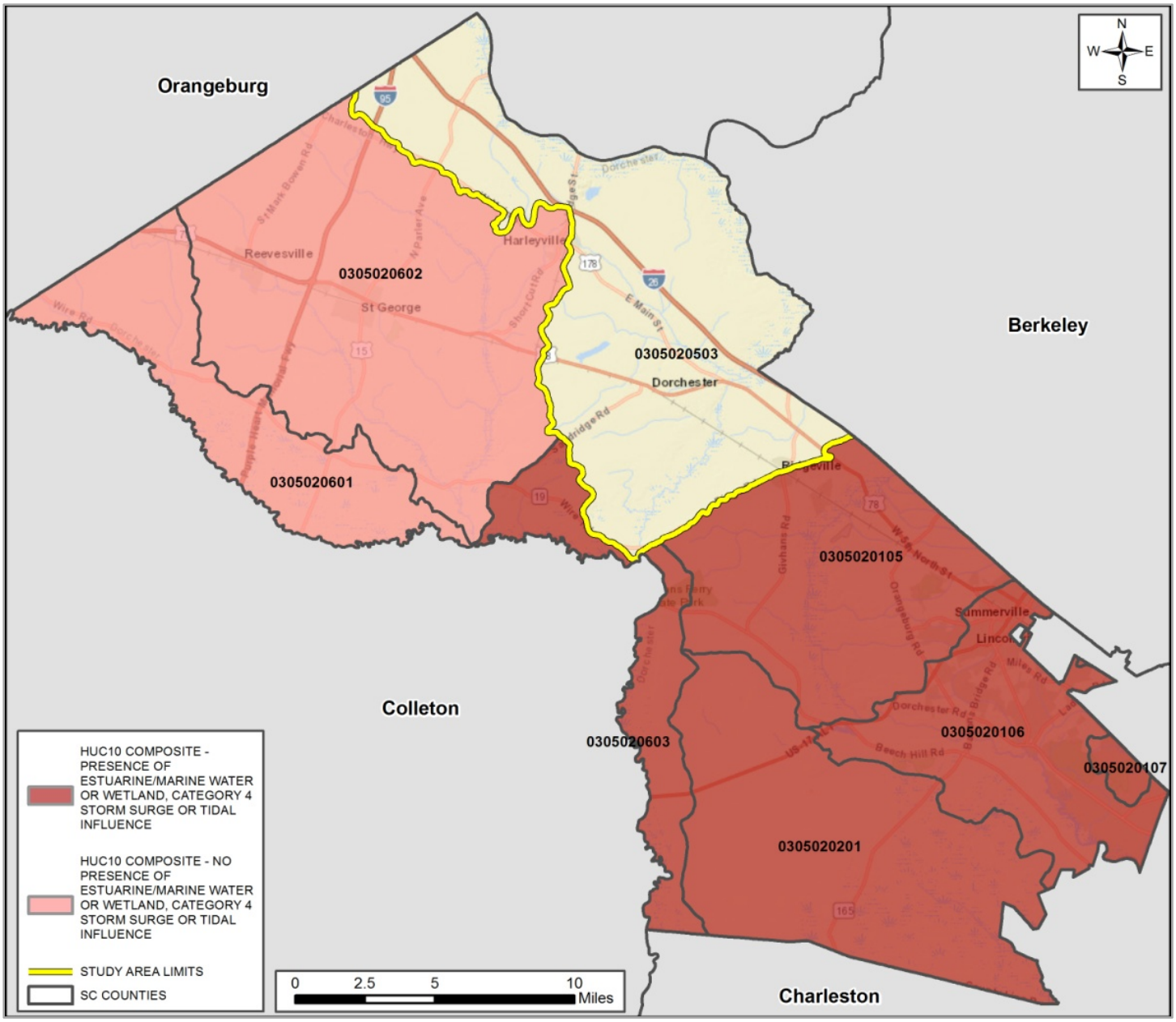

Figure 15: Dark red represents HUCs that answered “yes” to one or more of the three analysis questions, light red represents the remainder of the study area.

Discussion

The interaction of land with tidal, estuarine and coastal waters provides a dynamic and valuable natural system that yields a myriad of benefits to the citizens of South Carolina. Healthy coastal ecosystems provide opportunities for recreation, support commercial and recreational fisheries and bolster domestic and international tourism, thus underpinning major engines of the state's economy. These interdependent resource-based benefits have been formally recognized by the General Assembly since 1979 and are articulated in statute.[42] According to the South Carolina Department of Parks, Recreation and Tourism, coastal tourism accounted for more than $8 billion in domestic expenditures and supported approximately 83,000 jobs in 2015.[43] Additionally, commercial and recreational fisheries - which depend on fertile critical areas for habitat, reproduction and juvenile development - supported nearly 6,000 jobs while generating over $500 million in retail sales in 2012.[44] Further, according to recent independent[45] and academic[46] studies, these quality of life factors are increasingly important in the state's ability to attract and retain new industries, entrepreneurs and skilled workers.

"The Charleston region's economy has been transformed in the last decade into a STEM-based economy centered on advanced industry sectors including advanced manufacturing, computer technology, logistics and transportation, and medical research. Thousands of new jobs are being created in the region and economic growth is attracting investors and development. The challenge for the region is how to sustain strong economic performance, manage growth and protect the local environment." – *The Charleston Regional Development Alliance and the Charleston Metro Chamber of Commerce, 2015 Regional Economic Scorecard for the Charleston region, which consists of Berkeley, Charleston, and Dorchester counties.*

Population growth trends along South Carolina's coast have continued unabated in recent decades. According to a 2016 U.S. Census Bureau report,[47] Myrtle Beach, Hilton Head and Charleston metropolitan areas all ranked within the top 20 fastest growing regions of the country in 2014 and 2015. Combined, these metropolitan areas have added over 155,000 new permanent residents since 2010. According to the statistics, the Charleston tri-county area (Charleston, Berkeley and Dorchester) gain an average of 48 new residents each day. This growth provides economic benefit to the coastal region and the state, but also puts significant pressure on the productivity and resilience of natural and coastal resources as land use and conversion permanently alter the landscape.

As contemplated by statute, coastal resources are subject to competition and are vulnerable to adverse changes in ecological systems that may cause irretrievable loss or damage by ill-planned development.[48] The coastal environment is varied among numerous ecoregions that support migratory, indigenous and state and federally-listed threatened and endangered species of plants and animals. According to the S.C. Department of Natural Resources, the coastal zone

[42] S.C. Code of Laws, Ann 48-39-20

[43] Hancock, J. South Carolina Department of Parks, Recreation and Tourism, Personal Communication, 28 September 2016.

[44] NOAA, National Marine Fisheries Service. (2014) *Fisheries of the United States 2012: Economics and Sociocultural Status and Trends Series*. NOAA Technical Memorandum NMFS-F/SPO-137. Retrieved November 2016 from http://www.st.nmfs.noaa.gov/Assets/economics/documents/feus/2012/FEUS2012_SouthAtlantic.pdf

[45] Woodward, Dr. Douglas P. and Dr. Paulo Guimaraes. (2009). Underappreciated Assets: The Economic Impact of South Carolina's Natural Resources. University of South Carolina Moore School of Business. Retrieved September 2016 from http://www.dnr.sc.gov/green/index.html

[46] SCDNR. (2009). Green means Green: 30 Billion Reasons Why Life's Better Outdoors. Retrieved September 2016 from http://www.dnr.sc.gov/green/greenreport.pdf

[47] U.S. Census Bureau. (2016). *U.S. Census Bureau Releases Population Estimates for Nation's Cities and Counties*. Retrieved September 2016 from https://www.commerce.gov/news/blog/2016/03/us-census-bureau-releases-population-estimates-nations-cities-and-counties

[48] S.C. Code of Laws, Ann 48-39-20

contains the most diverse amount of habitats in South Carolina, which are intricately linked to priority wildlife species, including those of commercial, recreation and ecological value.[49] However, many of these species are also acutely vulnerable to habitat fragmentation and exposure to pollutants from stormwater runoff resulting from development.[50]

In addition to the loss of direct economic value and habitat, the degradation of coastal ecological systems results in non-commercial value loss of ecosystem services, including water filtration and pollutant removal, soil conservation and flood mitigation.[51] The preservation of these benefits is significantly influenced by the relationship between land use, watersheds and floodplains. Ecosystem services have garnered particular significance in understanding and promoting resilience to natural disasters and acute meteorological events, including hurricanes and extreme precipitation events. During the October 2015 floods, extreme rainfall produced flashfloods throughout the coast, with major impacts felt along tributaries and rivers in the Edisto and Santee watersheds. During the multi-day event, precipitation and runoff from saturated soils and impervious surfaces drained from throughout the watersheds into tributaries and rivers, exacerbating flood conditions downstream. Notably, the drainage of the Edisto watershed resulted in the Edisto River sustaining water levels well above major flood stage for over two weeks[52], displacing residents and severely damaging property. On October 8, 2015, the Edisto River near Givhans Ferry reached 16.06 feet, its highest water level in 81 years.[53] Although this particular storm system was statistically rare in its occurrence, its social and economic impacts were major and the likelihood of similar events should not be discounted, particularly as the population within coastal watersheds continues to swell and changes in land use and development affect hydrology.

Five major river basins drain into the Critical Area: PeeDee, Santee, Edisto, Salkehatchie and Savannah. Within these river basins, hydrologic unit codes (HUC) are used to subdivide larger areas to delineate downstream movement of water. HUCs are used extensively by federal and state resource management agencies for the implementation of watershed management programs. For example, DHEC Bureau of Water's Watershed Strategy and Program helps facilitate solutions to water quality issues within the state based on 10-digit HUC boundaries. The program has traditionally shared extensive water quality data and watershed information through the Watershed Water Quality Assessments (WWQAs).[54] This information is used by a variety of water quality stakeholders to manage and improve critical water resources within the state.

Despite the relatively low occurrence of Critical Area in Dorchester County, the county is approximately 78% within the defined coastal and estuarine drainage watershed boundaries (Figure 29). Based on the analysis of coastal watershed boundaries at the 10-digit HUC level, a portion of Dorchester County appears to be outside of areas that may be considered to have a direct and significant impact on coastal waters and resources. However, applying this watershed-based methodology consistently would result in the inclusion of portions of six additional counties that are currently not included in the Coastal Zone boundary, including: Allendale, Clarendon, Florence, Hampton, Marion, and Williamsburg counties.

[49] SCDNR. (2015). *State Wildlife Action Plan*. Retrieved October 2016 from http://www.dnr.sc.gov/swap/
[50] Ibid.
[51] Pendleton, Linwood H. (2008). *The Economic and Market Value of Coasts and Estuaries – What's at Stake?* Retrieved October 2016 from: http://www.habitat.noaa.gov/pdf/economic_and_market_valueofcoasts_and_estuaries.pdf
[52] USGS. (2016). *National Water Information System*. Retrieved October 2016 from http://nwis.waterdata.usgs.gov/
[53] SCDNR. (2016). *Online interactive journal outlines 2015 South Carolina historic rain and flooding*. Retrieved October 2016 from http://www.dnr.sc.gov/news/2016/feb/feb11_floodjournal.html
[54] DHEC. (2015). *Last Published WWQAs*. Retreived October 2016 from http://www.DHEC.gov/HomeAndEnvironment/Water/Watersheds/WatershedMap/

Conclusion

Fundamentally, the purpose of the Coastal Zone is to provide an adequate geographic region in which an integrated planning, regulatory permitting and indirect permit review authority may be applied to manage activities that have a direct and significant impact on the quality of coastal resources and coastal waters. As a complement to direct permitting authority within the Critical Area, the CZC review process affords the state the authority to review and certify state and federal permits within the Coastal Zone to ensure that activities do not contravene the enforceable policies of the coastal program.[55] The certification process also provides a coordinated and efficient mechanism for state resource agencies to review and comment on individual project applications that may have a direct and significant impact on resources within the Coastal Zone, including unique and fragile biological, cultural and historical resources. Specific comments made by resource agencies may be incorporated into the CZC certification to ensure that permitted activities provide adequate measures to avoid, minimize, and mitigate negative impacts to sensitive areas and resources.

Exclusion of a county or region from the Coastal Zone does not relieve permit applicants from federal and state regulatory permitting requirements associated with air quality, water quality, stormwater runoff or wetland fill. Further, exclusion from the Coastal Zone does not preclude state resource management agencies from commenting on specific project applications received by federal and state regulatory agencies; however, the responsibility for preliminary review and impact analysis would shift from DHEC's consolidated CZC review process to individual resource management agencies, including the S.C. Department of Natural Resources and S.C. Department of Archives and History, among others. This would potentially result in a fractured and inconsistent framework for coastal resource protection and limit the state's ability to safeguard biological, cultural and historical resources of value for current and future generations.

As determined by NOAA in its 1992 review of the South Carolina Coastal Zone boundary, the inclusion of the eight coastal counties that contain one or more of the Critical Area types is a sufficient approach to manage land and water uses that significantly impact the state's coastal waters, tidelands, beaches and beach/dune systems. Further, South Carolina's Coastal Zone boundary delineation was found to be consistent with the methodology employed by other coastal states currently implementing approved Coastal Zone management programs with similar hydrologic, geologic and biologic features. The delineation of the Coastal Zone along county political boundaries also provides predictability in state and federal regulatory coordination, decision-making processes and communication among stakeholders. However, as illustrated by this analysis, South Carolina's current eight-county Coastal Zone does not include all surface waters that have a direct connection with and influence on coastal waters and resources. Similarly, the current Coastal Zone extends beyond the composite results from this analysis, in some areas. Nevertheless, the two areas are similar in size, with the composite results yielding an area that is 0.5% larger than the current Coastal Zone. DHEC makes no recommendations based on this preliminary analysis regarding the modification to the inland extent or area of the Coastal Zone.

The analysis contained in this report is preliminary, utilizing available data and applying a watershed-based approach to identify geographic and hydrologic regions that have apparent interaction and affect on coastal waters and resources. A partial or wholesale revision of the South Carolina Coastal Zone boundary would require an extensive process to assess available and applicable data, identify data gaps and conduct a comprehensive assessment using the best available science and most appropriate methodology. Based on alternative boundary scenarios, an analysis of resource protection gain or loss should be performed. This process would require significant time and effort among DHEC program areas and the active contribution of subject matter experts within federal and state agencies, academia and non-governmental organizations in addition to opportunities for public participation. Further, the revision process would require adherence

[55] *S.C. Coastal Program Document, Chapter V: Management Authorities and Governmental/Public Involvement*. Retrieved October 2016 from http://www.DHEC.gov/HomeAndEnvironment/Docs/SC_Coastal_%20Program%20(Pt.%202%20-%20Ch.%20V).pdf

to federal Coastal Zone Management Act procedural guidelines to ensure that any proposed modification of the state's Coastal Zone boundary complies with coastal program approval criteria and would not jeopardize the validity or continuity of program implementation. Subsequently, amendments to the S.C. Code of Laws, S.C. Code of Regulations and the South Carolina Coastal Program Document would be required to ensure consistency across decision-making processes and eliminate ambiguity in jurisdictional authority resulting from the proposed boundary change.

Profile: Dorchester County

In accordance with Proviso 34.55 of the 2016-2017 Appropriation Act, DHEC has compiled available data pertaining to Dorchester County's geography, population, business and economy, geology, water resources, land cover, habitat and protected species, and cultural and historical resources. A change in the South Carolina Coastal Zone boundary would require detailed evaluation, along the entire coast, of many of the resources in this section. Not all of the data included in this section were fully evaluated in the preliminary analysis.

Geography

Dorchester County, founded in 1897, is located roughly 55 miles southwest of the South Carolina capital city of Columbia. Adjacent counties include Berkeley County to the east, Charleston County to the southeast, Colleton County to the southwest, and Orangeburg County to the northwest. Municipalities within Dorchester County include Harleyville, North Charleston, Reevesville, Ridgeville, St. George, and Summerville. A general map of Dorchester County is provided in Figure 16. Table 5 provides land area, water area, and total area for Dorchester County, the seven other coastal counties, and the state of South Carolina. Dorchester County has a total area (land area plus water area) of approximately 576 square miles, making it the smallest of the eight coastal counties.[56]

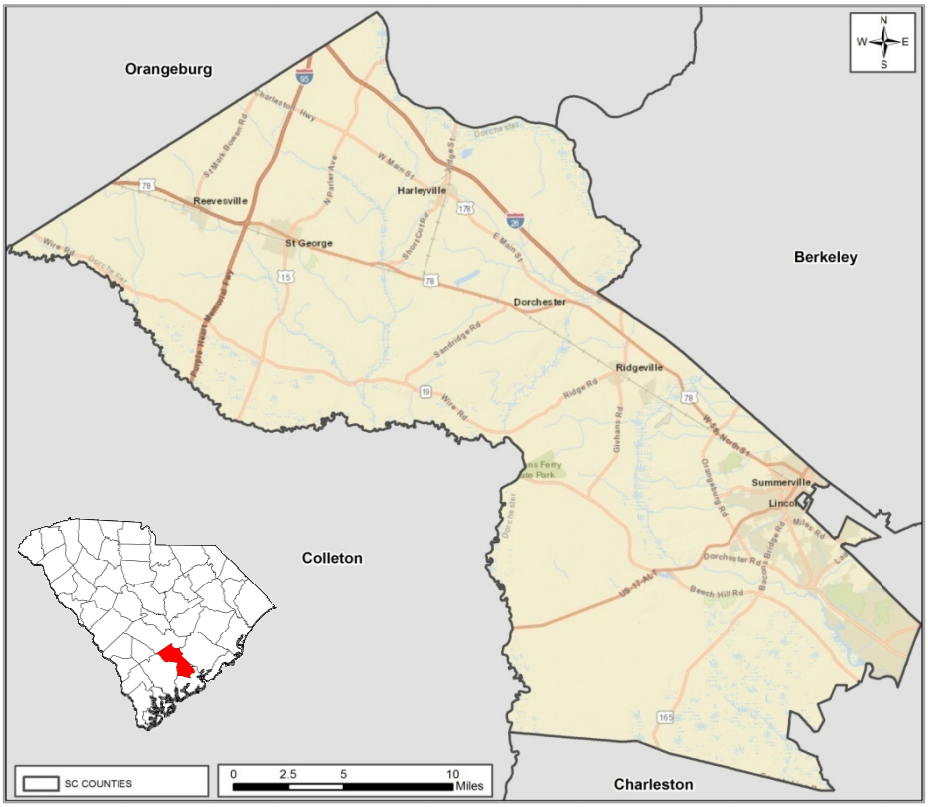

Figure 16: Map of Dorchester County, South Carolina.

Table 5: Land, water, and total area for the eight coastal counties and South Carolina (includes 3-nautical mile state waters).[57]

Location	Land Area (mi^2)	Water Area (mi^2)	Total Area (mi^2)
Dorchester County	***573.2***	***2.6***	***575.8***
Beaufort County	576.3	347.1	923.4
Berkeley County	1,098.9	130.4	1,229.2
Charleston County	916.1	441.9	1,358.0
Colleton County	1,056.5	76.8	1,133.3
Georgetown County	813.6	221.1	1,034.7
Horry County	1,133.9	121.1	1,255.0
Jasper County	655.3	44.0	699.4
South Carolina	**30,060.7**	**1,959.8**	**32,020.5**

[56] U.S. Census Bureau. *American Fact Finder, Community Facts.* Retrieved June 2016 from https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml

[57] Ibid.

Population

Table 6 includes population information for Dorchester County, the seven other coastal counties, and the state of South Carolina. The U.S. Census Bureau's 2015 population estimate for Dorchester County is 152,478, which is an 11.6% increase since 2010. Based on 2015 estimates, the population of Dorchester County represents approximately 3% of the entire population of South Carolina (4,896,146). Of the eight coastal counties, Dorchester County has the fifth highest population and is the third highest in population per square mile (based on 2015 population estimates).[58]

Table 6: Population estimates and percent change for the eight coastal counties and South Carolina.[59]

Location	April 2010 (Census)	April 2010 (Est. Base)	July 1, 2014 (Est.)	% Change 2010 - 2014	July 1, 2015 (Est.)	% Change 2010 - 2015	Population per mi^2
Dorchester County	***136,555***	***136,589***	***148,469***	***8.7%***	***152,478***	***11.6%***	***238.2***
Beaufort County	162,233	162,233	175,852	8.40%	179,589	10.70%	281.5
Berkeley County	177,843	177,850	198,205	11.40%	202,786	14.00%	161.8
Charleston County	350,209	350,204	381,015	8.80%	389,262	11.20%	382.3
Colleton County	38,892	38,892	37,771	-2.90%	37,731	-3.00%	36.8
Georgetown County	60,158	60,158	60,773	1.00%	61,298	1.90%	73.9
Horry County	269,291	269,291	298,832	11.00%	309,199	14.80%	237.5
Jasper County	24,777	24,777	27,170	9.70%	27,824	12.30%	37.8
South Carolina	**4,625,364**	**4,625,401**	**4,832,482**	**4.5%**	**4,896,146**	**5.9%**	**153.9**

Business and Economy

According to the Dorchester County Economic Development Department, Dorchester County is one of the fastest growing areas in the state. Identified market clusters, described below, include aerospace, automotive, bioscience, distribution, and marine. Dorchester County's top 10 employers, which range from industrial facilities to call centers, are listed in Box 6.[60]

- **Aerospace:** The aerospace industry is an emerging business cluster spurred by Boeing's presence in Charleston.
- **Automotive:** The automotive industry has been tied to the area for nearly half a century. With the majority of Dorchester's workforce employed in this sector, it is considered to be the area's leading cluster.
- **Bioscience:** With nearby access to the Medical University of South Carolina, the bioscience industry is steadily emerging, and continued growth is expected in this cluster.
- **Distribution:** Dorchester County's multimodal transportation infrastructure offers this industry cluster convenient access to rail, interstate, and ports.
- **Marine:** Dorchester County is steadily gaining attention as a growing boatbuilding community due to the county's proximity to the coast and the area's deep-rooted tradition of recreational boat manufacturing.

BOX 6. Top 10 Employers in Dorchester County

1. Robert Bosch Corporation
2. iQor
3. InterContinental Hotels Group
4. Showa Denko Carbon, Inc.
5. Scout Boats, Inc.
6. Giant Cement Holding
7. Key West Boats, Inc.
8. Kapstone-Charleston Wood Procurement
9. ArborGen
10. Kion North America

[58] U.S. Census Bureau. *Quick Facts, Table*. Retrieved June 2016 from https://www.census.gov/quickfacts/table/PST045215/00
[59] Ibid.
[60] Dorchester County Economic Development. (2016). Retrieved June 2016 from http://www.dorchesterforbusiness.com/index.php

Geology

South Carolina is divided into geologic, or physiographic regions which include the Blue Ridge, Piedmont, Upper Coastal Plain, Middle Coastal Plain, and Lower Coastal Plain. The majority of Dorchester County is located in the Lower Coastal Plain. A small section of the county along the northern border falls within the Middle Coastal Plain. Figure 17 illustrates the geologic regions of South Carolina and Dorchester County.[61]

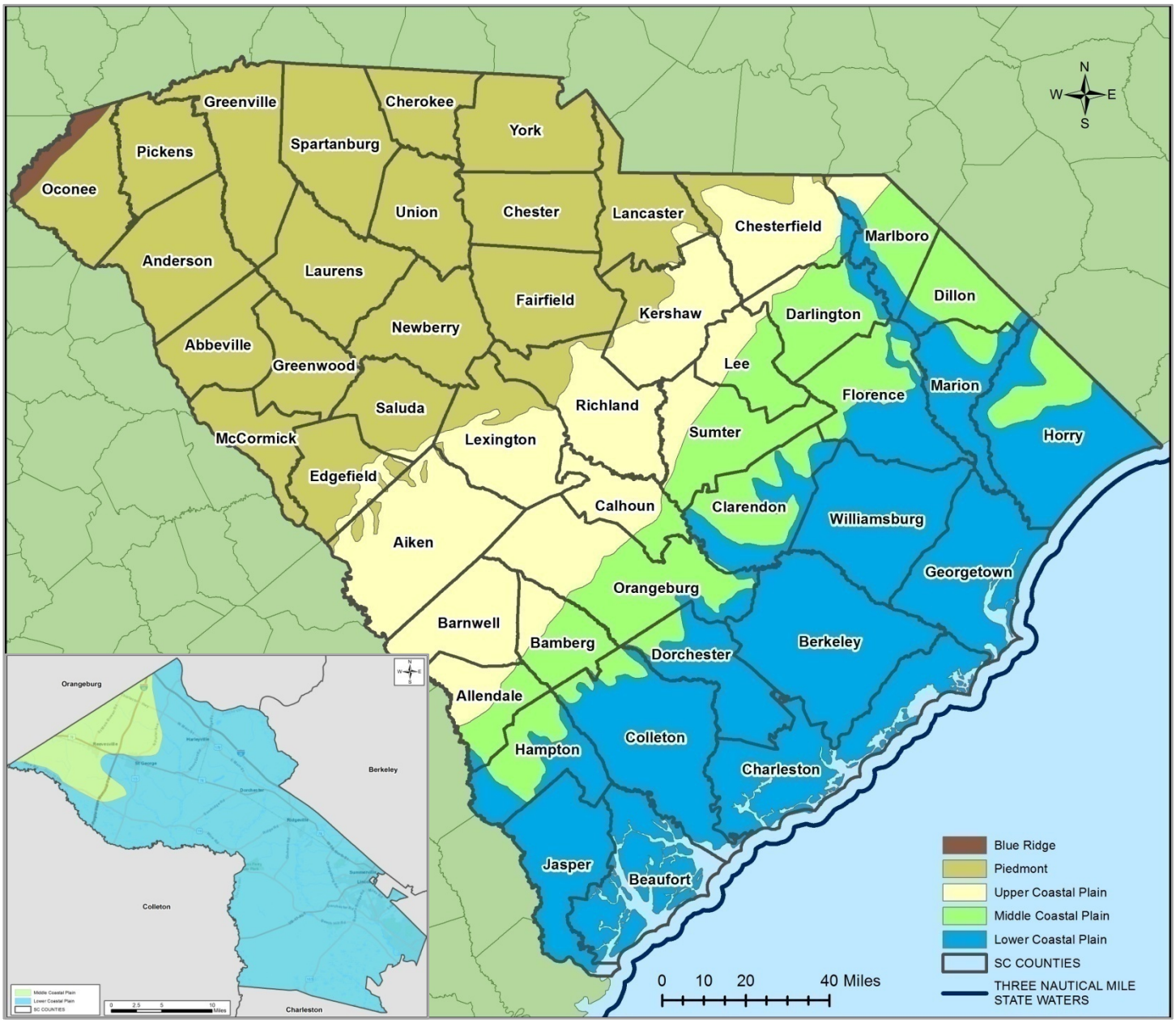

Figure 17: Geologic regions of South Carolina and Dorchester County.[62]

[61] SCDNR. South Carolina Geological Survey. (2005). *Geologic Regions Polygon*. Retrieved November 2016 from http://www.dnr.sc.gov/GIS/descgeolrp.html

[62] SCDNR. South Carolina Geological Survey. (2005). *Geologic Regions Polygon*. Retrieved November 2016 from http://www.dnr.sc.gov/GIS/descgeolrp.html

More specifically, Dorchester County is characterized by Pliocene, Pleistocene, and Holocene geologic map units, as shown in Figure 18.[63] Map unit descriptions are provided below.[64]

- **Pliocene:** Marine sediments widely distributed from the coast to the Fall Line. This unit documents the last major transgression of the sea over the Coastal Plain.
- **Pleistocene:** Recent fluvial sands, back-barrier muds (i.e. marsh), and barrier beach sands less than 3 million years old.
- **Holocene:** Active deposition along the shore, behind the shore, and in stream valleys. Most of the Carolina low country is covered by a 5-10 meter thick blanket of unconsolidated Quaternary marine and fluvial deposits.

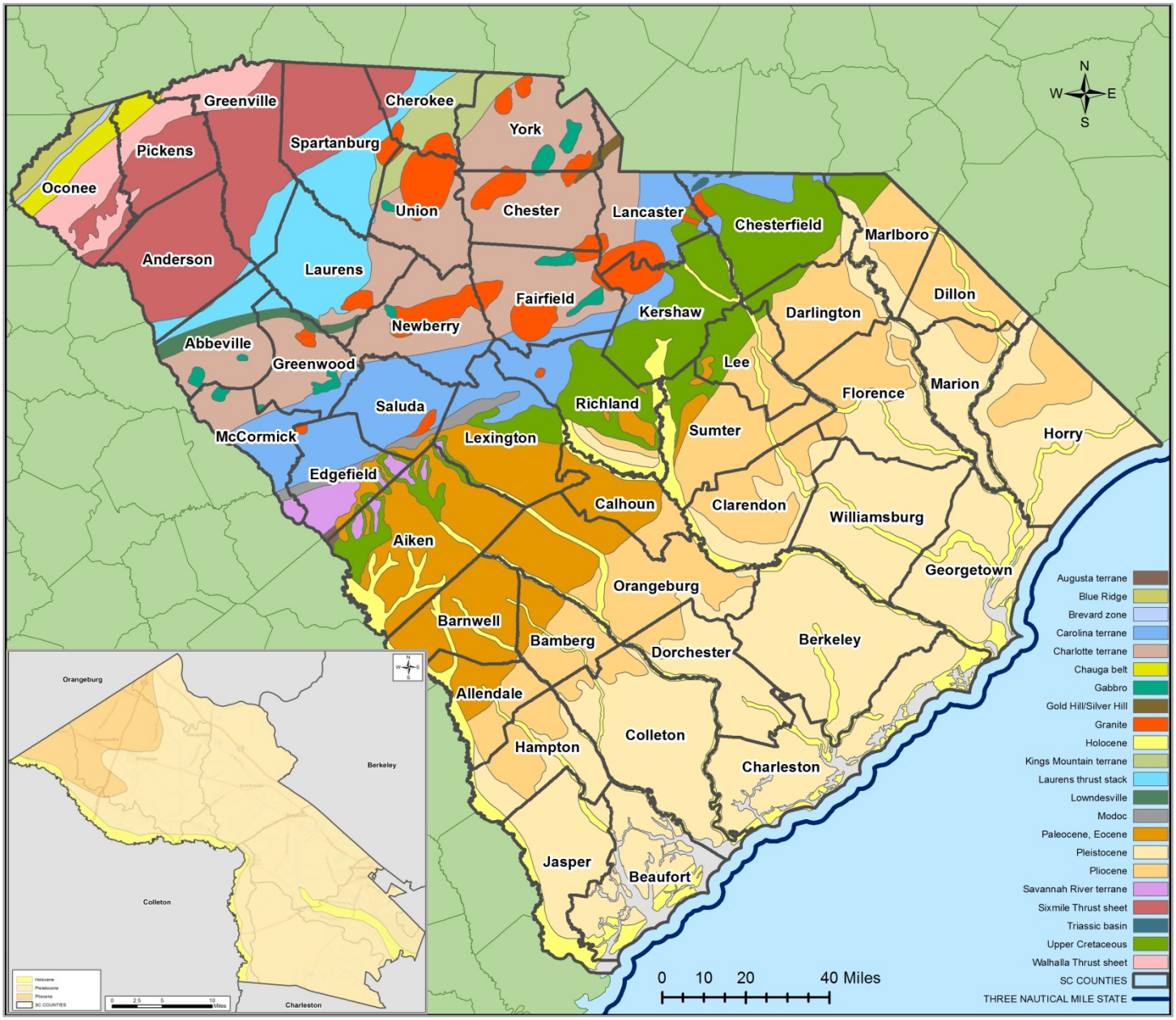

Figure 18: Generalized Geologic Map of South Carolina and Dorchester County.[65]

[63] SCDNR, South Carolina Geological Survey. (2005). *Generalized Geologic Map of South Carolina*. Retrieved June 2016 from http://www.dnr.sc.gov/geology/images/GGMS-1%20Poster%20x1_2011.pdf

[64] SCDNR, South Carolina Geological Survey. *Geology of South Carolina Online Map*. Retrieved June 2016 from http://scdnr.maps.arcgis.com/apps/Viewer/index.html?appid=735411a2f5714f28a424422296f77bb1

Water Resources

The following sections describe the hydrography, drinking water supply, waterbody classifications, impaired waters, and potential for flood-based hazards in South Carolina and Dorchester County.

Hydrography

DHEC divides South Carolina into eight major river basins, which include the Savannah, Saluda, Edisto, Salkehatchie, Broad, Catawba, Santee, and Pee Dee river basins. Dorchester County is situated within the Edisto and Santee basins, as shown in Figure 19.[66]

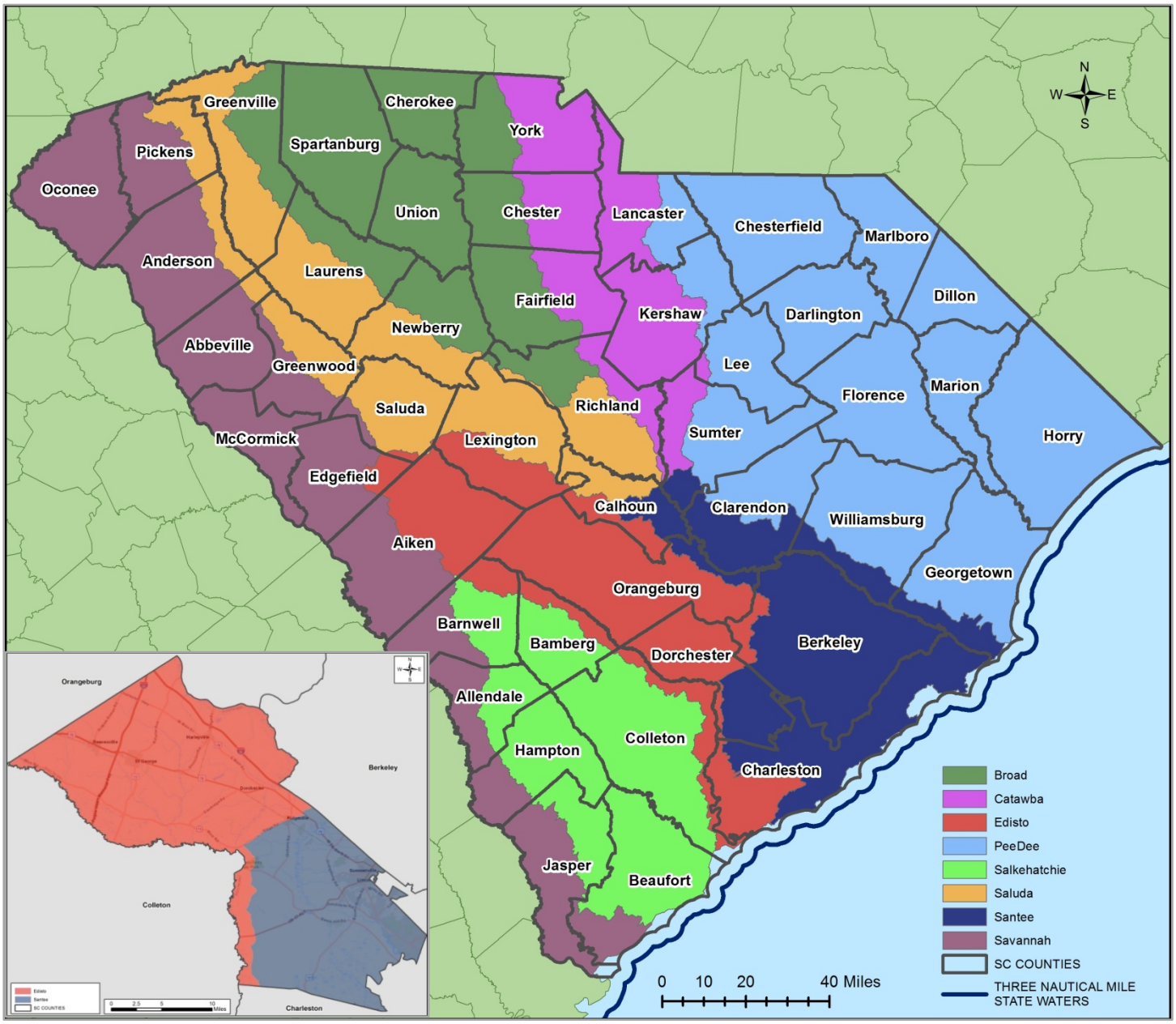

Figure 19: Major river basins in South Carolina and Dorchester County.[67]

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[65] SCDNR, South Carolina Geological Survey. (2005). *Generalized Geologic Map of South Carolina*. Retrieved June 2016 from http://www.dnr.sc.gov/geology/images/GGMS-1%20Poster%20x1_2011.pdf

[66] DHEC. *South Carolina Watershed Atlas, Major River Basins*. Retrieved November 2016 from https://gis.dhec.sc.gov/watersheds/

[67] Ibid.

The Ashley River extends from the Charleston Harbor inland and into the southern portion of Dorchester County. The Edisto River runs along the southwestern border of the county, and Four Holes Swamp forms the upper northeastern boundary of Dorchester County. There are no major lakes located within, or partially within, Dorchester County.

A 22-mile segment of the Ashley River of Dorchester and Charleston Counties was designated a State Scenic River in two parts; one in 1998 and the other in 1999. The Ashley is a tidal river with a variety of natural habitats and historic sites of regional and national significance.[68] Figure 20 illustrates State Scenic Rivers in South Carolina and Dorchester County.[69]

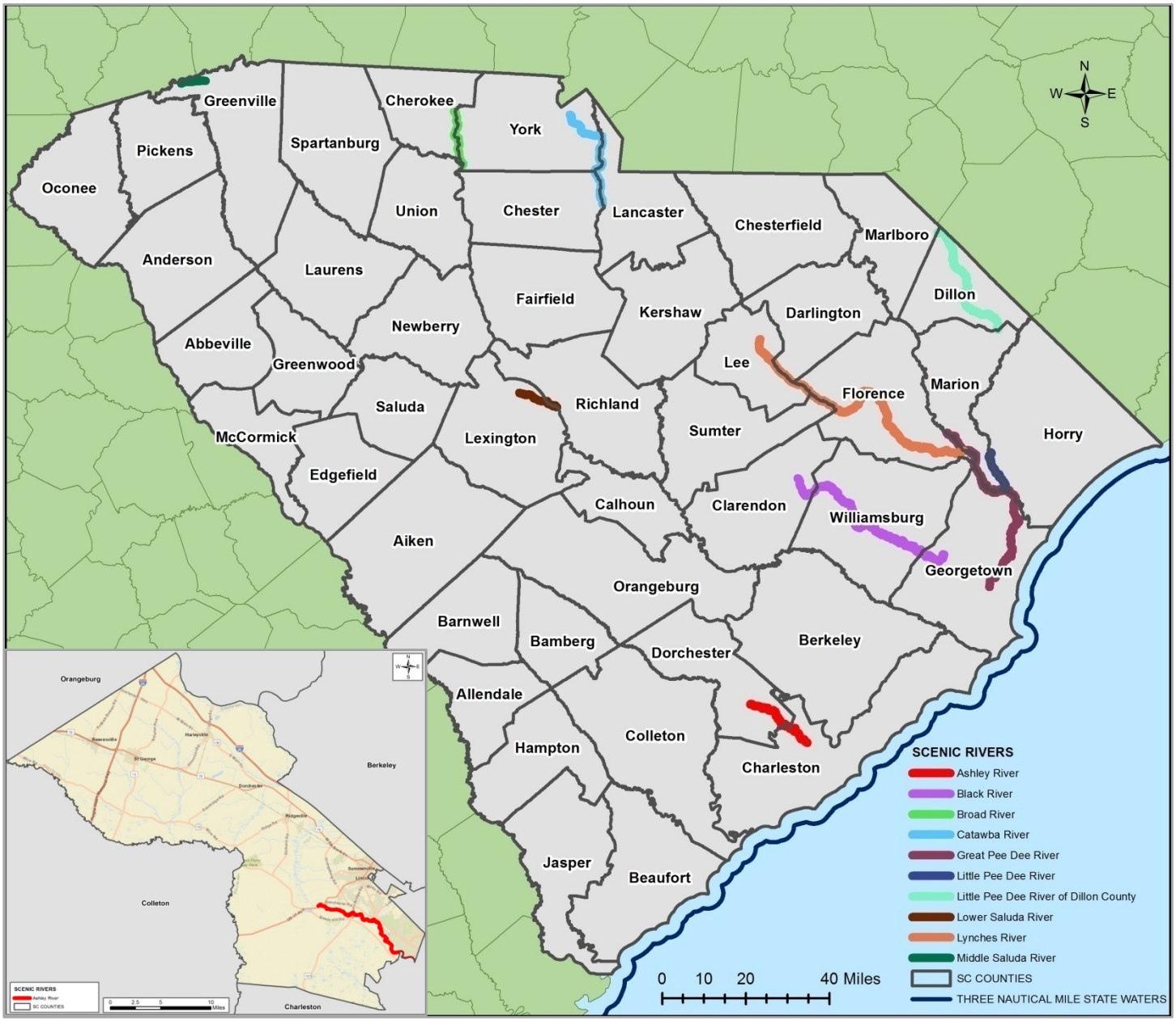

Figure 20: Designated scenic rivers in South Carolina and Dorchester County.[70]

[68] SCDNR. (2015). *Ashley Scenic River*. Retrieved November 2016 from http://www.dnr.sc.gov/water/river/scenic/ashley.html
[69] SCDNR (2015). *Scenic Rivers*. Retrieved November 2016 from http://www.dnr.sc.gov/water/river/
[70] Ibid.

Drinking Water Supply

DHEC's Source Water Assessment Program (SWAP) determines boundaries of areas that are the source-waters for public water systems. Known and potential sources of contamination in these areas must be identified, and the inventoried sources evaluated to determine the susceptibility of public water systems to such contaminants.[71] Public water supply wells (PSWS), and protection zones for PWSWs and surface waters in South Carolina and Dorchester County are shown in Figure 21.

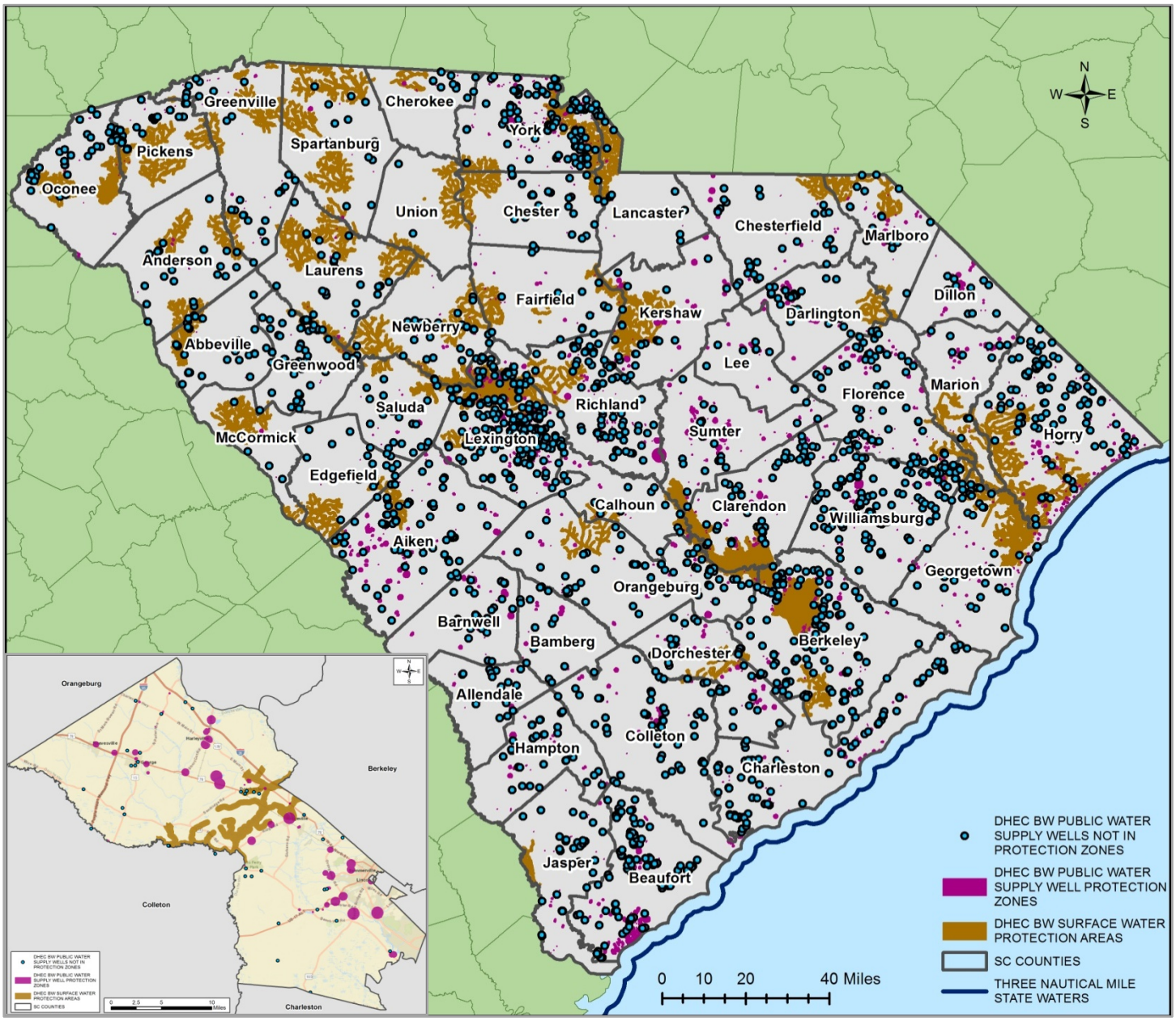

Figure 21: PWSWs, and protection zones for PWSWs and surface waters in South Carolina and Dorchester County.[72]

[71] DHEC. *South Carolina Watershed Atlas, Public Water Supply*. Retrieved November 2016 from https://gis.dhec.sc.gov/watersheds/
[72] Ibid.

Waterbody Classification

South Carolina waters have been classified in regulation based on the desired uses of each waterbody. State standards for various parameters have been established to protect all uses within each classification. All adopted classifications must conform to the standards and rules contained within R.61-68, or site-specific standards listed within this regulation. Waterbody classifications in South Carolina and Dorchester County are shown in Figure 22.[73]

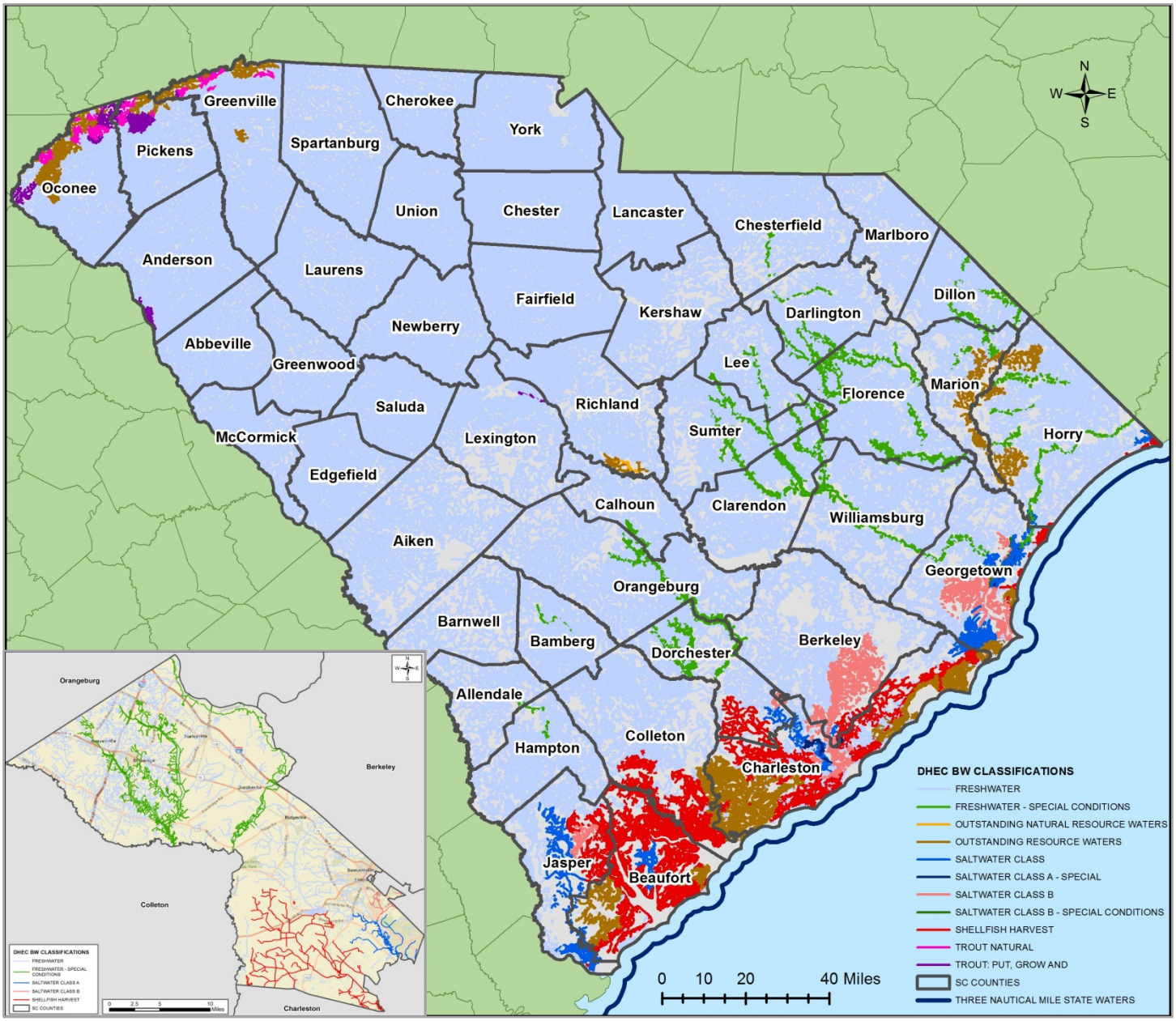

Figure 22: Waterbody classifications in South Carolina and Dorchester County.[74]

[73] DHEC. *South Carolina Watershed Atlas, Water Classification*. Retrieved November 2016 from https://gis.dhec.sc.gov/watersheds/
[74] Ibid.

Waterbody classifications in Dorchester County include FW, SFH, SA, and SB. A description of these classifications is provided below.[75]

- Class **FW**, or "freshwaters", are freshwaters that are suitable for primary and secondary contact recreation and as a source for drinking water supply, after conventional treatment.
- Class **SFH**, or "shellfish harvesting" waters, are tidal saltwaters protected for shellfish harvesting, and are suitable also for uses listed in Classes SA and SB.
- Class **SA** comprises "tidal saltwaters" suitable for primary and secondary contact recreation, crabbing and fishing. These waters are not protected for harvesting of clams, mussels, or oysters for market purposes or human consumption.
- Class **SB** are "tidal saltwaters" suitable for the same uses listed in SA. The difference between the Class SA and SB saltwater concerns the dissolved oxygen (DO) limitations.

Impaired Waters

For all states, the EPA mandates the 303(d) list of impaired waters, which do not meet water quality standards. The 303(d) list is to be developed by states every two years and submitted for approval according to Section 303(d) of the Clean Water Act. Listed waterbodies do not meet water quality standards even after controls for point and nonpoint source pollution have been put in place. The purpose is to identify impaired waters so that the source of impairment can be described and corrective actions can be implemented to improve water quality. A Total Maximum Daily Load (TMDL) is a means for recommending controls needed to meet water quality standards in a particular water or watershed. A TMDL is the calculated maximum allowable pollutant loading to a waterbody at which water quality standards are maintained. Table 7 lists the number of waterbodies on the 2014 303(d) list, by county, for the eight coastal counties. Dorchester and Jasper counties have the fewest number of listed waterbodies, 13 and 22 respectively. Charleston and Horry counties have the highest number of listed waterbodies, 85 and 75 respectively.

Table 7: Number of waterbodies on the 2014 303(d) list for the eight coastal counties.[76]

County	# of waterbodies on 2014 303(d) list
Dorchester	***13***
Beaufort	43
Berkeley	42
Charleston	85
Colleton	47
Georgetown	37
Horry	75
Jasper	22

Of the 13 impaired waterbodies in Dorchester County, nine are within the Edisto River Basin and four are within the Santee River Basin. Seven of the waterbodies were listed for aquatic life (dissolved oxygen) impairment. Three waterbodies were listed for recreational swimming (E. coli or Enterococci) impairment. And two waterbodies were listed for fish consumption (mercury) impairment. Impaired waterbodies on the 2014 303(d) list in Dorchester County, and

[75] DHEC. *South Carolina Watershed Atlas, Water Classification*. Retrieved June 2016 from https://gis.dhec.sc.gov/watersheds/
[76] DHEC. *State of South Carolina Integrated Report for 201. Part 1: Section 303(d) List of Impaired Waters*. (2014, May 1). Retrieved June 2016 from http://www.DHEC.gov/HomeAndEnvironment/Docs/tmdl_14-303d.pdf

respective TMDL target dates, are listed in Table 8.[77] Figure 23, on the following page, shows 303(d) impaired waters and approved TMDL sites and TMDL watersheds in South Carolina and Dorchester County.[78]

Table 8: Impaired waterbodies on the 2014 303(d) list in Dorchester County.[79]

Location Description	Basin	12 Digit HUC	Station	Use Support Impairment	Cause	TMDL Target Date(s)*
Four Hole Swamp at SC 453	Edisto	030502050305	E-112	Aquatic Life	Dissolved Oxygen	2017
4 Hole Swamp at UA 78 E of Dorchester	Edisto	030502050311	E-100	Recreational (Swimming)	Escherichia coli	2015**
Edisto River near the end of Fishtale Road sample off of dock between white trailer and brick house 6.5 mi SE of Brachville	Edisto	030502060106	RS-06180	Recreational (Swimming)	Escherichia coli	2016
Edisto River at US 15 S of St George	Edisto	030502060108	E-014	Fish Consumption	Mercury	2027
Polk Swamp at Unimp Rd S-18-180 2 mi S of St George	Edisto	030502060203	E-016	Aquatic Life	Dissolved Oxygen	2016
Polk Swamp at S-18-19	Edisto	030502060203	E-109	Aquatic Life	Dissolved Oxygen	2016
Indian Field Swamp at S-18-19	Edisto	030502060204	E-032	Aquatic Life	Dissolved Oxygen	2017
Big Branch at S-18-378	Edisto	030502060204	RS-10373	Aquatic Life	Dissolved Oxygen	2017
Edisto River at SC 61 at Givhans Ferry State Park	Edisto	030502060302	E-015	Fish Consumption	Mercury	2027
Dorchester Ck at SC 165	Santee	030502010601	CSTL-013	Aquatic Life	Dissolved Oxygen	2022
Sawmill Branch at SC 78 E of Summerville	Santee	030502010601	CSTL-043	Aquatic Life	Dissolved Oxygen	2022
Eagle Creek at SC 642 5 mi SSE of Summerville	Santee	030502010603	CSTL-099	Recreational (Swimming)	Enterococci	2022
Ashley River at Dorchester State Park	Santee	030502010604	CSTL-560	Fish Consumption	Mercury	2027
* In accordance with EPA integrated report guidance, target dates are established for development of TMDLs from 2-13 years after a site is listed as impaired by each pollutant. All target dates are subject to change, based on the severity of pollution, designated use, the availability of additional site-specific information, available resources, or other factors the Department deems appropriate for scheduling TMDL development. If the water quality standard demonstrates attainment for the pollutant of concern subsequent to initial listing, a TMDL will not be necessary.						
** TMDL to be developed within two years						

[77] DHEC. *State of South Carolina Integrated Report for 201. Part 1: Section 303(d) List of Impaired Waters*. (2014, May 1). Retrieved June 2016 from http://www.DHEC.gov/HomeAndEnvironment/Docs/tmdl_14-303d.pdf

[78] DHEC. *South Carolina Watershed Atlas, Water Quality Assessments*. Retrieved November 2016 from https://gis.dhec.sc.gov/watersheds/

[79] Ibid.

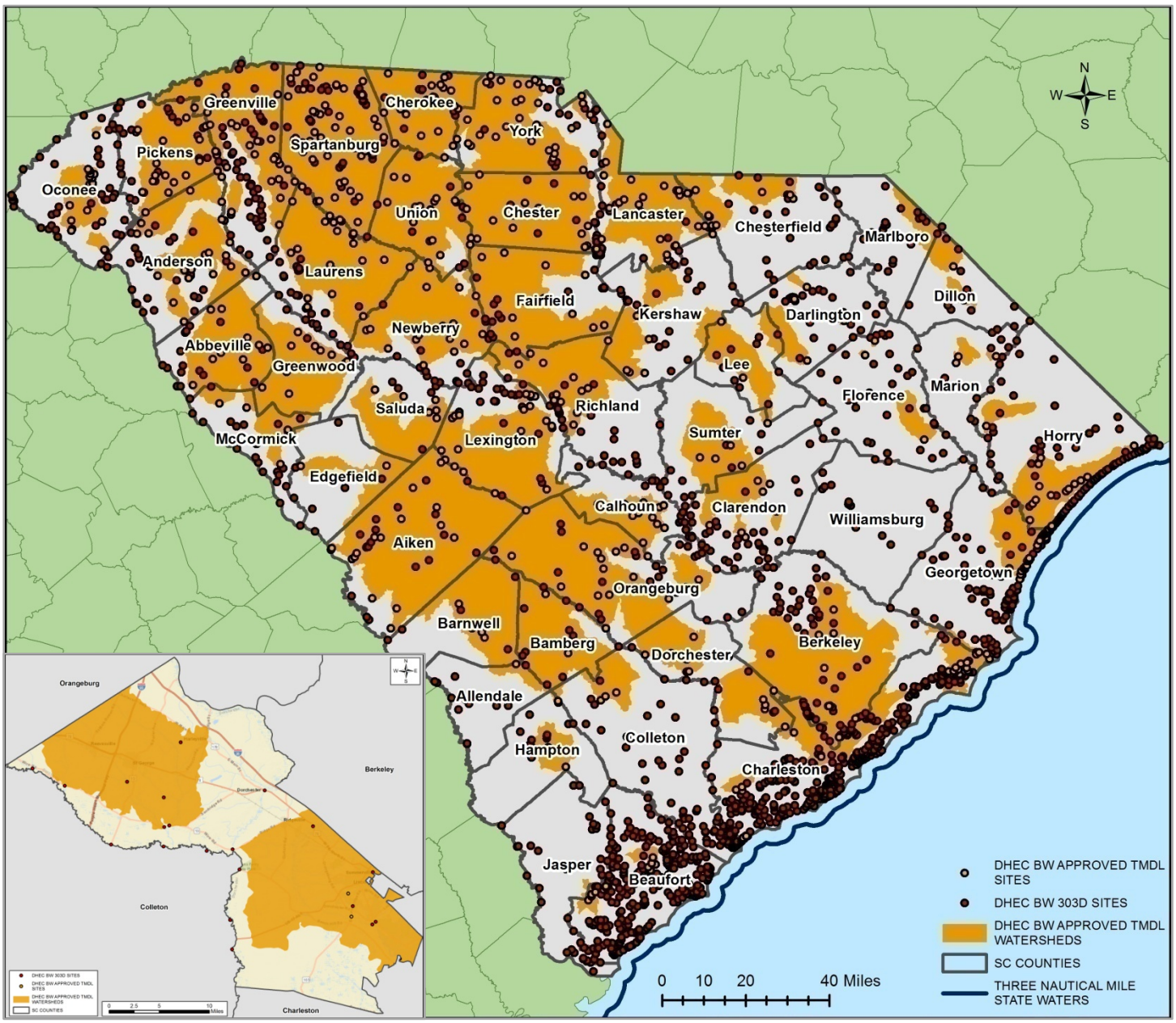

Figure 23: 303(d) Impaired Waters, TMDL sites, and TMDL Watersheds in South Carolina and Dorchester County.[80]

[80] DHEC-BOW. *South Carolina Watershed Atlas, Water Quality Assessments*. Retrieved November 2016 from https://gis.dhec.sc.gov/watersheds/

DHEC and the South Carolina Department of Natural Resources (SCDNR) work together to provide annual fish consumption advisories based on fish tissue monitoring results. These advisories provide the public advice on safe amounts and types of fish to eat in South Carolina. The advisories particularly focus on providing statewide advice for at-risk women and children. DHEC also tests rivers, lakes and streams for bacteria levels. Swimming advisories are issued when high amounts of bacteria are found. Figure 24 illustrates fish and swim advisories (as of November 21, 2016) in South Carolina and Dorchester County.[81]

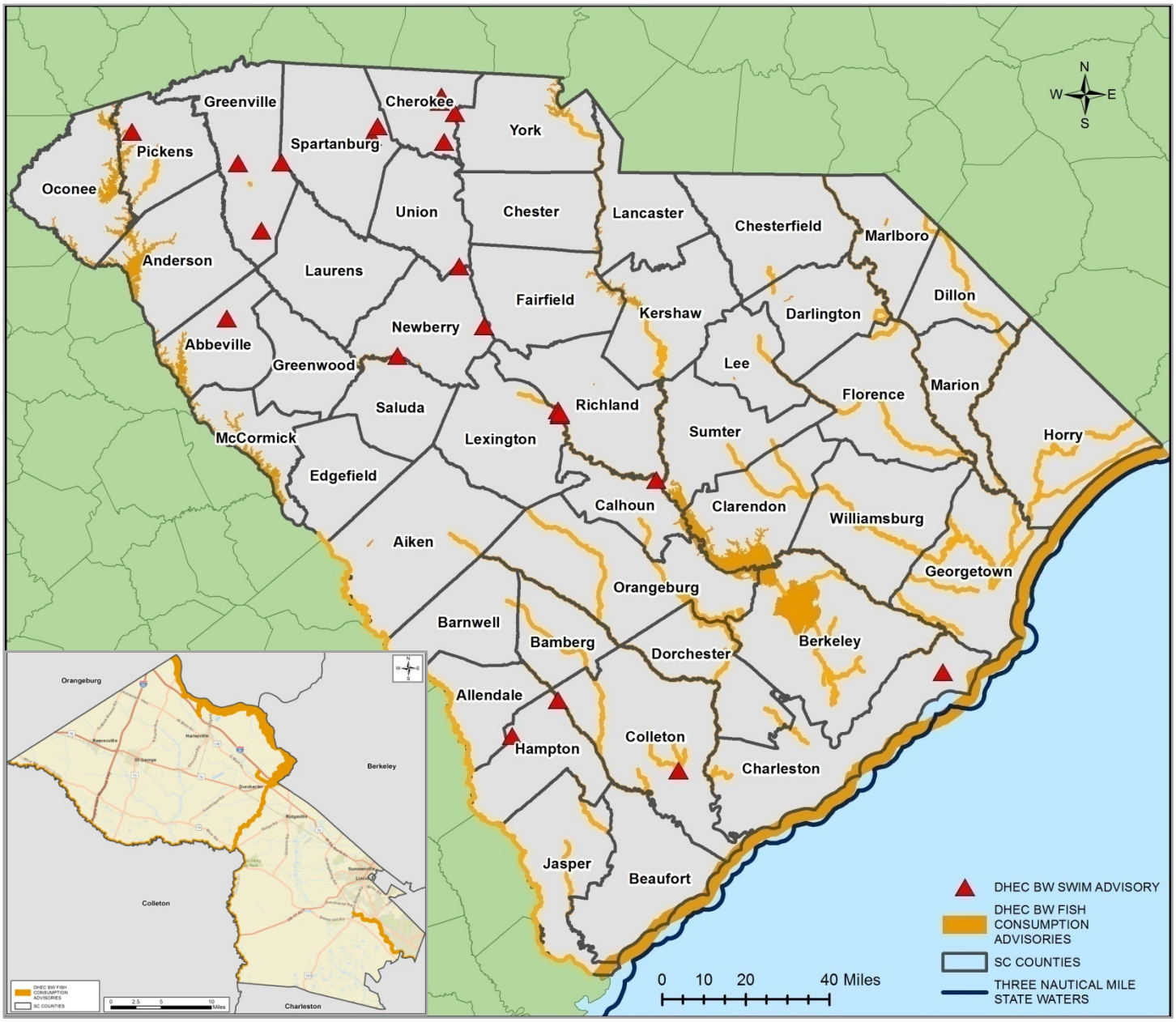

Figure 24: Fish and swim advisories in South Carolina and Dorchester County.[82]

[81] DHEC. *South Carolina Watershed Atlas, Water Advisories*. Retrieved November 2016 from https://gis.dhec.sc.gov/watersheds/
[82] Ibid.

Hazards

Many areas along the South Carolina coast are vulnerable to flooding due to their low elevation relative to mean sea level, as well as their proximity to the Atlantic Ocean. Flooding may result from heavy rainfall events, storm surge from hurricanes, or gradual changes in mean sea level. Figure 25 illustrates preliminary floodplain areas in South Carolina and Dorchester County.[83, 84]

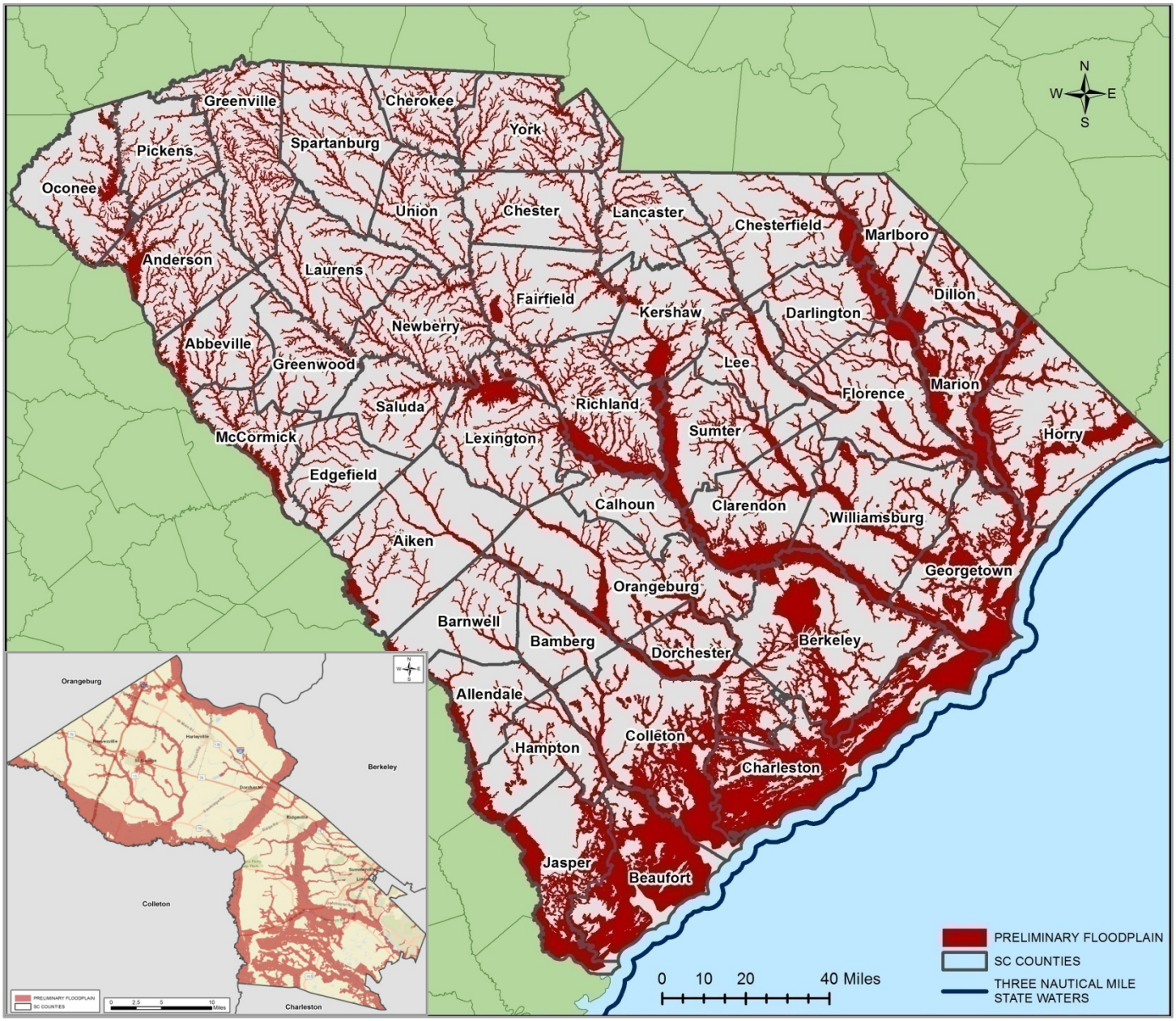

Figure 25: Preliminary FEMA floodplain areas in South Carolina and Dorchester County.[85, 86]

[83] DHEC. *South Carolina Watershed Atlas, Preliminary Floodplain Areas*. Retrieved November 2016 from https://gis.dhec.sc.gov/watersheds/

[84] FEMA. *Preliminary Floodplain areas in Dorchester County*. Retrieved November 2016 from https://hazards.fema.gov/femaportal/prelimdownload/

[85] DHEC. *South Carolina Watershed Atlas, Preliminary Floodplain Areas*. Retrieved November 2016 from https://gis.dhec.sc.gov/watersheds/

Maximum extent of storm surge inundation can be modeled using the National Hurricane Center's SLOSH model. Inundation is modeled according to storm intensity, based on the Saffir-Simpson Hurricane Wind Scale, which categorizes storms from Category 1 (74-95 mph sustained winds) through Category 5 (157 mph or higher sustained winds). A detailed description of the SLOSH model can be found in the Storm Surge Inundation section of this report. Figure 26 illustrates maximum storm surge inundation from a Category 5 hurricane landfall in South Carolina.[87] This inundation map represents a worst-case-scenario for the entire South Carolina coast (e.g. Category 5 hurricane landfall during high tide).

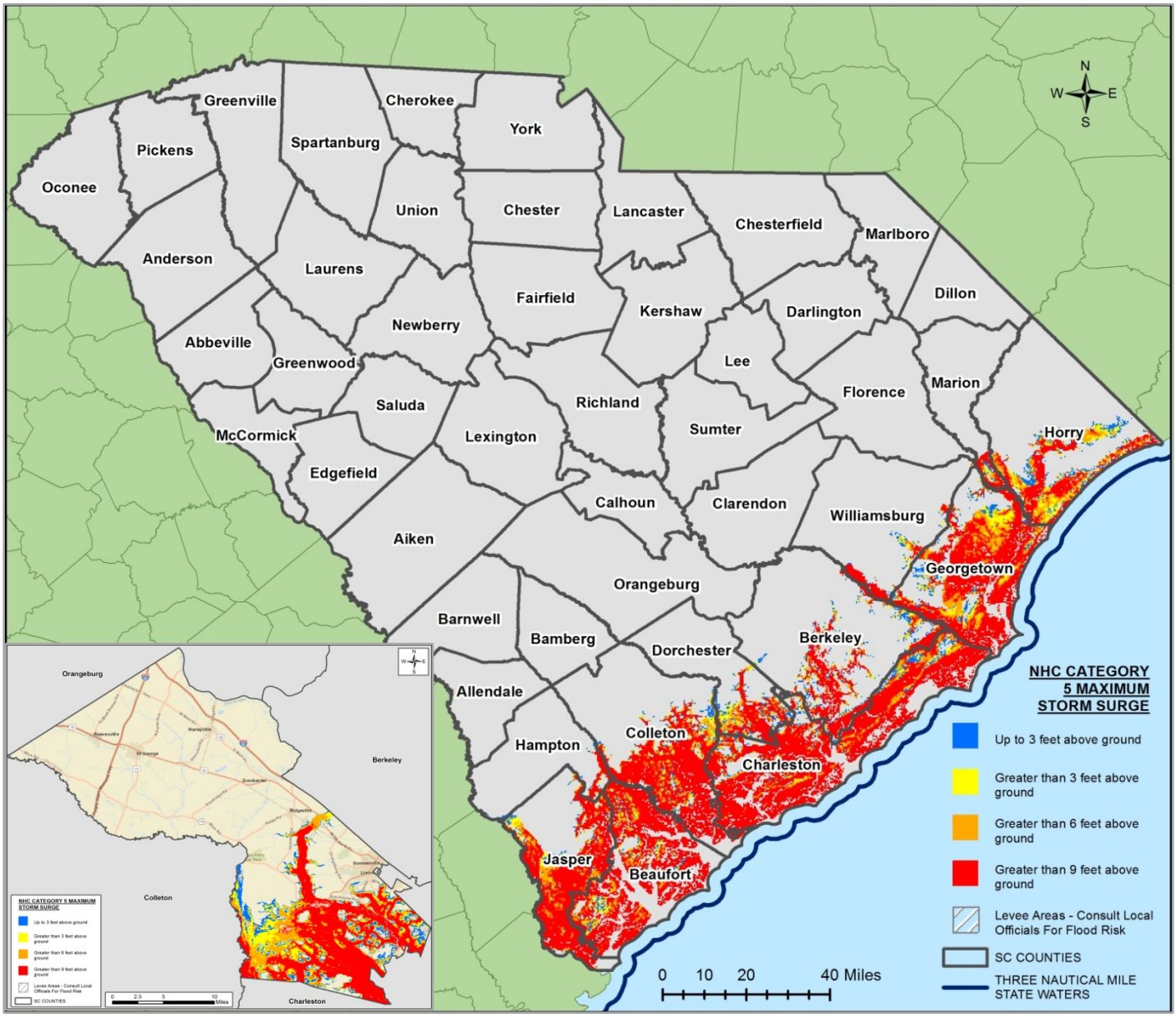

Figure 26: Maximum storm surge inundation modeled for a Category 5 hurricane in South Carolina and Dorchester County.[88]

[86] FEMA. *Preliminary Floodplain areas in Dorchester County*. Retrieved November 2016 from https://hazards.fema.gov/femaportal/prelimdownload/

[87] NOAA, National Weather Service. *Storm Surge Inundation*. Retrieved November 2016 from http://noaa.maps.arcgis.com/apps/StorytellingTextLegend/index.html?appid=b1a20ab5eec149058bafc059635a82ee

[88] Ibid.

NOAA's Center for Operational Oceanographic Products and Services (CO-OPS) monitors water levels at coastal stations across the country and has been measuring sea level for over 150 years. Changes in mean sea level, either a sea level rise or sea level fall, have been computed at 142 long-term water level stations using a minimum span of 30 years of observations at each location. These measurements have been averaged by month to remove the effect of higher frequency phenomena in order to compute an accurate linear sea level trend. There are three long-term water level stations in or near South Carolina (Table 9) including Springmaid Pier (SC), Charleston Harbor (SC), and Fort Pulaski (GA). Data shows that mean sea level is rising at each of these three stations with rates increasing from south to north.[89]

Table 9: Mean sea level trend at three long-term water level stations in or near South Carolina.[90]

Station Location	Station ID	Date Range of Monthly Mean Sea Level Data	Mean Sea Level Trend (mm/yr)	95% confidence interval (mm/yr)	Equivalent change (in feet) over 100 years
Springmaid Pier, SC	8661070	1957 to 2015	+ 3.90	+/- 0.58	+ 1.28
Charleston Harbor, SC	8665530	1921 to 2015	+ 3.21	+/- 0.22	+ 1.05
Fort Pulaski, GA	8670870	1935 to 2015	+ 3.17	+/- 0.28	+ 1.04

Figure 27 provides a graphical representation of mean sea level trends at these stations. The average rate of mean sea level change for these sites is +3.43 mm/yr, which is equivalent to a rise in water levels of 1.12 feet over 100 years along the South Carolina coast.[91] This calculation is based on the rate of change observed between the time periods listed in Table 9, and does not account for potential accelerated or decelerated rates of change that may be experienced over the next 100 years.

NOAA's Sea Level Rise Viewer is a mapping tool that allows for the visualization of community-level impacts from coastal flooding or sea level rise (up to 6 feet above average high tides). Based on the average rate of mean sea level change, and the equivalent change in mean sea level over the next 100 years, listed above, NOAA's Sea Level Rise Viewer was set to a 1 foot rise in relative sea level (above average high tide) to evaluate the potential impacts of sea level change along the South Carolina coast and in Dorchester County (Figure 28, following page).[92]

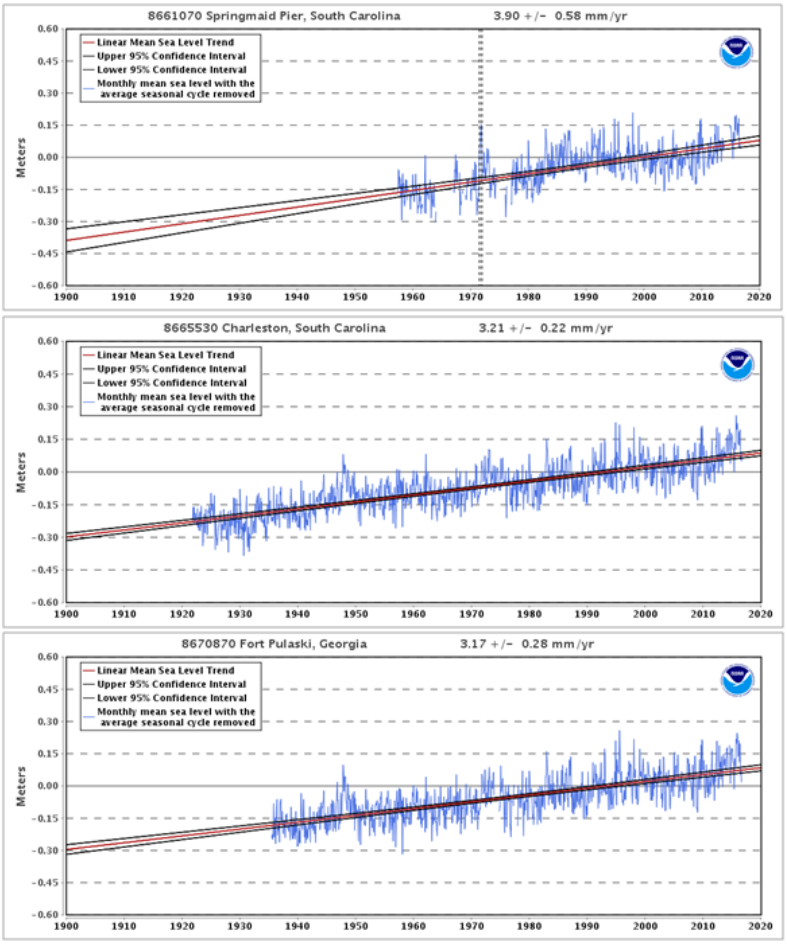

Figure 27: NOAA COOPs mean sea level trends at Springmaid Pier, Charleston Harbor, and Fort Pulaski.

[89] NOAA, COOPS. *Tides and Currents, Sea Level Trends*. Retrieved November 2016 from https://tidesandcurrents.noaa.gov/sltrends/sltrends.html
[90] Ibid.
[91] Ibid.
[92] NOAA, OCM. *Sea Level Rise Viewer*. Retrieved November 2016 from https://coast.noaa.gov/digitalcoast/tools/slr.html

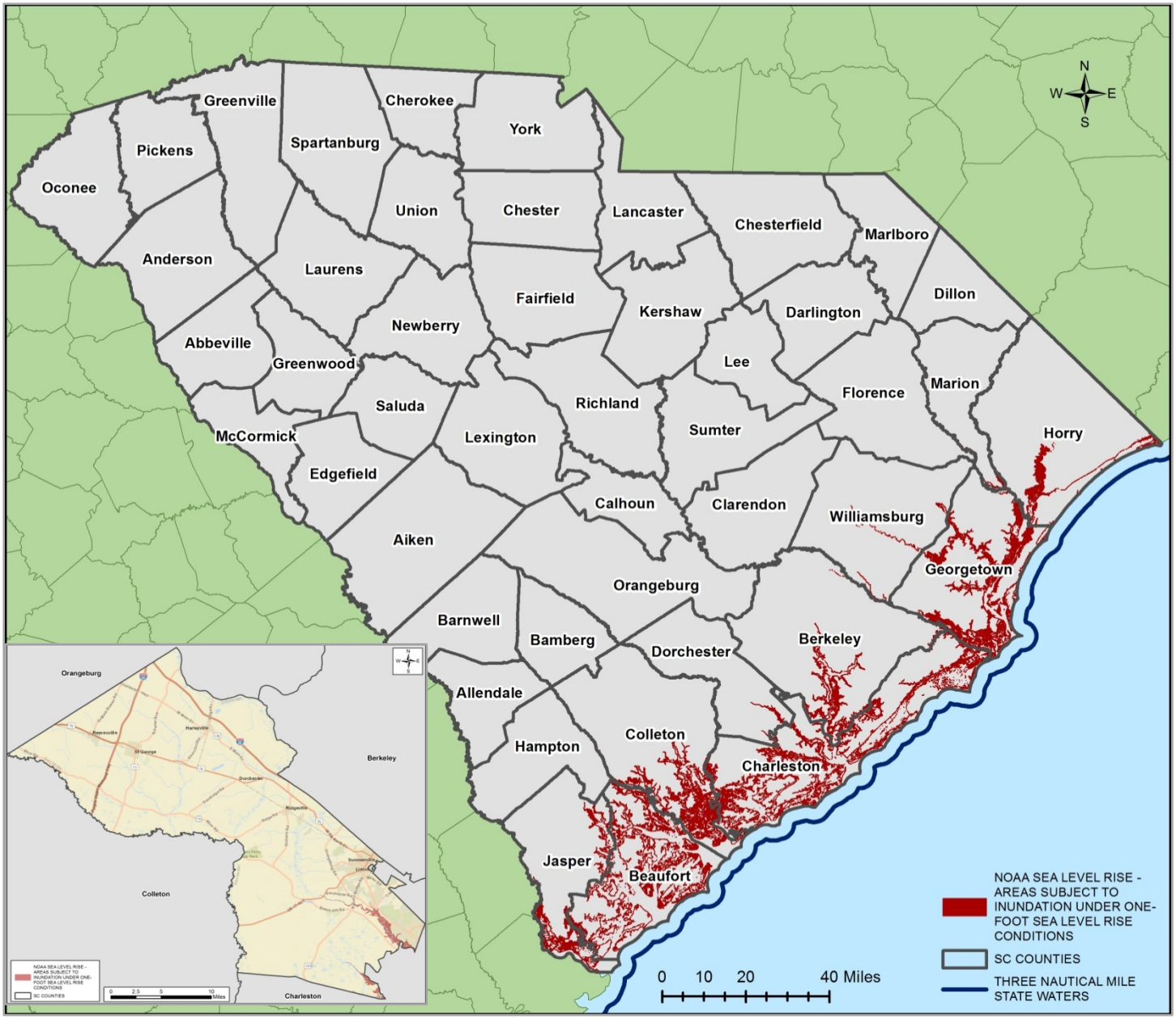

Figure 28: Modeled inundation from a 1 foot rise in mean sea level (above average high tide) for South Carolina and Dorchester County.[93]

Land Cover

Land cover data classifies the physical material at the surface of the earth into various categories. There are a number of sources of land cover data. Land cover data from three sources is shown below including NOAA's Coastal Change Analysis Program, the U.S. Fish and Wildlife Service's National Wetlands Inventory, and the U.S. Geological Survey's National Gap Analysis Program.

NOAA Coastal Change Analysis Program

NOAA's Coastal Change Analysis Program (C-CAP) Land Cover Atlas provides access to coastal land cover and land cover change information. NOAA C-CAP land cover categories were developed as target indicators of coastal ecosystems and

[93] NOAA, Office for Coastal Management. *Sea Level Rise Viewer*. Retrieved November 2016 from: https://coast.noaa.gov/digitalcoast/tools/slr.html

were identified as features that can be consistently and accurately derived primarily through remote-sensing means.[94] The most recent NOAA C-CAP dataset available for South Carolina counties is from 2010. C-CAP land cover data from 1996, 2001, and 2006 are also available for South Carolina counties, allowing for land cover change analysis between those years. South Carolina and Dorchester County C-CAP land cover (2010) is shown in Figure 29.

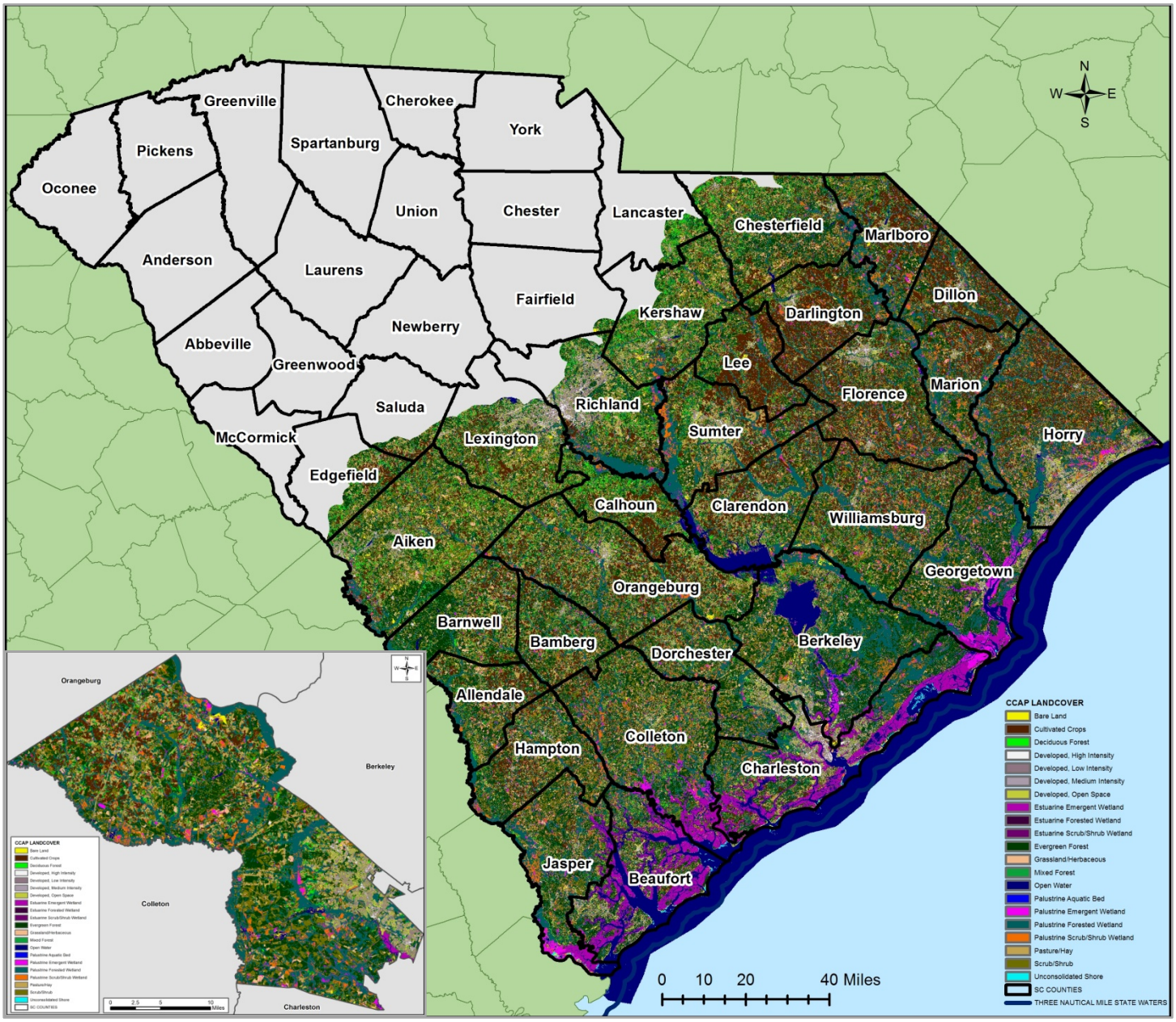

Figure 29: NOAA C-CAP land cover for South Carolina and Dorchester County.[95]

[94] NOAA, Office for Coastal Management. *Coastal Change Analysis Program Regional Land Cover and Change*. Retrieved June 2016 from https://coast.noaa.gov/dataregistry/search/collection/info/ccapregional

[95] Ibid.

Land Cover Change 1996-2010

Approximately 21% of Dorchester County (121.3 miles) changed between 1996 and 2010. Land cover area by type in 1996 and 2010 in Dorchester County is shown graphically in Figure 30. In this chart, the difference between the two bars represents the net difference in the area for that category.[96] Table 10 includes 1996 and 2010 land cover area by type, as well as area lost and gained, net change in area, and percent change by land cover type in Dorchester County.[97]

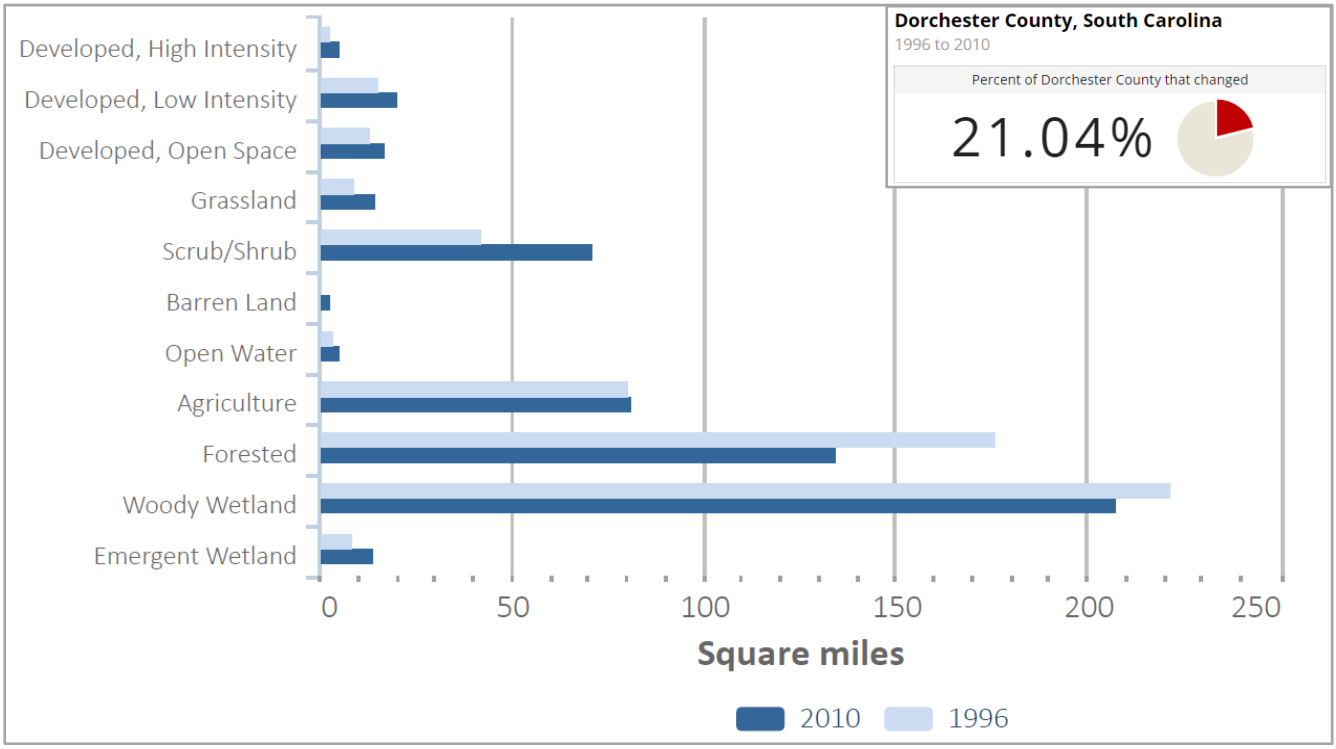

Figure 30: Land cover area by type in 1996 and 2010 in Dorchester County.[98]

Table 10: Land cover area and land cover area change by type between 1996 and 2010 in Dorchester County.[99]

Land Cover	1996 Area (mi^2)	Area Lost (mi^2)	Area Gained (mi^2)	2010 Area (mi^2)	Net Change (mi^2)	% Change
High/Medium Intensity Developed	2.9	0.0	2.6	5.5	2.6	88%
Low Intensity Developed	15.8	0.2	4.8	20.4	4.6	29%
Open Space Developed	13.0	0.3	4.2	16.9	3.9	30%
Grassland	9.3	6.7	12.6	15.2	5.9	63%
Agriculture	80.8	1.9	2.6	81.5	0.7	1%
Forested	176.7	53.6	11.9	135.0	-41.7	-24%
Scrub/Shrub	42.7	12.4	41.2	71.5	28.8	67%
Woody Wetland	221.7	16.6	2.8	207.9	-13.9	-6%
Emergent Wetland	8.3	1.3	7.3	14.3	6.0	72%
Barren Land	1.2	0.2	2.3	3.2	2.1	178%
Open Water	4.3	0.2	1.3	5.4	1.2	27%

[96] Ibid.
[97] Ibid.
[98] Ibid.
[99] Ibid.

Land cover change (losses and gains) between 1996 and 2010 is shown in Figure 31. The land cover type with the greatest net area lost during this time period is forested land, with a net loss of 41.7 square miles (mi^2). The land cover type with the greatest net area gained is scrub-shrub land, with a net gain of 28.8 mi^2. Land cover types that experienced the greatest change include barren land (+178% change), high/medium intensity developed (+88% change), emergent wetland (+72% change), scrub-shrub (+67% change), and grassland (+63% change). Two land cover types had a net loss in area including forested (-24% change) and woody wetland (-6% change).[100]

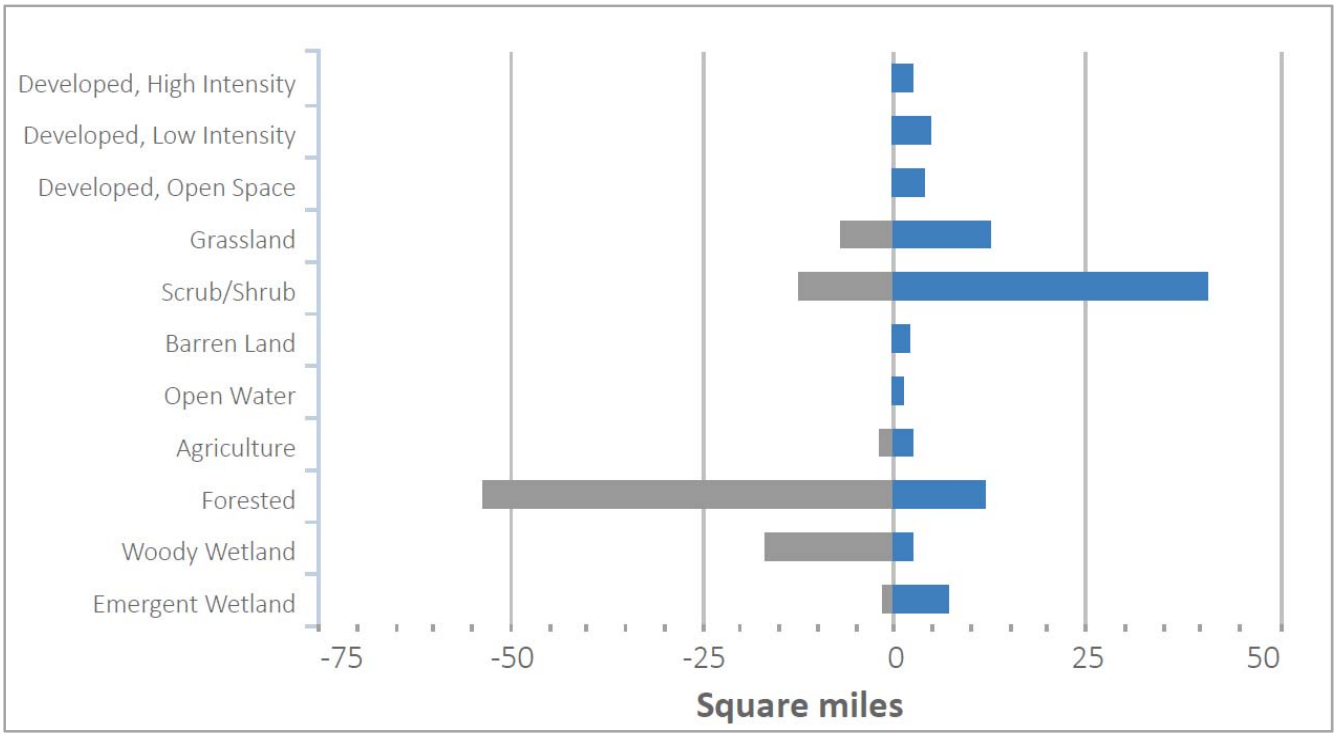

Figure 31: Land cover change (losses and gains) in Dorchester County, 1996-2010.[101]

Development Change

The percentage of developed land in Dorchester County has increased from 5.5% in 1996 to 7.4% in 2010, which is a +34.7% change and represents an 11 square mile gain. The percentage of impervious surface in the county has increased from 1.35% to 1.93%, which is a +42.3% change and represents a 3.3 square mile gain. On the following page, Figure 32 shows that all developed land cover types have gained area since 1996.[102] Land area converted to development by land cover type is shown in Figure 33, on the following page.[103]

[100] Ibid.
[101] Ibid.
[102] Ibid.
[103] Ibid.

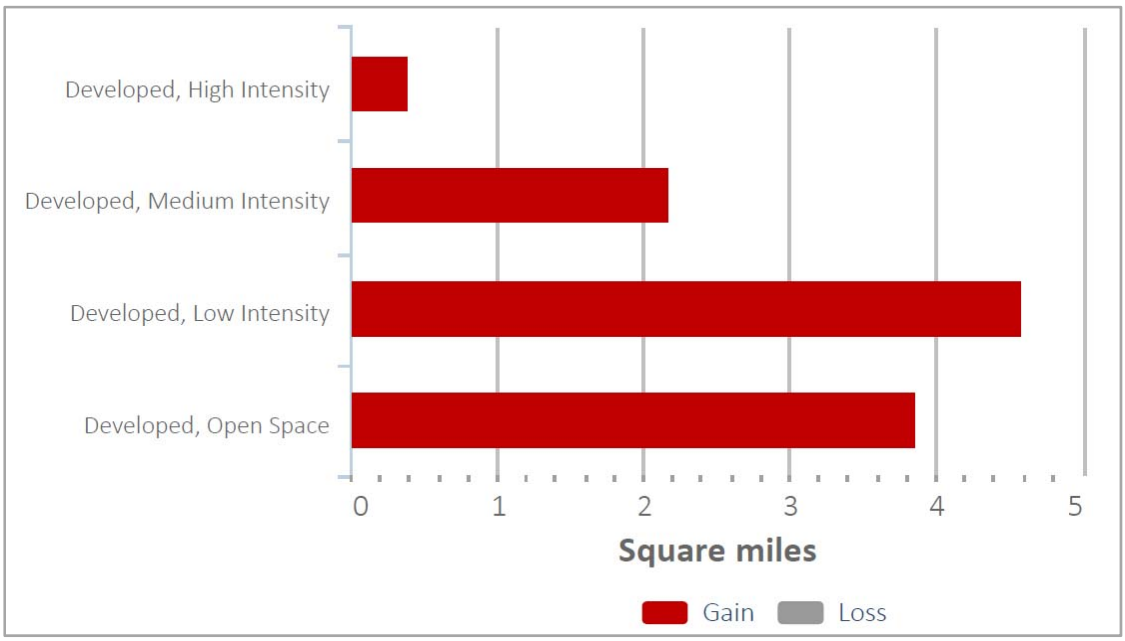

Figure 32: Net change in developed land area by development type.[104]

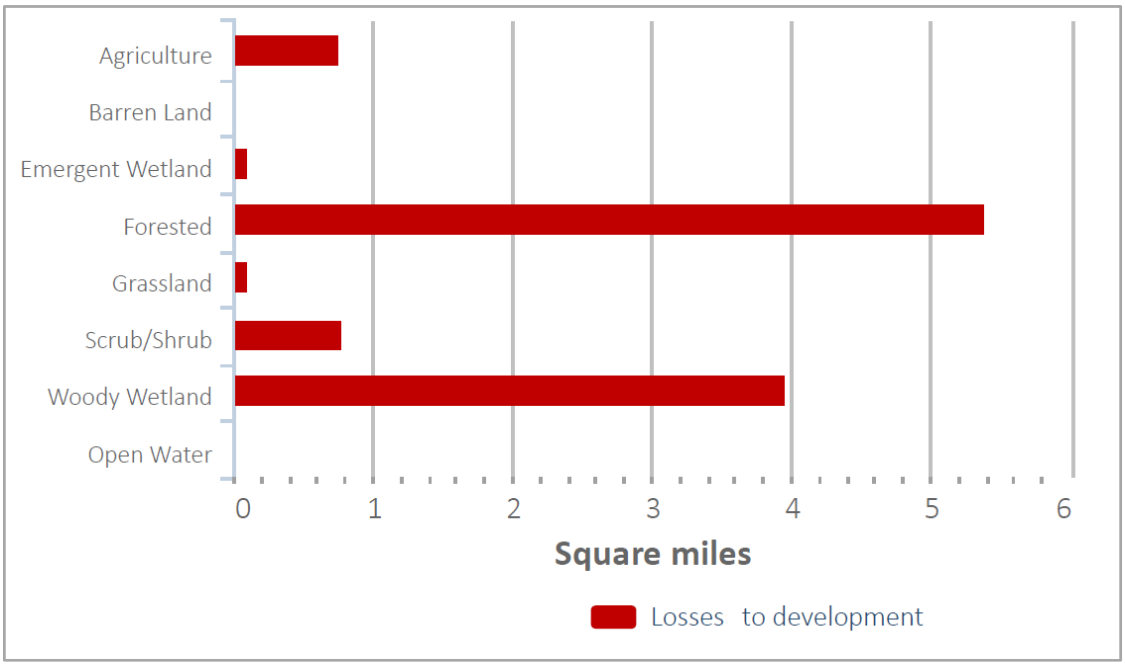

Figure 33: Area lost to development by land cover type.[105]

[104] Ibid.
[105] Ibid.

Wetland Change

The percentage of wetland area in Dorchester County has decreased from 39.9% in 1996 to 38.5% in 2010, a -3.5% change and an eight square mile loss. Change in wetland area by wetland type (Figure 34) shows a gain in palustrine scrub/shrub wetland and palustrine emergent wetland and a loss in palustrine forested wetland resulting in an overall net loss of wetlands since 1996. Figure 35 highlights the transformation of lost wetlands into different land cover types. It also features the origin of any wetland gains.[106]

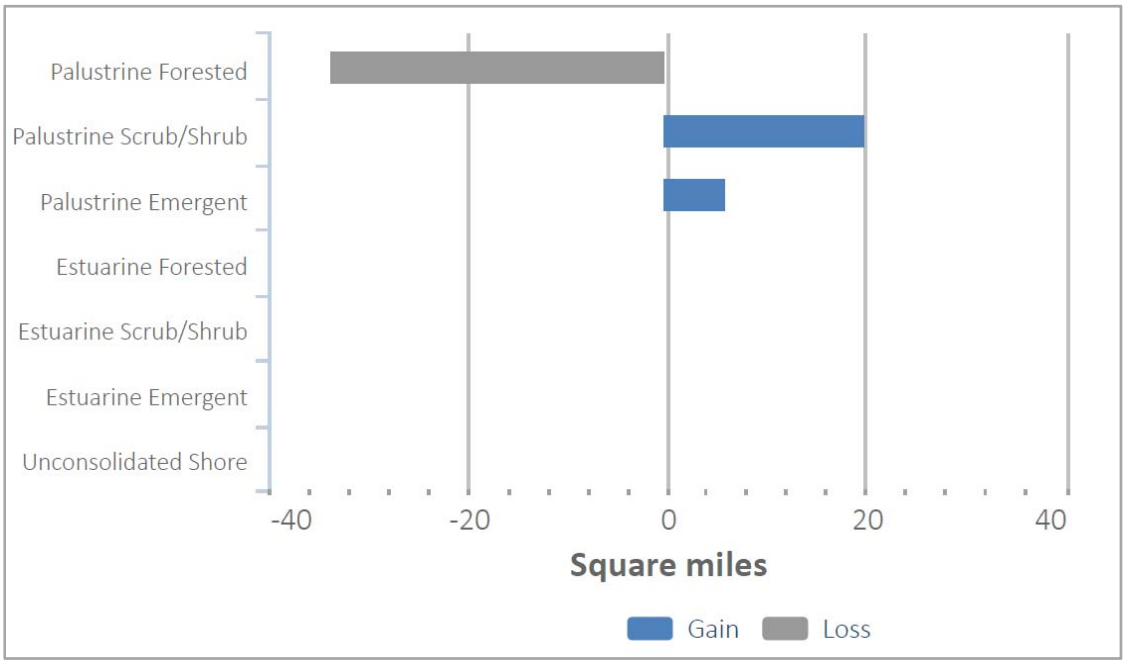

Figure 34: Wetland change (losses and gains) by wetland type in Dorchester County, 1996-2010.[107]

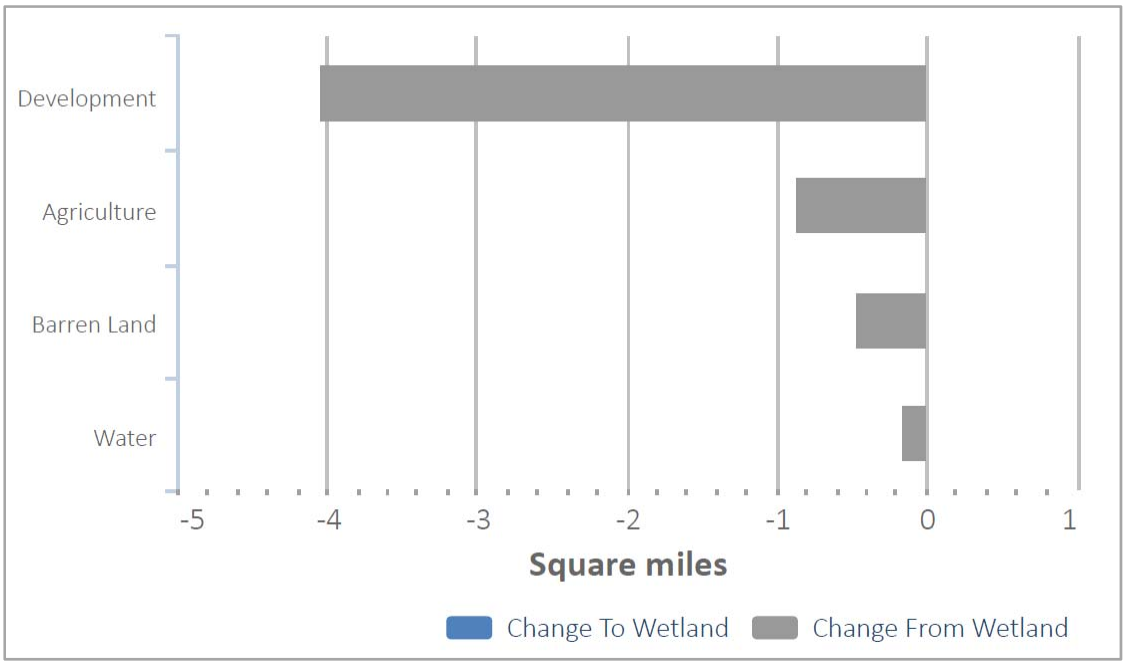

Figure 35: Conversion of wetland area into different land cover areas by type in Dorchester County from 1996-2010.[108]

[106] Ibid.
[107] Ibid.

USFWS National Wetlands Inventory

The U.S. Fish and Wildlife Service (USFWS) is the principal federal agency that provides information to the public on the extent and status of the Nation's wetlands. The National Wetlands Inventory (NWI) was established by the USFWS in 1974 to conduct a nationwide inventory of wetlands to provide its biologists and others with information on the distribution of wetlands to aid in wetland conservation efforts.[109] NWI land cover categories are based on a wetland classification system by Cowardin et al. 1979.[110] Figure 36 shows NWI data for South Carolina and Dorchester County.[111]

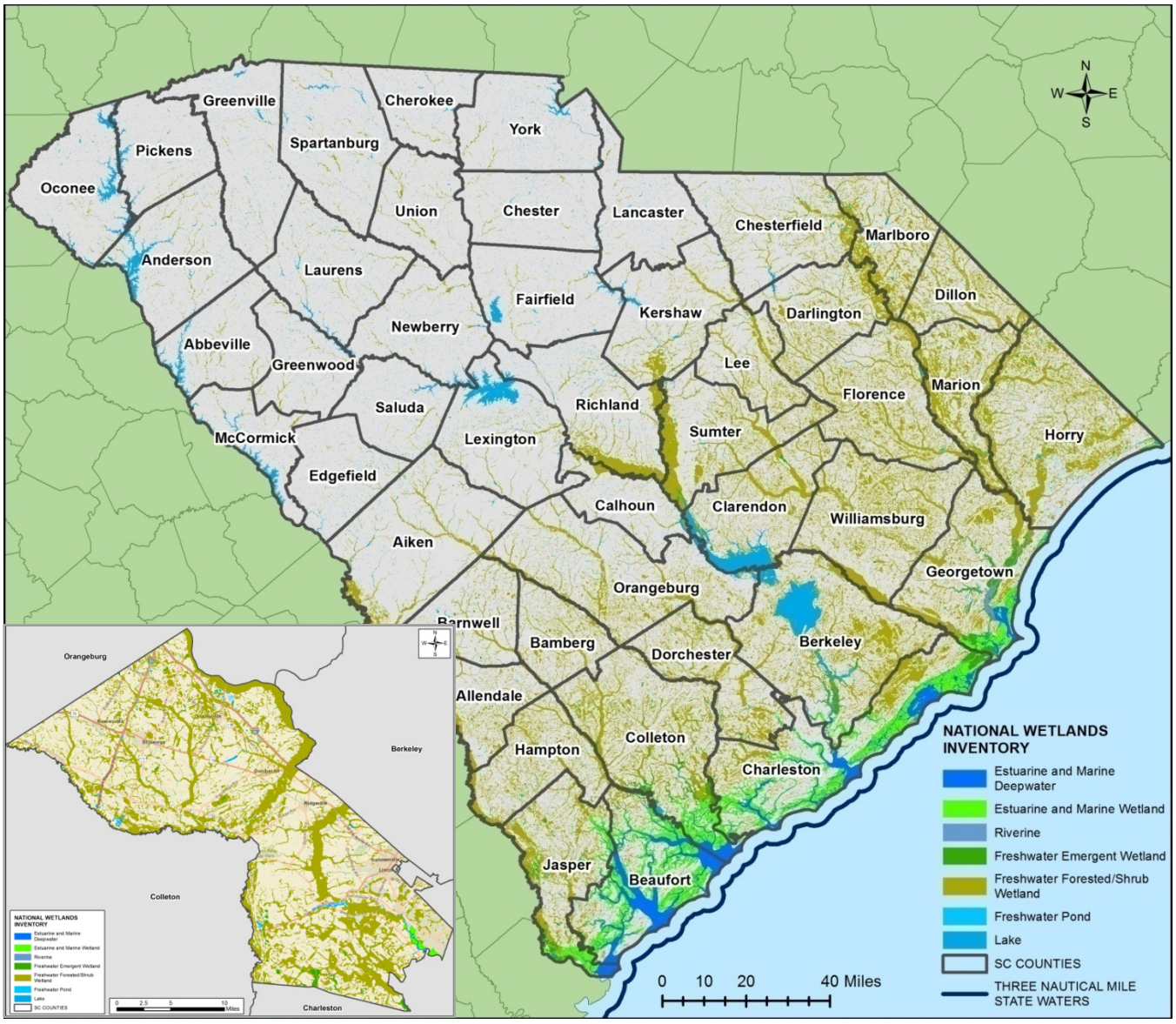

Figure 36: NWI data for South Carolina and Dorchester County.[112]

[108] Ibid.
[109] USFWS. *The National Wetlands Inventory*. Retrieved October 2016 from https://www.fws.gov/wetlands/nwi/index.html
[110] Cowardin, L. M., Carter, V., Golet, F. C., & LaRoe, E. T. (1979). Classification of wetlands and deepwater habitats of the United States. *US Fish and Wildlife Service FWS/OBS*, *79*(31), 131.
[111] USFWS. *Download Seamless Wetlands Data*. Retrieved May 2016 from https://www.fws.gov/wetlands/data/data-download.html
[112] Ibid.

USGS National Gap Analysis Program

The U.S. Geological Survey (USGS) National Gap Analysis Program (GAP) Land Cover Data Set includes detailed vegetation and land use patterns for the continental United States. GAP land cover data can be used to identify locations with sufficient, good-quality habitat to support wildlife. GAP land cover categories, which are vegetation-based, differ from NWI and NOAA C-CAP categories. GAP land cover data is based on the National Vegetation Classification (NVC) and can be displayed at various levels. Figure 37 illustrates USGS GAP land cover data for South Carolina and Dorchester County.[113]

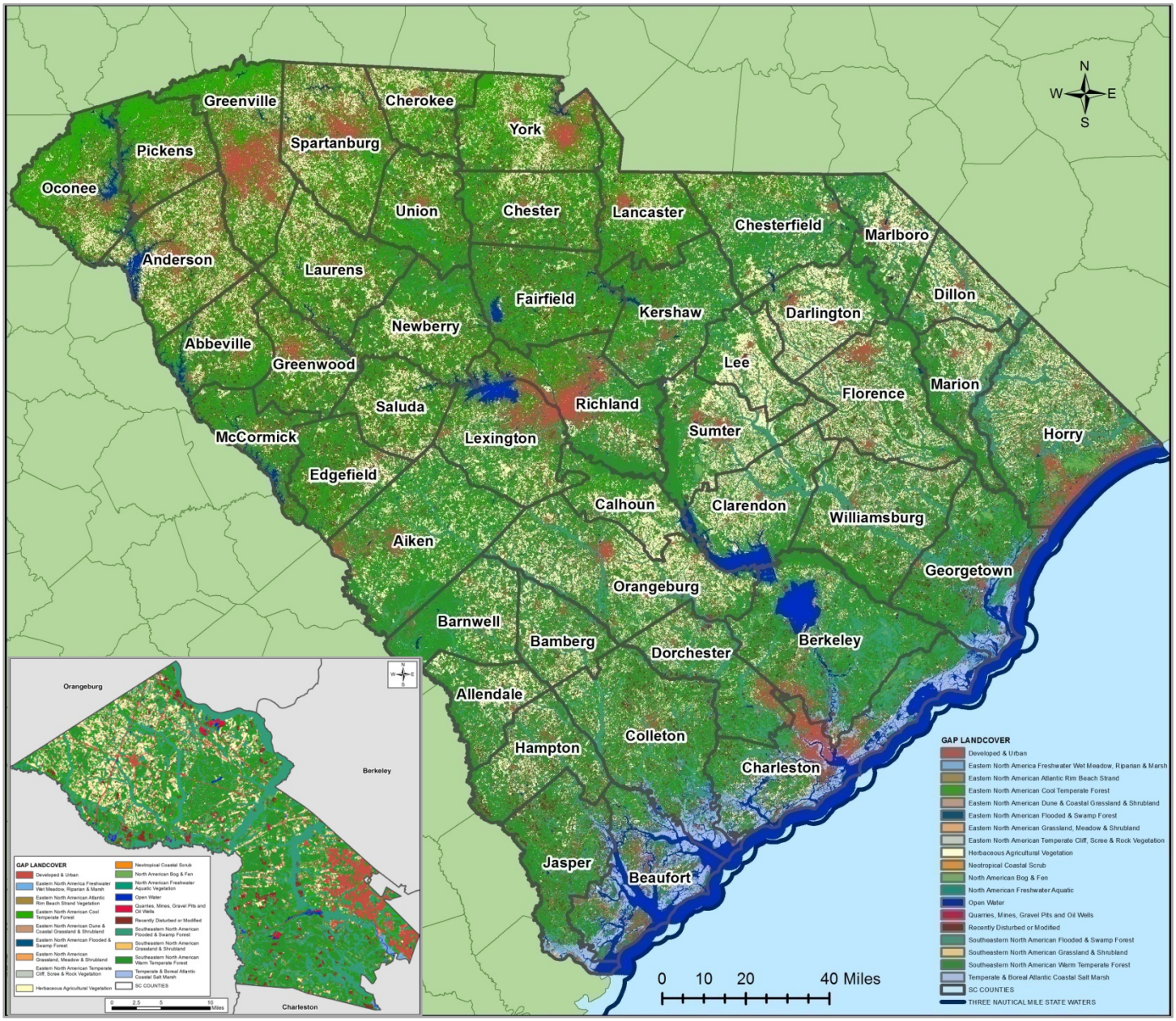

Figure 37: USGS GAP land cover for South Carolina and Dorchester County.[114]

[113] USGS. (2015, July 24). *National Gap Analysis Program*. Retrieved June 2016 from http://gapanalysis.usgs.gov/
[114] Ibid.

Threatened and Endangered Species

The South Carolina Coastal Plain, part of the larger North American Coastal Plain, is globally recognized for its biodiversity. In early 2016, the Critical Ecosystem Partnership Fund named the North American Coastal Plain the world's 36th Biodiversity Hotspot. Criteria for designation are based on Myers et al. (2000)[115] and include having more than 1,500 endemic vascular plants and greater than 70 percent habitat loss.[116] Dorchester County is home to over 50 rare, at-risk, threatened, and endangered species and communities. Table 11 includes a list of select at-risk, threatened, and endangered species from the USFWS and SCDNR.[117,118] Full species lists for Dorchester County from USFWS and SCDNR can be found in Appendix 4. Federal and state protection level is provided in Table 11, as well as state rank, which identifies the current status of the species in the state. A description of state rankings is provided in Table 12, on the following page.[119]

Table 11: At-risk, threatened, and endangered species known in Dorchester County.[120, 121]

Common Name	Scientific Name	Federal Protection/Status	State Protection	State Rank
Amphibian				
Gopher Frog	*Rana capito*	At Risk Species	Endangered	S1
Bird				
American Wood Stork	*Mycteria americana*	Threatened		
Bald Eagle	*Haliaeetus leucocephalus*	Bald and Golden Eagle Protection Act	Threatened	S2
Red-cockaded Woodpecker	*Picoides borealis*	Endangered	Endangered	S2
Least Tern	*Sterna antillarum*		Threatened	S3
American Swallow-tailed Kite	*Elanoides forficatus*	Species of Concern	Endangered	S2
Fish				
American Eel	*Anguilla rostrata*	At Risk Species		
Atlantic Sturgeon	*Acipenser oxyrinchus*	Endangered		
Blueback Herring	*Alosa aestivalis*	At Risk Species		
Shortnose Sturgeon	*Acipenser brevirostrum*	Endangered		
Mammal				
Rafinesque's Big-eared Bat	*Corynorhinus rafinesquil*	At Risk Species	Endangered	S2?
Tri-colored Bat	*Perimyotis subflavus*	At Risk Species		
Reptile				
Gopher Tortoise	Gopher Tortoise	Gopher Tortoise		

[115] Myers, N., Mittermeier, R. A., Mittermeier, C. G., Da Fonseca, G. A., & Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature*, *403*(6772), 853-858.

[116] Noss, Reed. (2016, February 18). *Announcing the World's 36th Biodiversity Hotspot: The North American Coastal Plain*. Critical Ecosystem Partnership Fund. Retrieved July 2016 from http://www.cepf.net/news/top_stories/Pages/Announcing-the-Worlds-36th-Biodiversity-Hotspot.aspx#.WDR8sbIrJQI

[117] SCDNR. (2014, June 11). *Rare, Threatened, and Endangered Species and Communities Known to Occur in Dorchester County, SC.* Retrieved June 2016 from http://www.dnr.sc.gov/species/pdf/Dorchester2014.pdf

[118] USFWS. (2015, February 10). South Carolina List of At-Risk, Candidate, Endangered, and Threatened Species - Dorchester County. Retrieved June 2016 from https://www.fws.gov/charleston/pdf/Endangered/species_by_county/dorchester_county.pdf

[119] SCDNR. *State Rank - NatureServe National (N) and Subnational (S) Conservation Status Rank Definitions*. Retrieved June 2016 from http://www.dnr.sc.gov/species/staterank.html

[120] SCDNR. (2014, June 11). *Rare, Threatened, and Endangered Species and Communities Known to Occur in Dorchester County, SC.* Retrieved June 2016 from http://www.dnr.sc.gov/species/pdf/Dorchester2014.pdf

[121] USFWS. (2015, February 10). South Carolina List of At-Risk, Candidate, Endangered, and Threatened Species - Dorchester County. Retrieved June 2016 from https://www.fws.gov/charleston/pdf/Endangered/species_by_county/dorchester_county.pdf

Common Name	Scientific Name	Federal Protection/Status	State Protection	State Rank
Eastern Diamondback Rattlesnake	*Crotalus adamanteus*	At Risk Species		
Southern Hognose Snake	*Heterdon simus*	At Risk Species		
Spotted Turtle	*Clemmys guttata*	At Risk Species	Threatened	S5
Plants				
American Chaffseed	*Schwalbea americana*	Endangered		
Bog Asphodel	*Narthecium americanum*	Candidate		SNR
Boykin's Iobella	*Lobelia boykinii*	At Risk Species		
Canby's Dropwort	*Oxypolis canbyi*	Endangered		
Carolina-birds-in-a-nes	*Macbridea caroliniana*	At Risk Species		
Carolina Bishopweed	*Ptilimnium ahlesii*	At Risk Species		
Ciliate-leaf Tickseed	*Coreopsis integrifolia*	At Risk Species		
Pondberry	*Lindera melissifolia*	Endangered		
Raven's Seedbox	*Ludwigia ravenii*	At Risk Species		
Sun-facing Coneflower	*Rudbeckia heliopsidis*	At Risk Species		

Table 12: Definitions of state rankings of threatened and endangered species.[122]

State Rank	Definition
S1	**Critically Imperiled**: Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S2	**Imperiled**: Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
S3	**Vulnerable**: Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4	**Apparently Secure**: Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5	**Secure**: Common, widespread, and abundant in the nation or state/province.
SNR	**Unranked**: Nation or state/province conservation status not yet assessed.
?	Inexact or Uncertain: Denotes inexact or uncertain numeric rank. (The ? qualifies the character immediately preceding it in the S-rank.)

When a species is proposed for listing as endangered or threatened under the Endangered Species Act, the USFWS and NOAA's National Marine Fisheries Service must consider whether there are areas of habitat believed to be essential to the species' conservation. Those areas may be proposed for designation as critic habitat.[123] South Carolina contains designated critical habitat for four species including the Loggerhead Sea Turtle, Carolina Heelsplitter, Frosted Flatwoods Salamander, and the Piping Plover. In June 2016, NOAA issued two proposed rules to designate critical habitat for five distinct population segments of federally listed Atlantic sturgeon. Two of these distinct population segments, the Carolinas and South Atlantic, occur in South Carolina.[124] The Edisto River, which runs along the southern border of

[122] SCDNR. *State Rank - NatureServe National (N) and Subnational (S) Conservation Status Rank Definitions*. Retrieved June 2016 from http://www.dnr.sc.gov/species/staterank.html

[123] USFWS. (2016). Listing and Critical Habitat. Retrieved November 2016 from https://www.fws.gov/endangered/what-we-do/critical-habitats.html

[124] NOAA, National Marine Fisheries Service. (2016). *NOAA issues proposed rules designating critical habitat for Atlantic sturgeon.* Retrieved November 2016 from http://www.nmfs.noaa.gov/mediacenter/2016/June/02_06_atl_sturgeon_ctitical_habitat.html

Dorchester County, is included in the Carolinas distinct population segment. Figure 38 illustrates designated and proposed critical habitat in South Carolina. [125,126]

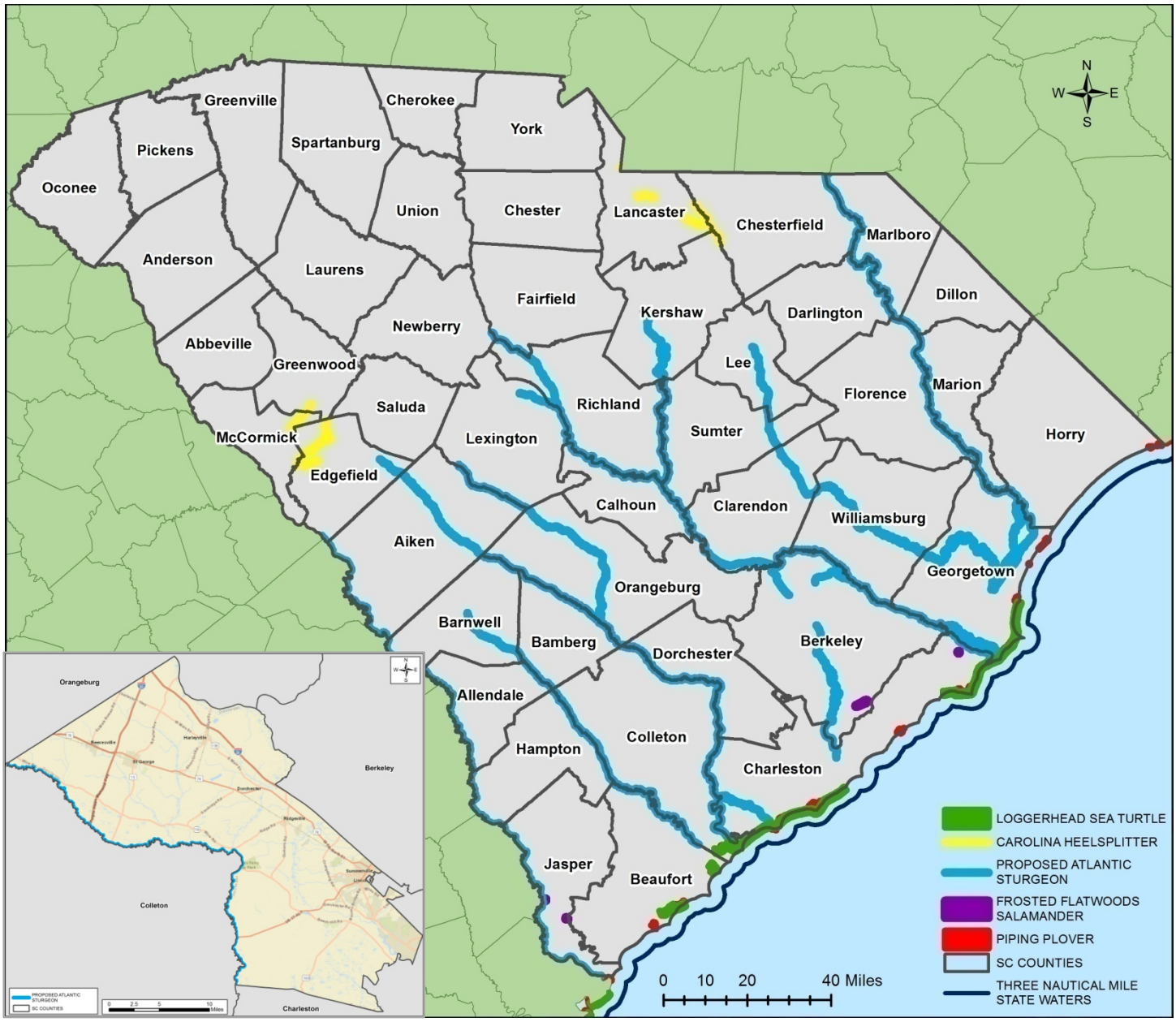

Figure 38: Designated and proposed critical habitat in South Carolina and Dorchester County.[127, 128]

[125] USFWS. Designated Critical Habitat for Carolina Heelsplitter, Frosted Flatwoods Salamander and Piping Plover. Retrieved July 2016 from http://ecos.fws.gov/ecp/report/table/critical-habitat.html

[126] NOAA, National Marine Fisheries Service. Proposed Critical Habitat for Atlantic Sturgeon and Loggerhead Sea Turtle. Retrieved July 2016 from http://sero.nmfs.noaa.gov/maps_gis_data/protected_resources/critical_habitat/index.html

[127] USFWS. Designated Critical Habitat for Carolina Heelsplitter, Frosted Flatwoods Salamander and Piping Plover. Retrieved July 2016 from http://ecos.fws.gov/ecp/report/table/critical-habitat.html

[128] NOAA, National Marine Fisheries Service. Proposed Critical Habitat for Atlantic Sturgeon and Loggerhead Sea Turtle. Retrieved July 2016 from http://sero.nmfs.noaa.gov/maps_gis_data/protected_resources/critical_habitat/index.html

Cultural and Historical Resources

The South Carolina Department of Archives and History (SCDAH) is an independent state agency whose mission is to preserve and promote the documentary and cultural heritage of South Carolina. The State Historic Preservation Office (SHPO), a program of the SCDAH, encourages and facilitates the responsible stewardship of South Carolina's historic and prehistoric places. SCDAH maintains an inventory of culturally and historically significant sites. Figure 39 is a density map of SCDAH inventoried cultural resources in South Carolina and Dorchester County.[129]

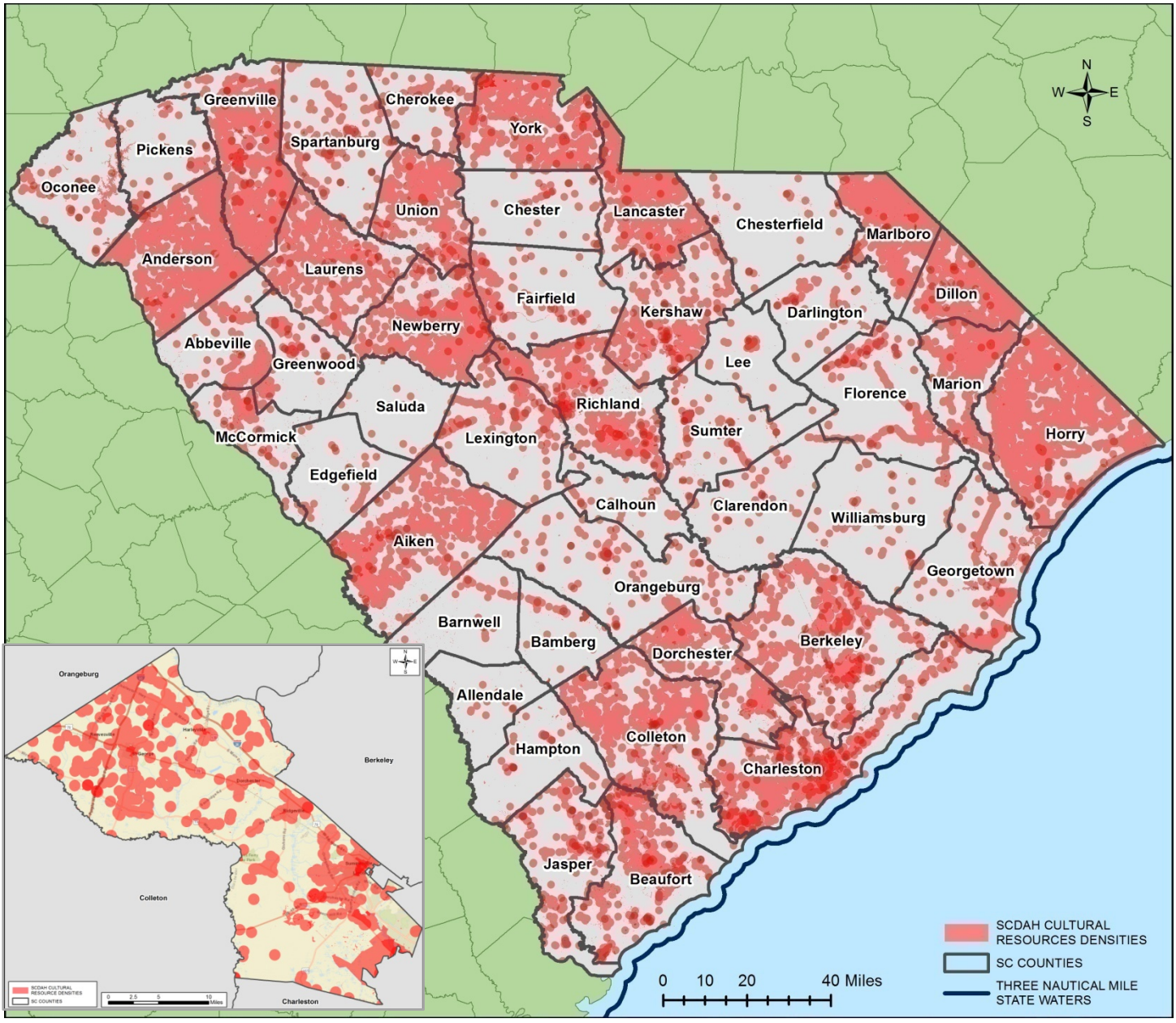

Figure 39: Cultural resources density map for South Carolina and Dorchester County.[130]

[129] SCDAH. Cultural Resources Data Received by mail November 2016.
[130] Ibid.

Table 13 includes select preservation program statistics for Dorchester County and the other seven coastal counties.[131] Dorchester County has 407 recorded archaeological sites and nearly 1,700 historic sites that have been surveyed.

Table 13: Selected preservation program statistics for the eight coastal counties.[132]

County	Statewide Survey Sites	County surveyed (1986 – 2015)	Historical Markers	National Register of Historic Places (# of districts)	National Historic Landmarks	Archaeology Sites	African American Sites
Dorchester	***1,695***	***Y***	***21***	***12 (2)***	***1***	***407***	***5***
Beaufort	4,708	Y	55	72 (4)	5	2,289	48
Berkeley	1,537	Y	70	25 (5)	5	2,608	11
Charleston	9,883	Y	92	186 (16)	42	2,400	60
Colleton	1,771	Y	21	9 (2)	0	363	3
Georgetown	2,650	Y	60	38 (4)	3	584	17
Horry	4,672	Y	27	30 (5)	0	570	8
Jasper	488	Y	25	9 (0)	0	608	2

The National Register of Historic Places (NRHP) is a list of properties significant in our nation's past, which is maintained in Washington, D.C., by the National Park Service. Properties are added to the list by nominations submitted by citizens nationwide through SHPOs. South Carolina has over 1,500 listings in the NRHP. This includes over 185 historic districts.[133] There are 12 sites in Dorchester County that are on the NRHP. Two of these sites are also classified as historic districts, and one site is a National Historic Landmark (Table 14).[134]

Table 14: List of sites in Dorchester County on the National Register of Historic Places including Historic Districts and National Historic Landmarks.[135]

Site Name	National Register of Historic Places	Historic District	National Historic Landmark
Appleby's Methodist Church	✓		
Ashley River Historic District	✓	✓	
Ashley River Road	✓		
Carroll Place	✓		
Cypress Methodist Camp Ground	✓		
Indian Fields Methodist Campground	✓		
Middleton Place	✓		✓
Newington Plantation	✓		
Old Dorchester	✓		
Old White Meeting House Ruins and Cemetery	✓		
St. Paul Camp Ground	✓		
Summerville Historic District	✓	✓	

[131] SCDAH, State Historic Preservation Office. Personal communication. May 31, 2016.
[132] Ibid.
[133] SC Dept. of Archives and History, State Historic Preservation Office. *National Register of Historic Places.* Retrieved June 2016 from http://shpo.sc.gov/programs/natreg/Pages/default.aspx
[134] SC Dept. of Archives and History, State Historic Preservation Office. *The National Register of Historic Places: National Register Sites in Dorchester County,* SC. Retrieved June 2016 from http://www.nationalregister.sc.gov/dorchester/nrdorchester.htm
[135] Ibid.

Appendix 1: Policy Goals and Objectives of the S.C. Coastal Zone Management Program

Excerpted from the Coastal Management Program Document, Chapter III

Goal: Development of a management program that will achieve a rational balance between economic development and environmental conservation of natural resources in the Coastal Zone of South Carolina.

Objectives:

1. To protect and conserve coastal land and water areas of a significant resource value, including those of scientific, geologic, hydrologic and biologic importance.
2. To encourage and assist in research pertaining to coastal natural resource systems and economic and social impacts in order to develop a comprehensive data base to aid in making rational decisions.
3. To protect and sustain the unique character of life on the coast that is reflected in its cultural, historical, archeological, and aesthetic values.
4. To promote increased recreational opportunities in coastal areas and increased public access to tidal waters in a manner which protects the quality of coastal resources and public health and safety.
5. To develop and institute a comprehensive beach erosion policy that identifies critical erosion areas, evaluates the long-term costs and benefits of erosion control techniques, seeks to minimize the effects on natural systems (both biological and physical), and avoids damage to life and property.
6. To encourage new coastal development to locate in existing developed areas, capable of accommodating additional growth, and in areas determined to be more environmentally and economically suitable for development.
7. To resolve existing use conflicts and minimize potential conflicts among activities through improved coastal management reflecting the public's desires, natural resource capacity, and expected costs and benefits.
8. To encourage new water-dependent activities to locate in shoreline areas where adverse social, economic and environmental impacts can be minimized and to encourage the inland siting of facilities which are not water-dependent.
9. To promote employment of thorough assessments of probable energy benefits, positive and negative economic effects and probable social and environmental impacts as the basis for decisions on development of energy resources; and to ensure that affected local governments obtain sufficient financial and technical assistance to adequately cope with these impacts.
10. To support the wise commercial development of harbors, rivers and waterways for trade and commerce in locations and using methods which maintain the natural environmental integrity of the coastal region.
11. To protect and, where possible, to restore or enhance the resources of the State's Coastal Zone for this and succeeding generations.
12. To develop a coastal program with flexibility for revision and improvement with the evolution of increased knowledge and experience in managing coastal resources.

Goal: To develop a permitting system for activities in Critical Areas of the Coastal Zone (beaches, primary sand dunes, tidelands, and coastal waters) that will serve to implement the goals and objectives of the management program and promote the best interests of all citizens of South Carolina.

Objectives:

1. To develop and implement a streamlined and simplified permitting system for activities in Critical Areas which maintains the integrity and purpose of the management program.

2. To include conditions and stipulations in permits for activities approved for Critical Areas in order to minimize negative impacts on water quality, marine productivity, beach and shoreline stability, and other environmental aspects.

3. To give full consideration to the Rules and Regulations for Permitting, as promulgated by the Coastal Council (DHEC), in thorough and comprehensive reviews of all permit applications.

4. To specify environmentally suitable methods of design, construction and development in Critical Areas and assist permit applicants to incorporate these environmentally suitable alternatives in their proposals.

Goal: To promote intergovernmental coordination and public participation in the development and implementation of the coastal management program for South Carolina.

Objectives:

1. To provide full opportunity for participation by relevant Federal, State, and local government agencies, concerned organizations, and the general public in the development, implementation, and updating of the Coastal Management Program.

2. To increase public awareness and encourage public participation in the development of the Coastal Council's management program and decisions made pursuant to that program.

3. To strengthen the planning and decision-making capabilities of cities and counties in the Coastal Zone through provision of financial, technical and other assistance, and provide for coordination of local comprehensive plans and ordinances with the policies and rules and regulations of the coastal management program.

4. To promote coordination and use of existing State programs to minimize duplication of efforts, conflicting actions and permit processing delays, and to achieve coastal management objectives and policies.

5. To provide adequate representation of the interests of the State of South Carolina in Federal agency decisions and actions affecting the Coastal Zone.

Appendix 2: State Coastal Zone Boundaries

State Coastal Zone Boundaries February 9, 2012	
State	**Definition Of State's Coastal Zone** (The seaward boundary of the Great Lake States is the U.S.-Canada International boundary, and for all other States is the 3 nautical mile territorial sea, except for those States marked with an asterisk (*)
Alabama	Alabama's coastal zone extends inland to the continuous 10-foot elevation contour in Baldwin and Mobile Counties.
Alaska	As of July 1, 2011, Alaska no longer has a federally approved coastal management program or defined coastal zone and federal consistency does not apply to Alaska. Contact NOAA's Office of Ocean and Coastal Resource Management for additional information.
American Samoa	American Samoa's coastal zone is the entire Territory.
California & BCDC	California's coastal zone generally extends 1,000 yards inland from the mean high tide line. In significant coastal estuarine habitat and recreational areas it extends inland to the first major ridgeline or 5 miles from the mean high tide line, whichever is less. In developed urban areas, the boundary is generally less than 1,000 yards. The coastal zone for the San Francisco Bay Conservation and Development Commission (BCDC) includes the open water, marshes and mudflats of greater San Francisco Bay, and areas 100 feet inland from the line of highest tidal action. The boundary also includes: the Suisun marsh and buffer zone: managed wetlands diked off from the Bay; and open waters diked off from the Bay and used in salt production.
Connecticut	Connecticut's coastal zone has two tiers incorporated within the 36 coastal townships. The first tier is bounded by a continuous line delineated by a 1,000 foot linear setback measured from the mean high water mark in coastal waters; or a 1,000 foot linear setback measured from the inland boundary of state regulated tidal wetlands; or the continuous interior contour elevation of the one hundred year frequency coastal flood zone; whichever is farthest inland. The second tier is the area between the inland boundary of the 36 coastal communities and the inland boundary of the first tier.
Delaware	Delaware's coastal zone includes the whole state.
Florida *	Florida's coastal zone is the entire State, but has two tiers. Local governments eligible to receive coastal management funds are limited to those Gulf and Atlantic coastal cities and counties which include or are contiguous to state water bodies where marine species of vegetation constitute the dominant plant community. Florida's seaward boundary in the Gulf of Mexico is 3 marine leagues (9 nautical miles) and is 3 nautical miles in the Atlantic.
Georgia	Georgia's coastal zone includes the 11 counties that border tidally-influenced waters or have economies that are closely tied to coastal resources.
Guam	Guam's coastal zone is the entire Territory.
Hawai'i	Hawai'i's coastal zone is the entire state.
Illinois	Illinois' coastal zone has two components. The Lakeshore Boundary is based on the Lake Michigan watershed and is generally parallel to the Lake Michigan shoreline. The Inland Waterway Boundary includes Inland Waterway Corridors, which are select segments of the Chicago River system (North Branch, South Branch, Main Branch and North Shore Channel) and select segments of the Little Calumet and Grand Calumet Rivers. The Inland Waterway Corridors consist of both the waterway and designated land area to either side of the waterway.

Indiana	Indiana's coastal zone is based on watershed boundaries within coastal townships and the counties of Lake, Porter and LaPorte. To create an inland boundary that is identifiable in practical landmarks, the coastal zone boundary is described based on the U.S. Geological Survey Quadrangle maps and major roads for each county. The coastal zone boundary is located in the northern portions of Lake, Porter, and LaPorte Counties. At its widest extent, the boundary extends away from the shoreline 17 miles to the Crown Point area and at its narrowest point, less than 2 miles, just north of Hudson Lake in LaPorte County. *See* NOAA, *Indiana Lake Michigan Coastal Program and Final Environmental Impact Statement*, Appendix C (April 2002), to determine the precise coastal zone boundary in a particular area of the State.
Louisiana	Louisiana's coastal zone varies from 16 to 32 miles inland from the Gulf coast and generally follows the Intracoastal Waterway running from the Texas-Louisiana state line then follows highways through Vermilion, Iberia, and St. Mary parishes, then dipping southward following the natural ridges below Houma, then turning northward to take in Lake Pontchartrain and ending at the Mississippi-Louisiana border.
Maine	Maine's coastal zone includes the inland line of coastal towns on tidewaters and all islands.
Maryland	Maryland's coastal zone extends to the inland boundary of the 16 counties bordering the Atlantic Ocean, the Chesapeake Bay, and the Potomac River (as far as the municipal limits of Washington, D.C), and includes Baltimore City and all local jurisdictions within the counties.
Massachusetts	Massachusetts' coastal zone extends 100 feet inland of specified major roads, RR tracks, or other visible right of ways which are located within a half mile of coastal waters or salt marshes. The coastal zone includes all islands, transitional and intertidal areas, and coastal wetlands and beaches. In instances where the road boundary excludes significant resource areas, the boundary line may depart from the road to encompass.
Michigan	Michigan's coastal zone, generally, extends a minimum of 1,000 feet from the ordinary high water mark. The boundary extends further inland in some locations to encompass coastal lakes, rivermouths, and bays; floodplains; wetlands; dune areas; urban areas; and public park, recreation, and natural areas.
Minnesota	Minnesota's coastal zone is divided into three areas. The first includes the area of the St. Louis River in Carlton County, south of Duluth. The second is the city of Duluth and surrounding areas of urban growth and expansion to the north and west. The third is the region between the Duluth city limits north to the Canadian border, also known as the "North Shore," which includes portions of St. Louis, Lake, and Cook Counties. *See* NOAA, *Minnesota's Lake Superior Coastal Program Final Environmental Impact Statement*, Chapter One, (May 1999), to determine the precise coastal zone boundary in a particular area of the State.
Mississippi	Mississippi's coastal zone includes the 3 counties adjacent to the coast. The coastal zone includes these counties, as well as all adjacent coastal waters. Included in this definition are the barrier islands of the coast.
New Hampshire	New Hampshire's coastal zone is the 17 coastal municipalities.
New Jersey	New Jersey's coastal zone recognizes four distinct regions of the State and treats them separately. From the New York border to the Raritan Bay, the boundary extends landward from mean high water to the first road or property line. From the Raritan Bay south along the Atlantic shoreline and up to the Delaware Memorial Bridge, the boundary extends from half a mile to 24 miles inland (1,376 square miles of land area). From the Delaware Memorial Bridge northward up the Delaware River to Trenton, the boundary extends landward to the first road inclusive of all wetlands. The fourth boundary serves a 31-mile square area in the northeast corner of the state bordering the Hudson river (New Jersey Meadowlands Commission).

New York	New York's coastal zone varies from region to region while incorporating the following conditions: The inland boundary is approximately 1,000 feet from the shoreline of the mainland. In urbanized and developed coastal locations the landward boundary is approximately 500 feet from the mainland's shoreline, or less than 500 feet where a roadway or railroad line runs parallel to the shoreline at a distance of under 500 feet and defines the boundary. In locations where major state-owned lands and facilities or electric power generating facilities abut the shoreline, the boundary extends inland to include them. In some areas, such as Long Island Sound and the Hudson River Valley, the boundary may extend inland up to 10,000 feet to encompass significant coastal resources, such as areas of exceptional scenic value, agricultural or recreational lands, and major tributaries and headlands.
North Carolina	North Carolina's coastal zone includes the 20 counties that in whole or in part are adjacent to, adjoining, intersected by or bounded by the Atlantic Ocean or any coastal sound(s). Within this boundary, there are two tiers. The first tier is comprised of Areas of Environmental Concern (AEC) and is subject to more thorough regulatory controls. AECs include: coastal wetlands, estuarine waters, public trust areas, estuarine shorelines, ocean beaches, frontal dunes, ocean erosion areas, inlet lands, small surface water supply watersheds, pubic water supply well-fields, and fragile natural resource areas. The second tier includes land uses which have potential to affect coastal waters even though they are not located in AECs.
Northern Mariana Islands	Northern Mariana Islands' coastal zone is the entire Commonwealth. (Note: a recent federal court decision ruled that the Commonwealth does not own the adjacent territorial sea. A consent decree allows the CNMI to manage the area.)
Ohio	Ohio's coastal zone includes portions of 9 counties bordering Lake Erie and its tributaries and varies depending on biophysical characteristics of various coastal regions– in the western part of the coast the boundary extends inland up to 15 miles along certain low lying wetland and floodplain areas; in most of the eastern part of the State, areas with high bluffs, the boundary extends inland for only about an eighth of a mile, with the exception of the Mentor Marsh area.
Oregon	Oregon's coastal zone extends inland to the crest of the coastal range, except for the following: along the Umpqua River, where it extends upstream to Scottsburg; along the Rogue River, where it extends upstream to Agness; and except in the Columbia River Basin, where it extends upstream to the downstream end of Puget Island.
Pennsylvania	Pennsylvania's coastal zone along Lake Erie varies from 900 feet in urban areas to over 3 miles in more rural areas, and encompasses the floodplains of Lake Erie and tributary streams, bluff hazards recession areas, and coastal wetlands. The coastal zone along the Delaware River Estuary extends inland to 660 feet in urbanized areas, to 3.5 miles in rural areas, and includes floodplains of the Delaware and Schuykill Rivers and their tributaries to the upper limit of tidal influence, and tidal and freshwater wetlands.
Puerto Rico *	Puerto Rico's coastal zone, generally, extends 1,000 meters inland; however, it extends further inland in certain areas to include important coastal resources. Puerto Rico's seaward boundary is 3 marine leagues (9 nautical miles).
Rhode Island	Rhode Island's coastal zone includes the whole state. However, the inland extent of the regulatory authority of the State's CZMA agency is 200 feet inland from any coastal feature, to watersheds, and to certain activities that occur anywhere within the State that include: power-generating plants; petroleum storage facilities; chemical or petroleum processing; minerals extraction; sewage treatment and disposal plants; solid waste disposal facilities; and, desalination plants.
South Carolina	South Carolina's coastal zone includes all lands and waters in the counties which contain any one or more of the critical areas (coastal waters, tidelands, beaches, and primary oceanfront sand dunes).
Texas *	Texas' coastal zone is generally the area seaward of the Texas coastal facility designation line which roughly follows roads that are parallel to coastal waters and wetlands generally within one mile of tidal rivers. The boundary encompasses all or portions of 18 coastal counties. Texas' seaward boundary is 3 marine leagues (9 nautical miles).

Virginia	Virginia's coastal zone includes the 29 counties, 17 cities, and 42 incorporated towns of Tidewater Virginia, including the Atlantic Coast watershed and portions of the Chesapeake Bay and Albemarle-Pamlico Sound watersheds.
Virgin Islands	Virgin Islands' coastal zone includes the entire territory.
Washington	Washington's coastal zone is the 15 coastal counties that front saltwater.
Wisconsin	Wisconsin's coastal zone is the 15 counties that front Lake Superior, Lake Michigan, or Green Bay.

Appendix 3: Federal Consistency Programs that Operate In and Outside of the Coastal Zone

1. **Consistency for Federal Assistance to State and Local Governments (Federal Assistance - FA)**

   Department of Agriculture: Soil Conservation Service

   Department of Commerce: Economic Development Administration – Economic Development Planning Grants; Economic Development Grants for Public Works and Development Facilities.

   Department of Energy: State Energy Conservation Program.

   Department of Housing and Urban Development: Housing Assistance, Mortgage Insurance, Community Development Block Grants, and Section 701 Planning Assistance Grants.

   Department of Interior: Heritage Conservation and Recreation Service – Land and Water Conservation Fund, Fish & Wildlife Service.

   Department of Transportation: Federal Aviation Administration – Airport Development Aid Program; Federal Highway Administration – Federal Aid Highway Program; Urban Mass Transportation Administration - Urban Mass Transportation Grants.

   Environmental Protection Agency: Air Pollution Control Program Grants, Construction Grants for Wastewater Treatment Works, and State and Interstate Program Grants for Water Pollution Control.

2. **Consistency for Federal Agency Activities (Direct Federal Activities – DFA)**

   Department of Agriculture – Forest Service: Construction or silviculture activities.

   Department of Agriculture – Soil Conservation Service: Planning and management activities

   Department of Defense - Army Corps of Engineers, Air Force, Army and Navy: Navigation projects; maintenance dredging; shoreline protection projects; beach nourishment; other public works projects with the potential to impact coastal lands and waters; construction -of docks, piers, bulkheads, mooring dolphins, etc; construction or maintenance of sewage or drainage ditches or canals located in coastal waters or wetlands; location, acquisition and design of new or enlarged defense installations; actions conducted on Federal lands with potential impact on coastal lands and waters.

   Department of Energy: Demonstration projects for the production of energy; the underwriting of the conversion of existing dams to small-scale hydroelectric projects.

   Department of Homeland Security - U.S. Coast Guard: Construction of docking facilities and navigation approaches with the exception of Coast Guard maintained or authorized aids to, navigation; Construction of Coast Guard bases, facilities and installations; Any activity related to oil spill or other clean-up operations which involves permanent alteration of a Critical Area.

   Department of the Interior - Fish & Wildlife Service: Construction and/or maintenance of waterfowl impoundments; construction and/or maintenance of docking facilities and navigation approaches; construction and/or maintenance of shoreline protection project; proposed acquisition of wildlife refuges.

Department of the Interior - National Park Service: Proposed acquisition of national parks and seashores and national park and seashore management activities; preservation of historic and cultural sites.

Department of the Interior - Bureau of Land Management: OCS Pre-lease sale activities (*e.g.,* tract selection, stipulations).

Department of Transportation - Federal Highway Administration: Construction of roads, bridges or rights-of-way in the Coastal Zone.

General Services Administration: Location and design of proposed Federal government property acquisition and building construction; Disposal of surplus Federal lands.

3. Consistency for Outer Continental Shelf Exploration, Development and Production Activities (OCS) Permits

Department of Defense - Army Corps of Engineers: permits related to the installation of platforms, pipelines, artificial islands, fixed structures, navigation and free floating structures and the transportation and disposal of dredged or fill material.

Department of Interior - Bureau of Ocean and Energy Management: geological and geophysical exploration.

Department of Interior - Bureau of Land Management and Department of Transportation - Materials Transportation Bureau: construction of common carrier pipelines.

Department of the Interior – Bureau of Ocean Energy Management: drilling and construction of flow and gathering lines required by the Geological Survey.

Environmental Protection Agency: permits related to discharges of pollutants from fixed platforms and structures and/or dumping of non-dredged material.

4. Consistency for Activities Requiring a Federal Permit or License (FPL)

Department of Defense - Army Corps of Engineers: Discharge of dredged or fill: material in navigable waters; obstructions or alterations in navigable waters, transportation of dredged material in navigable water.

Department of Energy: Siting and operation of nuclear and fossil fuel power plants and transmission lines; Construction and operation of facilities needed to import or export natural gas; Construction and operation of facilities used in interstate gas transportation; Construction and operation of interstate gas pipelines, both onshore and offshore; Construction and operation of LNG import/export marine terminals pursuant to the Natural Gas Act; Construction and operation of natural gas pipelines, transportation and storage facilities pursuant to the Natural Gas Act; Construction and operation of non-federal hydroelectric power projects.

Department of Homeland Security - Coast Guard: Construction and operation of deepwater ports; construction of bridges over navigable waters.

Environmental Protection Agency: Dumping material other than dredged material in navigable waters.

Federal Energy Regulatory Commission: Non-Federal hydroelectric projects and associated transmission lines; interconnection of electric transmission facilities; construction and operation of natural gas pipeline facilities, defined to include both interstate pipeline and terminal facilities; abandonment of natural gas pipeline facilities.

Department of Transportation: Construction or alteration of airports, transportation of liquids (other than petroleum products) by pipeline.

Nuclear Regulatory Commission: Construction and operation of nuclear facilities and the possession and use of byproduct, source and special nuclear material.

5. Consistency for Federal Activities Having Interstate Coastal Effects (ISC)

Interstate Coastal Effect means any reasonably foreseeable effect resulting from a federal action (four listed above) occurring in one State of the United States on any coastal use or resource of another State that has a federally approved management program.

Appendix 4: Species Lists for Dorchester County

SCDNR Rare, Threatened, and Endangered Species and Communities Known to Occur in Dorchester County, SC June 11, 2014					
Scientific Name	**Common Name**	**USESA Designation**	**State Protection**	**Global Rank**	**State Rank**
Vertebrate Animals					
Clemmys guttata	Spotted Turtle		ST: Threatened	G5	S5
Condylura cristata	Star-nosed Mole			G5	S3?
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat		SE: Endangered	G3G4	S2?
Elanoides forficatus	American Swallow-tailed Kite	SC: Sp. of Concern	SE: Endangered	G5	S2
Gopherus polyphemus	Gopher Tortoise	C: Candidate	SE: Endangered	G3	S1
Haliaeetus leucocephalus	Bald Eagle		ST: Threatened	G5	S2
Heterodon simus	Southern Hognose Snake			G2	SNR
Limnothlypis swainsonii	Swainson's Warbler			G4	S4
Myotis austroriparius	Southeastern Bat			G3G4	S1
Neotoma floridana floridana	Eastern Woodrat			G5T5	S3S4
Picoides borealis	Red-cockaded Woodpecker	LE: Endangered	SE: Endangered	G3	S2
Pseudacris feriarum	Upland Chorus Frog			G5	S5
Rana capito	Gopher Frog		SE: Endangered	G3	S1
Sterna antillarum	Least Tern		ST: Threatened	G4	S3
Animal Assemblage					
Waterbird Colony	GNR	SNR			
Vascular Plants					
Agalinis tenella				G4Q	SNR
Asplenium resiliens	Black-stem Spleenwort			G5	S1
Carex basiantha	Widow Sedge			G5	S2
Carex cherokeensis	Cherokee Sedge			G4G5	S2
Carex granularis	Meadow Sedge			G5	S2
Carex oligocarpa	Eastern Few-fruit Sedge			G4	SNR
Coreopsis gladiata	Southeastern Tickseed			G4G5	SNR
Eleocharis vivipara	Viviparous Spike-rush			G5	S1
Epidendrum conopseum	Green-fly Orchid			G4	S3?

Ilex amelanchier	Sarvis Holly			G4	S3
Listera australis	Southern Twayblade			G4	S2
Magnolia macrophylla	Bigleaf Magnolia			G5	S1
Menispermum canadense	Canada Moonseed			G5	S2S3
Narthecium americanum	Bog Asphodel	C: Candidate		G2	SH
Pilea fontana	Springs Clearweed			G5	SNR
Plantago sparsiflora	Pineland Plantain			G3	S2
Ponthieva racemosa	Shadow-witch Orchid			G4G5	S2
Pteroglossaspis ecristata	Crestless Plume Orchid			G2G3	S2
Trillium pusillum var. pusillum	Least Trillium			G3T2	S1
Xyris stricta	Pineland Yellow-eyed Grass			G4	S1
Communities					
Bald cypress - tupelo gum swamp				G5	S4
Bottomland hardwoods				G5	S4
Depression meadow				G3	S2
Fagus grandifolia - quercus alba - (*acer barbatum*) / mixed herbs forest	Atlantic Coastal Plain Mesic Mixed Hardwood Forest			G4	SNR
Non-alluvial swamp forest				G5	S4S5
Pine flatwoods				G5	S3S4
Pine savanna				G3	S2
Pocosin				G3G4	S3S4
Pond cypress pond				G4	S4
Pond pine woodland				G4G5	S3
Southern mixed hardwood forest				GNR	S1
Spruce pine - mixed hardwood forest				G3	S2
Streamhead pocosin				G4	S4
Swamp tupelo pond				G3	S3
Upland pine - wiregrass woodland				G3	S3
Geological					
Calcareous cliff				G3?	S1S2
Carolina bay				GNR	SNR

USFWS South Carolina List of At-Risk, Candidate, Endangered, and Threatened Species - Dorchester County				February 10, 2015
CATEGORY	**COMMON NAME/ STATUS**	**SCIENTIFIC NAME**	**SURVEY WINDOW/ TIME PERIOD**	**COMMENTS**
Amphibian	Gopher frog (ARS)	*Lithobates capito*	Breeding: October-March	Call survey: February-April
Bird	American wood stork (T)	*Mycteria americana*	February 15-September 1	Nesting season
	Bald eagle (BGEPA)	*Haliaeetus leucocephalus*	October 1-May 15	Nesting season
	Red-cockaded woodpecker (E)	*Picoides borealis*	April 1-July 31	Nesting season
Crustacean	**None Found**			
Fish	American eel (ARS)	*Anguilla rostrata*	March 1-May 30; October 1-December 15	Temperature dependent: normally (17-20oC); can be found between 13-25oC
	Atlantic sturgeon* (E)	*Acipenser oxyrinchus**	February 1-April 30	Spawning migration
	Blueback herring (ARS)	*Alosa aestivalis*	Mid-January-mid May	Peak: March-April
	Shortnose sturgeon* (E)	*Acipenser brevirostrum**	February 1-April 30	Spawning migration
Insect	**None Found**			
Mammal	Rafinesque's big-eared bat (ARS)	*Corynorthinus rafinesquii*	Year round	Found in mines, caves, large hollow trees, buildings, and bat towers
	Tri-colored bat (ARS*)	*Perimyotis subflavus*	Year round	Found in mines and caves in the winter
Mollusk	**None Found**			
Plant	American chaffseed (E)	*Schwalbea americana*	May-August	1-2 months after a fire
	Bog asphodel (ARS*)	*Narthecium americanum*	June-July	
	Boykin's lobelia (ARS)	*Lobelia boykinii*	May-July/August	
	Canby's dropwort (E)	*Oxypolis canbyi*	Mid-July-September	
	Carolina-birds-in-a-nest (ARS)	*Macbridea caroliniana*	July-November	
	Carolina bishopweed (ARS)	*Ptilimnium ahlesii*	May-July	
	Ciliate-leaf tickseed (ARS)	*Coreopsis integrifolia*	August-November	
	Pondberry (E)	*Lindera melissifolia*	February-March	
	Raven's seedbox (ARS)	*Ludwigia ravenii*	June-October	
	Sun-facing coneflower (ARS)	*Rudbeckia heliopsidis*	July-September	
Reptile	Eastern diamondback rattlesnake (ARS)	*Crotalus adamanteus*	Most of the year	Peak: April-November
	Southern hognose snake (ARS)	*Heterdon simus*	Most of the year	
	Spotted turtle (ARS)	*Clemmys guttata*	February-mid April	

* Contact National Marine Fisheries Service (NMFS) for more information on this species

**	The U.S. Fish and Wildlife Service (FWS) and NMFS share jurisdiction of this species
ARS	Species that the FWS has been petitioned to list and for which a positive 90-day finding has been issued (listing may be warranted); information is provided only for conservation actions as no Federal protections currently exist.
ARS*	Species that are either former Candidate Species or are emerging conservation priority species
BGEPA	Federally protected under the Bald and Golden Eagle Protection Act
C	FWS or NMFS has on file sufficient information on biological vulnerability and threat(s) to support proposals to list these species
CH	Critical Habitat
E	Federally Endangered
P or P - CH	Proposed for listing or critical habitat in the Federal Register
S/A	Federally protected due to similarity of appearance to a listed species
T	Federally Threatened

These lists should be used only as a guideline, not as the final authority. The lists include known occurrences and areas where the species has a high possibility of occurring. Records are updated as deemed necessary and may differ from earlier lists.

For a list of State endangered, threatened, and species of concern, please visit https://www.dnr.sc.gov/species/index.html