

# Sea Level Rise Adaptation Report Beaufort County, South Carolina

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## Executive Summary

March 2015

*S.C. Sea Grant Consortium Product # SCSGC-T-15-02*



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## Acknowledgements

This report is the collaborative effort of stakeholders in Beaufort County, South Carolina, and a project team consisting of the Beaufort County Planning Department, South Carolina Sea Grant Consortium, Social and Environmental Research Institute, North Carolina Sea Grant, and Carolinas Integrated Sciences and Assessments program at the University of South Carolina. The project team assembled a Beaufort County Stakeholder Group, which met five times from August 2013 to November 2014. This group of local decision makers learned about sea level rise and the impacts to Beaufort County and discussed possible actions to increase the County's resiliency. The group drew heavily upon the local knowledge and experience of its members, and also reached out to colleagues and engaged a larger audience in two public workshops. The project team drafted this report with frequent consultation with the Stakeholder Group.

This project was sponsored by the S.C. Sea Grant Consortium pursuant to the National Oceanic and Atmospheric Administration's [National Sea Grant Office Community Climate Change Adaptation Initiative](#) Award No. NA10OAR4170073, Amendment 10. Because consultation with the Stakeholder Group began as formal academic research, the study's methodology was reviewed and approved by the [College of Charleston's](#) Institutional Review Board.<sup>1</sup> The Board requires that the identities of research subjects remain confidential unless waived. In later stages of the project, the majority of the Stakeholder Group chose to identify their affiliated organization to lend their support to the importance of this project.

The project team would like to thank the Beaufort County Stakeholder Group for their time, enthusiasm, and dedication to seeing this project through to completion. The project team would also like to thank all of the stakeholders who participated in interviews or workshops and provided their local knowledge and opinions to develop opportunities for Beaufort County to become more resilient to future sea level rise impacts. The College of Charleston provided several resources in support of this project, including GIS capabilities and printing services, and the South Carolina Department of Natural Resources helped facilitate the public workshops.



### Affiliations of Beaufort County Stakeholder Group Members

Beaufort County Council  
Beaufort County Planning Department  
Beaufort County School District  
Beaufort Soil & Water Conservation District  
Gullah/Geechee Sea Island Coalition  
Town of Bluffton

Beaufort County Department of Public Works  
Beaufort County Stormwater Utility  
Beaufort Group, LLC  
Coastal Conservation League  
National Stormwater Center

### Project Team

[Beaufort County Planning Department](#)  
[South Carolina Sea Grant Consortium](#)  
[Social and Environmental Research Institute](#)  
[North Carolina Sea Grant](#)  
[Carolinas Integrated Sciences and Assessments](#)



<sup>1</sup> College of Charleston. 2014. "Office of Research & Grants Administration." [http://orga.cofc.edu/pub/compliance\\_irb\\_index.shtml](http://orga.cofc.edu/pub/compliance_irb_index.shtml)



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## Introduction

Beaufort County, South Carolina, is a low-lying coastal county with a high sensitivity to tidal flooding and storm surge. Just over half of Beaufort County is open water, sounds, marshes, and estuaries and two thirds of its dry land is located within a flood zone. Given these vulnerabilities, community leaders pressed for the inclusion of sea level rise as an issue to consider in the [2010 Beaufort County Comprehensive Plan](#). The Plan calls for the County government to anticipate and plan for sea level rise impacts.

In response, the Beaufort County Planning Department joined with the project team to investigate opportunities for the County to adapt, or increase its capacity to adapt, to future sea level rise impacts. Adaptation is the process of adjusting one's activities to a changing environment to take advantage of benefits and reduce negative effects. Adaptive capacity is the ability of a community to make those adjustments.

The project team assembled a Beaufort County Stakeholder Group, consisting of local decision makers and stakeholders, which met five times in 2013-2014 and was frequently consulted during the development of this final report. The group drew heavily upon the local knowledge and technical experience of its members, and also reached out to colleagues and engaged a larger audience in two public workshops.

This executive summary highlights the three major sections of the full report: Beaufort County's vulnerability to sea level rise and coastal flooding, stakeholder-generated adaptation actions to respond, and a final section that briefly reviews how community input was gathered. The summary puts the data front and center, whereas the full report includes far more detail, especially regarding community commentary on adaptation actions and additional information about helpful tools or actions being taken in other communities.

*With this report, Beaufort County has begun the process of preparing for sea level rise. As a next step, the Beaufort County Stakeholder Group recommends these adaptation actions be considered by the Beaufort County Regional Implementation Committees and the Beaufort County Council Natural Resources Committee.*



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## Beaufort County's Vulnerability

Local sea level has risen 6 inches since 1965, according to long-term data available at Fort Pulaski, GA, [tide gauge](#) on the Savannah River. As a result, Beaufort County experiences tidal flooding more frequently than in past decades (Figure 1). While most of these floods are minor nuisances today, the threat of major flooding is likely to increase rapidly with faster rates of sea level rise (Figure 2).

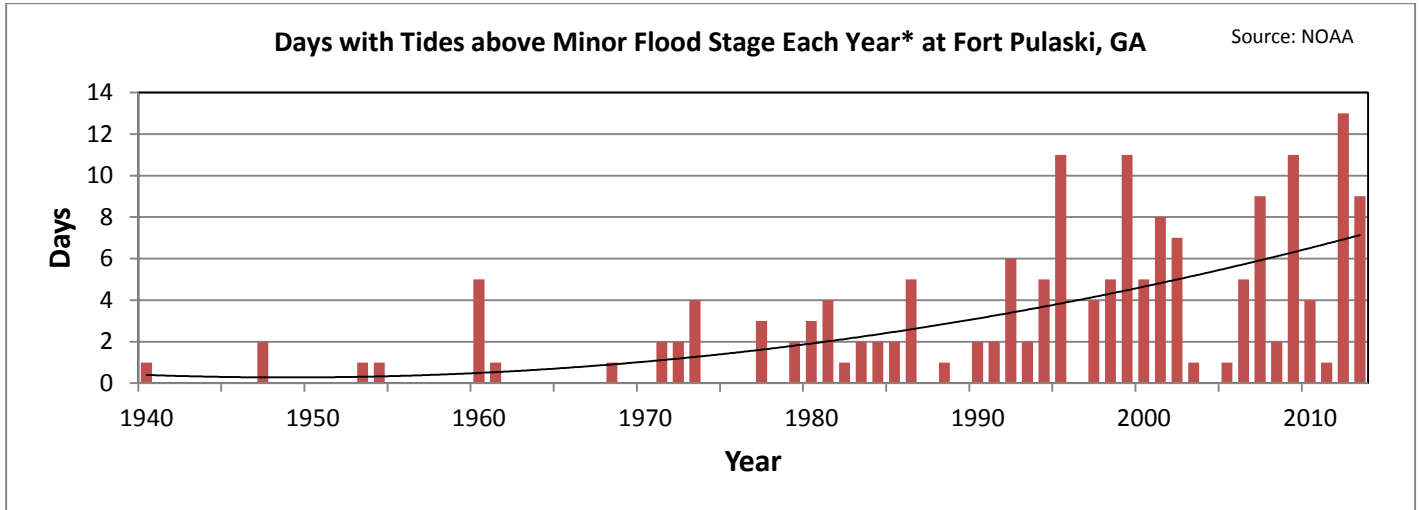


Figure 1: Extreme tides have become more common in recent decades according to tide gauge data at [NOAA Station 8670870](#) Fort Pulaski, GA. The graph displays the number of days each year when tide levels exceeded the National Weather Service [minor flood stage](#), defined as 1.7 ft. above the mean higher high tide (MHHW). The upward trend is likely due to relative sea level rise in the area (6 in. between 1965-2015). \*We use the meteorological year from May 1 to April 30 so we do not split the winter storm season.

Scientists are confident that sea level will continue to rise, but they are uncertain about the pace. They expect local sea levels to rise another 3-7 inches by 2040.

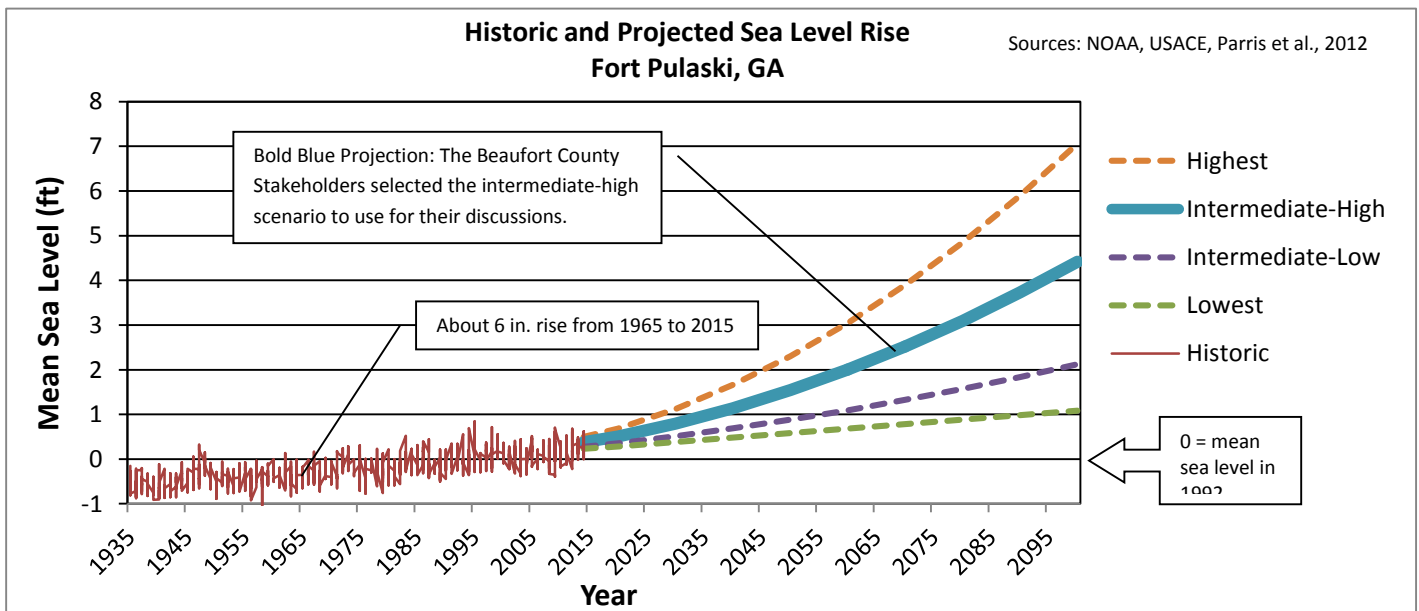


Figure 2: [Historic data](#) from the Fort Pulaski, GA, tide gauge are displayed with future [global sea level scenarios](#) provided by the U.S. National Climate Assessment and modified to incorporate the gradual sinking of the land surface in the region (land subsidence).



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## Tidal Flood Map of Beaufort County, South Carolina

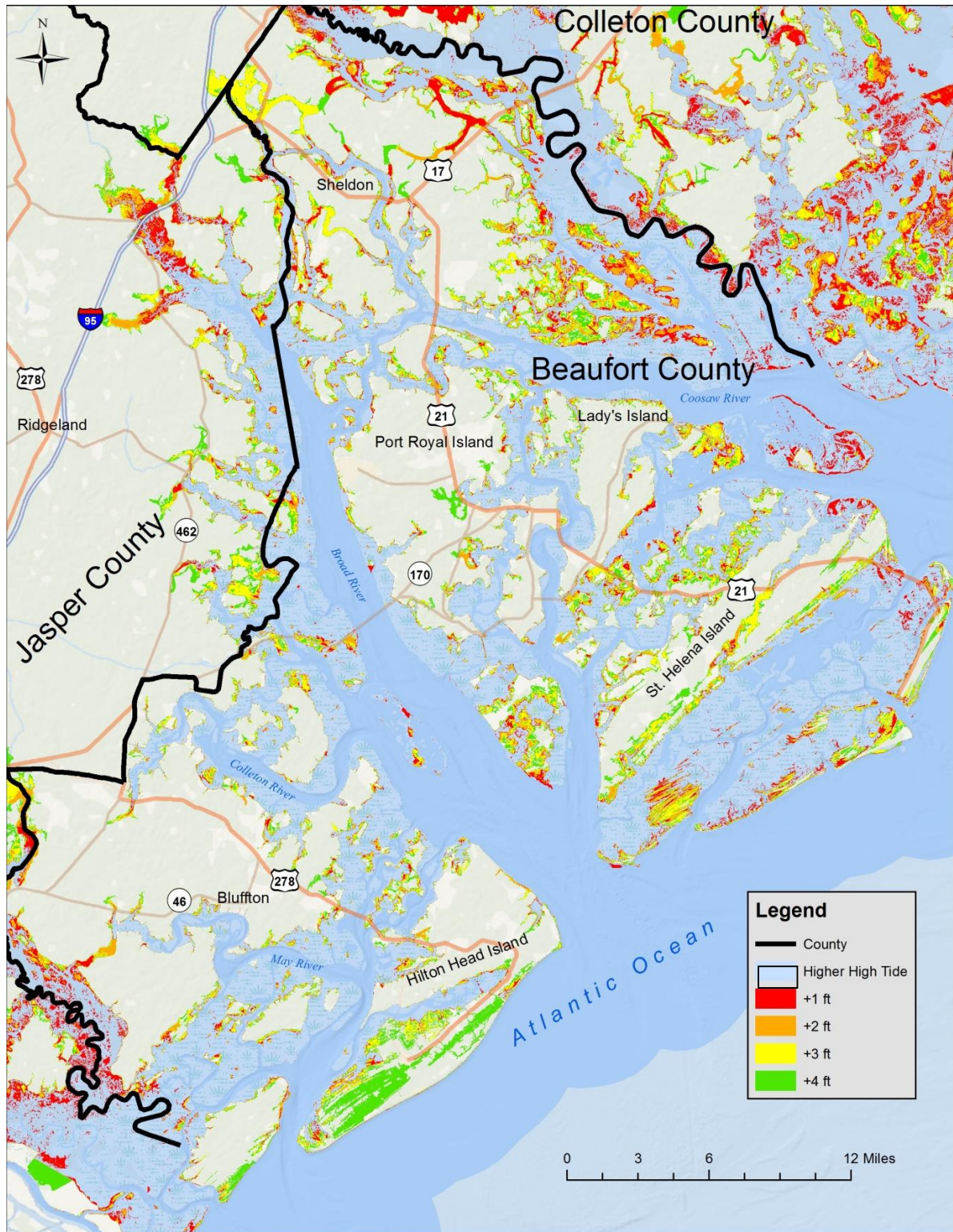


Figure 3: This flood map indicates where tidal flooding will likely occur at designated water levels above the current Mean Higher High Water mark, or the average higher high tide. Future average high tides could extend into the +1 ft. zone by 2040 and the +2 ft. zone by 2065 according to the National Climate Assessment's Intermediate-High [sea level rise scenario](#). Semi-regular [extreme tides](#) already approach the +2 ft. zone. Future extreme tides could extend into the +3 ft. zone by 2040 and the +4 ft. zone by 2065.

Sources: [NOAA](#); [Esri](#)®.



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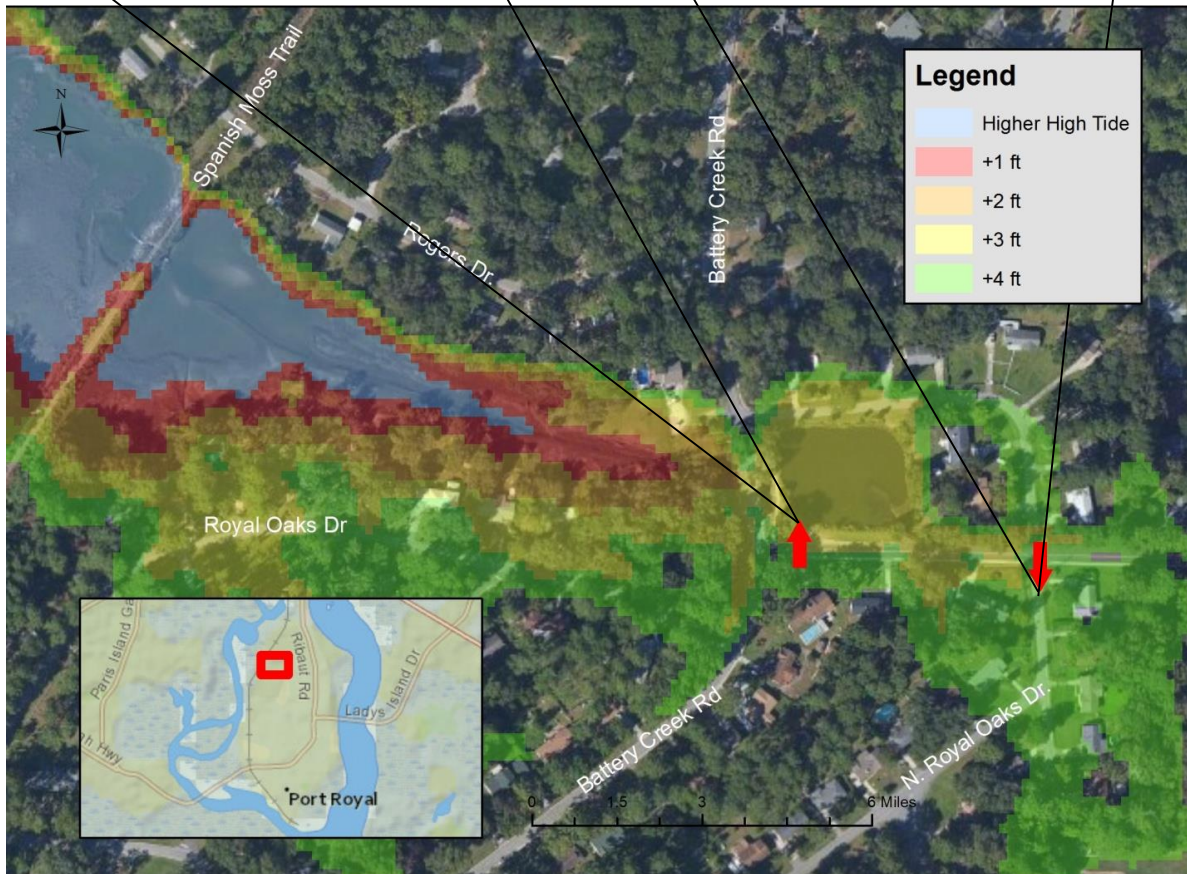
## An Example of Impact: Mossy Oaks Flooding on August 10, 2014



Credit: F. White

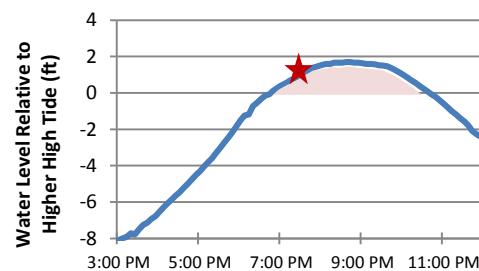


Credit: F. White



**Figure 4:** A real life example of tidal flooding occurred in the Beaufort neighborhood of Mossy Oaks on August 10, 2014. Heavy rains and exceptionally high tides combined to generate flooding in the +3-4 ft. zones. The photos above were taken at 7:30 p.m. (see red star in tide gauge data to the right), when the tide was about 1.5 ft. above the higher high tide line. The shaded area to the right identifies when the nearby water level exceeded the average higher high tide, which indicates potential flooding.

**Tide Gauge: Fort Pulaski, GA**  
**August 10, 2014**











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## Sea Level Rise Adaptation Action List

The following actions were identified by local stakeholders to help Beaufort County prepare for sea level rise.












	<p>1) Coordination, Cooperation, &amp; Collaboration</p> <p><i>1.1: Improve coordination among governments and agencies.</i></p> <p><i>1.2: Facilitate a dialogue on how to balance public and private interests/responsibilities.</i></p>
	<p>2) Education &amp; Information</p> <p><i>2.1: Develop and implement a public education campaign.</i></p> <p><i>2.2: Provide disclosure and disclaimer notice to purchasers of high risk properties.</i></p>
	<p>3) Emergency Management</p> <p><i>3.1: Incorporate future sea level rise impacts into emergency management plans.</i></p>
	<p>4) Land Management</p> <p><i>4.1: Maintain and strengthen setback policies.</i></p> <p><i>4.2: Install and encourage the use of living shorelines.</i></p> <p><i>4.3: Limit development in high risk areas.</i></p> <p><i>4.4: Use conservation to respond to sea level rise.</i></p> <p><i>4.5: Revise building codes to higher standards and incentivize better design.</i></p> <p><i>4.6: Preserve and restore ecosystems and species.</i></p> <p><i>4.7: Establish funding structures and/or tax districts to help property owners.</i></p> <p><i>4.8: Develop affordable housing in safer areas.</i></p> <p><i>4.9: Create a transfer of development rights program for low elevation properties.</i></p> <p><i>4.10: Assist with beach renourishment.</i></p>
	<p>5) Research &amp; Monitoring</p> <p><i>5.1: Identify or establish environmental monitoring programs in the area.</i></p> <p><i>5.2: Identify trigger points for changing policy.</i></p>
	<p>6) Social Adaptation</p> <p><i>6.1: Address the impacts on disadvantaged social groups, values, and symbolic places.</i></p>
	<p>7) Transportation Adaptation</p> <p><i>7.1: Prioritize, elevate, and protect low-lying roads and causeways.</i></p>
	<p>8) Water Management</p> <p><i>8.1: Use low impact development practices.</i></p> <p><i>8.2: Build water control structures.</i></p>
	<p>9) Miscellaneous</p> <p><i>9.1: Support climate change mitigation programs.</i></p> <p><i>9.2: Increase the County's Community Rating System score.</i></p>

## The Community's Top Priorities

During the public workshop, participants were given three dots to individually rank their first, second, and third priorities on the table. In this tabulation of participant voting, each action item was given a weighted score depending upon its rank, as displayed below:

Participant Rank	Weighted Score
1	3
2	2
3	1

Items that did not receive priority votes were not necessarily unimportant to the participants. These adaptation actions encompass a broad range of near- and long-term strategies, and in general some of these longer-term strategies did not receive as many votes.

Overall Rank	Adaptation Action	Category	Weighted Score
1	Identify or establish environmental monitoring programs in the area.	 Research & Monitoring	60
2	Develop and implement a public education campaign.	 Education & Outreach	44
3	Prioritize, elevate, and protect low-lying roads and causeways.	 Transportation Adaptation	39
4	Improve coordination among governments and agencies.	 Coordination, Cooperation, & Collaboration	24
5	Maintain and strengthen setback policies.	 Land Management	22
6	Install and encourage the use of living shorelines.	 Land Management	18
7	Limit development in high risk areas.	 Land Management	16
8	Use conservation to respond to sea level rise.	 Land Management	14
9	Use low impact development practices.	 Water Management	11
10	Incorporate future sea level rise impacts into emergency management plans.	 Emergency Management	10
10	Revise building codes to higher standards and incentivize better design.	 Land Management	10













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Overall Rank	Adaptation Action	Category	Weighted Score
10	Identify trigger points for changing policy.	 Research & Monitoring	10
11	Facilitate a dialogue on how to balance public and private interests.	 Coordination, Cooperation, & Collaboration	8
12	Provide a disclosure and disclaimer notice to purchasers of high risk properties.	 Education & Outreach	7
12	Consider the impacts on disadvantaged social groups, values, and symbolic places.	 Social Adaptation	7
13	Preserve and restore ecosystems and species.	 Land Management	5
14	Establish funding structures and/or tax districts to help property owners.	 Land Management	4
15	Support climate change mitigation programs.	 Miscellaneous	3
16	Develop affordable housing in safer areas.	 Land Management	0*
16	Create a transfer of development rights program for low elevation properties.	 Land Management	0*
16	Assist with beach renourishment.	 Land Management	0*
16	Increase the County's Community Rating System score.	 Miscellaneous	0*
16	Build water control structures.	 Water Management	0*

\*Items that did not receive priority votes were not necessarily unimportant to the public. Individuals could only vote on their top 3 priorities.



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## Community Input Process

The project team relied on the input of the Beaufort County Stakeholder Group, their colleagues, and other members of the public. They sought this input in order to preserve the Beaufort County community's ownership of the results. There were three formal phases of community input: scoping interviews, stakeholder group meetings, and public workshops. The interviews and stakeholder group meetings were conducted as official academic research for the College of Charleston, a member institution of the S.C. Sea Grant Consortium. Therefore, the identities of participants must remain confidential.

### Scoping Interviews (June 2013)

The first step in the project was to conduct interviews to gather background information on local environmental issues and the planning process in Beaufort County. Many of these key community members would later participate in the Beaufort County Stakeholder Group.

### Stakeholder Group (August 2013 & February, May, November 2014)

In the next step, the project team invited a group of local decision makers to a meeting to discuss the consequences of and responses to sea level rise in a facilitated group discussion. The first two meetings in August 2013 were structured using the Vulnerability, Consequences, and Adaptation Planning Scenarios (VCAPS) process (see full report for more information). Later meetings were informal continuations of the discussion.

### Public Workshops (August 2014)

On August 25 and 26, 2014, the S.C. Sea Grant Consortium hosted two public workshops seeking local input on the Stakeholder Group's list of adaptation actions. The open workshops were advertised publicly via e-mail, press release, paper flyer, and word of mouth during the month prior.

### How the Community Input was Used

Community input was the cornerstone of this project. The scoping interviews provided the necessary context information for subsequent steps. For example, the project team learned about the extensive partnership of public and private groups involved in maintaining water quality across Beaufort County. This partnership represents a success story for environmental management and an effective local network to be accessed for climate adaptation efforts.

The Stakeholder Group, using the VCAPS process for structure, created the initial list of adaptation actions. Group members have continued to provide much needed advice throughout every stage of the project, including final edits.

The public workshops critiqued, expanded, and combined adaptation actions. Whereas membership to the Stakeholder Group was by invitation only to preserve the confidentiality of its members, the workshops offered a wider opportunity for anyone in the Beaufort County community to comment.



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