

Camden County Resiliency Implementation Workplan

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PREPARED BY:

Goodwyn Mills Cawood, LLC
1612 Newcastle Street, Ste. 218
Brunswick, GA 31520

Photo Credit: UGA Marine Extension and Georgia Sea Grant



Core Project Team:
The Nature Conservancy
Goodwyn Mills Cawood, LLC
Carl Vinson Institute of Government at the Univ. of GA/Georgia Sea Grant Legal Program

Stakeholder Committee:
Camden County, Georgia
City of Kingsland, Georgia
City of St. Marys, Georgia
City of Woodbine, Georgia
Naval Submarine Base Kings Bay
National Park Service – Cumberland Island National Seashore
Little Cumberland Island Homes Association
Southeast Regional Partnership for Planning and Sustainability (SERPPAS)
Georgia Sentinel Landscape Partnership
Georgia Department of Natural Resources – Coastal Resources Division
U.S. Army Corps of Engineers
Georgia Conservancy
St. Marys Riverkeeper
UGA Marine Extension and Georgia Sea Grant
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Green Infrastructure Center, Inc.

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Acronyms

Acronym	Definition
1-m	1 Meter or 3.3 Feet
2-m	2 Meters or 6.6 Feet
BRIC	FEMA's Building Resilient Infrastructure and Communities
C-CAP	NOAA Coastal Land Cover and Land Cover Change Data
CDBG	Community Development Block Grant (DR = Disaster Recovery) (MIT = Mitigation)
CC	Unincorporated Camden County (project ID's)
CI	Cumberland Island (project ID's)
CIP	Capital Improvement Plan
CRD	GA Department of Natural Resources, Coastal Resources Division
CRS	Community Rating System
CTP	Cooperating Technical Partner
DCA	Georgia Department of Community Affairs
DNR	Georgia Department of Natural Resources
DOD	Department of Defense
DRRP	Disaster Recovery and Redevelopment Plan
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRMs	Flood Insurance Rate Maps
FIS	Flood Insurance Study
FPMS	USACE's Flood Plain Management Services
GADNR	Georgia Department of Natural Resources
GDOT	Georgia Department of Transportation
GEMA/HS	Georgia Emergency Management and Homeland Security Agency
GI/LID	Green Infrastructure / Low Impact Development
GIS	Geospatial Information System
GMC	Goodwyn Mills Cawood, LLC
HOA	Homeowner's Association
KB	Kings Bay (project ID's)
KL	Kingsland (project ID's)
LCI	Little Cumberland Island (project ID's)
MAP	Mapping, Assessment & Planning
NCEI	National Centers for Environmental Information
NCRF	NFWF's National Coastal Resilience Fund Program
NFIP	National Flood Insurance Program
NFWF	National Fish and Wildlife Foundation

NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
OPB	Georgia Governor's Office of Planning and Budget
RCP	Representative Concentration Pathways [<i>Carbon Emission Scenarios</i>]
RCF	Resilient Coastal Forests of Georgia (<i>concurrent local project with RIW</i>)
REPI	Readiness and Environmental Protection Integration Program
RIW	Resiliency Implementation Workplan
RTC	Real-Time Control (stormwater management control system)
SACS	South Atlantic Coastal Study
SFHA	Special Flood Hazard Area
SLAMM	Sea Level Rise Affecting Marsh Migration
SLOSH	Sea, Lake and Overland Surges from Hurricanes
SLR	Sea Level Rise
SM	St. Marys (project ID's)
TAD	Tax Allocation District
TNC	The Nature Conservancy
UGA	University of Georgia
USACE	United States Army Corps of Engineers
WB	Woodbine (project ID's)

Executive Summary

This *Resiliency Implementation Workplan* (RIW) for Camden County, Georgia, reflects a robust stakeholder engagement process that was informed by technical expertise and built upon existing efforts and successes. It was created and will be implemented with the help of partners, including Camden County and its three municipalities, Cities of Kingsland, St. Marys, and Woodbine; Naval Submarine Base Kings Bay; National Park Service (Cumberland Island National Seashore); Little Cumberland Island Homes Association; and The Nature Conservancy.

Short-term outcomes from this planning process include:

- A stakeholder group to steer and inform the project (Section 1)
- A community resiliency inventory of existing plans and findings (Section 2)
- A sea level rise and flooding vulnerability assessment (Section 3)
- Stakeholder engagement through stakeholder interviews and a public survey (Section 4)
- A resiliency infrastructure prioritization tool (Section 5.1)
- Shoreline/resiliency management practices (Section 5.2)
- The *Resiliency Implementation Workplan* (Section 5.4)

Through this plan and process, expected long-term outcomes include:

1. Increased community capacity for resilience
2. Stronger awareness of adaptation needs and planning
3. Implementation of identified resiliency projects.

The two major sections of this plan are the SLR and Flooding Vulnerability Assessment in Section 3 and Project Prioritization and Implementation Plan in Section 5. Both sections present data and information individually for the seven main geographies in the County:

1. Unincorporated Camden County
2. City of Kingsland
3. City of St. Marys
4. City of Woodbine
5. Naval Submarine Base Kings Bay
6. Cumberland Island
7. Little Cumberland Island

Within the SLR and Flooding Vulnerability Assessment in Section 3, the following flooding hazards related to SLR are presented:

- Sea level rise (Section 3.3)
- Flooding (Section 3.4)
- High tide flooding (Section 3.4.4)
- Storm surge (Section 3.4.5)
- Sea level rise affecting marsh migration (SLAMM) (Section 3.5)

After receiving feedback from staff at each jurisdiction/geography and the public through an online survey, 91 projects and vulnerable areas were identified countywide. A matrix was developed as a step to prioritize individual projects and the most vulnerable areas. Section 5.1 describes how the

matrix was developed, the factors included, and how each factor and project are scored. Eight factors were used to rank and score the projects for prioritization. The high-tier scoring factors (with a maximum score of 10 points) were infrastructure type, infrastructure proximity, flood + SLR impacts. The mid-tier factors (7 points maximum) were current flood frequency and erosion rate. The remainder were low-tier factors (5 points maximum) – low-moderate income status, ownership, and adjacent/threatened special habitat.

The resulting distribution of projects was as follows:

1. Unincorporated Camden County – 22
2. City of Kingsland – 16
3. City of St. Marys – 23
4. City of Woodbine – 8
5. Naval Submarine Base Kings Bay – 3
6. Cumberland Island – 7
7. Little Cumberland Island – 12

Each project also included potential partners/grants based on property ownership and potential granting or coordinating agencies. Proposed solutions were presented for each project based on the review of the shoreline/resiliency management practices, where there was a general interest in nature-based solutions. In some cases, multiple steps and options are presented. Several projects offer the opportunity for multiple jurisdictions to partner and work together. If not working directly together, there are a lot of similar projects, so it is recommended to share experiences on grant pursuits and project implementation.

1. Introduction

Camden County is located in the southeastern corner of the state of Georgia just north of the Florida border, and it is home to approximately 55,000 people, three cities (Kingsland, St. Marys, and Woodbine), and Naval Submarine Base Kings Bay, the east coast homeport for ballistic-missile and guided-missile submarines and the only naval base in the Atlantic fleet capable of supporting the Trident II missile. Per the 2021 Governor's Office of Planning and Budget population projections, Camden County's population is expected to grow by approximately 7,500 people, or 13%, in the next 20 years, creating additional development pressures.

The area is also home to significant natural resources. The Cumberland Island National Seashore – known for its expansive beaches and dunes and historic features – consists of 9,800 acres of federally designated wilderness and is Georgia's largest and southernmost barrier island. Two of Georgia's five "blackwater" rivers, the Satilla and St. Marys, flow through Camden County. Both river systems are known for their "iced tea" color waters, white sand bars, and ecological diversity. The Satilla River is also included in the State Wildlife Action Plan. In 2019, the Ceylon Wildlife Management Area – a 16,000-acre property – was created in Camden County with the help of the Georgia Department of Natural Resources. A mix of salt marsh and coastal forest, the Ceylon Wildlife Management Area encompasses coastal habitat critical to the conservation of gopher tortoises, threatened indigo snakes and other species. It is the largest coastal land acquisition project in Georgia.

The updated *2021 Hazard Mitigation Plan* identified 3,834 residential parcels and 9,982 people at risk for flood in Camden County. Virtually all of the areas with concentrated development are at risk of flooding from coastal storm surge from a major storm. Two recent hurricanes, Matthew (2016) and Irma (2017), left hundreds of homes with flood damage. In the *Hazard Mitigation Plan*, the hazards of flood, hurricane, and sea level rise were all identified as having an impact of "critical." The spatial extent of the impact was listed as "moderate" for flood and sea level rise and "large" for hurricanes, and the probability of occurrence was listed as "likely" for hurricane and sea level rise and "very likely" for flood. In addition, approximately 50% of county land is classified as wetlands.

Downtown St. Marys is one of the more prominent locations in Camden County that has been experiencing increasing impacts from sea level rise, high tide flooding (also known as "king tide," "sunny day," or "nuisance" flooding) and coastal storm surge. The City's tidal range averages 6.6 feet but can increase to over 9 feet during perigean spring tides, which are the highest high tides each year. When rain events occur during high tides, the flooding impacts are amplified because the high-water levels render the stormwater drainage systems non-functional.

Over the past few years, Camden County, jurisdictions within it, and project partners have worked on a number of projects to identify the ecological, flooding, and coastal hazard vulnerabilities within the County. These efforts include:

- A countywide *Disaster Recovery and Redevelopment Plan* in 2019.
- An updated countywide *Hazard Mitigation Plan* in 2021, in which sea level rise was added as a new hazard.

- ‘Rise Ready’ Coastal Resilience Project, which included three online web applications (Apps) to prepare for rising sea levels – a Flood Risk App, a Community Planning App and a Community Rating System (CRS) Open Space Explorer App.
 - The Flood Risk App allows users to search for a specific address within Camden County and layer flood hazard data, such as Sea Level Rise, Storm Surge, or FEMA Flood Zones, to show a predicted impact of current and future potential flood risks.
 - The Community Planning App can be used independently, or simultaneously with the Flood Risk App. It shows users localized community planning data, such as critical infrastructure, future land use and zoning, to help make informed decisions regarding flood risk.
 - The CRS Open Space Explorer App helps identify preserved open space areas that are currently eligible for claiming community CRS points, and helps prioritize additional open space, that if preserved, would increase their CRS score, resulting in flood insurance discounts annually to their residents.
- Identification of septic systems vulnerable to flooding and funding resources for upgrades.
- Living shoreline demonstration projects. Two are underway, with the County serving as a key partner in one.
- Coastal resilience workshop held in August 2019 to explore ways to better integrate local planning with adjacent military installations.
 - Led by Southeast Regional Partnership for Planning and Sustainability (SERPPAS), a planning partnership led by the Department of Defense and a rotating state agency in the Southeast, and the Carl Vinson Institute of Government/Georgia Sea Grant Legal Program.
- Engagement related to dredging considerations at Naval Submarine Base Kings Bay with U.S. Army Corps of Engineers, SERRPAS, and Georgia Sentinel Landscape, including discussion on updates to the Master Plan and consideration of beneficial reuse of dredged material
- *Downtown St. Marys Strategic Vision and Plan* in 2016 that included proposals related to some of the flooding issues in the City’s waterfront area.
- A green infrastructure / low impact development (GI/LID) demonstration project in downtown St. Marys – “Sidewalk Hydro Road Improvement Maintenance Project (SHRIMP)”
- *St. Marys Flood Resiliency Project* in 2017 that included a report identifying current flooding risks and future sea-level rise risks for infrastructure in the City, including roads, stormwater drainage structures and critical facilities.
- Collaboration with U.S. Army Corps of Engineers (USACE) on a countywide *Sea Level Rise Vulnerability Assessment* in 2021 through the Floodplain Management Services (FPMS) Program that summarizes impacts of 10% and 1% annual exceedance probability (AEP) storm events both with and without sea level rise on land use, critical infrastructure, transportation routes, and census tract populations
- Collaboration with USACE on flood studies for areas of (1) White Oak and (2) Flea Hill/ Browntown as part of the non-structural floodrisk management study program.
- Participation in the USACE’s *South Atlantic Coastal Study (SACS)*.

Each community in Camden County has made steps to improve resiliency in recent years. However, a need was identified to build upon and expand existing efforts and work at a larger scale to create an integrated and prioritized list of specific, actionable projects that would address flooding, coastal erosion, sea level rise impacts, and associated risks for the County as a whole. While transcending local jurisdictional boundaries, this plan, the *Resiliency Implementation Workplan* (RIW), identifies and prioritizes concrete coastal resilience, nature-based projects that will address these identified vulnerabilities. The RIW was developed based on robust stakeholder engagement among all the participating communities and building on previous and existing successes. A major outcome was the “pipeline” of projects eligible for future design and implementation funding. An additional outcome has been an increase in community understanding about how investing in green infrastructure and nature-based solutions brings value to the community, protects property, and restores and/or preserves ecosystems by developing shared messaging and communication processes among all of the local governments in Camden County.

The RIW includes four major sections:

- Chapter 2 – Community Resiliency Inventory
- Chapter 3 – Sea Level Rise & Flooding Vulnerability Assessment
- Chapter 4 – Stakeholder Engagement
- Chapter 5 – Project Prioritization & Implementation Plan

The “Community Resiliency Inventory” in Chapter 2 contains a data assessment that includes a review of existing plans, tools, data, and related information. Any existing resiliency issues, strategies and activities from all of the participating entities were identified and served as the foundation for this project. Since most of these plans were broad planning documents, specific projects and associated costs were not always available.

A “Sea Level Rise & Flooding Vulnerability Assessment” in Chapter 3 provides background and context to definitions of resilience. It explores historical data on sea level rise and future projections. As part of the “Community Resiliency Inventory,” there were a number of important GIS datasets available in the tools such as NFWF Crest Tool, NOAA Sea Level Rise Viewer, The Nature Conservancy’s ‘Rise Ready’ Apps and Resilient Coastal Sites data, NOAA Coastal Flood Exposure Mapper, and the Georgia Coastal Hazards Portal. These datasets were downloaded and utilized in Chapter 3 to explore areas vulnerable to flooding and sea level rise.

The “Stakeholder Engagement” process is summarized in Chapter 4. A robust stakeholder engagement process was important to inform the process, build support for the plan, prioritize strategies and projects, identify stakeholders, and craft an effective engagement and education program. Targeted interviews with staff from each jurisdiction and other key stakeholders, as well as an online public survey were used to gather input on resiliency needs and to identify projects and vulnerable areas.

The “Project Prioritization & Implementation Plan” is presented in Chapter 5. First, the Project Prioritization Tool is presented, which is a matrix of eight weighted-factors. Next, 14 management measures are presented that include primarily nature-based solutions and green infrastructure approaches, but a few traditional gray infrastructure options are also included. A list of specific, actionable projects that will reduce flooding impacts and risk is identified and prioritized, and the

final product includes a GIS layer of vulnerable areas and potential project sites. The strategy for implementation also included responsible parties and recommended funding sources.

1.1. Core Project Team

The Nature Conservancy (TNC) is the lead applicant for the National Fish and Wildlife Foundation (NFWF) Grant that funded this project. The Carl Vinson Institute of Government at the University of Georgia/Georgia Sea Grant Legal Program (UGA) is also a participant on the grant. TNC issued an RFQ for a technical consultant to lead the project prioritization, stakeholder facilitation, and plan development in spring 2021, and Goodwyn Mills Cawood, LLC (GMC) was selected. The Core Project Team, including TNC, GMC, and UGA, met several times during the project to coordinate efforts and to facilitate the planning process. The Team met monthly, prior to each Stakeholder Committee meeting, to finalize the agenda topics and make final logistic preparations. Members of the Core Project Team included:

- The Nature Conservancy: Ashby Nix Worley, Christi Lambert
- Goodwyn Mills Cawood: Rob Brown, Courtney Reich, Rachel Kuntz, Ed DiTommaso
- The Carl Vinson Institute of Government at the University of Georgia/Georgia Sea Grant Legal Program: Shana Jones, J. Scott Pippen

1.2. Stakeholder Committee

The Stakeholder Committee included partners from:

- Camden County: Shawn Boatright, Shalana McNamee, Scott Brazell, Julie Haigler, Joey Yacobacci, Chuck White, Sarah Long
- City of Kingsland: Lee Spell, Scott Kimball, Ron Knox
- City of St. Marys: Kenneth Hughes, Bobby Marr, Robby Horton
- City of Woodbine: Samantha Young, Jimmie Cohen, and Rick Baird
- Naval Submarine Base Kings Bay: Russell Byrd
- National Park Service/Cumberland Island National Seashore: Gary Ingram, Michael Seibert
- Little Cumberland Island Homes Association: James Hunter
- Southeast Regional Partnership for Planning and Sustainability (SERPPAS): Addie Thornton
- Georgia Sentinel Landscape Partnership: Ken Bradley
- Georgia Department of Natural Resources Coastal Resources Division (GADNR-CRD): Jennifer Kline
- U.S. Army Corps of Engineers: Jared Lopes
- Georgia Conservancy: Charles McMillan
- St. Marys Riverkeeper: Anna Laws and Emily Floore
- UGA Marine Extension and Georgia Sea Grant: Jessica Brown
- UGA Camden County Cooperative Extension: Jessica Warren
- Green Infrastructure Center, Inc.: Matthew Lee

These partners provided feedback throughout the planning process and met collectively as a group on four occasions during this project. The partners also agreed to share information and formulate cohesive and linked efforts between all members to increase disaster resiliency countywide. Unfortunately, due to the timing of each meeting and COVID restrictions, all committee meetings were virtual via Zoom.

A brief summary of each meeting is described in Table 1.1, and detailed meeting summaries are included in Appendix A. An initial Kickoff Meeting was held on May 18, 2021, to introduce the project and gather initial feedback on stakeholder engagement. The next several months focused on data gathering and meeting with each jurisdiction individually via targeted interviews to identify flooding hot spots, vulnerable areas, and/or potential projects. These interviews are detailed in Chapter 4. Following the data collection period, a 2nd committee meeting was held on August 11, 2021, to review the results of the data gathering efforts from both GIS analyses and targeted interviews. After presenting various types of management practices, including nature-based solutions and traditional gray infrastructure techniques, a breakout session of four groups was conducted using Mural, a digital visual collaboration platform, to solicit additional feedback from the Stakeholder Committee on other vulnerable areas, preferred management practices, and targeted areas for implementation. These results were used to guide preferred and alternate solutions for each project. The focus of the 3rd committee meeting on November 16, 2021, was the Project Prioritization Tool. Each of the factors and associated weights were presented to the Stakeholder Committee for feedback. The resulting matrix and associated procedure to rank and prioritize individual projects was followed to draft the plan over the next few months. On March 25, 2022, a 4th committee meeting was held to discuss the draft plan and comments from the Stakeholder Committee.

Table 1.1: Summary of Stakeholder Committee Meetings.

Meeting	Activities
Stakeholder #1 (Kickoff) 5/18/2021*	• Stakeholder Committee introductions and role • Discussed project scope, outline, stakeholder engagement • Reviewed initial results from data & plan review • Shared draft public survey and solicited feedback
Stakeholder #2 8/11/2021*	• Presented preliminary results from public survey • Reviewed results from environmental resiliency data in GIS • Summarized the issues and vulnerable locations identified during the targeted interviews/focus group discussions • Presented management practices for coastal resiliency including nature-based solutions, green infrastructure, and traditional techniques • Mural Breakout Session (4 groups) – identified preferred management practices to address vulnerable areas identified earlier
Stakeholder #3 11/16/2021*	• Reviewed results from previous meeting's Mural Breakout Session – preferred and practical management measures by jurisdiction • Finalized list for other stakeholders to target • Discussed a new management practice: Real-time Stormwater Control • Explained the prioritization tool and weighting of management measures and/or project locations; solicited feedback
Stakeholder #4 3/25/2022*	• Review draft plan and discuss comments

* Virtual Meeting

2. Community Resiliency Inventory

A Community Resiliency Inventory was initiated through the review of existing planning documents, tools, data, and related information to identify existing resiliency issues, strategies, and activities from all of the participating entities to serve as a foundation for this project. This chapter summarizes the key themes and details such as local concerns, resiliency, mitigation, and modeled impacts relating to Sea Level Rise (SLR). The locals Plans that were reviewed included:

- *Disaster Recovery and Redevelopment Plan* (2018)
- *Camden County 2018-2038 Joint Comprehensive Plan* (2018)
- *Camden County, Georgia Multi-Jurisdictional Hazard Mitigation Plan* (2021)
- *St. Marys Flood Resiliency Project* (2017)
- *Camden County Sea Level Rise Vulnerability Assessment* (2021)

These plans built upon other, previous documents such as the *Camden Kings Bay Joint Land Use Study* (2014), *Downtown St. Marys Strategic Plan and Vision Report* (2016), and *Greenprint for Camden County, Georgia* (2008), which were reviewed but not included in this summary analysis because relevant information has already been updated and included in the more recent plans included in this summary.

This chapter separates the beforementioned plans and categorizes the information from each into one of the following categories:

- Resiliency Issues/Hazards
- Vulnerable Areas/ “Hot Spots”
- Specific Infrastructure/Resiliency Projects
- Mitigation Strategies

During the development of the Camden RIW, another resiliency planning effort titled, “Resilient Coastal Forests (RCF) of Georgia,” was being led by Green Infrastructure Center, Inc.; Georgia Forestry Commission; and USDA Forest Service, Southern Region. These plans had several overlapping stakeholders and strategies, and members of the Camden RIW Core Project Team participated in RCF project. The RCF project was a pilot study of coastal forests, focused in Camden County, and it was designed to take a landscape-scale look at the challenges facing coastal forests and make suggestions to adapt forest planning to meet these challenges. The study included an assessment of coastal forest resources and assets, an analysis of their benefits, an evaluation of the various threats and their level of risk to coastal forests, local and state stakeholder interests, and the values of coastal forests and recommended management strategies to mitigate or adapt to future impacts. Threats evaluated included: SLR, storms, wildfire, development, utility-scale solar development, invasive species, pests/disease, and fragmentation. The final RCF plan contains a set of recommended next steps for each local government and state agency.

2.1. Resiliency Issues/Hazards

This section details resiliency-related issues that exist within Camden County, including potentially hazardous threats and impacts deemed likely to occur, as documented in local, relevant Plans. The resiliency hazards and impacts described in the reviewed Plans are summarized below.

Disaster Recovery and Redevelopment Plan, 2018

The Disaster Recovery and Redevelopment Plan (DRRP) listed Coastal Erosion as a possible hazard (0.01-30% annual probability). Flooding was listed as “Likely” (30.01-60% annual probability), and Sea Level Rise was ranked “Highly Likely” (60.01-100% annual probability).

Camden County 2018-2038 Joint Comprehensive Plan

The 2018-2038 Camden County Joint Comprehensive Plan mentions Storm Surge as a hazardous issue within the County, and it identifies percentage of development located in Category 1, 2, and 3 storm surge zones. In Camden County, 4.35% of development is within Category 1, while 16.20% is within Category 2, and 24.70% is within Category 3. More specifically,

- In Kingsland, 1.75% of development is within Category 1, while 10.89% of development is within Category 2, and 31.67% is within Category 3;
- In St. Marys, 6.9% of development is within Category 1, while 17.44% of development is within Category 2, and 22.31% of development is within Category 3;
- In Woodbine, 3.41% of development is within Category 1, while 22.63% of development is within Category 2, and 28.19% of development is within Category 3.

Camden County, Georgia Multi-Jurisdictional Hazard Mitigation Plan, 2021

Camden County’s Hazard Mitigation Plan detailed many different hazards and impacts that are of concern using the Priority Risk Index (PRI). The PRI determines the threat level to the general population and/or built environment. The following hazards and details were mentioned:

- **SLR:** Sea Level Rise was modeled and given a “Likely” probability ranking, with “Critical” impact, and a PRI score equating to “Moderate Risk”. As noted in the Plan, Camden County is particularly vulnerable to the effects of sea level rise due to its coastal location, subtropical environment, low topography and tourism economy. Also included in the Hazard Mitigation Plan were estimates for parcels to be affected by sea level rise, including the percent and value of the parcel with modeled impacts. As depicted in Table 2.1 below, approximately 16% of all parcels in the County will potentially be affected by 3 feet of SLR, and 74% of all affected parcels are residential.
- **Flooding:** Flood was given a “Highly Likely” probability ranking and a “Critical” impact ranking. As noted in the Plan, the loss ratios resulting from the Hazus [flood] analysis are greater than 16% in the County and all incorporated jurisdictions, meaning that a 1%-annual-chance flood would be difficult to recover from. All communities also face a uniform [high] probability of flooding. According to Climate Central, the Fernandina Beach water level station, 20 miles from Camden County, experienced 16 total coastal flood days between

2005 through 2014 up from 11 between 1995-2004. Of these days, 100 percent would not have occurred without climate change and the resulting sea level rise.

- Table 2.2 was included in the referenced Plan and summarizes consequences as they relate to flooding impacts.

Table 2.1. Parcels Affected by 3-ft SLR, Camden County. Source: 2021 Georgia Multi-Jurisdictional Hazard Mitigation Plan

Occupancy	Parcels Affected	% of Total	Structure Value	Estimated Content Value	Total Value
1 foot					
Agricultural	543	14.1%	\$65,681,744	\$65,681,744	\$131,363,488
Commercial	495	33.9%	\$522,333,662	\$522,333,662	\$1,044,667,324
Education	3	50.0%	\$1,315,334	\$1,315,334	\$2,630,668
Government	23	8.7%	\$10,110,491	\$10,110,491	\$20,220,982
Industrial	3	2.1%	\$646,158	\$969,237	\$1,615,395
Religious	2	1.8%	\$1,525,812	\$1,525,812	\$3,051,624
Residential	2,581	10.0%	\$497,863,879	\$248,931,940	\$746,795,819
Total	3,650	11.6%	\$1,099,477,080	\$850,868,220	\$1,950,345,300
2 feet					
Agricultural	623	16.2%	\$72,940,550	\$72,940,550	\$145,881,100
Commercial	562	38.5%	\$532,878,523	\$532,878,523	\$1,065,757,046
Education	3	50.0%	\$1,315,334	\$1,315,334	\$2,630,668
Government	31	11.8%	\$11,035,719	\$11,035,719	\$22,071,438
Industrial	3	2.1%	\$646,158	\$969,237	\$1,615,395
Religious	2	1.8%	\$1,525,812	\$1,525,812	\$3,051,624
Residential	3,121	12.1%	\$561,672,267	\$280,836,134	\$842,508,401
Total	4,345	13.8%	\$1,182,014,363	\$901,501,309	\$2,083,515,672
3 feet					
Agricultural	677	17.6%	\$77,849,776	\$77,849,776	\$155,699,552
Commercial	582	39.8%	\$537,624,229	\$537,624,229	\$1,075,248,458
Education	3	50.0%	\$1,315,334	\$1,315,334	\$2,630,668
Government	42	16.0%	\$21,763,174	\$21,763,174	\$43,526,348
Industrial	3	2.1%	\$646,158	\$969,237	\$1,615,395
Religious	2	1.8%	\$1,525,812	\$1,525,812	\$3,051,624
Residential	3,737	14.5%	\$624,343,021	\$312,171,511	\$936,514,532
Total	5,046	16%	\$1,265,067,504	\$953,219,073	\$2,218,286,577

Source: Camden County Parcel Data, 2020

Table 2.2. Consequence Analysis - Flood. Source: 2021 Georgia Multi-Jurisdictional Hazard Mitigation Plan

Category	Consequences
Environment	Chemicals and other hazardous substances may contaminate local water bodies. Wildlife and livestock deaths possible. The localized impact is expected to be severe for incident areas and moderate to light for other areas affected by the flood or HazMat spills.
Economic Condition of the Jurisdiction	Local economy and finances will be adversely affected, possibly for an extended period of time. During floods (especially flash floods), roads, bridges, farms, houses and automobiles can be destroyed. Additionally, the local government must deploy firemen, police and other emergency response personnel and equipment to help the affected area. It may take years for the affected communities to be re-built and business to return to normal.
Public Confidence in the Jurisdiction's Governance	Ability to respond and recover may be questioned and challenged if planning, response, and recovery are not timely and effective.

Category	Consequences
Public	Localized impact expected to be severe for incident areas and moderate to light for other adversely affected areas.
Responders	First responders are at risk when attempting to rescue people from their homes. They are subject to the same health hazards as the public. Flood waters may prevent access to areas in need of response or the flood may prevent access to the critical facilities themselves which may prolong response time. Damage to personnel will generally be localized to those in the flood areas at the time of the incident and is expected to be limited.
Continuity of Operations (including Continued Delivery of Services)	Floods can severely disrupt normal operations, especially when there is a loss of power. Damage to facilities in the affected area may require temporary relocation of some operations. Localized disruption of roads, facilities, and/or utilities caused by incident may postpone delivery of some services.
Property, Facilities and Infrastructure	Buildings and infrastructure, including transportation and utility infrastructure, may be damaged or destroyed. Impacts are expected to be localized to the area of the incident. Severe damage is possible.

- **Erosion:** Climate change is expected to make heavy rain events and tropical storms/hurricanes more frequent and intense. As a result, the erosion typically caused by these storms can be expected to occur more frequently.
 - *Loss of Dry Land:* The inundation of normally dry land could lead to the loss of marshes and wetlands and the positive benefits associated with those areas. These areas buffer against waves and storm surge, protect from erosion and even encourage accretion, and provide natural wildlife habitats.
 - *Water Contamination:* SLR may lead to saltwater intrusion as the groundwater table may also rise, potentially leading to contaminated drinking and agriculture water.

St. Marys Flood Resiliency Project, 2017

The St. Marys Flood Resiliency Project describes flooding as the main hazards of related concern within the City of St. Marys. Table 2.3 indicates the estimated monetary value of flood damages likely to occur in the city in 30 and 50 years due to SLR, under three scenarios.

Table 2.3. Estimated Property Damages in City of St. Marys under Various SLR Scenarios.

Sea Level Rise Scenario & Year		10% AEP (10-yr)	2% AEP (50-yr)	1% AEP (100-yr)	0.2% AEP (500-yr)
Current Conditions	2015	\$146,570	\$14,460,900	\$27,977,200	\$110,895,500
Low	2045	\$248,435	\$16,809,742	\$18,529,422	\$119,322,878
Low	2065	\$317,614	\$16,021,642	\$28,468,782	\$125,076,703
Int-Low	2045	\$615,711	\$20,876,869	\$36,213,482	\$133,501,939
Int-Low	2065	\$1,397,458	\$24,634,483	\$39,100,935	\$156,493,545
Int-High	2045	\$2,193,537	\$32,505,526	\$49,081,770	\$165,957,380
Int-High	2065	\$8,905,013	\$60,799,055	\$77,402,095	\$231,404,195

Data Source: 2017 St. Marys Flood Resiliency Project

Camden County Sea Level Rise Vulnerability Assessment, 2021

The *Camden County Sea Level Rise Vulnerability Assessment* summarized findings of potential impacts to land use, critical infrastructure, transportation routes, and census tract populations based on 10% and 1% annual exceedance probability (AEP) storm events for three future

projections (2050, 2075, and 2100) under the NOAA Intermediate-High SLR scenario. The conclusions of this vulnerability assessment stated that the county is particularly vulnerable to storm surge from coastal storms and high tides, as well as in-land and riverine flooding from high precipitation events, and these risks are projected to increase with sea level rise. Based on the results of the modeled scenarios from this analysis, rising sea levels are projected to increasingly impact multiple facets within the county. Details of these impacts are summarized below.

- Land Use:** In the existing condition, the dominant land use type that is presently located within both the 10% and 1% AEP flood zones is conservation and preservation land, mostly coastal marshland. A significant amount of acreage may be impacted by saltwater inundation which can increase root zone salinization, and ultimately degrade or kill less salt-tolerant species and affect biodiversity. The loss of bottomland hardwoods due to extended hydroperiods and increases in salinity can reduce the roughness or friction that slows and mitigates storm surge, which may exacerbate flood risks within the county. With the absence of prohibitive boundary conditions, salt marsh species may migrate inland invading low-lying forests, agricultural fields, and suburban areas. Approximately 84% of the land area classified as conservation, preservation and open space have the potential to be impacted by a 1% AEP flood event by the year 2100. Table 2.4 depicts how the existing conditions of several different land use categories are projected to be impacted by 10% and 1% AEP.

Table 2.4. Land Use Impacted by 10% and 1% AEP Storm Events under Existing Conditions

<i>Land Use Description</i>	<i>10% AEP Existing Conditions Impacted Acres</i>	<i>10% AEP Existing Conditions Percent Acreage</i>	<i>1% AEP Existing Conditions Impacted Acres</i>	<i>1% AEP Existing Conditions Percent Acreage</i>
<i>Agriculture</i>	879	1.9	1418	3.1
<i>Forestry</i>				
<i>Commercial</i>	5	0.2	71	2.8
<i>Conservation Preservation</i>	61623	70.7	69928	80.3
<i>Industrial General</i>	328	3.4	905	9.4
<i>Kingsland</i>	159	0.6	6181	22.7
<i>Little Cumberland Island</i>	1108	52.3	1615	76.3
<i>Mixed Use</i>	1020	2.4	6427	15.4
<i>Multi-Family Residential</i>	6	0.3	120	6.8
<i>Public/Inst</i>	4708	31.6	5794	38.9
<i>Rural</i>	8942	13.2	3134	4.6
<i>Rural Residential</i>	1596	2.6	2682	4.4
<i>Single-Family Residential</i>	555	2.7	2655	12.7
<i>St Mary's</i>	4427	31.5	5902	42.0
<i>Woodbine</i>	59	2.1	205	7.4

- Important Infrastructure/Facilities:** The extent of potentially impacted key structures is significantly increased within the 1% AEP zone in comparison with the 10% AEP zone (Table 2.5). While the recurrence interval of these flooding events may be less frequent, even a

singular flooding event can cause fatalities, injuries, and extensive infrastructure damage. Much of the vital freshwater and wastewater infrastructure in the county is located in low-lying areas and vulnerable to coastal storms and sea level rise. This report further details the impacts to key structures and critical infrastructure individually for the cities of Woodbine, St. Marys, and Kingsland, under SLR scenarios for 2050, 2075, and 2100.

Table 2.5. Impacted Structures for the 10% and 1% AEP Existing Conditions

<i>Existing Condition</i>	<i>Bridges</i>	<i>Cell Towers</i>	<i>Private Culverts</i>	<i>County Culverts</i>
10% AEP	5	0	0	5
1% AEP	31	2	4	111
<i>Existing Condition</i>	<i>Cumberland Emergency Areas</i>	<i>Site Address Point</i>	<i>Fire Stations</i>	<i>Landing Zones</i>
10% AEP	4	396	0	1
1% AEP	5	2581	1	1
<i>Existing Condition</i>	<i>Waste Water Facilities</i>	<i>Water Facilities</i>	<i>Hydrants</i>	<i>Dams</i>
10% AEP	1	1	21	0
1% AEP	1	3	241	1

Table 8: Impacted Structures for 10% and 1% AEP Existing Conditions

As the inundation boundaries extend laterally based on the modeled scenarios, the quantity of impacted structures generally increases. For example, based on the 1% AEP flood event for the years 2050 to 2100, the number of potentially impacted bridges increases from 24 to 32 out of 128 total bridges presently located within the county. Potential impacts from the more frequent 10% AEP flood event for the years 2050 to 2100 include 9 and 16 bridges, respectively. Dependent on the height of the existing freeboards of these bridges, elevated freeboards may be appropriate for bridges over waterways with increasing water surface elevations and debris potential. Of note, over one hundred county culverts are located within the 1% AEP flood event inundation boundary to allow the safe passage of water and debris.

Further, under the 1% AEP flood event scenario, emergency service infrastructure, including two fire stations and three police stations are projected to be impacted by the year 2100. Impacts to essential support services could affect the prevention, protection, response, and recovery efforts provided by first responders.

- **Transportation:** Flood hazards resulting from SLR are projected to impact major transportation and important hurricane evacuation routes throughout the county. Portions of two major evacuation routes, I-95 and U.S. Hwy 17, are predicted to be impacted based on the 1% AEP flood event, year 2100 scenario. These impacted areas will not only affect residents of Camden County, but also those travelling north from Florida that may be evacuating from natural disasters impacting their state. Many local roads are projected to be impacted by inundation as sea levels increase, which may exacerbate congestion of these critical evacuation routes during evacuation scenarios. Deterioration of road structural integrity because of flooding may cause huge expenditures for rehabilitation and maintenance of the impacted roadways. Repeat or lengthy inundation of roadways will not

only temporarily impact residential and commercial transportation access, but subgrade soils may be compromised causing permanent impairment (A. N. Ghani et al. 2016). A summary of the impacts to roads based on the 10% and 1% AEP scenarios are depicted in Table 2.6.

Table 2.6. Roads Impacted by 1% and 10% AEP under Existing Conditions and SLR Scenarios.

Flood / SLR Scenario	Impacted Road Miles	Impacted Evacuation Road Miles
10% AEP Existing Conditions	25.7	2.5
10% AEP 2050	42.4	2.9
10% AEP 2075	57.8	3.3
10% AEP 2100	85.1	4.8
1% AEP Existing Conditions	145.8	3.2
1% AEP 2050	175.7	13.5
1% AEP 2075	215.2	18.0
1% AEP 2100	264.9	20.3

Data Source: 2021 Camden County Sea Level Rise Vulnerability Assessment

2.2. Vulnerable Areas/ “Hot Spots”

This section identifies areas in the County that are deemed vulnerable to impacts from hazards such as flooding and SLR, as documented in the local, relevant plans. Specific details from each of the aforementioned plans regarding the vulnerable areas and “Hot Spots” of concern are summarized below.

Disaster Recovery and Redevelopment Plan, 2018

There are 192 identified critical facilities within the county.

Camden County 2018-2038 Joint Comprehensive Plan

The most vulnerable populations include children less than five years old, the elderly and frail elderly, persons living in poverty, and persons without reliable transportation that live in communities with limited public transportation. The population over the age of 65 is growing countywide, with notable increases in Kingsland (more than tripled from 2000 to 2010) and St. Marys (more than doubled from 2000 to 2010). Lack of public transportation was noted for St. Marys, but it was also discussed as a regional problem.

Additionally, St. Marys has the largest weakness in terms of stormwater and flooding, and threat from sea level rise.

Camden County, Georgia Multi-Jurisdictional Hazard Mitigation Plan, 2021

The flood vulnerability assessment identified 106 individual critical facilities and assets within the County that are exposed to flood hazard areas.

Kingsland has 20 repetitive loss structures (due to flood), all of which are located outside of the SFHA; additionally, only 20% of these properties are insured. Mitigation strategies should prioritize these structures.

According to the Coastal Vulnerability Index (CVI), developed by USGS, Central Cumberland Island, on the Atlantic Coastline and the Cumberland Sound, and inland along the Crooked River are areas most vulnerable to SLR in the region, rated very high. Shorelines along the remainder of the Atlantic Coast, along the St. Marys River, which creates the border between Georgia and Florida, and the remainder of the Cumberland Sound coastline are all rated moderate to high vulnerability. The northern border of the County and inland along the Satilla River are rated as low vulnerability.

As reported by climate central, approximately 1,799 in Camden County people currently live in areas expected to be impacted by 3-feet of sea level rise. Note: this data, based on the 2010 census, is the most recent available. Per this assessment, none of the population at risk to 3 feet of sea level rise are categorized as high social vulnerability.

St. Marys Flood Resiliency Project, 2017

Three publicly owned facilities—City Hall, the Liberty Tree Water Plant Site, and the St. Marys Women’s Club—show potential vulnerability to a Matthew-sized flood event at 2100 under the Intermediate High sea-level rise scenario.

High vulnerability was indicated in historic downtown St. Marys.

Camden County Sea Level Rise Vulnerability Assessment, 2021

The following areas were identified as vulnerable “hot spots” and potentially hazardous conditions in Camden County through various analyses. The majority of priority “hot spots” were located near St. Marys.

- While much of the critical infrastructure within the county is located outside of the existing condition 10% AEP flood event inundation boundary, there are presently some vulnerable structures predominately located near St. Mary’s that may be impacted by a 10% AEP flood event.
- Due to SLR, projected impacts to St Mary’s shows that nearly 50% of the city’s land mass may be subject to the effects of a 1% AEP flood event in the year 2100.
- It is projected that two wastewater and four water treatment facilities will be impacted by the 1% AEP flood event for the year 2100 scenario. The main priority area for these critical structures will be in the greater St. Mary’s area.
- Impacts to critical infrastructure, including an electrical substation in St. Mary’s, are projected to occur under the 1% AEP flood event scenario. Additionally, in the St. Mary’s area, a private earthen dam previously owned by the Durango Paper Mill (National Inventory of Dams NID ID GA06540) is located within the 1% AEP flood zone and may require further investigation to determine any potential threats should the dam be impaired or breached.
- Portions of I-95 and U.S. Highway 17 are predicted to be impacted based on the 1% AEP flood event, year 2100 scenario. These two major evacuation routes will not only affect residents of Camden County, but also those travelling north from Florida that may be evacuating from natural disasters impacting their state. Coastal evacuation routes may need to be adjusted to account for future sea level rise to redirect traffic to other major roadways in the event of a high intensity storm. Many local roads are projected to be impacted by inundation as

sea levels increase, which may exacerbate congestion of these critical evacuation routes during evacuation scenarios.

- The total estimated expected annual damage (EAD) for Camden County is approximately \$8.7 million in the existing condition, and approximately \$27.3 million in the future conditions with 3 feet of sea level rise. The City of Kingsland has an estimated EAD of \$600,000 under the existing condition and \$2.1 million under the future condition. The census place with the highest economic risk within Camden County is St. Mary's, with estimated EAD of \$4.8 million under the existing condition and a projected \$15.7 million under the future condition (USACE 2021a).

2.3. Specific Infrastructure/Resiliency Projects

This section details specific projects that have been identified, proposed, and/or recently planned in the County in an effort to combat flooding and SLR hazards posed against its infrastructure and citizens. Specific details from the relevant plans regarding resiliency projects are summarized below.

Disaster Recovery and Redevelopment Plan, 2018

There were no relevant projects identified in this Plan.

Camden County 2018-2038 Joint Comprehensive Plan

There were no relevant projects identified in this Plan.

Camden County, Georgia Multi-Jurisdictional Hazard Mitigation Plan, 2021

- Coastal Erosion:
 - To combat coastal erosion issues, the County wants to implement a hybrid of hard/soft engineering techniques (i.e., combine low-profile rock, rubble, oyster reefs, or wood structures with vegetative planting or other soft stabilization techniques). Additionally, the County is considering establishing setbacks in high-risk areas that account for potential sea level rise. Both of these actions were ranked as “High priority” in the Mitigation Action Plan table, and the proposed timeline for implementation is 2021-2026.
- Flood: Identify the critical facilities, roads and bridges in potential flood and surge zones and develop a plan to relocate or retrofit to withstand hazards. Timeline: 2021-2026. Progress has been made so far with this objective, and facilities have been identified in Kingsland.
- Property Protection/SLR:
 - Raise existing structure above Base Flood Elevations
 - Install back-up generators for pumping and lift stations in sanitary sewer systems along with other measures. Implementation Progress: GEMA/FEMA grant funding awarded in 2020; waiting for funds to be released
 - Acquire, demolish or relocate structures located in high-risk areas. Implementation Progress: Kingsland has completed 4 demolitions, currently working on CDBG-DR/MIT grants for further funding.

- Identify critical facilities and those facilities that shelter vulnerable populations; seek funding to retrofit structures to strengthen resistance to damage.
 - Kingsland: Fire Station remodel Phase I complete, Phase II funding identified in SPLOST VIII, WWTP retrofit construction underway. WTP #1 Rehab complete, clear well under construction, WTP #2 new well complete and maintenance complete.

St. Marys Flood Resiliency Project, 2017

There were no relevant projects identified in this Plan.

Camden County Sea Level Rise Vulnerability Assessment, 2021

More recent efforts include conservation easements limiting development on approximately 27,000 acres of land, known as Ceylon and Cabin Bluff.

2.4. Mitigation Strategies

This section summarizes mitigation strategies that were proposed to combat flooding and SLR hazards in the aforementioned local plans.

Disaster Recovery and Redevelopment Plan, 2018

In this Plan, there were numerous “strategies” and specific actions/practices mentioned and prioritized as either “immediate action,” “short-term action,” or “long-term action.” Examples include: Floodproofing; ordinance adoption for post-disaster rebuilding; support restoration of dunes threatened by beach erosion; relocate critical facilities out of high-hazard areas; protect greenspace; GI/LID; etc.

Camden County 2018-2038 Joint Comprehensive Plan

Mitigation strategies identified in this plan include:

- Continue to preserve natural infrastructure such as marshes, dune systems, floodplains, oyster reefs that aid in protecting the county from current and future coastal hazards (hurricanes, riverine flooding, storm surge, sea level rise, etc.)
- Consider current and future flooding scenarios (30-50 years) with the siting and design of development, including residential and commercial as well as infrastructure such as roads, sewer, wastewater treatment, etc.
- The recommended buffer width for flood control should be up 200 feet.
- Prepare for long-range sea level rise impacts through zoning and planning
- Avoid the development of flood areas, sea rise and surge zones
- Discourage development within designated flood zones or Special Flood Hazard Areas.
- Encourage GI/LID (green infrastructure/low impact development)
- Participate in a county-wide resiliency plan that is consistent with the County Plan and National Incident Management System for disaster response, recovery and redevelopment.
- Develop a prioritized capital improvement plan (CIP) for making stormwater repairs recommended in the Resiliency Study and Stormwater Master Plan.

Camden County, Georgia Multi-Jurisdictional Hazard Mitigation Plan, 2021

It is very likely that development can and will change the flood hazard and increase risk. The County states an additional goal of preserving natural infrastructure to maintain protection for the county from coastal hazards. With these goals, the County is continuing to encourage green space and conservation areas along the coast and riverbanks.

Identify critical facilities and those facilities that shelter vulnerable populations; seek funding to retrofit structures to strengthen resistance to damage. Include these buildings in plan: (1) St. Marys Airport, (2) Sheriff's Office Main Center, (3) Camden County Schools, (4) St. Marys Fire Department, (5) Kingsland Water Treatment Plant, (6) Kingsland Fire Department, (7) St. Marys Water Treatment Plant, (8) Kingsland Water Treatment Plant, (9) Woodbine Water Treatment Plant, (10) All Water City Systems and wells, (11) St. Marys Public Works, (12) Camden County Road Department, (13) Kingsland Public Works, (14) Camden Fire and Rescue, (15) Southeast Georgia Health System Camden Campus, (16) Woodbine City Hall, (17) St. Marys City Hall, (18) Kingsland City Hall, (19) Health Department.

St. Marys Flood Resiliency Project, 2017

Installation of backflow preventers on low-lying outfalls subject to tidal inundations. Backflow prevention devices include a variety of flap gates, check valves, and slide gates that are designed to keep tide water from entering into stormwater systems during high tide events.

One of the Vinson Institute recommendations is to direct stormwater from rooftops into bioswales, vegetated greenspace, or capture and reuse devices like cisterns and rain barrels.

Camden County Sea Level Rise Vulnerability Assessment, 2021

Proactive coastal storm risk management (CSRM) measures including both structural and non-structural may be warranted to mitigate for future impacts to critical infrastructure.

To help mitigate for increased flow [through culverts], a routine maintenance schedule that involves keeping culverts and stormwater ditches clear of debris and overgrown vegetation will help to mitigate flooding into residential, commercial, and county property and infrastructure by minimizing impediments to overall flow capacity. The public should be made aware of how important it is to keep these areas, including the right-of-way, clean and mowed.

Flood hazards resulting from SLR are projected to impact major transportation and important hurricane evacuation routes throughout the county. For the continued future use of these roadways in providing rapid movement of people away from the threat or actual occurrence of a coastal storm event, CSRM measures such as road elevation may need to be assessed. Coastal evacuation routes may need to be adjusted to account for future sea level rise to redirect traffic to other major roadways in the event of a high intensity storm.

3. Sea Level Rise & Flooding Vulnerability Assessment

This chapter provides background and context to definitions of resilience. The following types of hazards are presented – SLR, stormwater flooding, high tide flooding, storm surge, and sea level rise affecting marsh migration (SLAMM). Within each hazard there is a description of current conditions. The SLR and SLAMM sections include projections for multiple scenarios. The SLR section also contains historical data to provide a baseline of historic and more recent results. Within each section, there are analyses of seven main geographies in Camden County, which are presented in Figure 3.1. Camden County was separated into the following regions – (1) Unincorporated Camden County Mainland, (2) Cumberland Island, (3) City of St. Marys, (4) Little Cumberland Island, (5) City of Kingsland, (6) Kings Bay, and (7) City of Woodbine.

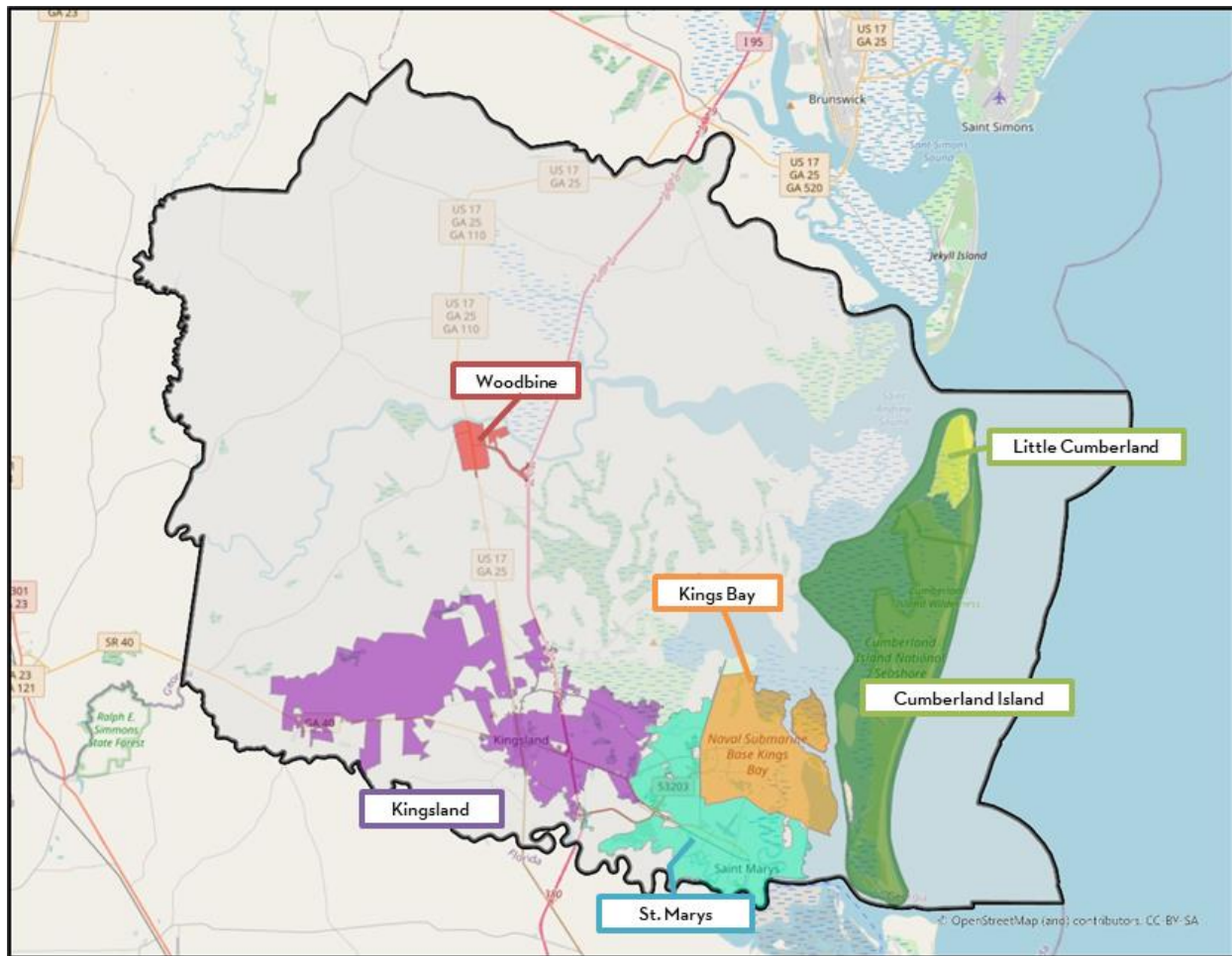


Figure 3.1. Camden County Geographies Used in Analysis

3.1. Resilience

Resilience can be defined as “the ability of a community to bounce back after hazardous events such as hurricanes, coastal storms, and flooding – rather than simply reacting to impacts” (NOAA, 2015). Resilient communities, ecosystems, and watersheds along the coast must learn to resist, adapt to, and recover from coastal hazards that include storm surge, flooding, and SLR. The Coastal Resilience Index, a community planning tool developed by NOAA, states that resilience is determined by the degree to which a community is capable of organizing itself to increase its capacity for learning from past disasters (Sempier, 2010).

Coastal Georgia has roughly 100 miles of coastline and is therefore particularly vulnerable to the types of coastal hazards identified above. Communities and habitats within coastal Georgia are directly connected to the coastline and the impacts resulting from coastal hazards present a substantial threat to communities, infrastructure, and natural resources throughout these areas. These impacts will only be exacerbated by the effects of SLR and increased storm intensity as the climate continues to change.

The social, economic, and environmental systems along the coasts are being affected by climate change. Threats from SLR are exacerbated by dynamic processes such as high tide and storm surge flooding, erosion, waves and their effects, saltwater intrusion into coastal aquifers and elevated groundwater, local rainfall, river runoff, increasing water and surface air temperatures, and ocean acidification. (USGCRP, 2018)

Collectively, these threats present significant direct costs related to infrastructure. Roads, critical facilities and bridges in coastal floodplains are already demonstrably vulnerable to extreme storms and hurricanes that cost billions in repairs. If shoreline recession is assumed to continue, the national average increase in the Special Flood Hazard Area (SFHA) by the year 2100 may approach 40% for riverine and coastal areas, and 45% for riverine and coastal areas if fixed coastlines are assumed (i.e., do not recede). Additionally, indirect economic costs (such as lost business) and adverse sociopsychological impacts have the potential to negatively affect citizens and their communities. (USGCRP, 2018)

Table 3.1 illustrates the economic importance of these vulnerable coastal areas as of 2013, further underscoring the significance of the threat that coastal hazards present in light of climate impacts.

Vulnerability refers to how susceptible a natural or human system is to coastal hazards, such as shoreline change, sea-level rise, flooding, and storm surge. Vulnerability is a function of a system's **sensitivity** and its capacity to **adapt** to impacts and changes. Systems that are **sensitive** to coastal hazards are easily affected or have a disproportionately large area affected by a small change. **Adaptation** consists of actions taken to reduce the vulnerability of natural and human systems to the effects of climate change in the coastal zone. –
Maryland's CoastSmart Community Scorecard

Table 3.1. Economic Importance of U.S. Coastal Areas

Region	Employment		GDP		Population		Land Area
	Millions	% of U.S.	\$ Trillions	% of U.S.	Millions	% of U.S.	% of U.S.
United States	134.0		\$16.7		316.5		
All Coastal States	109.2	81.5%	\$13.9	83.7%	257.9	81.5%	57.0%
Coastal Zone Counties	56.2	42.0%	\$8.0	48.0%	133.2	42.1%	19.6%
Shore-Adjacent Counties	50.2	37.5%	\$7.2	43.2%	118.4	37.4%	18.1%

Source: Kildow et al. (2016).

The NOAA Digital Coast Tool provides Coastal County Snapshots for how flooding and sea level rise impacts the population and economy. The impacts of SLR and flooding on the Camden County population are noted in Table 3.2. According to the “Total Coastal Economy” snapshot, there are 103 potential businesses in Camden County affected by current flooding from the 100-year floodplain, and 107 affected by 6-ft of SLR.

Table 3.2. Summary of Flooding Impacts on Camden County Population

Scenario	Population		Population Over 65		Population in Poverty	
Total	52,714		6,436		6,546	
2-ft SLR	11,899	22.6%	1,825	28.4%	1,195	18.3%
4-ft SLR	13,179	25.0%	2,018	31.4%	1,330	20.3%
6-ft SLR	15,016	28.5%	2,285	35.5%	1,527	23.3%
Inside 100-yr floodplain	16,303	30.9%	2,402	37.3%	1,771	27.1%

Source: NOAA Digital Coast, Coastal County Snapshots (<https://coast.noaa.gov/snapshots/>).

Many naturally occurring features or processes directly influence the vulnerability of Camden County including its geographic location along the Atlantic Coast, existing physiography (predominately Lower Coastal Plains), topography, annual rainfall (approximately 50 inches per year), and SLR. The coastal area is defined by large areas of wetlands and marsh, with a barrier island beyond. In addition, the sensitivity of Camden County is increased by the built-environment (i.e., percentage of impervious cover, percentage of urbanization, construction within the 100-year floodplain, etc.), which are discussed throughout this section.

Coastal counties in the U.S. continue to experience greater population growth than inland counties, and this region had some of the fastest growing coastal areas in the nation. As of 2021, Georgia ranks third of all coastal states for population density. Over the coming decades, the populations of coastal Georgia’s major cities and surrounding communities are expected to continue following this trend. According to the U.S. Census Bureau, Camden County had a population of 54,768 in 2020. This depicts a growth of 8.4% since 2010. According to the Georgia Governor’s Office of Planning and Budget (OPB), the population of Camden County is projected to grow by 11,120 people (20.3%) to 65,888 in 2050 (GA OPB, 2021). Coupled with the potential impacts of climate change and SLR on storm intensity and frequency, communities will be required to plan for events where more citizens and their homes and businesses are in the path of increasingly dangerous and costly storm conditions. The planning and regulatory decisions communities are making today about how and where they develop dictate their ability to recover after coastal storm events. Understanding where

and how our communities are vulnerable to loss from coastal hazards, and adapting planning and development practices to compensate for these vulnerabilities, will ultimately result in lives, dollars, and habitats saved and more resilient communities in the future.

3.2. Historical Precipitation Changes

Precipitation since 1991 (relative to 1901-1960) has increased the most in the Northeast (8%), Midwest (9%), and southern Great Plains (8%), while much of the Southeast and Southwest has a mix of areas of increases and decreases (USGCRP, 2014). The map below shows the annual total precipitation changes for 1991-2012 compared to the 1901-1960 average, and shows relatively unchanged conditions in Coastal Georgia, but wetter conditions for the Southeast as a whole. The bar graphs in Figure 3.2 show the average precipitation differences by decade for each region.

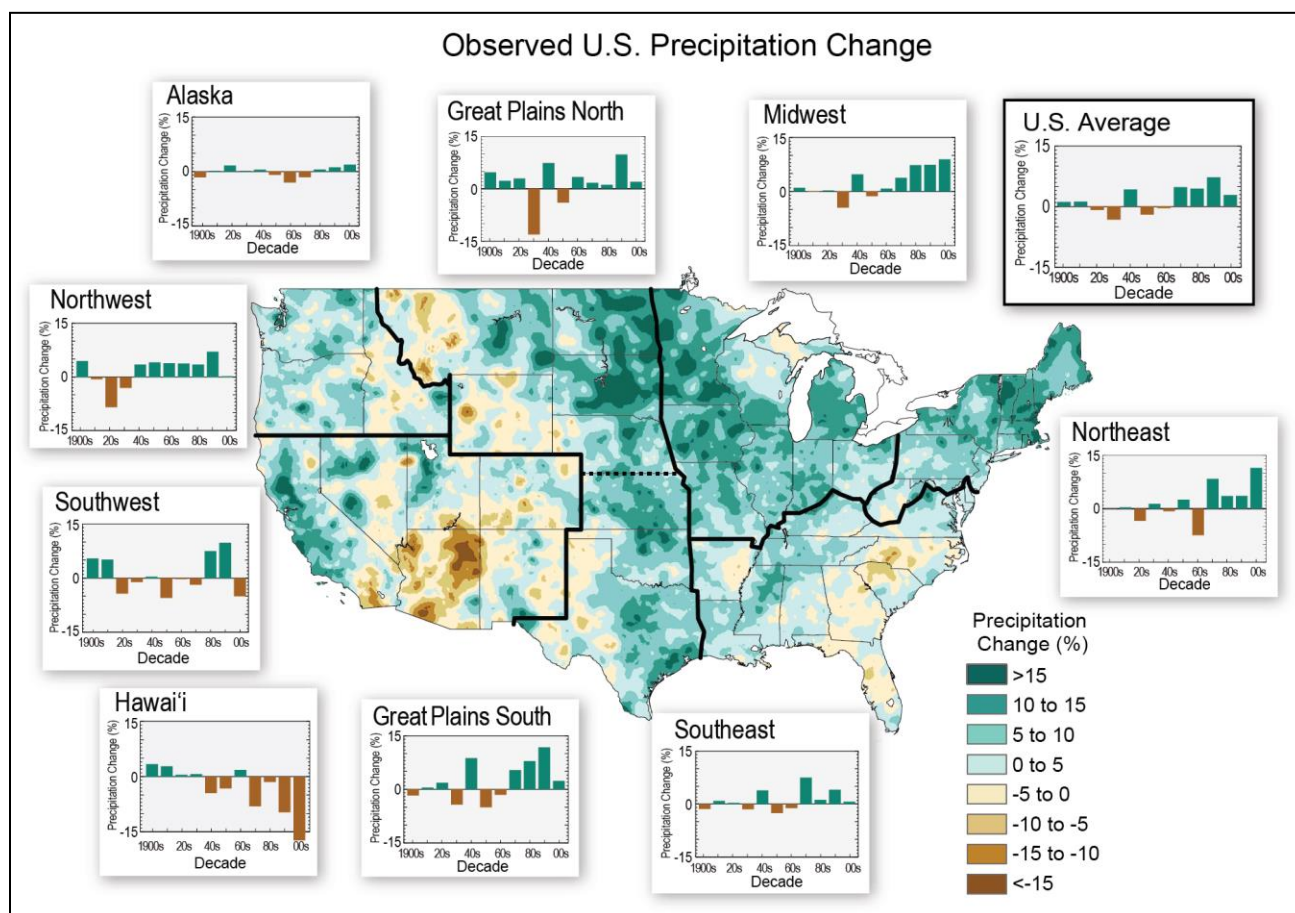


Figure 3.2: Observed U.S. Precipitation Change
Figure source: Adapted from (Peterson et al., 2013).

In observations of changes in very heavy precipitation, Figure 3.3 shows percent increases in the amount of precipitation falling in very heavy events (defined as the heaviest 1% of all daily events) from 1958 to 2012 for each region of the continental U.S. These trends are larger than natural variations for the Northeast, Midwest, Puerto Rico, Southeast, Great Plains, and Alaska (USGCRP, 2014). As shown, the Southeast region, including coastal Georgia, has experienced a 27 percent increase in heavy precipitation events. Likewise, Figure 3.4 displays the annual number of days with precipitation greater than three inches (1900–2016) averaged over the Southeast by decade and

individual station trends (1950–2016). The number of days with heavy precipitation has increased at most stations, including some near coastal Georgia (USGCRP, 2018). Overall increases in heavy precipitation events will increase the severity and frequency with which flooding due to rainfall occurs within the Camden County area. Flash flooding events will happen more frequently and pose a real threat to life and property.

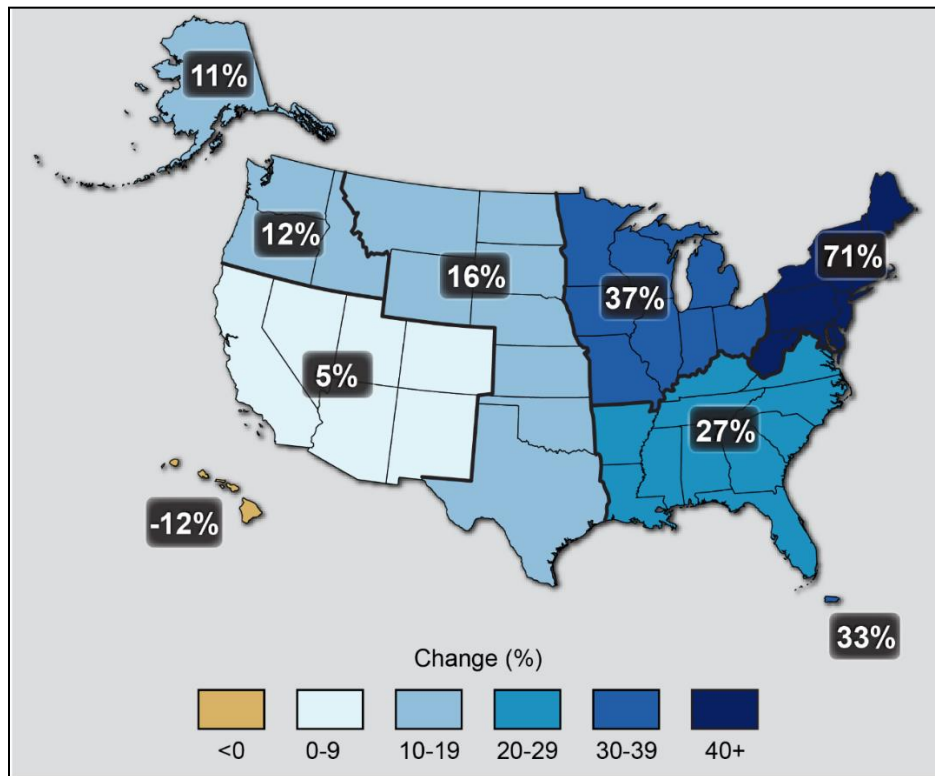


Figure 3.3: Observed Change in Very Heavy Precipitation

Figure source: updated from (Karl et al, 2009).

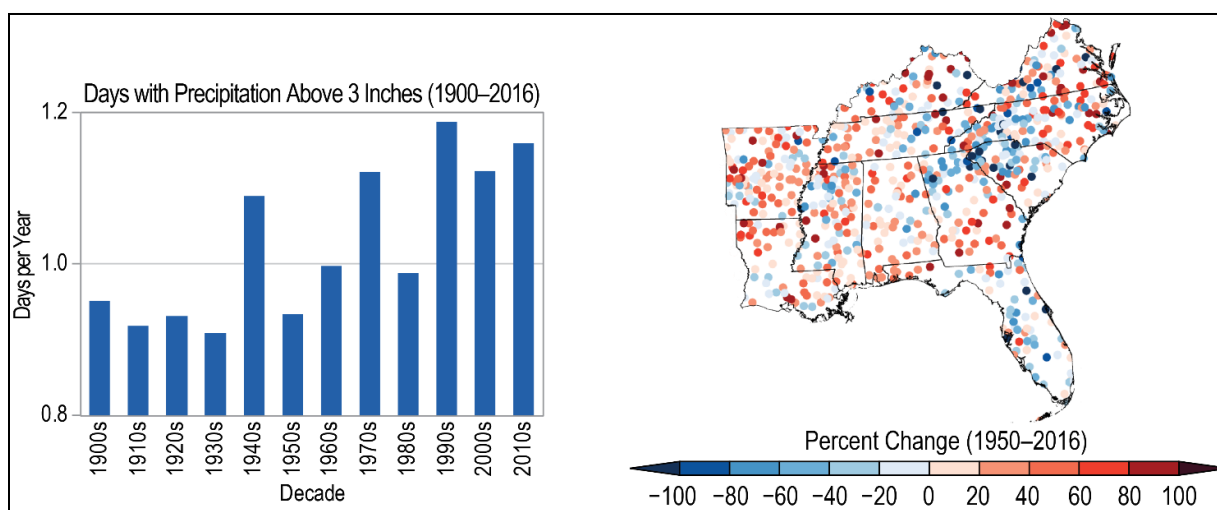


Figure 3.4: Frequency of Heavy Precipitation

3.3. Sea Level Rise (SLR)

SLR has been a persistent trend observed globally for over a century. It is expected to continue with rates anticipated to accelerate through the end of this century and beyond (IPCC, 2013). However, developing future SLR projections is complex due to the numerous variables involved, and as a result, there is a wide range of projections in the scientific literature. SLR is caused by two primary factors: 1) thermal expansion of ocean waters and 2) the melting of polar continental ice sheets. These factors are affected by rising global temperatures controlled by wide range of variables including changes in greenhouse gas emission and numerous other feedback loops. Due to this complexity, SLR projections are expressed in terms of potential scenarios and probabilistic ranges.

In addition to the complexity in predicting future rates of SLR, global sea level trends are not the same as relative sea level trends. SLR may be greater than or less than the global average due to many local factors, including: subsidence (land sinking), upstream flood control, erosion, regional ocean currents, variations in land height, and whether the land is still rebounding from the compressive weight of Ice Age glaciers (NOS, 2019b).

The report, “Global and Regional Sea Level Rise Scenarios for the United States” (NOAA, 2017), incorporates the latest SLR data to provide updated global and regional SLR scenarios. A fact sheet summarizing the findings of this report and regional Camden County-specific SLR predictions was created by NOAA, Sentinel Site Cooperative, Sea Grant, and U.S. Environmental Protection Agency (EPA). Regional SLR scenarios consider a variety of processes that influence what SLR looks like on a regional scale. For example, vertical land movement such as subsidence can change how SLR is experienced locally. This report suggests relative sea level rise/subsidence rates of about 1-2 mm/year are found broadly along the U.S. East Coast. Furthermore, it states that *“when planning under any sea level scenario, both short and/or long-term decisions should recognize that locations with lower elevation thresholds for impacts, less variability in extreme water levels, or higher rates of regional SLR have been the most prone to rapid (often-accelerating) increases in event probabilities (Sweet and Park, 2014) and will continue to be so in the future (Hunter, 2012; Tebaldi et al., 2012; Kopp et al., 2014, Sweet and Park, 2014; Buchanan et al., 2016)”* (NOAA, 2017). These qualifying characteristics are especially common in Coastal Georgia.

3.3.1. Local Sea Level Rise Projections

Figure 3.5 shows the various SLR scenarios through the year 2100 for Camden County, GA, ranging from low to extreme scenarios. Most resources generally recommend that communities plan for either the NOAA intermediate scenario or intermediate-high scenario; the recommendations for Camden County are presented in Section 3.3.3. The updated scenarios, low through extreme, cover the range of scientifically plausible scenarios. The intermediate scenario predicts an increase of 1.9 feet of SLR by 2060 and the intermediate-high scenario predicts 2.7 feet by 2060.

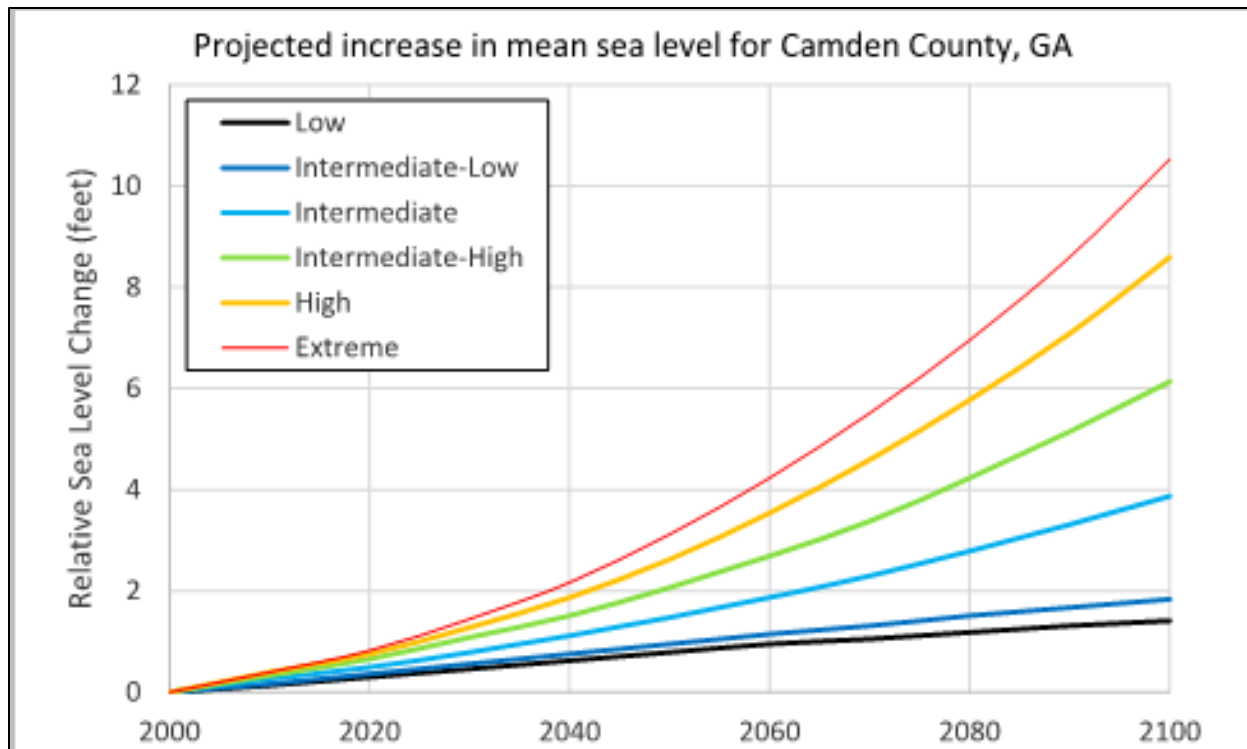


Figure 3.5: Project Increase in Mean Sea Level for Camden County, GA; Associated with six different global sea level rise standards

Data source: NOAA Technical Report NOS CO-OPS 083; Site: 1005852785

The likelihood of each SLR scenario depends on the amount of carbon gas in the atmosphere. Carbon emission scenarios, also known as Representative Concentration Pathways (RCPs), represent different potential futures based on various global policies and actions. Table 3.3 illustrates the probability of each SLR scenario under three different RCPs: RCP2.6 is a dramatic reduction in carbon emissions; RCP4.5 is a modest decrease in global carbon emissions; and RCP8.5 is continuing on current global emissions trends. For example, under RCP8.5, it is 100% likely (low scenario) that there will be at least 1.4 feet of SLR by 2100, while there is a 0.3% probability (high scenario) that there will be 8.6 feet of SLR by 2100.

Table 3.3: Global Sea Level Rise RCP Scenarios

Global Sea Level Rise Scenario	RCP2.6 Dramatic Reduction in Carbon Emissions	RCP4.5 Modest Reduction in Carbon Emissions	RCP8.5 No Change in Carbon Emissions
Low	94%	98%	100%
Intermediate-Low	49%	73%	96%
Intermediate	2%	3%	17%
Intermediate-High	0.4%	0.5%	1.3%
High	0.1%	0.1%	0.3%
Extreme	0.05%	0.05%	0.1%

Data Source: NOAA Technical Report NOS CO-OPS 086.

SLR in Camden County is projected to be around 30% greater than the global average. Table 3.4 provides the numeric SLR projections for each Global SLR Scenario that is illustrated in Figure 3.5. The 2040 projections were included to understand impacts for a 20-year programming horizon for capital projects. Under this horizon, the corresponding SLR is 1.1 feet for the intermediate scenario and 1.5 feet for intermediate-high scenario. Since it is already 2021 and the projections start at 2000, each scenario would have already had a relative SLR increase of 0.5 feet and 0.6 feet since 2000, respectively. Numerical projections are also provided for 2060 and 2100. The intermediate-low scenario, which is more likely than not under all carbon emission scenarios, predicts an increase of 1.2 feet of SLR by 2060 and 1.9 feet by 2100. For the most commonly recommended SLR scenarios, intermediate and intermediate-high, it is predicted that relative SLR will be 3.9 feet and 6.1 feet, respectively. Lastly, for a 50-year planning horizon (Year 2070), the relative SLR for the intermediate scenario is predicted to be 2.4 feet, and it is predicted to be 3.4 feet for the intermediate-high scenario.

Table 3.4. Numeric SLR Projections for Camden County (based on 2000 Relative Sea Level)

Global Sea Level Rise Scenario	SLR in 2040	SLR in 2060	SLR in 2100
Low	0.6	1.0	1.4
Intermediate-Low	0.7	1.2	1.9
Intermediate	1.1	1.9	3.9
Intermediate-High	1.5	2.7	6.1
High	1.9	3.5	8.6
Extreme	2.1	4.2	10.5

As the Georgia coastline is the western-most point of the east coast, it creates the Georgia Bight, which causes a large tidal range of about 8 feet. This tidal range is higher than neighboring states to the north and to the south, where Florida and North Carolina typically see a range of 2-4 feet. Minor flooding associated with high tides is a problem in Camden County and the severity and frequency of flooding will increase as sea levels rise. The graph in Figure 3.6 below projects future days of high-tide flooding on Fort Pulaski, under different SLR scenarios. These projections could apply to locations in Camden County that are currently experiencing high-tide flooding several days per year. Coastal flooding will become more frequent and occur in more places as sea levels rise. At Fort Pulaski, high tide flooding starts when water level is at or above 1.9 feet. Based on the intermediate-low scenario, high tide flooding is likely to occur on Fort Pulaski on approximately 75 days per year by 2060, and on approximately 200 days per year by 2100. If the relative SLR is tracking on the intermediate-low scenario, this would equate to flooding about 5 to 10 days per year in 2020, where it was 0 days per year in 2000. The frequency of days of flooding per year escalates quicker when under higher-risk scenarios. High tide flooding will disrupt commerce, damage property, and threaten public safety, putting more communities and assets at risk. When high tide flooding occurs during rain events, the drainage system capacity is limited or non-existent and severe flooding can occur.

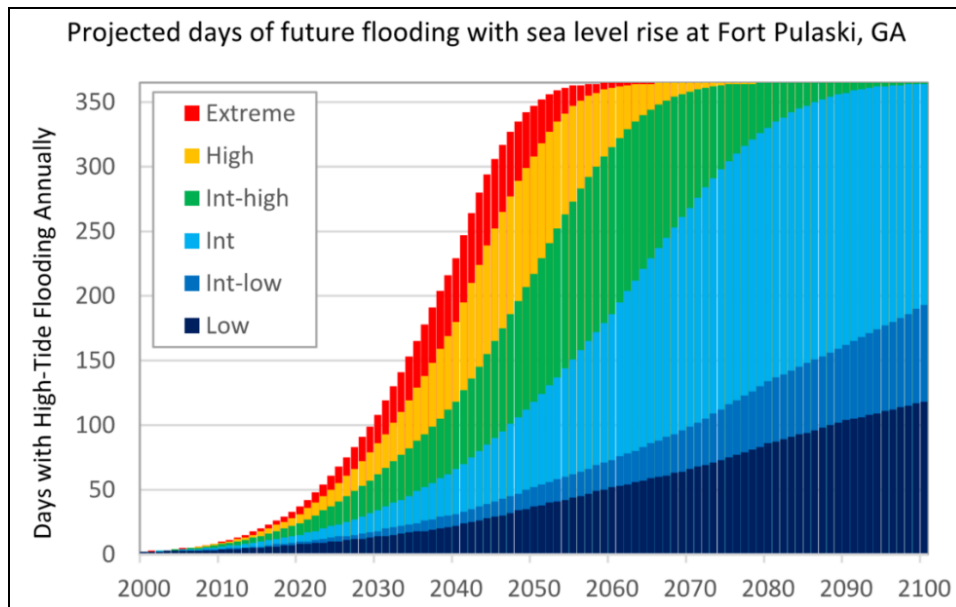


Figure 3.6: Projected Days of Future Flooding with SLR at Fort Pulaski, GA

Data Source: NOAA Technical Report NOS CO-OPS 086.

Two scenarios of SLR are presented in Figure 3.7 – 3-feet and 5-feet. SLR of 3-feet is projected to occur in Camden County around 2065 for the intermediate-high scenario, 2085 for the intermediate scenario and beyond 2100 for the intermediate-low scenario. SLR of 5-feet is projected to occur in Camden County around 2090 for the intermediate-high scenario and beyond 2100 for the intermediate scenario. Large-scale SLR maps are included by individual jurisdiction in Appendix D.

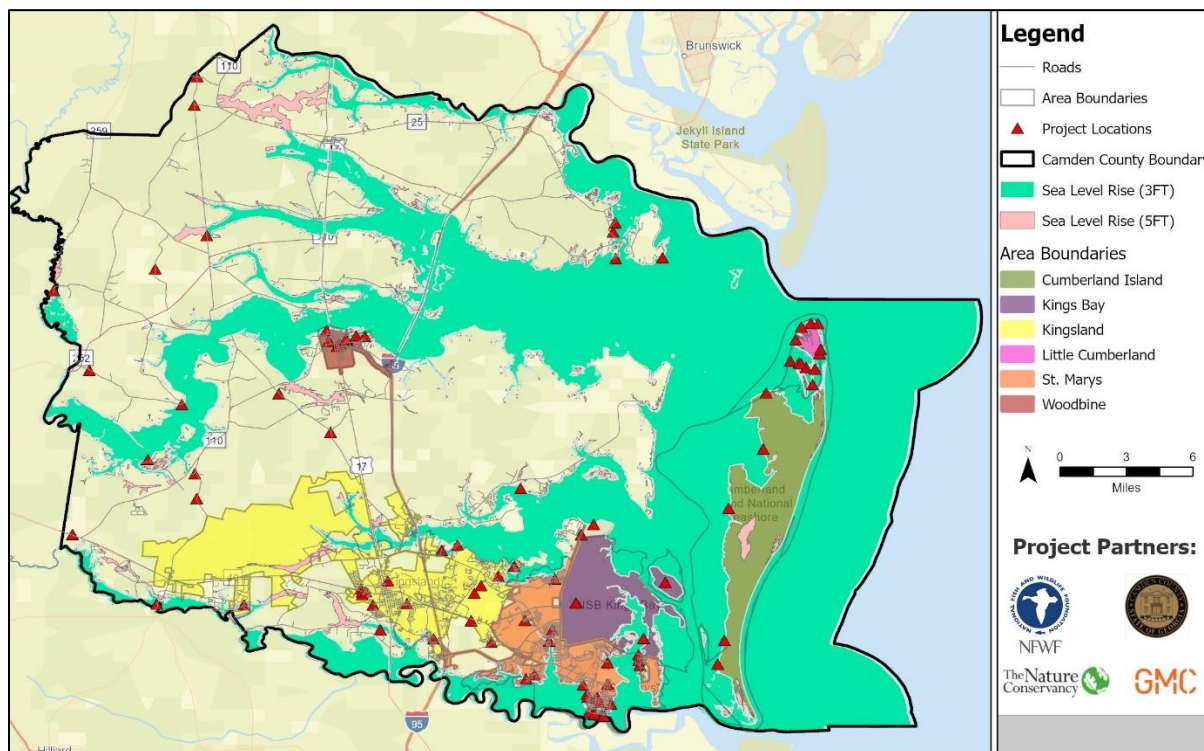


Figure 3.7. Sea Level Rise Projections for 3-ft and 5-ft.

3.3.2. Historical Sea Level Measurements

The historical and linear SLR trend in Camden County, based on an 85-year observation period at nearby Fort Pulaski, is in accordance with the low scenario, which predicts SLR of approximately 1.0 feet by 2060 and 1.4 feet by 2100. However, because the rate of SLR can change and is currently accelerating, hazard mitigation planning should consider the full suite of possibilities.

The published data from the USGS Fort Pulaski Gauge shows that from 1935 to 2020, the increase in relative sea level trend has been occurring at a linear rate of 3.33 mm/yr (Figure 3.8), which equals 1.1 feet per 100 years. The raw data of monthly mean sea level is available through NOAA's website from July 1935 to December 2020. This data was pared into 20-year segments to further see how sea level has been changing over shorter time period because none of the future projections are a linear trend. The best-fit linear slope for 20-year intervals was calculated for 1940-1959, 1960-1979, 1980-1999, and 2000-2020. These 20-year intervals document an increase in rate of change over the previous 81 years. The results are presented in Figure 3.9 and Table 3.5.

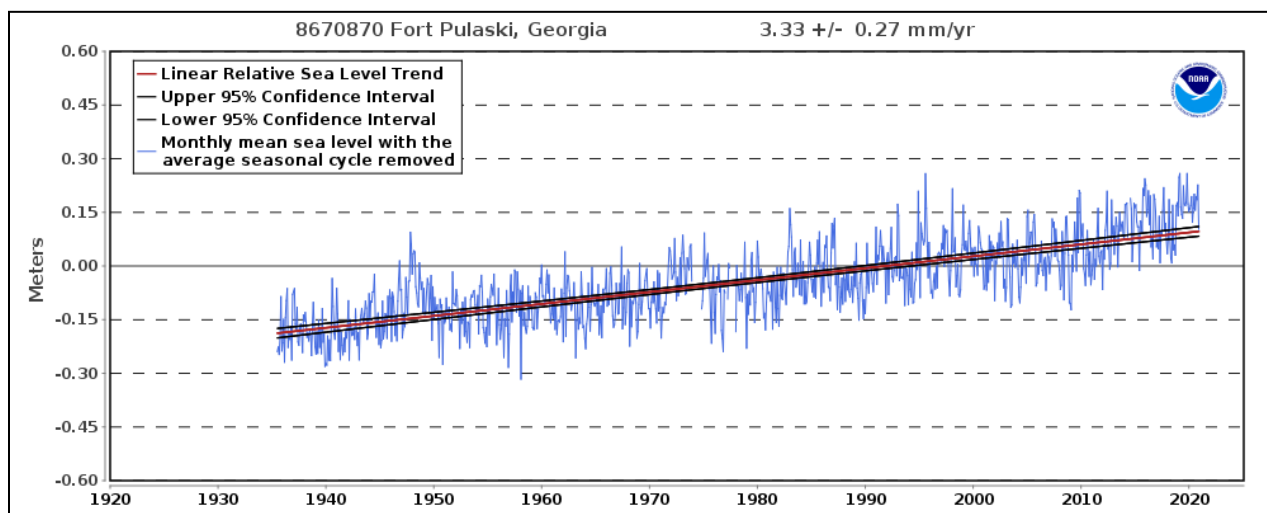


Figure 3.8. Relative Sea Level Trend at Fort Pulaski, Georgia (8670870)

Data Source: https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8670870

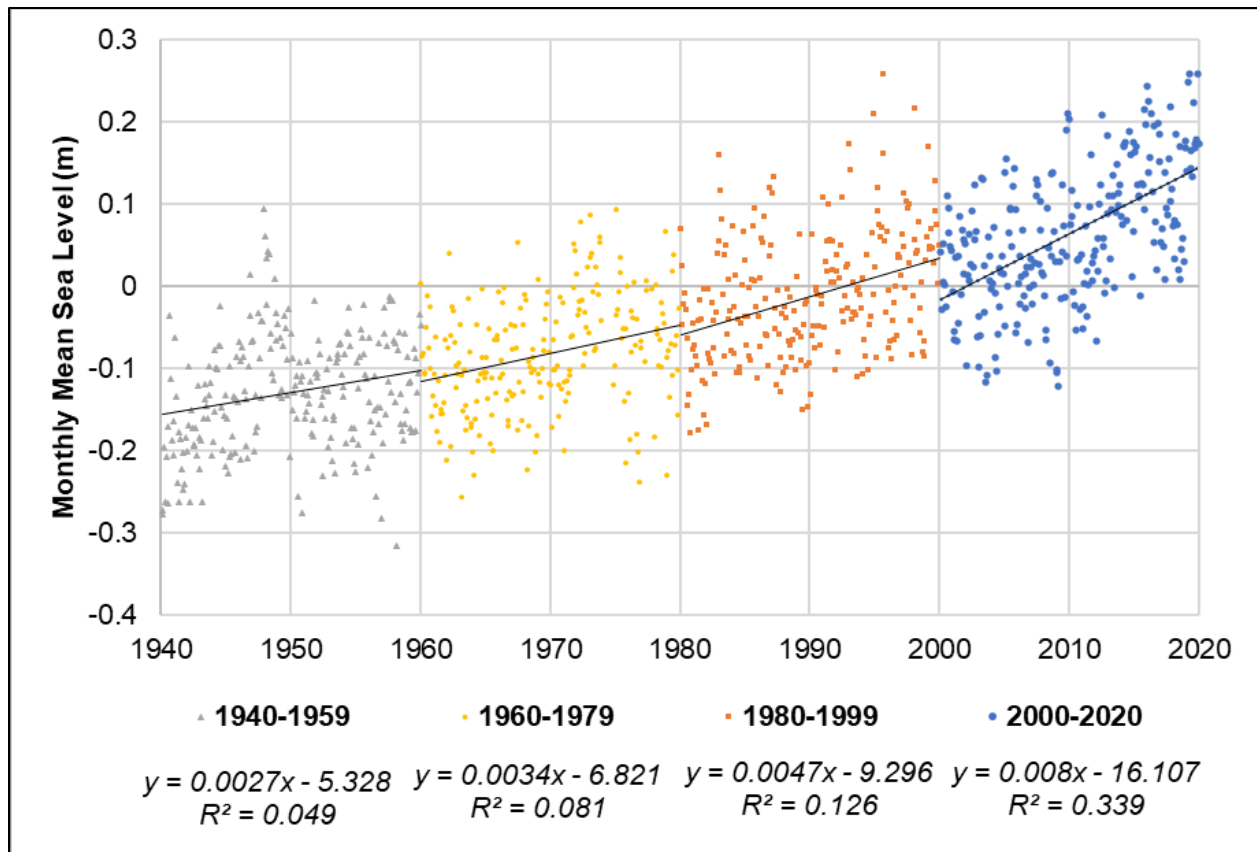


Figure 3.9. Monthly Mean Sea Level at Fort Pulaski, GA, in 20-Year Intervals

Table 3.5. Summary of Relative Sea Level Rate of Change in 20-Year Intervals at Fort Pulaski, GA

Year Range	Annual Rate of Change (mm/yr)	Annual Rate of Change (in/yr)	Rate of Change per Century (ft / 100 years)	20-Year Increase based on Annual Rate (ft)
1940-1959	2.7*	0.11	0.89	0.18
1960-1979	3.4*	0.13	1.12	0.22
1980-1999	4.7*	0.19	1.54	0.31
2000-2020	8.0*	0.31	2.62	0.52

* Based on having 20-years of data, the 95% confidence interval on the linear rate of change is +/- 2.9 mm/yr

The closest long-term sea level trend station to the south is at Mayport, Florida, at the mouth of the St. Johns River, just east of Jacksonville. This area experiences slightly less tidal fluctuations than Fort Pulaski. It has data, dating back to May 1928, and the calculated linear relative sea level trend from 1928 to 2020 is 2.72 mm/year, which equals 0.9 feet per 100 years. The same 20-year interval calculations were computed for this data from 1940 to 2020. The result was not as consistent, but it showed the recent years were increasing at a faster rate than the earlier years. In both cases, the rate of change per century was slightly greater than 2 feet, which provides support that the Low and Intermediate-Low projections are likely too low. The data from Mayport, Florida, is presented below in Figure 3.10 and Table 3.6.

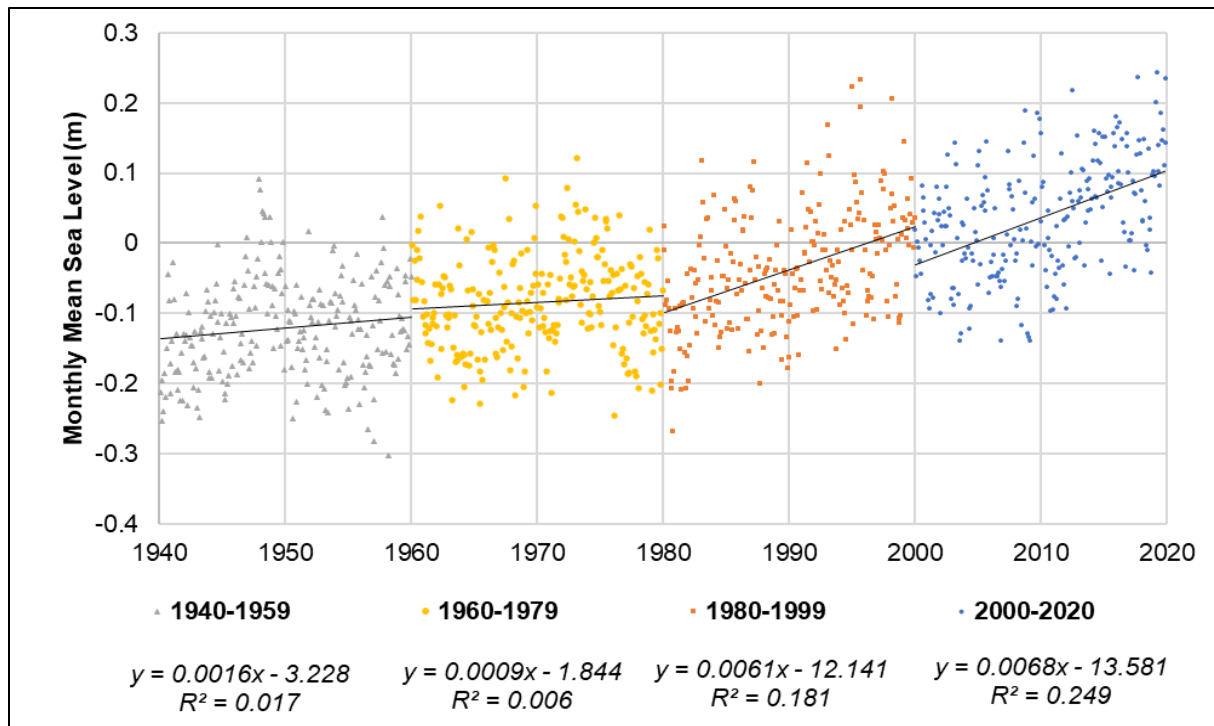


Figure 3.10. Monthly Mean Sea Level at Mayport, FL, in 20-Year Intervals

Table 3.6. Summary of Relative Sea Level Rate of Change in 20-Year Intervals at Mayport, FL

Year Range	Annual Rate of Change (mm/yr)	Annual Rate of Change (in/yr)	Rate of Change per Century (ft / 100 years)	20-Year Increase based on Annual Rate (ft)
1940-1959	1.6*	0.06	0.52	0.10
1960-1979	0.9*	0.04	0.30	0.06
1980-1999	6.1*	0.24	2.00	0.24
2000-2020	6.8*	0.27	2.23	0.27

* Based on having 20-years of data, the 95% confidence interval on the linear rate of change is +/- 2.9 mm/yr

As longer-term intervals are analyzed, the confidence interval gets narrower. With 20 years of data, an estimated 95% confidence interval is +/- 2.9 mm/yr, and this is reduced to +/- 0.9 mm/yr with 40 years of data. When the data is explored in 40-year intervals the results show that both sites had linear relative sea level trends from 1980 to 2020 of 1.48 feet per 100 years (Table 3.7).

Table 3.7. Summary of Relative Sea Level Rate of Change in 40-Year Intervals at Fort Pulaski, GA, and Mayport, FL

Site	Year Range	Annual Rate of Change (mm/yr)	Annual Rate of Change (in/yr)	Rate of Change per Century (ft / 100 years)	20-Year Increase based on Annual Rate (ft)
Fort Pulaski, GA	1940-1979	2.6*	0.10	0.85	0.17
	1980-2020	4.5*	0.18	1.48	0.30
Mayport, FL	1940-1979	1.7*	0.07	0.56	0.11
	1980-2020	4.5*	0.18	1.48	0.30

* Based on having 40-years of data, the 95% confidence interval on the linear rate of change is +/- 0.9 mm/yr

3.3.3. Interpretation & Conclusions

As 2000 was set as the baseline for projections out to 2100, and we are already 20% through this century, the annual mean relative sea level since 2000 was compared to the different projections. Data from the NOAA Sea Level site was plotted out to 2017, where the annual mean relative sea level at Year 2000 was set equal to 0.0. Figure 3.11 helps to assess which scenario(s) the trajectory of SLR is following as well as the magnitude of year-to-year variability. This figure shows the station's annual mean relative sea level compared to its six regionalized SLR scenarios. Most recently in 2014-2016, the annual mean relative sea level was tracking right on the NOAA intermediate scenario projection, as shown in Figure 3.11, but it dropped to the low scenario in 2017. Adding in the data through the end of 2020 (Figure 3.12) depicts that 2019 and 2020 were back to tracking on the intermediate scenario projection.

For the first 20 years, there is very small separation of any scenario at this point and a lot of weight is put on where the origin is set (e.g., Year 2000 = 0.0 m); therefore, caution should be applied to this interpretation. For example, if Year 2000 was similar to Year 2004, the origin would have been set approximately 0.05 m (0.16 feet) lower and the 2019-2020 data would have appeared to be 0.05 m higher and in line with the intermediate high scenario. On the opposite end of the spectrum, if Year 2000 was similar to Year 2005, the origin would have been set approximately 0.05 m (0.16 feet) higher and the 2019-2020 data would have appeared to be 0.05 m lower and in line with the low scenario.

Based on the sea level trends that have been observed since 2000 and the probability for each scenario (Table 3.3), the NOAA intermediate scenario appears most similar to recent observations, and it was estimated to have a 17% likelihood of occurrence under the scenario of no change in carbon emissions. As a result, this scenario seems most appropriate for new and substantial improvements to private infrastructure. Based on a 50-year lifetime, this equates to a SLR projection of 2.4 feet. However, for public infrastructure projects and critical facilities, local governments should follow the NOAA intermediate-high scenario because these projects are essential to local government function and should therefore be held to a higher construction standard. While this scenario has a 1.3% likelihood of occurrence, it has been recommended for other local SLR planning efforts in Coastal Georgia, including City of St. Marys and City of Tybee Island. Based on a 50-year lifetime, this equates to a SLR projection of 3.4 feet. For added resiliency, private infrastructure could also consider the NOAA intermediate-high scenario, but it is imperative for critical facilities/infrastructure.

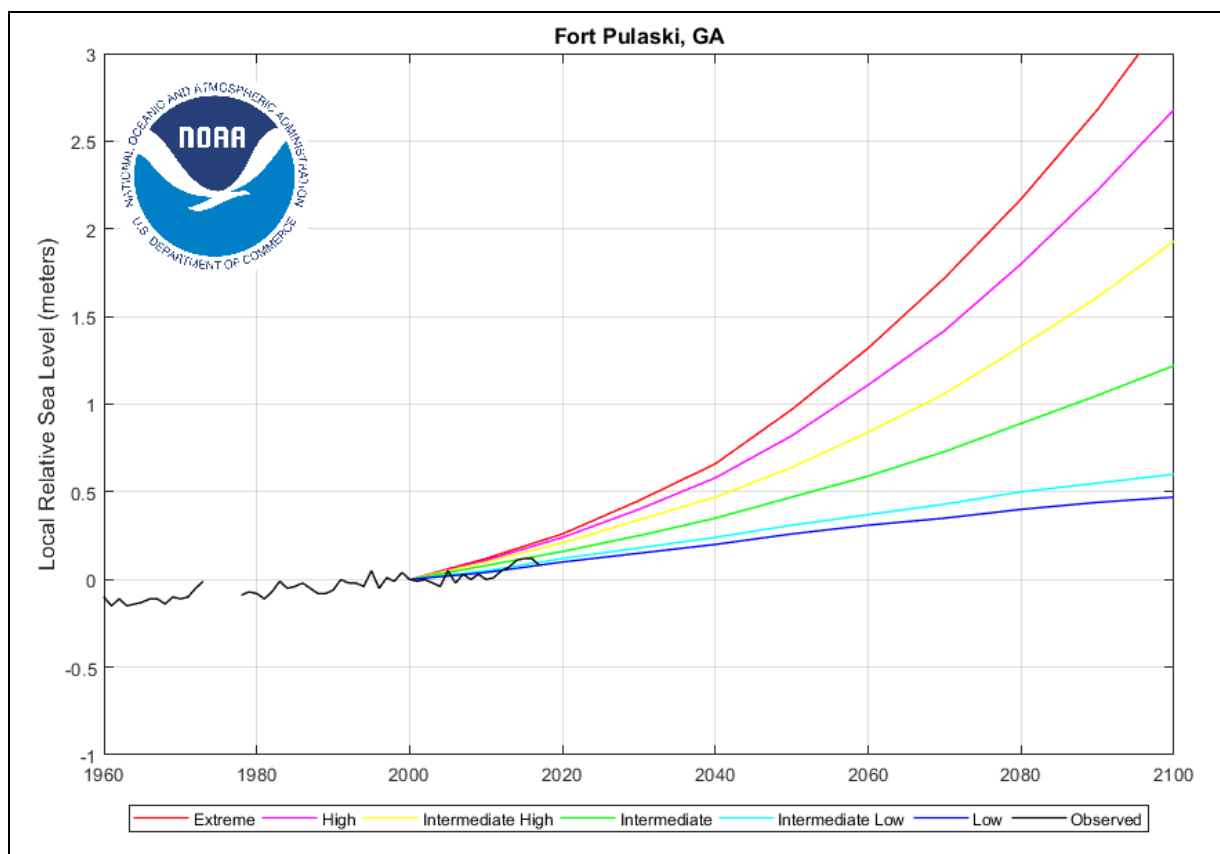


Figure 3.11. Annual Mean Relative Sea Level and Regional Scenarios at Fort Pulaski, GA

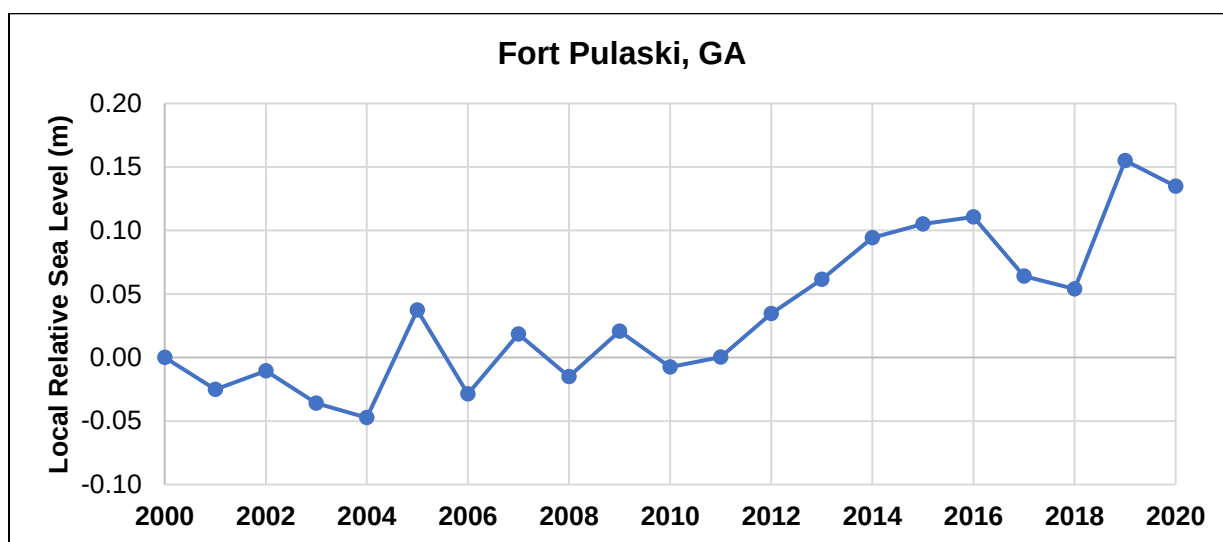


Figure 3.12. Annual Mean Relative Sea Level at Fort Pulaski, GA, from 2000 to 2020

3.4. Flooding

Susceptibility to flooding is dependent upon several different variables such as, topography, ground saturation, previous rainfall amounts, soil types, drainage basin size, drainage patterns, and vegetative cover. Most floods occur because the ground is already saturated with moisture and cannot absorb additional runoff. Flooding is one of the nation's most deadly types of weather hazard and is responsible for more damage to property each year than any other hazard. Camden County can experience severe flooding as a result of coastal surge flooding (due to storm surge), riverine flooding (due to rainfall), and tidal flooding (due to extreme high tides). Riverine floods and coastal floods in Camden County may occur concurrently with coastal storms/hurricanes. As noted in the 2017 Flood Insurance Study (FIS) report, the principal flood problem in Camden County is "flooding controlled by the Atlantic Ocean." This includes coastal storm surge tides augmented by wind induced waves along with flooding due to rains induced by hurricanes, tropical storms, and other storms.

Camden County has four major rivers that drain the western portion of the County – Little Satilla, Satilla, Crooked River, and the St. Marys River. Camden County's numerous rivers, streams, and tributaries running throughout its jurisdiction have proven susceptible to overflowing their banks during and following excessive precipitation events. Unfortunately, riverine-related flooding events are common in Camden County. Although the Camden County Flood Insurance Study (FIS) (2017) does not report riverine flooding as a "principal flood issue," the County's prior Hazard Mitigation Plan and floodplain management resources all cite the multiple rivers surrounding the low-lying coastal county as primary causes of flooding. Per the 2017 FIS Report, the sources of flooding in the County include the Crooked River, the Satilla River, and the St. Marys River, along with associated tributaries, as well as multiple creeks, ponds, and swamps.

Camden County's low topography, high annual rainfall, and impervious surfaces collectively contribute to the threat of routine flooding events. Additionally, previous land development facilitated the degradation and alteration of natural wetlands, stream buffers, and floodplains, further reducing the ability of the watershed to naturally buffer, retain, absorb, transport, and filter water. Furthermore, climate change is likely to impact precipitation patterns resulting in more frequent heavy precipitation events, combined with longer periods of time in between rain events (USGCRP, 2014). Heavy precipitation events (i.e., events where a significant amount of rain falls within a short period of time) are more likely to overwhelm drainage systems, including drainage ditches, and cause flooding.

3.4.1. Historical Flooding

In reviewing past flooding events in this region, the County's Hazard Mitigation Plan (HMP) describes how floods of varying severity occur regularly in Camden County, and impacts from past flood events have been noted by the NOAA National Centers for Environmental Information (NCEI) in all participating jurisdictions. NCEI reports 34 flood-related events in the 20-year period from 2000 to 2020, which equates to an average of 1.7 flood events per year. Therefore, the overall probability of flooding in the county is considered highly likely (over 100% annual probability). Communities within the County are routinely affected by storm events with high intensity and large total depth, as well as the less frequent major precipitation events such as hurricanes. When large rainfall events occur over short durations it can cause localized or widespread flooding, particularly in areas where the natural hydrologic system has been altered. Additionally, high tides and storm surges can also inhibit proper drainage, and exacerbate flooding during rain events.

Camden County has experienced numerous flood events from 1996-2021. The County's Hazard Mitigation Plan (2021) included the following list of flooding occurrences over the last 25 years, as reported by the NOAA National Centers for Environmental Information (NCEI), Storm Events Database. A few events that were not included in the County's Hazard Mitigation Plan but were reported more recently in the NCEI, were added to this list:

- Coastal Flood (7 events)
 - Coastal – 3 in 2015 (9/27, 10/27, 11/25), 1 in 2016 (11/13), and 3 in 2020 (9/20, 9/21, 10/17)
- Flash Flood (5 events)
 - Countywide – 1 event (9/18/1998)
 - St. Marys – 2 events (10/7/1996, 9/6/2000)
 - Scarlet – 1 event (6/26/2012)
 - Woodbine – 1 event (8/1/2011)
- Flood (6 events)
 - Countywide – 1 event (10/7/2005)
 - Greenville – 1 event (7/1/2012)
 - Inland Camden – 2 events (3/1/1998, 9/9/2004)
 - Spring Bluff – 1 event (4/5/2009)
 - St. Marys – 1 event (3/3/2002)
- Heavy Rain (16 dates)
 - Colesburg – 1 event (9/17/2013)
 - Countywide – 2 events (10/3/2005, 10/4/2005)
 - Harrietts Bluff – 2 events (8/3/2014, 7/5/2019)
 - Kingsland – 7 events (8/11/2003, 8/25/2007, 9/1/2009, 9/21/2011, 6/26/2012, 5/3/2013, 7/5/2019)
 - Scotchville – 1 event (6/25/2012)
 - St. Marys – 1 event (5/2/2013)
 - St. Marys Airport – 4 events (6/26/2012, 8/14/2013, 8/3/2014, 8/20/2015)
 - Woodbine – 2 events (6/25/2012, 12/1/2018)

According to NCEI, 40 recorded flood-related events affected the planning area from 1996 to 2021 causing an estimated \$869,000 in property damage, with no injuries, fatalities, or crop damage. These records specifically note flood impacts in all participating jurisdictions. The County's prior HMP also reports additional flood events in 1994 and 1995, detailed below.

The following event narratives are provided from the NCEI Storm Events Database and the previous HMP to illustrate the impacts of flood events on the county:

- Winter storms and tropical storms in 1994 and 1995 resulted in excess of \$56,000 in flood damages. The flooding on October 11, 1994 was a result of a tropical depression. Flooding damage occurred at the Mission Trace subdivision in St. Marys. The heavy rainfall from the storm overwhelmed the drainage systems and back-up flooding damaged numerous homes. Several roads closed including Colerain Rd., Spur 40, and N. River Causeway. Georgia Highway 40 was closed periodically throughout October 12th. Camden County received Presidential Disaster Declaration status on October 19th.
- **August 25, 1995** – Hurricane Jerry brought heavy rainfall to the area. Most flooding conditions occurred in Woodbine and south of White Oak, causing several washed out and impassable roads.

- **October 7, 1996** – Heavy rainfall (4 to 8 inches) from Tropical Storm Josephine caused flooding across most of Camden County. The flooding closed many roads which closed the public schools for two days.
- **March 1, 1998** – Severe flooding damage occurred on, from the effects of El Nino. Flooding occurred mainly along the St. Marys and Satilla Rivers. More than 200 homes were damaged in this event.
- **September 18, 1998** – Flooding closed numerous streets in St. Marys and Kingsland. One family was relocated by the Red Cross. Flooding events in 1998 resulted in excess of \$3,500,000 in damages. The total dollar value of damages paid by GEMA/FEMA as a result of flooding events is in excess of 3.6 million dollars. Most flooding issues occur as the rivers overflow banks and during periods of heavy rainfall. Many of the newly developed residential areas are located close to the rivers.
- **March 3, 2002** – Urban and small stream flooding occurred at Highway 40 overpass to Interstate 95. Spur 40 near Crooked River Elementary School flooded to one foot in depth. Numerous secondary roads were also flooded in St. Marys.
- **September 9, 2004** – 12 roads were closed in the Browntown area from flooding caused by Hurricane Frances.
- **April 5, 2009** – A stationary front draped across north Florida and southeast Georgia maintained a series of disturbances riding eastward along the boundary. Gulf moisture fed the storms with heavy rainfall occurring across most of the region. A strong disturbance over the Rockies became a low-pressure system that finally drove a cold front through the area. Jet dynamics were favorable for strong to severe storms during the period. The Camden County Emergency Manager reported major flooding on the Satilla River causing 20 residences to flood. This included 15 mobile homes, which were evacuated. Note that NCEI reports zero dollars in damages for this event.
- **September 21, 2011** – Moist yet weak south to southwest steering flow and active sea breezes supported heavy rainfall in showers and storms. Diurnal instability enhanced storms in the afternoon and early evening. Locally heavy rainfall produced minor street flooding in low lying areas. Standing water up to 3 inches deep was reported along State Road 40 and U.S. Highway 17 in Kingsland.
- **June 26-27, 2012** – Tropical Storm Debby moved across the area from the northeast Gulf of Mexico. Depp tropical moisture combined with a stalled frontal boundary across north Florida over a period of several days caused extensive flooding rainfall, as well as historic river flooding on the St. Marys River. A few severe storms developed each day, but the main impact was flooding rainfall and extensive river flooding. Observers measured between 3.5 to 5.7 inches in 24-hour periods; 48-hour rainfall totaled up to 11.7 inches. Floodwaters approached and damaged homes on Thrift Road.
- **July 1, 2012** – Historic river flooding along the St. Marys river continued after the passage of Tropical Storm Debby, which brought with it heavy rainfall. State Road 40 was closed between Kingsland and Folkston due to flooding. Approximately 37 homes in the Flea Hill area were flooded with river waters and evacuated.
- **September 27, 2015** – A period of persistent rain and the approach of the full Super Moon of 2015 created higher than normal tides along the local coast with minor flooding impacts around the times of High Tides. The USGS water level gage at Sea Camp Dock on Cumberland Island reached 5.3 feet above NAVD88. The highest astronomical tide is 4.7 feet above NAVD88.

- **October 27, 2015** – A full moon produced higher than normal astronomical tides and combined with moderate onshore flow created minor coastal flooding and beach erosion around the times of high tide. Water level departures were up to 0.75 feet above predictions along the Atlantic coast. The tide gauge at the Sea Camp Dock on Cumberland Island measured at water level of 5.59 feet above NAVD88; minor coastal flooding typically begins around 5 feet.
- **November 13, 2016** – A lingering NNE surge combined with high tide close to the full moon created elevated water levels along the Atlantic Coast and within the St. Johns River Basin. At 7:36 am, the water level gauge at the Sea Camp Dock on Cumberland Island measured 5.48 feet NAVD88, or 1.7 feet above MHHW. This was about 1 foot above predicted astronomical tide and was the peak tide during this perigee event. This resulted in minor coastal flooding.

Camden County has had two FEMA Major Disaster Declarations for severe storms that include elements of flooding in 1994 and 2009. Additionally, the county has received three Major Disaster Declarations for hurricanes in 2004, 2016, and 2017, which also may have included damages associated with flooding.

The threat of flooding can be reduced through channel maintenance, a robust drainage infrastructure system, and hazard mitigation – such as buyouts, building retrofits, advanced warning, and sound construction practices. Construction directly adjacent to the coast and within floodplains increases exposure to flooding, and strict land planning and construction standards should be met. New approaches to stormwater management, including the use of green infrastructure to increase infiltration of stormwater, can also mitigate flooding risk. If new development continues to occur in these low-lying areas, it will be crucial to mitigate flooding risks.

3.4.2. Flood Zones

The Camden County Flood Insurance Rate Maps (FIRMs) indicate that 48% of the County lies within a special flood hazard area. A Level 2 flood loss analysis in Hazus 4.2 was performed by leveraging 2020 parcel data provided by Camden County, and documented in the County's Hazard Mitigation Plan. This analysis identified that 511 commercial and 3,834 residential structures valued at roughly \$425 million are lying in areas of potential danger in the event of 1%-annual-chance flood event (HMP, 2021), resulting in 15% and 20% loss ratios, respectively. FEMA considers loss ratios greater than 10% to be significant and an indicator a community may have more difficulties recovering from a flood.

A summary of the FIRMs for Camden County are presented in Table 3.8. Overall, about one-half of Camden County is located in the X Zone. The jurisdictions with the largest land area in the X Zone include Woodbine at 86.2% and Kingsland at 73.1%. Excluding the islands (Cumberland and Little Cumberland), the other jurisdictions have about 50% of their land area in the X Zone (unincorporated county, Kings Bay, and St. Marys). With SLR, this number will decrease, in all jurisdictions. There is a lot of area in Table 3.8 that is coastal marshlands, so the VE, AE, and A are slightly inflated in terms of developable land.

Table 3.8. Summary of Flood Zones in Camden County

Geography	Total Area	High Risk			Medium Risk	Low Risk
	Acres	A	AE	VE	X 0.2 Pct	X Zone
Camden County	459,889	14.3%	14.6%	18.5%	4.2%	48.3%
Cumberland Island	34,148	0%	27.4%	37.3%	6.0%	29.0%
Kings Bay	13,474	4.5%	16.7%	22.6%	5.3%	50.9%
Kingsland	28,760	3.6%	21.5%	0.1%	1.7%	73.1%
Little Cumberland	2,385	0.0%	67.0%	12.1%	15.0%	6.1%
St. Marys	15,918	1.7%	30.6%	11.2%	10.4%	46.3%
Unincorporated Camden	363,561	16.9%	11.5%	18.1%	3.8%	46.7%
Woodbine	1,643	0.1%	9.2%	0%	4.5%	86.2%

Source: FEMA 2017 DFIRM

3.4.3. FEMA National Flood Insurance Program

The National Flood Insurance Program (NFIP), administered by the Federal Emergency Management Agency (FEMA), aims to reduce the impact of flooding on private and public structures. It does so by providing affordable insurance to property owners, renters and businesses and by encouraging communities to adopt and enforce floodplain management regulations. These efforts help mitigate the effects of flooding on new and improved structures. Overall, the program reduces the socio-economic impact of disasters by promoting the purchase and retention of flood insurance. The NFIP provides federally-backed flood insurance within communities that enact and enforce floodplain regulations to reduce risk to structures subject to flooding. This ordinance regulates building in the 1% floodplain (100-year) – the floodplain determined to have a 1% chance of flooding in any given year. It is important to note that the 1% floodplain is just a statistical model for insurance rating purposes and that flood damage can still result in areas outside of the 1% floodplain from floods that exceed the base flood, from flooding in unmapped areas, and from flooding that affects buildings constructed to lower standards, before the community joined the NFIP. Furthermore, a home that is located within the 1% floodplain has a 26% chance of flooding during the life-span of a 30-year mortgage (FEMA, 2019a).

The FEMA partners with Tribal nations, States, and communities to model flood hazards, assess flood risks, and provide accurate data to guide stakeholders in taking effective mitigation actions that result in safer and more resilient communities. This data is incorporated into flood maps, known as FIRMs, that support the NFIP and provide the basis for community floodplain management regulations and flood insurance requirements. The FIRMs illustrate the 1% (100-year) and 0.2% (500-year) floodplains also referred to areas of high and moderate risk, respectively. Flood hazards are dynamic and can change frequently because of a variety of factors, including weather patterns, erosion, and new development. FEMA, through the Risk M.A.P. (Mapping, Assessment & Planning) program, is currently working with communities to collect new or updated flood hazard data and updates flood maps to reflect these changes (FEMA, 2019b). The County's effective FIRMs were updated (adopted) on December 21, 2017, and can be viewed online at the following page: <https://map.georgiadfirm.com/>.

The Georgia Floodplain Management Office coordinates the NFIP with Georgia's local jurisdictions. As part of a Cooperating Technical Partner (CTP) Agreement with FEMA, the GADNR,

Environmental Protection Division accepted delegation and responsibility of FEMA’s mapping program for the State of Georgia. Through this program, the GADNR provides updated, easily accessible digital FIRMs for 159 counties and over 530 communities. Continuing as a CTP with FEMA, GADNR facilitates the implementation of FEMA’s Risk MAP Program through its Georgia Flood MAP program. This program provides direct management and support of NFIP regulatory, engineering, and mapping activities within the State of Georgia. An extensive online archive of floodplain management and mapping resources, tutorials, and tools can be located at GeorgiaDFIRM.com.

The Community Rating System (CRS) is a voluntary program associated with the NFIP. Under CRS, communities participating in NFIP are rewarded for doing more than regulating construction of new buildings to the minimum national standards. Program participants are rewarded with discounted flood insurance premiums for policyholders within their community. The City of Kingsland is currently in the process of joining the CRS program. Unincorporated Camden County and St. Marys joined the CRS program within the last decade and are continuously working to improve their ratings. As of the most recent CRS update in October 2021 (Table 3.9), St. Marys and Unincorporated Camden County had a CRS Rating of ‘6’. This means policyholders in the City of St. Marys and unincorporated County receive a 20% discount.

Table 3.9. Community Rating System (CRS) Ratings in Camden County

Community	CRS Entry Date	Current CRS Rating	Current CRS Effective Date*
St. Marys	5/1/2016	6	10/1/2019
[Unincorporated] Camden County	5/1/2013	6	5/1/2017
Kingsland	Currently pursuing application into program as part of grant		

* Ratings last updated 10/1/2021.

3.4.4. High-Tide Flooding

High-tide flooding occurs when higher than normal tides inundate low-lying coastal areas. This can occur during “spring tides,” when the moon is either full or new, and it is most extreme during a “perigean-spring tide,” when the moon is either full or new, and it is closest to the earth. A “king tide” is a non-scientific term to describe these occurrences of exceptionally high tides. SLR is affecting the extent of high tide flooding by raising the average daily water levels. As a result, high tides are reaching higher and extending further inland than in the past. King tides provide a preview of the future impacts related to SLR because the water level reached now during a king tide will be the water level reached at high tide on an average day in the future (EPA, 2019).

Annual occurrences of tidal flooding—exceeding local thresholds for minor impacts to infrastructure—have increased 5- to 10-fold since the 1960s in several U.S. coastal cities. The changes in high tide flooding over time are greatest where elevation is lower, local SLR rise is higher, or extreme variability is less. In a sense, today’s flood will become tomorrow’s high tide, as SLR will cause flooding to occur more frequently and last for longer durations of time.

In many locations along Georgia’s coast, the tidal range is much larger compared to other regions of the U.S., so they will be more significantly impacted by a perigean-spring tide (NOAA, 2020). As shown in the Table 3.10 below, approximately 22.4% (102,809 acres) of Camden County is subject to high tide flooding. This includes 85,516 acres in Unincorporated Camden County, 8,800 acres in Cumberland Island, 3,660 acres in St. Marys, 2,800 acres in Kings Bay, 1,114 acres in Little Cumberland Island, 824 acres in Kingsland, and 96 acres in Woodbine. These areas and percentages seem large

because much of the area subject to high tide flooding is currently regularly and irregularly flooded marsh and tidal swamp. As a result, high tide flooding was compared with “Undeveloped Dry Land” and “Developed Dry Land” from the SLAMM, initial conditions model to determine how much “dry land” overlapped this area of high tide flooding, and the results are presented in Table 3.10. Approximately 1.7% (3,954 acres) of Camden County that is classified as “dry land” is subject to high tide flooding. Approximately three-quarters of this is in unincorporated county (3,025 acres). The remaining acreage in order is as follows: 305 acres in St. Marys, 205 acres in Cumberland Island, 182 acres in Kings Bay, 118 acres in Kingsland, 94 acres in Little Cumberland Island, and 26 acres in Woodbine. NOAA has created a tool that allows users to view the extent of current high-tide flooding as well as future highest annual tide (HAT) under various SLR scenarios. To view HAT under future SLR scenarios, please visit <https://coast.noaa.gov/slr/>.

Table 3.10. Area Subject to High Tide Flooding

Geography	Total Area	Area Subject to High Tide Flooding	Percent of Area Subject to High Tide Flooding	Subset of Area Classified as “Dry” Land (SLAMM) ¹	Percent of Area Subject to High Tide Flooding as “Dry” Land ¹
	<i>Acres</i>	<i>Acres</i>		<i>Acres</i>	
Camden	459,889	102,809	22.4%	3,954	1.7%
Unincorporated Camden County	363,561	85,516	23.5%	3,025	1.7%
Cumberland Island	34,148	8,800	25.8%	205	1.7%
Kings Bay	13,474	2,800	20.8%	182	2.2%
Kingsland	28,760	824	2.9%	118	0.5%
Little Cumberland Island	2,385	1,114	46.7%	94	9.0%
St. Marys	15,918	3,660	23.0%	305	3.4%
Woodbine	1,643	96	5.8%	26	1.8%

¹ This subset represents where there is “High Tide Flooding” overlapping either “Undeveloped Dry Land” or “Developed Dry Land” under the existing conditions from the SLAMM dataset.

3.4.5. Storm Surge

Storm surge is the rise in seawater level during a storm, measured as the height of the water above the normal tide. The surge is caused primarily by wind pushing water onshore and changes in barometric pressure associated with the storm. The height of the storm surge at any given location depends on the orientation of the coastline with the storm track and wind direction; the intensity, size, and speed of the storm; the tidal cycle timing; and the local bathymetry (NOS, 2019a).

Hurricanes create significant storm surges, which have direct adverse impacts on coastal Georgia communities. In the last six years Camden County has experienced four tropical storms or hurricanes noted as having impacts in Camden County from the NOAA National Centers for Environmental Information (NCEI) Storm Events Database, although none were as a direct hit from a hurricane (NOAA, 2021). From 1990 to 2015, there were only 6 tropical storms (NOAA, 2021).

During Hurricane Matthew (2016), storm surge tides of 4 to 7 feet and associated waves resulted in flooding in the Camden County area. While the hurricane remained just offshore before making landfall in South Carolina, a strong onshore flow over coastal Georgia resulted in coastal flooding and minor to moderate beach erosion. According to a report by the United States Geological Survey (USGS), Matthew's storm surge and waves overwashed about 30 percent of the sand dunes along Georgia's coastline as the powerful storm brushed past the Southeast (Aon Benfield, 2017). A storm surge of just under 8 feet was recorded at Ft. Pulaski, Georgia, between Savannah and Tybee Island, according to NOAA/National Ocean Service data. Fort Pulaski set a new record tide level of 12.57 ft MLLW (above normal low tide), which occurred two hours after high tide.

Less than 11 months later, Hurricane Irma (2017) slammed Camden County with 7 to 11 inches of rain, record-setting storm surge. With maximum winds of 185 miles per hour, Irma became the strongest storm on record to exist in the Atlantic Ocean outside of the Caribbean and Gulf of Mexico. It sustained those maximum winds speeds for 37 hours and spent three consecutive days as a category 5 hurricane—making it the longest of any cyclone in the world since 1932 to maintain that intensity. Although Irma passed through Georgia about 100 miles west of the coast

as a weakening tropical storm, Camden County endured significant damages having been located in the northeast quadrant of the storm. Hurricane Irma's impact was made worse because it coincided with an unrelated Nor'easter that brought heavy rains of 4 to 6 inches in the days prior to Irma. Compounded with the heavy rains, this contributed to the excessive storm surge, which flooded homes along the coast and the inland marsh. The Satilla River at Woodbine crested at 6.85 feet on September 11th, which corresponds to a major flooding level. Irma is the fifth-costliest hurricane to hit the mainland United States, causing an estimated \$50 billion in damage, according to the National Hurricane Center.

Hurricane Irma Flooding - St. Marys, GA



Source: Curtis Compton/ccompton@ajc.com

As sea level continues to rise, future storm surges will be higher and more likely to present a serious threat to coastal Georgia. The National Weather Service (NWS) – i.e., NOAA – has developed a computerized numerical Sea, Lake and Overland Surges from Hurricanes (SLOSH) model to estimate storm surge heights resulting from historical, hypothetical, or predicted hurricanes by taking into account the atmospheric pressure, size, forward speed, and track data. These parameters are used to create a model of the wind field which drives the storm surge. SLOSH has been applied to the entire U.S. Atlantic and Gulf of Mexico coastlines, and extends to Hawaii, Puerto Rico, Virgin Islands, and the Bahamas. The SLOSH model coverage is subdivided into 32 regions or basins. These basins are centered upon particularly susceptible features: inlets, large coastal centers of population, low-lying topography, and ports. The SLOSH model is able to resolve flow through barriers, gaps, and passes and models deep passes between bodies of water. It also resolves inland inundation and the overtopping of barrier systems, levees, and roads. However, the SLOSH model does not explicitly model the impacts of waves on top of the surge nor does it account for normal river flow or rain flooding. It can resolve coastal reflections of surges such as coastally trapped Kelvin waves.

Table 3.11 below depicts the land area susceptible to storm surge flooding at different hurricane intensities. The majority of the land area (>50%) for each of the jurisdictions/geographic areas will not be impacted by storm surge under a Category 1 storm except Cumberland Island and Little Cumberland Island. The storm size required to inundate greater than 80% of the land area is a Category 2 storm for Little Cumberland Island (92.3%); a Category 3 storm for Cumberland Island (80.0%), St. Marys (82.3%) and Woodbine (88.7%); a Category 4 storm for Kingsland (82.5%) and Unincorporated Camden County (89.6%); and a Category 5 storm for Kings Bay (92.8%). Across all of Camden County, there is 29,589 acres of land where the storm surge is greater than a Category 5, and 87% of this land is in Unincorporated Camden County.

Table 3.11. Camden County Shoreline Vulnerability to Storm Surge - SLOSH Model

Geography	Total Area	Non-Inundated Area from Storm Surge (acres & percentage of total area)				
	Acres	No Surge Zone	Category 5+	Category 4-5+	Category 3-5+	Category 2-5+
Camden	459,889	29,589 (6.4%)	50,020 (10.9%)	107,636 (23.4%)	208,118 (45.3%)	276,378 (60.1%)
Unincorporated Camden County	363,561	25,618 (7.0%)	37,961 (10.4%)	77,883 (21.4%)	159,817 (44.0%)	216,997 (59.7%)
Cumberland Island	34,148	1,502 (4.4%)	3,678 (10.8%)	6,838 (20.0%)	10,113 (29.6%)	13,028 (38.2%)
Kings Bay	13,474	966 (7.2%)	2,758 (20.5%)	5,204 (38.6%)	6,684 (49.6%)	7,894 (58.6%)
Kingsland	28,760	1,406 (4.9%)	5,044 (17.5%)	14,638 (50.9%)	23,949 (83.3%)	27,110 (94.3%)
Little Cumberland Island	2,385	16 (0.7%)	34 (1.4%)	71 (3.0%)	184 (7.7%)	681 (28.5%)
St. Marys	15,918	76 (0.5%)	478 (3.0%)	2,818 (17.7%)	6,489 (40.8%)	9,212 (57.9%)
Woodbine	1,643	5 (0.3%)	68 (4.1%)	185 (11.3%)	881 (53.6%)	1,457 (88.7%)

3.5. Sea Level Affecting Marshes Model (SLAMM)

Salt marshes are amongst the most susceptible ecosystems to the effects of accelerated SLR, and many coastal resource management agencies have become concerned about the long-term loss of tidal marshes and the ecosystem services they provide. The SLAMM model was developed in the 1990s by the U.S. EPA to assist coastal resource management agencies in quantifying potential tidal marsh losses from SLR and to conserve areas for future marsh migration and to support planning efforts to offset those losses.

Between 2004 and 2009, it was estimated that U.S. coastal wetland environments have been lost at an average rate of about 80,160 acres per year (USGCRP, 2018)

Figure 3.13 illustrates how marshes, unimpeded, can migrate upland in response to SLR. If there are barriers to this migration, such as bulkheads, buildings or roads, then the marsh will be overtaken by SLR as water levels increase and waves and currents erode the substrate.

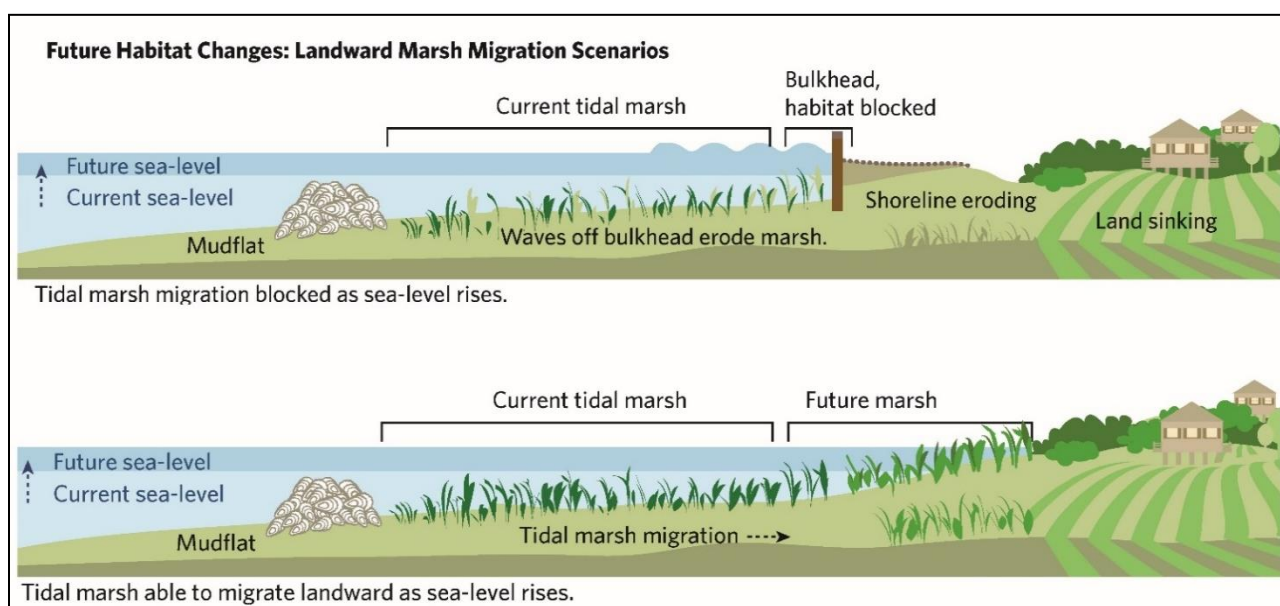


Figure 3.13: Landward Marsh Migration Scenarios

Source: Image from (WPC, 2019)

The SLAMM model incorporates elevation, land cover and wetland extent with locally derived empirical data on tides, overwash, saturation, accretion and erosion rates to predict where tidal marshes may migrate upland in response to changes in sea level over time.

NOAA has created a tool for viewing SLAMM model results that can be seen on the Sea Level Rise Viewer at <https://coast.noaa.gov/slr/>. This tool allows users to choose the SLR scenario, from current MHHW to 10 feet, and view the impacts of SLR on the migration of coastal habitats including upland, freshwater forested wetland, freshwater shrub wetland, freshwater emergent wetland, brackish/transitional marsh, still water marsh, unconsolidated shore, and open water (NOAA, 2019a). This tool also allows users to further investigate an area of interest based on the closest pre-determined Scenario Location. At this location, users can choose between five (5) local SLR scenarios (by year or by individual scenario) and customize the scenarios and accretion rate to view how accretion can offset SLR. SLAMM projections for Camden County at the 1-m SLR scenario are depicted in Figure 3.14, below.

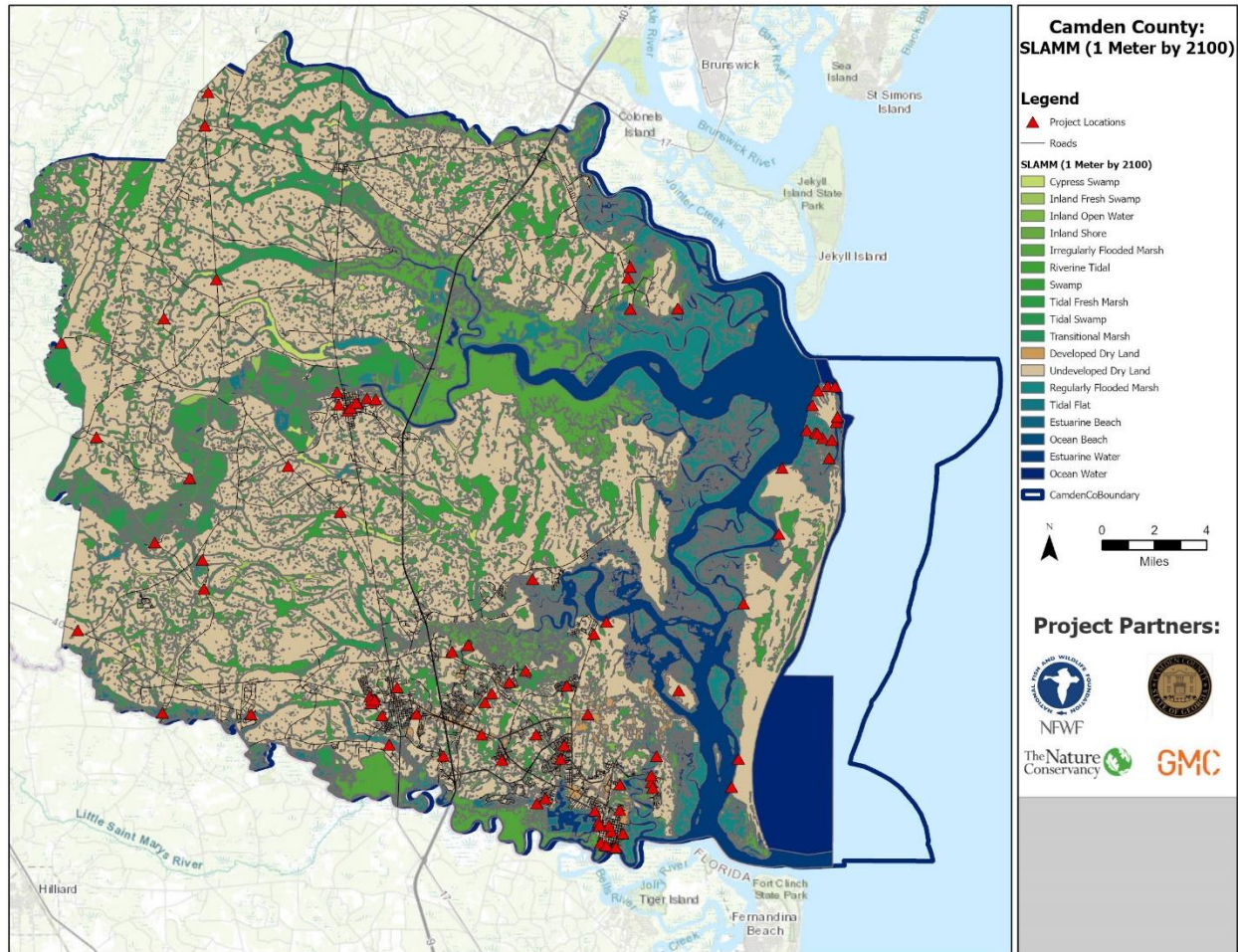


Figure 3.14: SLAMM Model Projected Conditions for 1 Meter SLR by 2100

3.5.1. SLAMM Analysis for Camden County – 1-Meter & 2-Meter

The tables below include the SLAMM data for change in acreage by land use modeled for the years 2050 and 2100 with 3.3-feet (1.0-meter) and 6.6-feet (2.0-meters) of SLR scenarios. Based on current projections in the area of interest, the 3.3-ft SLR scenario is between intermediate-low and intermediate, and the 6.6-ft SLR scenario is about 0.5-ft greater than the intermediate-high scenario. The most commonly recommended SLR scenarios for planning are intermediate and intermediate-high. The predicted SLR increases for these two scenarios are roughly equivalent to the 1-m and 2-m scenarios, respectively – 3.9 feet (1.2 m) and 6.1 feet (1.9 m), respectively.

An analysis of these tables indicates that the greatest impact of SLR to the coastal habitat regime in the area of interest is the conversion of undeveloped dry land to estuarine water and tidal flats, as salt water inundates these environments for prolonged periods of time, thus killing the vegetation. It is important to note that “undeveloped dry land” includes developed areas that contain significant tree cover. Therefore, land within this category (“undeveloped dry land”) may be somewhat developed as well, but the level of tree cover present defines what is considered “undeveloped” for the SLAMM modeling purposes. As a result, much of the later analysis lumps both “developed dry land” and “undeveloped dry land” as an aggregated “dry land.” There are 18 SLAMM land cover classes presented in the sections below, but not all are present for each geography of the County.

Several are grouped into a larger land cover category, and these and source classification details are detailed in Table 3.12. Each jurisdiction has a different setting, i.e., adjacent to ocean, marsh, or higher elevation, so the primary conversions by jurisdiction are described below

(*Note: losses are depicted in red text*):

- Unincorporated Camden County: **undeveloped dry land, regularly flooded marsh, irregularly flooded marsh, and swamp** → tidal flat, estuarine water, and tidal fresh marsh
- Cumberland Island: **undeveloped dry land, regularly flooded marsh, and ocean beach** → tidal flat, estuarine water, and ocean water
- Little Cumberland Island: **undeveloped dry land and regularly flooded marsh** → tidal flat, estuarine water, ocean water, and irregularly flooded marsh
- St. Marys: **undeveloped/developed dry land and irregularly flooded marsh** → tidal flat and estuarine water
- Kingsland: **undeveloped dry land and swamp** → tidal flat and tidal swamp
- Kings Bay: **undeveloped dry land and regularly flooded marsh** → tidal flat and estuarine water
- Woodbine: **undeveloped dry land and swamp** → tidal flat, tidal swamp, and irregularly flooded marsh

Table 3.12. SLAMM Land Cover Categories, Land Classes, and Source Classification Details

SLAMM Land Cover Category	SLAMM Land Cover Class	Source Classification
Open Water	Inland Open Water	See SLAMM Technical Documentation
	Riverine Tidal	
	Estuarine Water	
	Ocean Water	
Low Tidal	Tidal Flat	Euryhaline Unvegetated
	Estuarine Beach	See SLAMM Technical Documentation
	Ocean Beach	
Salt Marsh	Regularly Flooded Marsh	Low Estuarine Mixing
Transitional Marsh	Irregularly Flooded Marsh	High Estuarine Mixing
	Transitional Marsh	Oligohaline Transition
Freshwater Tidal	Tidal Fresh Marsh	See SLAMM Technical Documentation
	Tidal Swamp	Tidal Freshwater
Freshwater Non-Tidal	Swamp	See SLAMM Technical Documentation
	Cypress Swamp	
	Inland Fresh Swamp	
	Inland Shore	
Aggregated Dry Land	Developed Dry Land	Low/Med/High Intensity Developed (NLCD)
	Undeveloped Dry Land	Dry Developed Land (NLCD)

Over the next several pages, there is a series of tables presenting the results from the SLAMM analysis. First there is a summary for the County as a whole. Next is Unincorporated Camden County, with a separate analysis for Unincorporated Camden County, Cumberland Island, Little Cumberland Island. This is followed by City of St. Marys, Kingsland, Kings Bay, and then Woodbine. For each geography, there are two tables – one for the 1-m (3.3-ft) scenario and one for the 2-m (6.6-ft) scenario. For each scenario/table, the results presented include total area under existing conditions, followed by net change in acres and how it relates as a percentage of the total area of

that geography at Year 2050 and then Year 2100. The SLAMM land cover classes are sorted in each table based on the net change in acres for year 2100 of each scenario, with the most losses at the top and most gains at the bottom. Losses are noted in red text.

For Camden County as a whole (Table 3.13 and Table 3.14), the SLAMM dataset has a total area of 459,035 acres. This is less than the 459,889 acres presented in earlier sections due to SLAMM not being run for large sections of “Ocean Water” east of the barrier islands. The previous sections, used the Census-designated boundary for the county. Under the 1-m scenario (Table 3.13), 11,701 acres (2.6% of total area) of “dry land” will be converted to one of the other categories by 2100. Under the 2-m scenario (Table 3.14), 31,455 acres (6.9% of total area) of “dry land” will be converted to one of the other categories by 2100. Considering the large dependency on the tourism industry located around the County, as well as large resident population, the loss of any developed and undeveloped land will have substantial impacts on the region. The categories that are predominately gaining land area include “tidal flat,” “tidal fresh marsh,” and “estuarine water.” By 2100, “irregularly flooded marsh” was the 4th largest category gaining land for the 1-m scenario, but it is the 3rd largest category losing land for the 2-m scenario. This is attributed to the water rising to such an extent that the flooding becomes so consistent that it becomes “estuarine water” or “tidal flat.” Following “dry land,” the next largest category losing land in both the 1-m and 2-m scenarios are “regularly flooded marsh” and then “swamp.” Overall, the net change of these categories results in more unvegetated and open water land area.

The primary conversions in SLAMM due to inundation from SLR in the County include:

- Swamp → Tidal Swamp
- Irregularly Flooded Marsh → Regularly Flooded Marsh
- Regularly Flooded Marsh → Tidal Flat
- Tidal Flat → Estuarine Water

Table 3.13. SLAMM Projections for Camden County; 1-Meter Scenario

Camden County	Current Conditions	2050 (1-Meter)		2100 (1-Meter)	
SLAMM Land Cover Class	Acres	Net Change Acres	Percent of Total Area	Net Change Acres	Percent of Total Area
Undeveloped Dry Land	227,062	-3,822	-0.83%	-11,459	-2.50%
Swamp	57,074	-6,261	-1.36%	-8,788	-1.91%
Regularly Flooded Marsh	43,938	365	0.08%	-5,231	-1.14%
Tidal Swamp	20,162	5,640	1.23%	-2,320	-0.51%
Estuarine Beach	1,911	-588	-0.13%	-1,161	-0.25%
Inland Fresh Swamp	5,459	-1,004	-0.22%	-1,110	-0.24%
Ocean Beach	1,016	-983	-0.21%	-921	-0.20%
Riverine Tidal	2,160	-236	-0.05%	-607	-0.13%
Developed Dry Land	7,670	-144	-0.03%	-242	-0.05%
Inland Open Water	2,203	-182	-0.04%	-230	-0.05%
Cypress Swamp	6,234	2	0.00%	-29	-0.01%
Inland Shore	16	0	0.00%	0	0.00%
Transitional Marsh	1,199	-159	-0.03%	229	0.05%
Ocean Water	12,480	1,013	0.22%	1,080	0.24%
Irregularly Flooded Marsh	28,171	-51	-0.01%	4,146	0.90%
Estuarine Water	38,347	2,157	0.47%	7,199	1.57%
Tidal Fresh Marsh	3,932	1,379	0.30%	8,613	1.88%
Tidal Flat	0	2,872	0.63%	10,831	2.36%

Table 3.14. SLAMM Projections for Camden County; 2-Meter Scenario

Camden County	Current Conditions	2050 (2-Meter)		2100 (2-Meter)	
SLAMM Land Cover Class	Acres	Net Change Acres	Percent of Total Area	Net Change Acres	Percent of Total Area
Undeveloped Dry Land	227,062	-7,044	-1.53%	-30,691	-6.69%
Regularly Flooded Marsh	43,938	-3,670	-0.80%	-30,200	-6.58%
Irregularly Flooded Marsh	28,171	552	0.12%	-19,640	-4.28%
Swamp	57,074	-7,822	-1.70%	-13,813	-3.01%
Tidal Swamp	20,162	3,800	0.83%	-7,964	-1.74%
Cypress Swamp	6,234	3	0.00%	-1,650	-0.36%
Inland Fresh Swamp	5,459	-1,073	-0.23%	-1,493	-0.33%
Estuarine Beach	1,911	-936	-0.20%	-1,427	-0.31%
Riverine Tidal	2,160	-278	-0.06%	-1,316	-0.29%
Developed Dry Land	7,670	-182	-0.04%	-763	-0.17%
Ocean Beach	1,016	-961	-0.21%	-446	-0.10%
Inland Open Water	2,203	-190	-0.04%	-379	-0.08%
Inland Shore	16	0	0.00%	0	0.00%
Ocean Water	12,480	1,023	0.22%	1,427	0.31%
Tidal Fresh Marsh	3,932	4,023	0.88%	5,010	1.09%
Transitional Marsh	1,199	592	0.13%	5,191	1.13%
Estuarine Water	38,347	4,253	0.93%	36,900	8.04%
Tidal Flat	0	7,911	1.72%	61,255	13.34%

The next series of tables are presented for the separate jurisdictions and geographic areas of interest for Camden County – (1) Unincorporated Camden County (Table 3.15 and Table 3.16), (2) Cumberland Island (Table 3.17 and Table 3.18), (3) Little Cumberland Island (Table 3.19 and Table 3.20), (4) City of St. Marys (Table 3.21 and Table 3.22), (5) City of Kingsland (Table 3.23 and Table 3.24), (6) Kings Bay (Table 3.25 and Table 3.26), and (7) City of Woodbine (Table 3.27 and Table 3.28). Unincorporated Camden County encompasses 363,561 acres in total area. Under the 1-m scenario (Table 3.15), 9,271 acres (2.6% of total area) of “dry land” will be converted to one of the other categories by 2100. Under the 2-m scenario (Table 3.16), 24,280 acres (6.7% of total area) of “dry land” will be converted to one of the other categories by 2100. After “dry land,” the land cover classes with the next largest net losses were “Swamp” and “Regularly Flooded Marsh.” The land cover classes with the largest net gains were “Tidal Flat,” “Tidal Fresh Marsh,” and “Estuarine Water.”

Cumberland Island has a total area of 34,148 acres. Under the 1-m scenario (Table 3.17), 582 acres (1.7% of total area) of “dry land” will be converted to one of the other categories by 2100. Under the 2-m scenario (Table 3.18), 1,892 acres (5.5% of total area) of “dry land” will be converted to one of the other categories by 2100. The land cover class with the largest net loss was “Regularly Flooded Marsh.” The land cover classes with the largest net gains were “Ocean Water,” “Estuarine Water,” and “Tidal Flat”.

Table 3.15. SLAMM Projections for Unincorporated Camden County; 1-Meter Scenario

Unincorporated Camden County	Current Conditions	2050 (1-Meter)		2100 (1-Meter)	
SLAMM Land Cover Class	Acres	Net Change Acres	Percent of Total Area	Net Change Acres	Percent of Total Area
Undeveloped Dry Land	180,087	-2,991	-0.82%	-9,189	-2.53%
Swamp	47,507	-5,993	-1.65%	-8,090	-2.23%
Regularly Flooded Marsh	31,022	-67	-0.02%	-3,047	-0.84%
Tidal Swamp	19,432	5,523	1.52%	-2,634	-0.72%
Inland Fresh Swamp	4,191	-995	-0.27%	-1,074	-0.30%
Estuarine Beach	1,083	-397	-0.11%	-684	-0.19%
Riverine Tidal	2,158	-235	-0.06%	-606	-0.17%
Inland Open Water	1,348	-169	-0.05%	-193	-0.05%
Developed Dry Land	1,504	-49	-0.01%	-82	-0.02%
Cypress Swamp	5,403	2	0.00%	-29	-0.01%
Ocean Beach	14	-14	0.00%	-14	0.00%
Inland Shore	13	0	0.00%	0	0.00%
Ocean Water	11,159	15	0.00%	15	0.00%
Transitional Marsh	1,066	-213	-0.06%	178	0.05%
Irregularly Flooded Marsh	25,132	472	0.13%	3,952	1.09%
Estuarine Water	28,642	1,675	0.46%	5,009	1.38%
Tidal Flat	0	2,091	0.58%	7,955	2.19%
Tidal Fresh Marsh	3,800	1,345	0.37%	8,536	2.35%

Table 3.16. SLAMM Projections for Unincorporated Camden County; 2-Meter Scenario

Unincorporated Camden County	Current Conditions	2050 (2-Meter)		2100 (2-Meter)	
SLAMM Land Cover Class	Acres	Net Change Acres	Percent of Total Area	Net Change Acres	Percent of Total Area
Undeveloped Dry Land	180,087	-5,597	-1.54%	-24,059	-6.62%
Regularly Flooded Marsh	31,022	-1,971	-0.54%	-20,343	-5.60%
Irregularly Flooded Marsh	25,132	846	0.23%	-18,915	-5.20%
Swamp	47,507	-7,343	-2.02%	-11,895	-3.27%
Tidal Swamp	19,432	3,613	0.99%	-8,515	-2.34%
Cypress Swamp	5,403	2	0.00%	-1,610	-0.44%
Inland Fresh Swamp	4,191	-1,044	-0.29%	-1,315	-0.36%
Riverine Tidal	2,158	-278	-0.08%	-1,314	-0.36%
Estuarine Beach	1,083	-584	-0.16%	-811	-0.22%
Inland Open Water	1,348	-176	-0.05%	-261	-0.07%
Developed Dry Land	1,504	-64	-0.02%	-221	-0.06%
Ocean Beach	14	-14	0.00%	-14	0.00%
Inland Shore	13	0	0.00%	0	0.00%
Ocean Water	11,159	15	0.00%	15	0.00%
Transitional Marsh	1,066	479	0.13%	4,125	1.13%
Tidal Fresh Marsh	3,800	4,000	1.10%	4,760	1.31%
Estuarine Water	28,642	2,910	0.80%	27,113	7.46%
Tidal Flat	0	5,204	1.43%	53,260	14.65%

Table 3.17. SLAMM Projections for Cumberland Island; 1-Meter Scenario

Cumberland Island	Current Conditions	2050 (1-Meter)		2100 (1-Meter)	
SLAMM Land Cover Class	Acres	Net Change Acres	Percent of Total Area	Net Change Acres	Percent of Total Area
Regularly Flooded Marsh	8,229	-539	-1.58%	-1,656	-4.85%
Ocean Beach	947	-923	-2.70%	-863	-2.53%
Undeveloped Dry Land	11,741	-152	-0.44%	-578	-1.69%
Estuarine Beach	552	-131	-0.38%	-290	-0.85%
Tidal Swamp	180	-91	-0.27%	-130	-0.38%
Swamp	2,070	-6	-0.02%	-34	-0.10%
Tidal Fresh Marsh	8	0	0.00%	-8	-0.02%
Inland Fresh Swamp	453	0	0.00%	-6	-0.02%
Developed Dry Land	7	-2	-0.01%	-4	-0.01%
Inland Open Water	40	-1	0.00%	-2	-0.01%
Cypress Swamp	65	0	0.00%	0	0.00%
Transitional Marsh	38	13	0.04%	2	0.01%
Irregularly Flooded Marsh	282	160	0.47%	352	1.03%
Estuarine Water	7,386	266	0.78%	884	2.59%
Ocean Water	1,298	942	2.76%	985	2.88%
Tidal Flat	0	464	1.36%	1,347	3.95%

Table 3.18. SLAMM Projections for Cumberland Island; 2-Meter Scenario

Cumberland Island	Current Conditions	2050 (2-Meter)		2100 (2-Meter)	
SLAMM Land Cover Class	Acres	Net Change Acres	Percent of Total Area	Net Change Acres	Percent of Total Area
Regularly Flooded Marsh	8,229	-1,190	-3.48%	-7,390	-21.64%
Undeveloped Dry Land	11,741	-353	-1.03%	-1,888	-5.53%
Swamp	2,070	-22	-0.06%	-531	-1.56%
Ocean Beach	947	-907	-2.66%	-436	-1.28%
Estuarine Beach	552	-217	-0.63%	-366	-1.07%
Tidal Swamp	180	-122	-0.36%	-156	-0.46%
Inland Fresh Swamp	453	-5	-0.01%	-110	-0.32%
Tidal Fresh Marsh	8	-8	-0.02%	-8	-0.02%
Developed Dry Land	7	-3	-0.01%	-4	-0.01%
Inland Open Water	40	-1	0.00%	-2	-0.01%
Cypress Swamp	65	0	0.00%	0	0.00%
Irregularly Flooded Marsh	282	278	0.81%	6	0.02%
Transitional Marsh	38	23	0.07%	529	1.55%
Ocean Water	1,298	948	2.78%	1,319	3.86%
Tidal Flat	0	1,053	3.08%	4,225	12.69%
Estuarine Water	7,386	526	1.54%	4,812	14.09%

Little Cumberland Island is 2,385 acres total in area. Under the 1-m scenario (Table 3.19), approximately 265 acres of “dry land” will shift to a land cover class that is not “dry land” by 2100 (11.1% of total area). Under the 2-m SLR scenario (Table 3.20), approximately 569 acres will shift to a land cover class that is not “dry land” by 2100 (23.9% of total area).

Table 3.19. SLAMM Projections for Little Cumberland Island; 1-Meter Scenario

Little Cumberland Island	Current Conditions	2050 (1-Meter)		2100 (1-Meter)	
SLAMM Land Cover Class	Acres	Net Change Acres	Percent of Total Area	Net Change Acres	Percent of Total Area
Undeveloped Dry Land	1,037	-94	-3.93%	-264	-11.06%
Regularly Flooded Marsh	959	-6	-0.26%	-79	-3.33%
Ocean Beach	54	-46	-1.94%	-44	-1.84%
Transitional Marsh	43	-22	-0.91%	-37	-1.55%
Inland Fresh Swamp	43	0	0.00%	-18	-0.77%
Swamp	52	0	0.00%	-13	-0.53%
Estuarine Beach	37	-4	-0.15%	-8	-0.32%
Developed Dry Land	1	-1	-0.04%	-1	-0.05%
Estuarine Water	113	14	0.57%	47	1.95%
Ocean Water	24	57	2.39%	80	3.36%
Tidal Flat	0	23	0.94%	117	4.89%
Irregularly Flooded Marsh	21	79	3.33%	221	9.25%

Table 3.20. SLAMM Projections for Little Cumberland Island; 2-Meter Scenario

Little Cumberland Island	Current Conditions	2050 (2-Meter)		2100 (2-Meter)	
SLAMM Land Cover Class	Acres	Net Change Acres	Percent of Total Area	Net Change Acres	Percent of Total Area
Regularly Flooded Marsh	959	-28	-1.18%	-638	-26.77%
Undeveloped Dry Land	1,037	-161	-6.75%	-568	-23.82%
Swamp	52	-4	-0.17%	-44	-1.85%
Transitional Marsh	43	-31	-1.30%	-43	-1.81%
Inland Fresh Swamp	43	-13	-0.56%	-40	-1.67%
Estuarine Beach	37	-6	-0.24%	-18	-0.74%
Developed Dry Land	1	-1	-0.04%	-1	-0.05%
Ocean Beach	54	-40	-1.68%	4	0.15%
Ocean Water	24	60	2.53%	93	3.88%
Irregularly Flooded Marsh	21	132	5.53%	147	6.15%
Estuarine Water	113	25	1.07%	334	14.00%
Tidal Flat	0	66	2.78%	775	32.51%

St. Marys encompasses 15,918 acres total in area. Under the 1-m scenario (Table 3.21), 739 acres (4.6% of total area) of “dry land” will be converted to one of the other categories by 2100. Under the 2-m scenario (Table 3.22), 2,259 acres (14.2% of total area) of “dry land” will be converted to one of the other categories by 2100. Under current conditions, there are 2,257 acres of developed land and 6,863 acres of undeveloped dry land, totaling 9,120 acres of “dry land.” The losses under the 1-m and 2-m scenarios represent 8.1% and 24.8% of the “dry land,” respectively. The land cover class with the largest net loss was “Irregularly Flooded Marsh.” The land cover classes with the largest net gains were “Estuarine Water” and “Tidal Flat.”

Table 3.21. SLAMM Projections for St. Marys; 1-Meter Scenario

St. Marys	Current Conditions	2050 (1-Meter)		2100 (1-Meter)	
SLAMM Land Cover Class	Acres	Net Change Acres	Percent of Total Area	Net Change Acres	Percent of Total Area
Irregularly Flooded Marsh	2,350	-827	-5.19%	-671	-4.21%
Undeveloped Dry Land	6,863	-346	-2.18%	-637	-4.00%
Developed Dry Land	2,257	-64	-0.40%	-101	-0.64%
Swamp	1,166	-44	-0.28%	-83	-0.52%
Tidal Swamp	170	-50	-0.31%	-78	-0.49%
Inland Open Water	357	-6	-0.04%	-25	-0.16%
Tidal Fresh Marsh	19	19	0.12%	-7	-0.04%
Cypress Swamp	278	0	0.00%	0	0.00%
Inland Fresh Swamp	86	0	0.00%	0	0.00%
Transitional Marsh	2	-1	-0.01%	1	0.01%
Regularly Flooded Marsh	1,059	1,268	7.97%	21	0.13%
Estuarine Water	1,313	26	0.16%	678	4.26%
Tidal Flat	0	24	0.15%	903	5.67%

Table 3.22. SLAMM Projections for St. Marys; 2-Meter Scenario

St. Marys	Current Conditions	2050 (2-Meter)		2100 (2-Meter)	
SLAMM Land Cover Class	Acres	Net Change Acres	Percent of Total Area	Net Change Acres	Percent of Total Area
Undeveloped Dry Land	6,863	-458	-2.88%	-1,892	-11.88%
Irregularly Flooded Marsh	2,350	-905	-5.68%	-941	-5.91%
Developed Dry Land	2,257	-79	-0.50%	-368	-2.31%
Swamp	1,166	-55	-0.34%	-192	-1.21%
Regularly Flooded Marsh	1,059	31	0.19%	-177	-1.11%
Inland Open Water	357	-6	-0.04%	-87	-0.54%
Tidal Swamp	170	-56	-0.35%	-63	-0.39%
Inland Fresh Swamp	86	0	0.00%	-2	-0.01%
Cypress Swamp	278	0	0.00%	-1	-0.01%
Tidal Fresh Marsh	19	-7	-0.05%	7	0.04%
Transitional Marsh	2	1	0.00%	10	0.06%
Tidal Flat	0	1,106	6.95%	1,397	8.78%
Estuarine Water	1,313	429	2.70%	2,309	14.50%

Kingsland has a total area of 28,760 acres. Under the 1-m scenario (Table 3.23), 279 acres (1.0% of total area) of “dry land” will be converted to one of the other categories by 2100. Under the 2-m scenario (Table 3.24), 983 acres (3.4% of total area) of “dry land” will be converted to one of the other categories by 2100. The land cover class with the largest net loss was “Swamp.” The land cover classes with the largest net gains were “Tidal Swamp” and “Tidal Flat.”

Table 3.23. SLAMM Projections for Kingsland; 1-Meter Scenario

Kingsland	Current Conditions	2050 (1-Meter)		2100 (1-Meter)	
SLAMM Land Cover Class	Acres	Net Change Acres	Percent of Total Area	Net Change Acres	Percent of Total Area
Swamp	5,501	-206	-0.71%	-523	-1.82%
Undeveloped Dry Land	19,451	-96	-0.34%	-273	-0.95%
Inland Open Water	240	-6	-0.02%	-10	-0.03%
Developed Dry Land	2,126	-6	-0.02%	-6	-0.02%
Inland Fresh Swamp	648	0	0.00%	-2	-0.01%
Riverine Tidal	2	-1	0.00%	-1	0.00%
Inland Shore	2	0	0.00%	0	0.00%
Cypress Swamp	365	0	0.00%	0	0.00%
Estuarine Water	10	10	0.03%	23	0.08%
Transitional Marsh	8	5	0.02%	24	0.08%
Irregularly Flooded Marsh	59	0	0.00%	42	0.14%
Tidal Flat	0	14	0.05%	46	0.16%
Tidal Fresh Marsh	65	8	0.03%	50	0.17%
Regularly Flooded Marsh	21	10	0.03%	78	0.27%
Tidal Swamp	263	268	0.93%	552	1.92%

Table 3.24. SLAMM Projections for Kingsland; 2-Meter Scenario

Kingsland	Current Conditions	2050 (2-Meter)		2100 (2-Meter)	
SLAMM Land Cover Class	Acres	Net Change Acres	Percent of Total Area	Net Change Acres	Percent of Total Area
Swamp	5,501	-367	-1.28%	-1,059	-3.68%
Undeveloped Dry Land	19,451	-169	-0.59%	-955	-3.32%
Cypress Swamp	365	0	0.00%	-39	-0.13%
Developed Dry Land	2,126	-6	-0.02%	-28	-0.10%
Inland Open Water	240	-7	-0.02%	-20	-0.07%
Inland Fresh Swamp	648	-2	-0.01%	-12	-0.04%
Riverine Tidal	2	-1	0.00%	-1	0.00%
Inland Shore	2	0	0.00%	0	0.00%
Irregularly Flooded Marsh	59	56	0.19%	16	0.06%
Regularly Flooded Marsh	21	17	0.06%	136	0.47%
Estuarine Water	10	13	0.05%	140	0.49%
Tidal Fresh Marsh	65	8	0.03%	289	1.01%
Transitional Marsh	8	29	0.10%	309	1.07%
Tidal Flat	0	31	0.11%	443	1.54%
Tidal Swamp	263	396	1.38%	781	2.71%

Kings Bay encompasses 13,474 acres total in area. Under the 1-m scenario (Table 3.25), 501 acres (3.7% of total area) of “dry land” will be converted to one of the other categories by 2100. Under the 2-m scenario (Table 3.26), 1,298 acres (9.6% of total area) of “dry land” will be converted to one of the other categories by 2100. Under current conditions, there are 1,648 acres of developed land and 6,570 acres of undeveloped dry land, totaling 8,218 acres of “dry land.” The losses under the 1-m and 2-m scenarios represent 6.1% and 15.8% of the “dry land,” respectively. The land cover class with the next largest net loss was “Regularly Flooded Marsh.” The land cover classes with the largest net gains were “Estuarine Water” and “Tidal Flat.”

Table 3.25. SLAMM Projections for Kings Bay; 1-Meter Scenario

Kings Bay	Current Conditions	2050 (1-Meter)		2100 (1-Meter)	
SLAMM Land Cover Class	Acres	Net Change Acres	Percent of Total Area	Net Change Acres	Percent of Total Area
Regularly Flooded Marsh	2,649	-302	-2.24%	-548	-4.07%
Undeveloped Dry Land	6,570	-122	-0.90%	-454	-3.37%
Estuarine Beach	239	-56	-0.41%	-179	-1.33%
Tidal Swamp	111	-34	-0.25%	-61	-0.46%
Developed Dry Land	1,648	-22	-0.17%	-47	-0.35%
Swamp	656	-5	-0.03%	-35	-0.26%
Tidal Fresh Marsh	6	-2	-0.01%	-4	-0.03%
Inland Fresh Swamp	25	-3	-0.02%	-3	-0.02%
Inland Open Water	215	0	0.00%	0	0.00%
Cypress Swamp	121	0	0.00%	0	0.00%
Transitional Marsh	42	59	0.44%	61	0.45%
Irregularly Flooded Marsh	313	64	0.47%	251	1.87%
Tidal Flat	0	256	1.90%	462	3.43%
Estuarine Water	880	166	1.23%	557	4.13%

Table 3.26. SLAMM Projections for Kings Bay; 2-Meter Scenario

Kings Bay	Current Conditions	2050 (2-Meter)		2100 (2-Meter)	
SLAMM Land Cover Class	Acres	Net Change Acres	Percent of Total Area	Net Change Acres	Percent of Total Area
Regularly Flooded Marsh	2,649	-530	-3.93%	-1,807	-13.41%
Undeveloped Dry Land	6,570	-266	-1.98%	-1,159	-8.60%
Estuarine Beach	239	-130	-0.96%	-233	-1.73%
Developed Dry Land	1,648	-29	-0.21%	-139	-1.03%
Tidal Swamp	111	-50	-0.37%	-87	-0.65%
Swamp	656	-24	-0.18%	-73	-0.54%
Irregularly Flooded Marsh	313	146	1.08%	-19	-0.14%
Inland Open Water	215	0	0.00%	-9	-0.07%
Inland Fresh Swamp	25	-3	-0.02%	-8	-0.06%
Tidal Fresh Marsh	6	-3	-0.03%	-4	-0.03%
Cypress Swamp	121	0	0.00%	0	0.00%
Transitional Marsh	42	91	0.68%	260	1.93%
Tidal Flat	0	450	3.34%	1,104	8.19%
Estuarine Water	880	348	2.59%	2,173	16.13%

Woodbine has a total area of 1,643 acres. Under the 1-m scenario (Table 3.27), 64 acres (3.9% of total area) of “dry land” will be converted to one of the other categories by 2100. Under the 2-m scenario (Table 3.28), 173 acres (10.6% of total area) of “dry land” will be converted to one of the other categories by 2100. After “dry land,” the land cover class with the next largest net loss under both scenarios was “Swamp.” “Tidal Fresh Marsh” has the largest gains under the 1-m scenario but had the 2nd largest loss under the 2-m scenario. The land cover class with the largest net gain was “Tidal Swamp.”

Table 3.27. SLAMM Projections for Woodbine; 1-Meter Scenario

Woodbine	Current Conditions	2050 (1-Meter)		2100 (1-Meter)	
SLAMM Land Cover Class	Acres	Net Change Acres	Percent of Total Area	Net Change Acres	Percent of Total Area
Undeveloped Dry Land	1,314	-21	-1.27%	-64	-3.93%
Swamp	122	-7	-0.45%	-11	-0.65%
Inland Fresh Swamp	14	-6	-0.38%	-6	-0.39%
Cypress Swamp	1	0	0.00%	0	0.01%
Developed Dry Land	128	0	0.00%	0	0.00%
Inland Open Water	3	0	0.00%	0	0.01%
Irregularly Flooded Marsh	16	0	0.00%	0	-0.03%
Regularly Flooded Marsh	0	0	0.02%	1	0.05%
Estuarine Water	4	1	0.05%	2	0.11%
Tidal Flat	0	1	0.03%	2	0.11%
Tidal Swamp	6	24	1.45%	31	1.91%
Tidal Fresh Marsh	34	9	0.53%	46	2.78%

Table 3.28. SLAMM Projections for Woodbine; 2-Meter Scenario

Woodbine	Current Conditions	2050 (2-Meter)		2100 (2-Meter)	
SLAMM Land Cover Class	Acres	Net Change Acres	Percent of Total Area	Net Change Acres	Percent of Total Area
Undeveloped Dry Land	1,314	-40	-2.46%	-171	-10.43%
Tidal Fresh Marsh	34	33	2.00%	-34	-2.07%
Swamp	122	-8	-0.48%	-19	-1.15%
Inland Fresh Swamp	14	-6	-0.39%	-6.3	-0.39%
Developed Dry Land	128	0	0.00%	-2	-0.13%
Inland Open Water	3	0	0.02%	-0.7	-0.04%
Cypress Swamp	1	0	0.00%	-0.4	-0.02%
Regularly Flooded Marsh	0	1	0.06%	19	1.16%
Estuarine Water	4	1	0.06%	20	1.23%
Tidal Flat	0	1	0.05%	55	3.35%
Irregularly Flooded Marsh	16	0	-0.02%	64	3.92%
Tidal Swamp	6	19	1.13%	76	4.60%

3.5.2. Marsh Migration

The Nature Conservancy (TNC) has recently completed the Resilient Coastal Sites for Conservation in the South Atlantic project which is focused on identifying tidal marsh that is likely to be resilient to SLR because the marsh has access to upland migration space. As part of this project TNC evaluated 1,200 sites (current tidal marsh from NOAA's C-CAP data, grouped into units) in the South Atlantic containing tidal marsh and other tidal habitats, and gauged the ability of tidal complexes to adapt to SLR and climatic changes. TNC developed a GIS StoryMap that shows different ways the results can be used for education and planning purposes, including identifying important and unprotected migration space.

The Story Map provides a tool for community decision makers to identify, visualize and prioritize resilient areas to protect to allow for future marsh migrations. The various conservation strategies that are examined as part of this tool include:

1. Prioritizing Land Protection
2. Influencing Future Development
3. Adaptive Management and Dynamic Coastal Sites
4. Identifying Restoration Priorities
5. Maintaining Coastal Productivity
6. Locating Long-Distance Migrations
7. Finding Potentially Fragmenting Roads

Development is one of the most serious threats to natural systems. When development occurs on the boundary of a coastal marsh, or directly in the marsh's migration space, it leaves nowhere for the marsh to migrate as the sea level rises. This is why it is so important to understand where and how marsh will migrate as sea levels rise and to identify opportunities to preserve that migration space. TNC has identified available migration space and has estimated the risk to migration space using a model that predicts future development. The model predicts that in Camden County, for SLR of 1-m, an estimated 35,585 acres of migration space is available to resilient marshes (TNC, 2019).

Figure 3.15 depicts land that could be considered for potential marsh migration in the County relative to the 1-m SLR scenario. These maps illustrate data developed by TNC, where coastal sites in Camden County were rated for their capacity to sustain biodiversity and natural services under increasing inundation from SLR. Each site received a relative resilience "score" based on the likelihood that its coastal habitats can and will migrate to adjacent lowlands, referred to as migration space. Those with a better score are more resilient to SLR based on size and quality of their migration space and on the intactness of their supporting processes. This information should be used by stakeholders to better understand where coastal habitats are likely to migrate in the future and to protect available migration land from development or isolation through construction of barriers such as bulkheads, sea walls and roads.

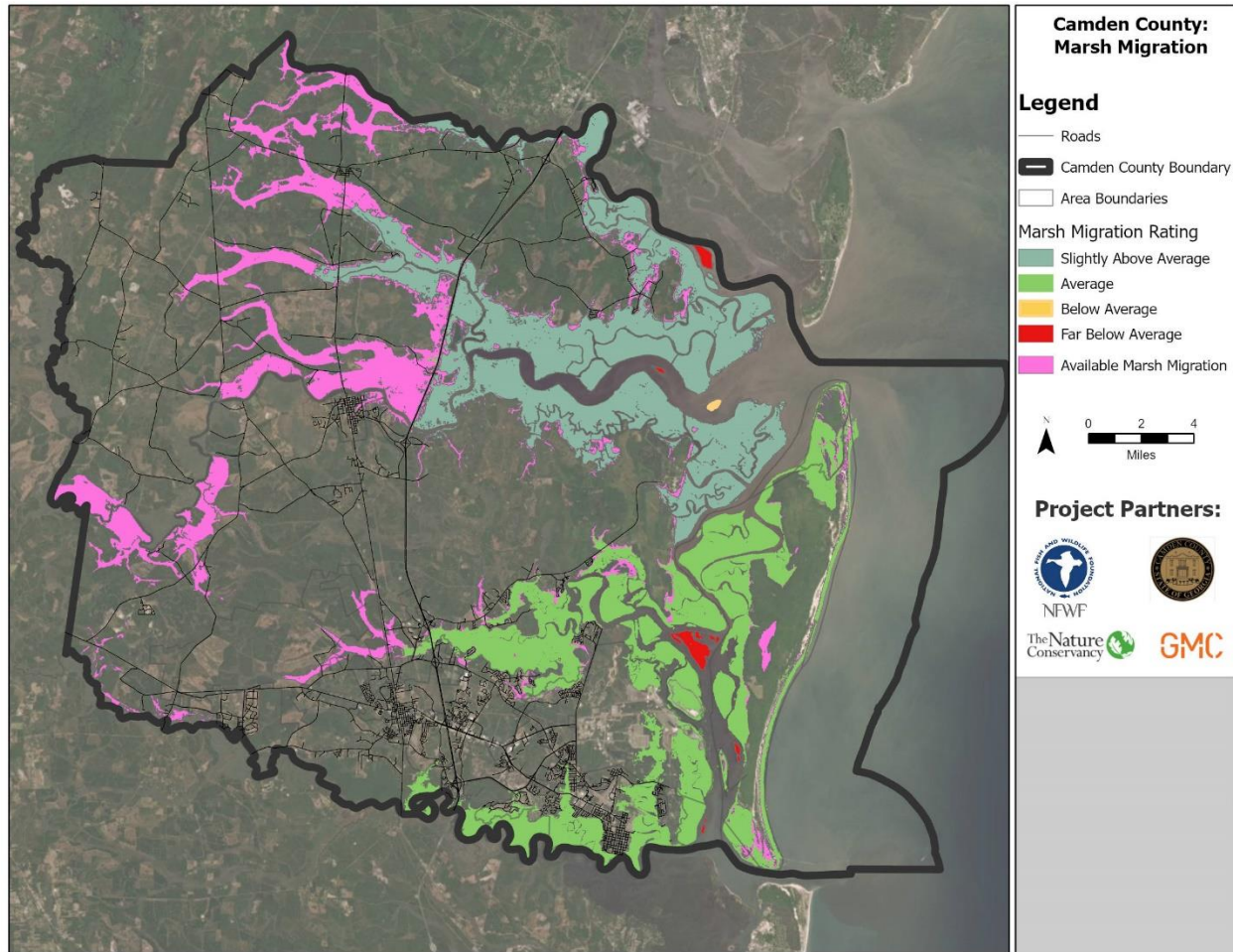


Figure 3.15: Available Marsh Migration in Camden County

The physical and condition characteristics of a site and its migration space account for 90% of the resilience score while the buffer area score (condition and physical, weighted equally) comprises the remaining 10%. The final estimated resilience was stratified to ensure that sites were compared within an ecological context. However, the report calculated unstratified physical, condition, and resilience scores to understand the results and regional patterns. Overall, the project reported the top ten highest scoring sites for the full region are clustered largely in Georgia. The high scoring physical sites in Georgia and South Carolina had at least one condition challenge and none scored “Far Above Average” for unstratified condition.

Other studies in Georgia (Reimold et al. 1978) and Louisiana (Cahoon & Cowan, 1987; LaSalle, 1992) have indicated that response is sensitive to depth of deposition, slope of the marsh surface, wave action, timing of storm events, and time since application. A recent global study assessing the ability of coastal wetlands to build up vertically by sediment accretion or laterally by migration, found that the resilience of global wetlands is primarily driven by the availability and accessibility of migration space (Schuerch et al. 2018). Collectively, the studies suggest that thin-layer sediment applications are unlikely to offset the persistent long-term effects of SLR but may be useful in alleviating short-term marsh losses or in facilitating the migration of marshes into their migration space.

A few Camden County examples of large-scale permanent protection of marsh and adjacent areas that can provide for future marsh migration include Cabin Bluff, Ceylon and Cumberland Island. Some of the land in these tracts are low-lying and highly vulnerable to loss, and permanent loss of high-quality habitat, due to SLR. Therefore, the County should consider protecting land to allow for the migration of coastal marshland as sea level rises. The County should focus on protecting land in the western half of the County (near Woodbine, White Oak, and Waverly, as well as south of Kingsland) as there appears to be much larger areas of available migration space than there are on the eastern side of the County. As a note, TNC created a CRS open space explorer application, which serves as a tool to identify priority areas to conserve that would also help with CRS points for open space preservation (<https://maps.coastalresilience.org/georgia/>). The current version of this application for Georgia includes data for Camden County.

Land use overlay districts could be a tool that the County considers to protect future marsh migration areas. Preservation of these areas (which are also typically in the current day floodplain) could help to mitigate flooding and improve CRS Ratings. The County should look at existing buffer requirements for coastal wetlands to determine if they are protective enough to allow for some migration.

There should be consideration for conversion of freshwater wetlands to salt marsh and the preservation of a diversity of wetland habitats. The County should look at beneficial use of sediment to help existing coastal marshlands “keep up” with SLR.

Table 3.29 shows the acreage and percentage of area within each of the County’s relative areas that is considered average or better resilient marsh, as well as the area and percentage of areas within each zone of the County that is available for the migration of resilient marshes if sea level rises 1-m. Unincorporated Camden County had the largest acreage of resilient marsh at 58,064 acres, or 16.0% of the total area, and the majority classified as “slightly above average.” However, resilient marshes were larger by percent of total area for Little Cumberland Island (42.5%), Cumberland Island (30.6%), Kings Bay (26.6%), and St. Marys (24.8%). For available marsh migration in Camden County, 90% of the 35,585 acres is within Unincorporated Camden County (31,872 acres). The next largest contributors by area are Cumberland Island (1,924 acres), Kingsland (1,134 acres), and Little Cumberland Island (481 acres).

Table 3.29. Resilient Marshes and Migration

Geography	Total Area	Resilient Marsh		Available Marsh Migration	
	<i>Acre</i> s	<i>Acre</i> s	<i>Percent of Area</i>	<i>Acre</i> s	<i>Acre</i> s
Camden County	459,889	77,164	16.8%	35,585	7.7%
Unincorporated Camden County	363,561	58,064	16.0%	31,872	8.8%
Cumberland Island	34,148	10,435	30.6%	1,924	5.6%
Kings Bay	13,474	3,583	26.6%	-	0.0%
Kingsland	28,760	126	0.4%	1,134	3.9%
Little Cumberland Island	2,385	1,014	42.5%	481	20.2%
St. Marys	15,918	3,941	24.8%	86	0.5%
Woodbine	1,643	-	0.0%	88	5.4%

As sea levels rise, existing marsh in these watersheds will become inundated and will shift to “tidal flats” and “open water” land cover categories, which is why it is so important to preserve space for these marsh habitats to migrate inland. In order to ensure that marshes continue to provide ecosystem services well into the future in these watershed areas, protection of all available marsh migration areas now is critical.

Land conservation will not only create necessary space for marsh migration and natural buffers for storm surge events, but it can also provide protection of critical recharge areas to help with freshwater availability and mitigate saltwater intrusion. Additionally, it can provide localized flooding relief and reduce sedimentation in local streams and drainageways by slowing overland flow rates and increasing time of concentration.

Another useful tool to determine important places for conservation and restoration is the Southeast Conservation Adaptation Strategy’s (SECAS’s) “Southeast Blueprint” because it demonstrates the nexus of habitat value locally (<https://secassoutheast.org/blueprint>). The Blueprint combines smaller subregional plans into one map, and it incorporates the best available information about the current condition of key species and habitats, as well as future threats. It is a living plan, so it will continue to evolve over time. Within Camden County, much of the land has “high” conservation value, which is the most important to protect for ecosystem health, function, and connectivity.

3.6. South Atlantic Coastal Study (SACS)

The USACE is currently engaged in implementation of the South Atlantic Coastal Study (SACS), which could identify and provide support for mitigation opportunities in coastal Watersheds. The USACE’s stated vision for SACS, as shown in Figure 3.16, is “to provide a common understanding of risk from coastal storms and SLR to support resilient communities and habitats. This collaborative effort will leverage stakeholders’ actions to plan and implement cohesive coastal storm risk management strategies along the South Atlantic and Gulf Coast shorelines, including the territories of Puerto Rico and the U.S. Virgin Islands.”

This process began in August of 2018 and is projected to be completed by August 2022. Key products that will be produced as part of SACS include:

- Tier 1 Risk Assessment
- Tier 2 Economic Risk Assessment
- Regional Sediment Management (RSM) Optimization Update
- Sand Availability and Needs Determination (SAND)
- Coastal Hazards System
- Geoportal
- Measures and Costs Library
- Coastal Program Guide
- Focus Area Action Strategies (FAAS)
- Planning Aid Report
- Institutional and Other Barriers Report
- Environmental Technical Report

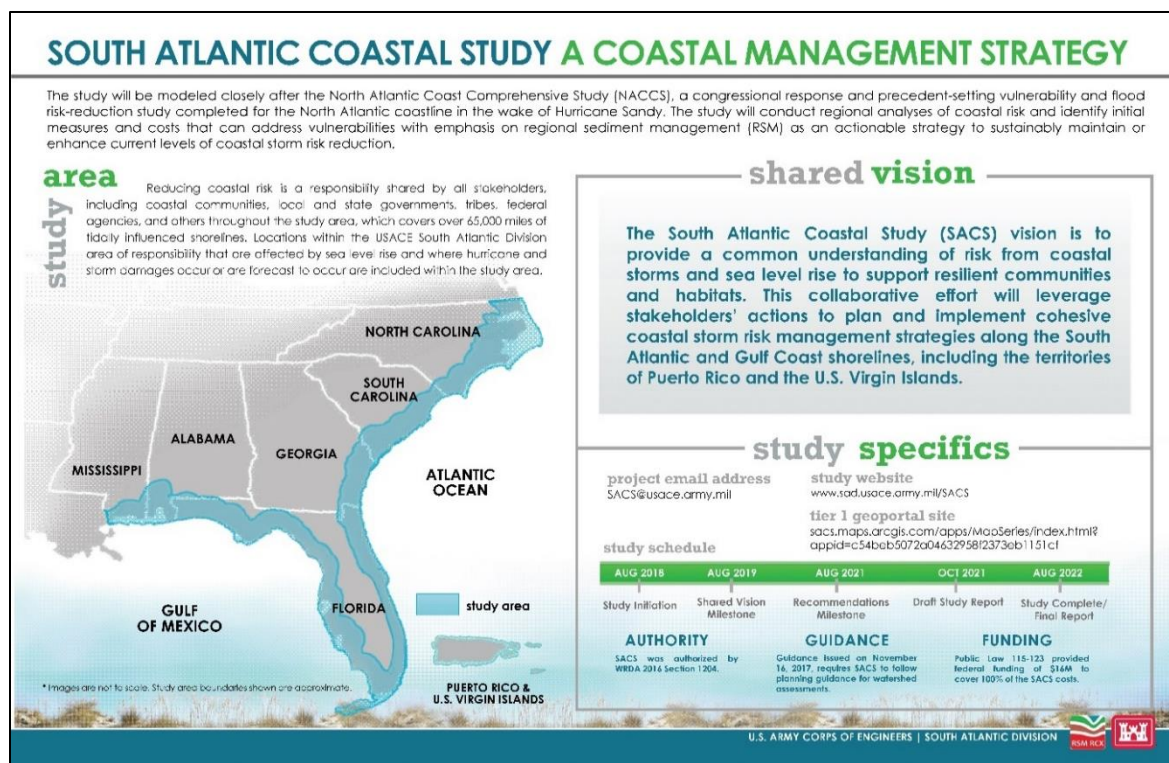


Figure 3.16: SACS Placement, USACE

Camden County was not selected as a focus area for the study, so a FAAS was not developed. USACE identified potential strategies that can be implemented throughout the coastal counties based on input from Chatham County and Glynn County, but they were broader study ideas (county road flood assessments, community outreach, etc.). Based on the SACS Tier II Economic Risk Assessment (FEMA Hazus level 1 data), Camden County was identified as the coastal Georgia county with the third highest existing and future risk of expected annual damages (EAD) at \$9.05M and \$27.73M, respectively. St. Mary's existing and future risk EAD constitutes slightly more than half of the projected economic risk in the county at approximately \$5M (existing) and \$16M (future).

Several Stakeholder Committee members have been engaged in SACS, and it is recommended to maintain involvement in this study to ensure that the County is well represented and included in the final products created as part of the SACS.

In addition to this effort, USACE recently completed the *Camden County Sea Level Rise Vulnerability Assessment*, through the Floodplain Management Services (FPMS) Program. This analysis utilized SACS/ERDC CHS data (<https://chswebtool.erdc.dren.mil/>) and methodologies and NOAA sea level rise scenarios to generate water surface grids for NOAA Intermediate-High SLR projections for 2050, 2075, and 2100 for a 10% and 1% AEP event for Camden County, GA. The modeled data better captures storm surge inundation in back bay areas than a typical "bathtub approach" which was used in the initial SACS SLR projections. Inundation data for 2050, 2075 and 2100 was intersected with a variety of infrastructure data to tabulate infrastructure impacts by AEP scenarios and projection years to identify the highly vulnerable areas within the county.

4. Stakeholder Engagement

A robust stakeholder engagement process was important to inform the process, build support for the plan, prioritize strategies and projects, identify key stakeholders, and craft an effective engagement and education program. Targeted interviews with staff from each jurisdiction and other stakeholders (Section 4.1) and an online public survey (Section 4.2) were used to gather input on resiliency needs and to identify projects and vulnerable areas.

Based on the vulnerable areas and feedback identified from these sources, the consultant completed desktop and/or field inspections of those sites to assess the issues and determine potential solutions. The Stakeholder Committee had an opportunity to review the complete list of projects and vulnerable areas to vet this list and provide any additional locations that were missing.

4.1. Stakeholder Interviews

Individual, targeted “interviews” were held in June for each jurisdiction within Camden County, with the exception of Woodbine which was held in December. The purpose of these meetings was to solicit discussion and feedback on specific vulnerability issues experienced in each jurisdiction or geographic area of the County. The discussion covered types and frequency of flooding events experienced (e.g., tidal, riverine, storm surge, stormwater), specific locations affected by flooding and/or severe erosion, public/private structures that are threatened or impacted, existing vulnerable communities that may be impacted, and any identified plans for addressing these issues. A brief summary of each interview is described below and highlights are included in Table 4.1.

Members of the Core Project Team met virtually with the Little Cumberland Island (LCI) Homes Association on June 21, 2021. During this meeting, participants identified 12 specific locations within the LCI jurisdiction that are affected by a variety of issues including high tide flooding, storm surge, and erosion. Some of the locations that are regularly impacted by tidal flooding include Shell Creek/General's Mound, East Ridge Trail, Ocean Trail, and Otter Trail. This has also led to severe erosion issues and increasing concerns in these areas; especially at Otter trail which provides sole access to the primary infrastructure and docks on the island. The impacts from erosion have consumed the emergency helicopter landing site (now lost) and limited the dock's accessible hours, thus creating emergency access concerns for the island. There were also homeowner flooding and erosion issues identified during the discussion. More specifically, homes along Eastridge Trail (where much of the housing stock is located) and Ocean Beach Trail are inaccessible during flood events and consistently threatened by erosion. Furthermore, archaeological sites, such as River Beach on the west side of the island and the historic lighthouse on the north end, were identified as areas vulnerable to erosion as well.

The meeting with Kings Bay took place on June 22, 2021, with members from TNC, GMC, and Naval Submarine Base Kings Bay. The discussion revealed no issues or concerns in this area regarding high tide flooding, as the roads are unaffected by these types of events. The main flooding issue identified during this meeting was stormwater, and the majority of these issues were said to be caused by blocked/unmaintained systems. There was one area along North River where erosion has

occurred, which has led to the relocation of a vulnerable power pole. A topic of concern discussed was the need to identify beneficial reuse opportunities for the Base's dredge spoil.

Members of staff from Camden County, including representatives from the EMA and CRS, identified 26 areas of concern on the map of unincorporated Camden County during the Unincorporated Camden County targeted interview on June 22, 2021. The points were not concentrated in one specific area of the county, but rather were scattered across the whole County. All categories of flooding and erosion concerns were captured by these points. Several areas were identified as vulnerable/affected by stormwater flooding, storm surge events, riverine flooding, and erosion, with a few concerns related to tidal flooding. Areas such as Flea Hill, Misty Harbor, Wolf Bay, 3R Fish Camp, and Summer Brooke were identified as areas where there are repetitive loss properties or properties affected by recent hurricanes/tropical storms. Potentially vulnerable communities were discussed and included an elderly population located around the 3R Fish Camp area.

The City of Kingsland identified 16 vulnerable areas within the City, but no issues were identified for erosion or high tide flooding. The primary issue discussed at the June 23, 2021 meeting was stormwater flooding due to downstream drainage capacity. They also noted storm surge at Gum Branch near Laurel Island. There was a general interest in combining stormwater management opportunities with recreation projects that was discussed during this stakeholder meeting.

Cumberland Island stakeholders met with members of the Core Project Team on June 23, 2021. During this stakeholder meeting, the primary issues identified were related to eroding banks and flooding located at the docks and the Cumberland Island visitor center in downtown St. Marys. The discussion also led into marsh elevation study, interest in learning more about thin-layer placement, and desire for increased resiliency.

The City of St. Marys met with members of the Core Project Team on June 29, 2021 and identified 26 points of vulnerability/concern in the City. The City discussed its increasing concern related to high tide flooding and storm surge events at the downtown and riverfront sections of the City. There were also several locations identified with vulnerable demographics present. There are small-scale erosion issues across the City, but the primary area of concern site is at the riverfront. Overall, St. Marys is the jurisdiction with the largest concern for tidal flooding as it has direct impact on its downtown/economy.

The final stakeholder interview took place on December 9, 2021 between members of the Core Project Team and City of Woodbine staff. The primary issues/area identified during this meeting included Dunn Branch, which drains about 75% of the City of Woodbine. Dunn Branch is tidally impacted and when coupled with heavy/intense rainfall, is impacted by flow backups and flooding. It was noted that the outfall at Dunn Branch is the correct size, but the issue is not easily resolved due to access/maintenance restrictions imposed by jurisdictional entities. In the western side of the City, there is little flooding likely due to unmaintained drainage ditches located on private properties. The biggest need identified was for funding to do drainage maintenance.

Table 4.1: Stakeholder Meeting Summary.

Date	Stakeholder	Highlights
6/21/2021	Little Cumberland Island	• 12 vulnerable/problem areas were identified on the map • Issues included high tide flooding, storm surge, and especially erosion
6/22/2021	Kings Bay	• 2 points were identified on the map for issues/concerns • Flooding concerns primarily due to lack of stormwater infrastructure maintenance • Some erosion at North River; moved power pole
6/22/2021	Camden County	• 26 points of concern were identified on map; scattered across County • Every category of flooding and erosion concerns covered
6/23/2021	Kingsland	• 16 points of concern were identified within the City • Primary issues related mostly to stormwater with some storm surge issues as well
6/23/2021	Cumberland Island	• Primary issues were eroding banks and flooding at docks/visitor center (in St. Marys)
6/29/2021	St. Marys	• 26 points identified on the map as vulnerable/concerning • Very concerned with high tide flooding downtown • Several locations with vulnerable demographics noted
12/9/2021	Woodbine	• Dunn Branch was primary area of concern

4.2. Public Events – Survey & Open House

A public survey was first unveiled at the St. Marys' 4th of July festival and then it was published on municipality webpages, in the local newspaper, and shared on social media and public networks. The survey closed on August 31, 2021 and a total of 143 responses were recorded. The survey included questions relating to Camden County's resiliency outlooks and challenges.

Based on the 2020 County population, the survey reached about 0.3% of the total population, but the responses by residents in the geographic areas closely matched the actual total population distribution. The response rate was 37% St Marys, 33% Kingsland, 25% Unincorporated, and 5% Woodbine, and the actual distribution is 33% St Marys, 35% Kingsland, 30% Unincorporated, and 2% Woodbine. Overall, hurricanes/tropical storm were rated as the largest threat to the community, followed closely by flooding. When comparing existing versus future threat of five environmental hazards, all five increased in level of threat for future conditions, and the greatest increase was reported for flooding. For those that rated the threat of flooding from moderate to high, they were most concerned about hurricanes/tropical storms (greater than 90% of responses). When comparing existing to future flooding threats, the largest changes were increasing 10 percentage points for high tides, 8 percentage points for SLR, and 7 percentage points for routine storm events. This is indeed what the county can expect based on the analysis in Chapter 3. Respondents felt that the most vulnerable infrastructure systems were electricity (84%) and water/sewer (77%). The majority of respondents (80%) have observed both flooded roads due to

rainfall and flooded roads due to storm surge. Lastly, there were mixed feelings on the level of preparedness that respondents felt their community was to environmental hazards. Planning efforts such as this and other efforts that the County is undertaking with its Resiliency Center should help to increase this rate in the future. The specific results to each question are described below.

1. Demographics of survey respondents:
 - 91% (130) live in Camden County
 - 92% (119) of those live in Camden County full-time; 8% (11) live here part-time
 - Geographic distribution of residents is as follows:
 - 37% (48) live in St. Marys
 - 33% (43) live in Kingsland
 - 25% (32) live in Unincorporated County
 - 5% (7) live in Woodbine
2. Based on the five environmental hazards and a rating of 1 to 5 with 5 being the highest, the weighted averages for *significance of the EXISTING threat to residents of your community* was as follows:
 - Hurricanes/Tropical Storms – 4.4
 - Flooding – 3.9
 - Tornados/Other Severe Weather – 3.7
 - Coastal Erosion – 3.1
 - Wildfire – 2.6
3. Based on the five environmental hazards and a rating of 1 to 5 with 5 being the highest, the weighted averages for *significance of the FUTURE threat to residents of your community* was as follows:
 - Hurricanes/Tropical Storms – 4.5 (*increase of 0.1*)
 - Flooding – 4.2 (*increase of 0.3*)
 - Tornados/Other Severe Weather – 3.9 (*increase of 0.2*)
 - Coastal Erosion – 3.2 (*increase of 0.1*)
 - Wildfire – 2.8 (*increase of 0.2*)
4. For those that listed the EXISTING Flooding threat level as a rating of 3 or higher, they were asked to *elaborate on the kinds of EXISTING flooding events that they were most concerned about*. The response rates were as follows (120 responses):
 - Hurricanes/Tropical Storms – 93%
 - Drains or ditch overflows – 68%
 - Routine storm events – 62%
 - Sea-level rise – 42%
 - High tides – 42%
 - River flooding – 37%

5. For those that listed the FUTURE Flooding threat level as a rating of 3 or higher, they were asked to *elaborate on the kinds of FUTURE flooding events that they were most concerned about*. The response rates were as follows (117 responses):
 - Hurricanes/Tropical Storms – 97% (*net increase of 4% points*)
 - Routine storm events – 69% (*net increase of 7% points*)
 - Drains or ditch overflows – 68% (*no change*)
 - High tides – 52% (*net increase of 10% points*)
 - Sea-level rise – 50% (*net increase of 8% points*)
 - River flooding – 39% (*net increase of 2% points*)
6. When asked to identify the infrastructure systems most vulnerable to environmental hazards in the community, the response was as follows:
 - Electricity Services – 84%
 - Water/Sewer Service – 77%
 - Emergency Response – 61%
 - Transportation – 56%
 - Medical Care – 46%
7. When asked about experience observing flooding or erosion incidents, the response rate was as follows:
 - Flooded roads due to rainfall – 80%
 - Flooded roads due to storm surge – 80%
 - Flooded roads at high tides – 47%
 - Flooded roads due to river flooding – 31%
 - Flooded areas causing wastewater overflows from sewers and septic systems – 35%
 - Shoreline erosion – 25%
8. Respondents were divided on how prepared they felt the community was for response to environmental hazards.
 - Well prepared – 2%
 - Prepared – 49%
 - Not prepared – 49%

A final mapping-based question was asked for respondents to identify any areas within the County particularly vulnerable to environmental hazards or have been impacted by such hazards in the recent past. This information was used to supplement the responses from the Stakeholder Committee and interviews with each jurisdiction. A few areas with greater than two repeated responses included:

- Downtown St. Marys / Waterfront – 13
- Little Cumberland Island – 11
- Harrietts Bluff Area (unincorporated) – 7
- The Meadows (Kingsland) – 6

- Hwy 40 between Kings Bay Road and Gross Road (commercial area east of I-95) – 6
- North River Causeway – 4
- Sugarmill (St.Marys) – 3
- The Lakes (Kingsland) – 3

Once the RIW was finalized and reviewed by the Stakeholder Committee, a public Open House was held at the Coastal Pines Technical College in Kingsland on May 3, 2022, from 2-4PM and 6-8PM. GMC and TNC gave a brief presentation on the project overview and elements of the RIW (Figure 4.1). Maps of the vulnerable areas and flooding hotspots as well as a board on the primary management measures were displayed throughout the room. Following the presentation, members of the Core Project Team from TNC and GMC discussed the individual projects, strategies and management measures with attendees. In total, ten people were in attendance at both events combined. Feedback from the Open House was positive and complementary on the project, process, and need. A few suggestions and comments from the attendees were:

- Share the synthesized information with the Coast Guard to help with their planning efforts.
- When pursuing future funding, it would be recommended to include public relations and marketing aspects to prioritize community engagement and education in future projects.
- Prioritize policy regarding marsh migration in this community.

It was also discussed to communicate the range of options listed within the plan. GMC clarified that the management practices/solutions offered in the RIW are just suggestions/options to consider at each site based on initial inspection of the 91 vulnerable areas and flooding hotspots. This project/grant was under the priority area of “Community Capacity Building and Planning” Priority Area in order to develop a prioritized list of projects in order to facilitate subsequent grant pursuits, with larger potential awards, for design, permitting, and construction.

An attendee on the Stakeholder Committee provided an update that since the final committee meeting, the County’s EMA Director is looking to incorporate the individual potential projects into the County’s Comprehensive Plan’s workplan, which has just started the process of a major update.



Figure 4.1. Open House Presentation

5. Project Prioritization & Implementation Plan

A matrix was developed as a step to prioritize individual projects and the most vulnerable areas. GMC created the initial matrix following feedback received from the August 11, 2021, meeting, and it was presented at the November 16, 2021, meeting for feedback and refinement of factors and rankings. Section 5.1 describes how the matrix was developed, the factors included, and how each factor and project are scored.

5.1. Project Prioritization Tool

Most of the datasets used in the analysis were reviewed on the Georgia Coastal Hazards Portal (<https://www.arcgis.com/home/item.html?id=2e2d61fad5d44e0c96995c38feb7052d>). Some of the data layers were downloaded individually and added to a GMC-housed WebMap to evaluate and rank each individual project.

Individual projects were identified and vetted by staff. Projects identified by the public were reviewed by the consultant and staff to determine applicability to this list. Eight factors were used to rank and score the projects for prioritization. They were prioritized into three tiers – three factors have a maximum score of 10, two with a maximum score of 7, and the remaining three with a maximum score of 5. Higher maximum scores equate to factors with more weight, and higher overall scores equate to higher prioritization. The factors and corresponding maximum score listed in parentheses is presented below:

- Infrastructure Type in Buffer Width (10)
- Infrastructure Proximity (10)
- Flood + Sea Level Rise Impacting Structures in Buffer (10)
- Current Flood Frequency (7)
- Presence of Erosion Rate & Rate (7)
- Vulnerable Populations (5)
- Ownership of Adjacent Parcel (5)
- Adjacent/Threatened Special Habitat (5)

Infrastructure Type is a top-tier factor with a maximum rating of 10. Based on feedback from the Task Force, the highest rating was given to critical facilities, historical structures, and major roads. Also, minor residential structures and roads were given higher priority over non-residential structures. The categories with five assigned scores are presented below:

- 10: major roads, critical facilities, historic structures
- 7: major residential roads and/or neighborhoods, residential structures
- 5: non-residential structures, small number of residential properties (<5), minor residential roads
- 3: recreation areas, parks
- 1: trails

Infrastructure Proximity is a top-tier factor with a maximum rating of 10. This includes infrastructure adjacent to shorelines or channels due to susceptibility to erosion or sea level rise. Not all project locations were adjacent to channels with “shoreline change rates” from the DNR-Coastal Hazards

Portal, so proximity to an eroding channel was used if “shoreline change rates” were not available. If there was active erosion that was closer to the infrastructure of concern, the edge of the channel was used to calculate infrastructure proximity. If there were segments on an eroding channel that did not have Shoreline Change data presented, the distance to infrastructure was based on the visual inspection. The categories with five assigned scores are presented below:

- 10: < 50 feet
- 7: 50 to 100 feet
- 5: 100 to 200 feet
- 3: 200 to 300 feet
- 1: 300 to 500 feet
- 0: > 500 feet

In relating distance to erosion rate, the erosion rates were multiplied by durations to determine the impacted lengths by 2050, 2075, and 2100. A summary is presented in Table 5.1. Based on these results, 100 feet of erosion would occur by 2050 for areas with an erosion rate of -1.0 m/year, 2075 when the rate is -0.6 m/year, and 2100 when the rate is -0.4 m/year. An impact beyond 300 feet will only occur by 2100 for areas with an erosion rate of -1.2 m/year or greater.

Table 5.1: Calculation of Future Erosion Distance at Major Year Intervals.

Erosion Rate (m/yr)	Erosion Rate (ft/yr)	Erosion Length (ft)		
		2020-2050	2020-2075	2020-2100
-1.2	-3.9	-118	-217	-315
-1.0	-3.3	-98	-180	-262
-0.8	-2.6	-79	-144	-210
-0.6	-2.0	-59	-108	-157
-0.4	-1.3	-39	-72	-105
-0.2	-0.7	-20	-36	-52

Flood + Sea Level Rise Impacts to Structures in Buffer is a top-tier factor with a maximum rating of 10. The USACE through the Floodplain Management Services (FPMS) Program recently completed a countywide SLR vulnerability assessment. This analysis utilized SACS/ERDC CHS data and methodologies and NOAA sea level rise scenarios to generate water surface grids for NOAA Intermediate-High SLR projections for 2050, 2075, and 2100 for a 10% and 1% AEP event for Camden County, GA. Combining the AEP scenarios and future SLR projections for 2050, 2075 and 2100 allows the County to better assess what size storm and SLR projection will impact infrastructure. The various AEP projection categories with corresponding assigned scores are presented below:

- 10: 10% AEP Current, 10% AEP 2050
- 9: 10% AEP 2075, 10% AEP 2100
- 5: 1% AEP Current, 1% AEP 2050
- 4: 1% AEP 2075, 1% AEP 2100
- 1: 0.2% AEP
- 0: X

Current Flooding Frequency is a medium-tier factor with a maximum rating of 7. This factor was included to incorporate impacts from high tide flooding or regular stormwater flooding, as well as from hurricanes/tropical storms or on rare occasion. The rating was based on NOAA High Tide Flooding layer, repetitive loss structures, feedback from local staff on whether a site experiences regular stormwater flooding or high tide flooding, or if it flooded during hurricanes Matthew (2016) or Irma (2017). The categories corresponding with the three assigned scores are presented below:

- 7: High tide flooding or regular flooding from stormwater
- 3: Flooded during recent hurricanes or on rare occasion
- 0: None

Presence of Erosion & Rate is a medium-tier factor with a maximum rating of 7. This factor was included and given higher weight due to the project committee's desire to account for projects that have both flooding and erosion. The dataset "Shoreline Change Rate," on Georgia Coastal Hazards Portal, (https://gchp.skio.uga.edu/arcgis/rest/services/Server/GA_ShorelineChange/MapServer) was the primary data used for this factor. Rates are presented as change in meters per year in 0.2-m intervals with greater than 1-m of erosion (−1.0) or accretion (+1.0) being the end groups, as presented in Figure 5.1, and a zoomed example from Crooked River State Park is presented in Figure 5.2. The shoreline change rates are based on conditions from the 1930s to 2000. The program to calculate these rates is AMBUR (Analyzing Moving Boundaries Using R, which was developed by Dr. Chester Jackson, a professor at Georgia Southern University. This digital tool is effective to analyze shoreline change along barrier islands with complex shapes and highly curved shorelines. If a channel was not in that data layer, then the evaluation was based on visual inspection. The categories with five assigned scores are presented below, with shoreline change rates presented in parentheses and visual assessment in quotes:

- 7: "High" (< −1.0 m/yr)
- 5: "Moderate-High" (−0.6 to −1.0 m/yr)
- 3: "Low-Moderate" (−0.4 to −0.6 m/yr)
- 1: "Low" (0.0 to −0.4 m/yr)
- 0: None

The "Shoreline" line from the "Shoreline Change Rate" dataset was targeted for use when calculating the distance of the shoreline to infrastructure of concern. However, there are some minor channels where the "Shoreline Change Rate" data is unavailable. Current conditions and historical knowledge from staff were used to visually assess erosion condition and rate, and the edge of the eroding channel was used to measure distance to infrastructure.

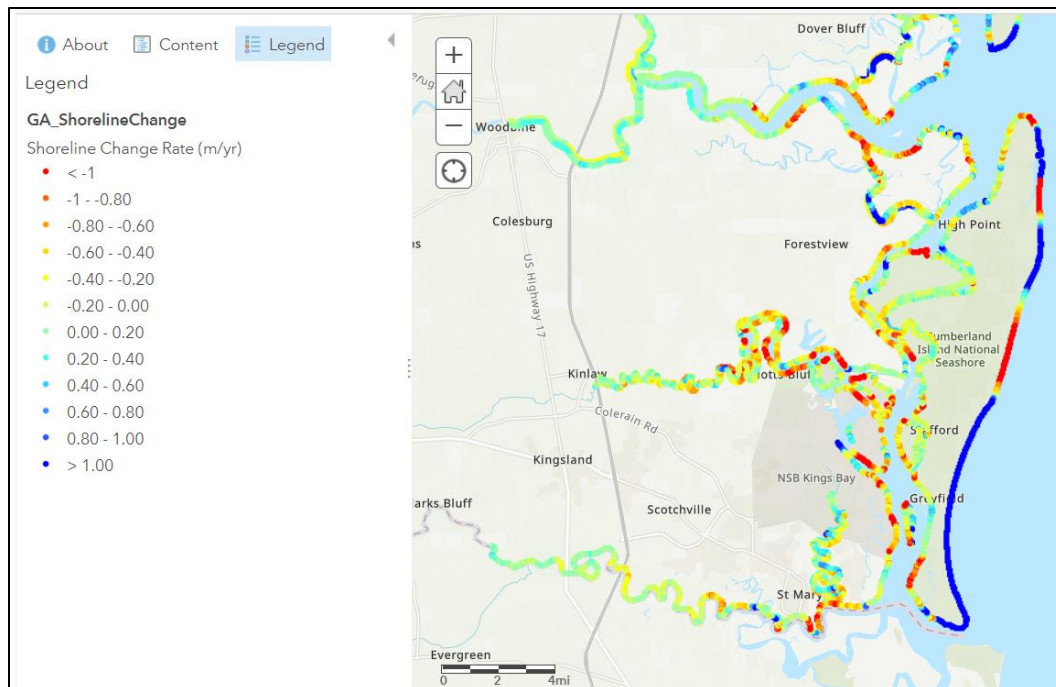


Figure 5.1: Example of “Shoreline Change Rate” Dataset.

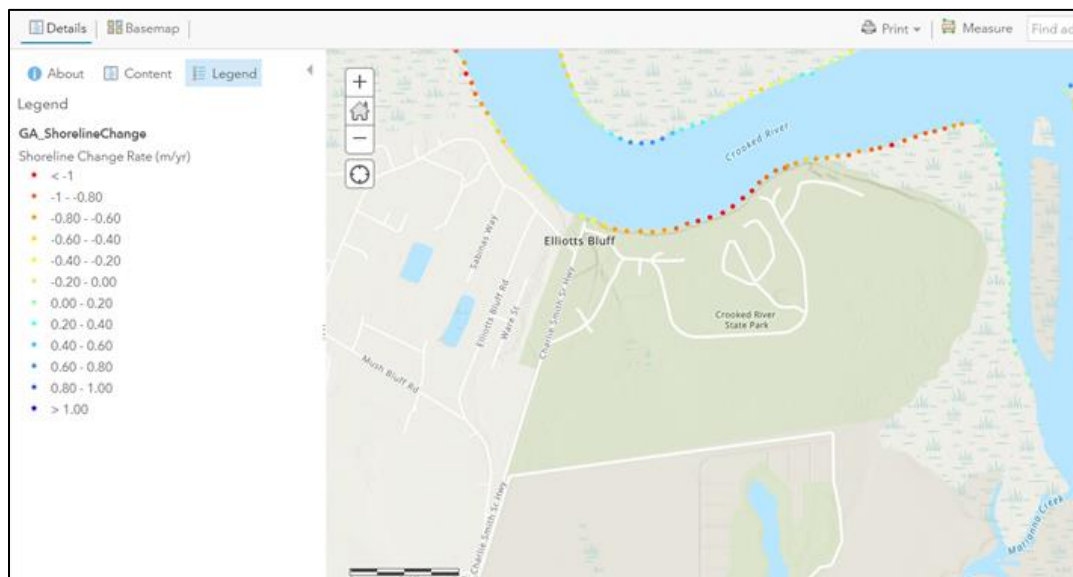


Figure 5.2. Presence of Erosion & Rate Along Crooked River

Ownership of Adjacent Parcel is a low-tier factor with a maximum rating of 5. This factor was included to incorporate ease for construction and coordination, where if a property is already owned by the local government, property acquisition is not required. The categories corresponding with three assigned scores are presented below:

- 5: Public / Local Government (City, County, NPS, Kings Bay)
- 2: Other Government (School Board, DOT, State, Federal)
- 0: Private

Vulnerable Populations is a low-tier factor with a maximum rating of 5. This factor was selected as a surrogate to incorporate vulnerable populations and grant eligibility. This specific criterion is used to determine eligibility for Community Development Block Grant (CDBG) funding, with greater than 50% being the threshold for prioritized eligibility. The scoring was determined based on the Census Block Group that the project was located within and corresponding CDBG Low- and Moderate-Income Data from the HUD Exchange (Department of Housing and Urban Development) for 2011-2015. The categories with three assigned scores are presented below:

- 5: > 50%
- 3: 40 to 50%
- 0: < 40%

Adjacent/Threatened Special Habitat is a low-tier factor with a maximum rating of 5. This factor was included to incorporate protecting nearby and threatened special habitats. The datasets used to rate this factor were from the U.S. Fish and Wildlife Services National Wetland Inventory (NWI) (Figure 5.3). Freshwater and riverine wetlands from the NWI, as well as turtle and piping plover habitats (beaches) were assigned the highest score. If there is an existing seawall or bulk head present, the project would be rated as a ‘3’ due to the hard feature impacting natural function. Armored shorelines were assessed in the field, and a dataset for “Armored Shoreline Distribution” (https://gchp.skio.uga.edu/arcgis/rest/services/Server/Armored_Shorelines/MapServer) was also explored on the Georgia Coastal Hazards Portal (Figure 5.4). The Figures below depict the NWI and armored shorelines results for Camden County. The categories with three assigned scores are presented below:

- 5: Habitat is Eroding/Vulnerable
- 3: Adjacent to Habitat or Hard Feature(s) Impacting Natural Function
- 0: None



Figure 5.3. National Wetland Inventory Dataset Example

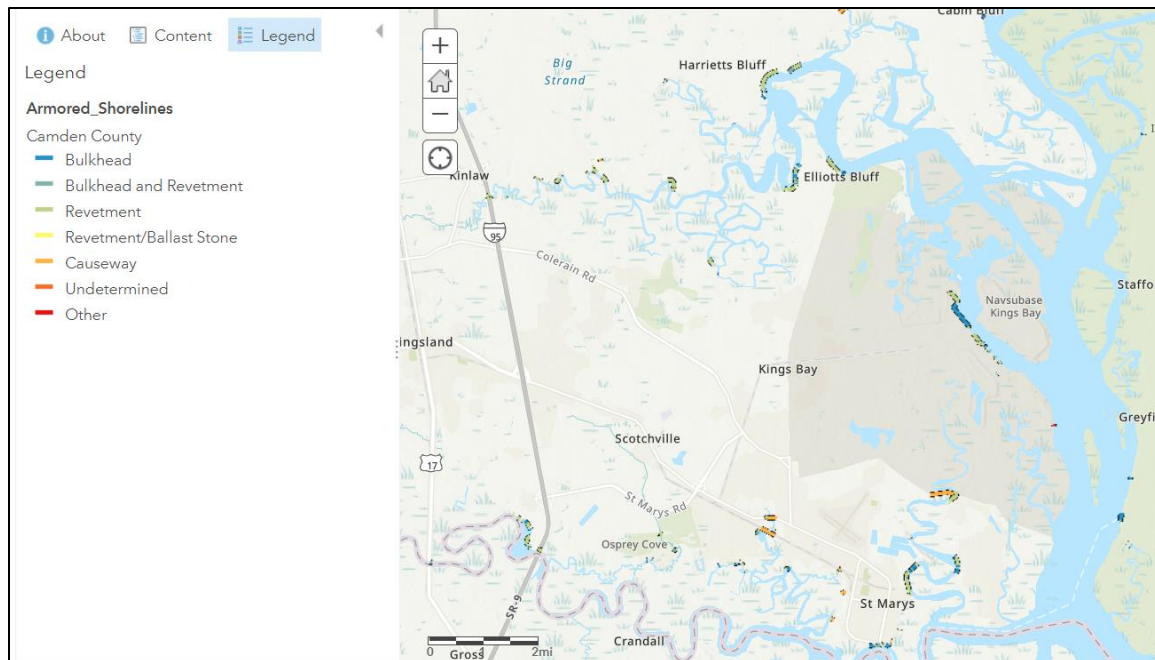


Figure 5.4. Armored Shoreline Dataset Example

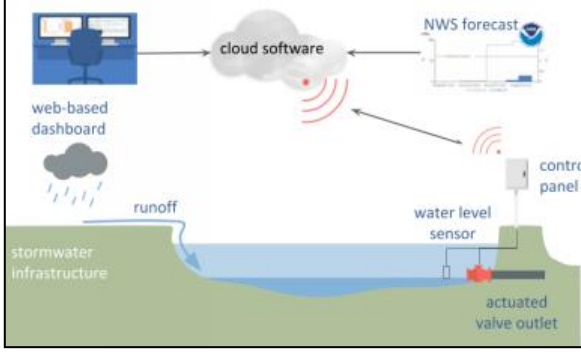
5.2. Shoreline/Resiliency Management Practices

At the August 2021 stakeholder meeting, the stakeholders were presented with a list of shoreline management practices. Overall, there was a general interest in nature-based solutions, with noted interest in living shorelines. Nature-based solutions are project solutions that are motivated and supported by nature and that may also offer environmental, economic, and social benefits, while increasing resilience. This is an umbrella concept that covers a range of approaches, including restoration, management, conservation, and nature-based infrastructure (e.g., green infrastructure and low impact development), engineering with nature, bioengineering, etc. It is prioritized in FEMA BRIC funding, USACE funding, and a number of other grants. Table 5.2 describes scale, context, and description of each management practice, and a few representative photo examples are provided from sites in Coastal Georgia, with several in Camden County.

Table 5.2: Management Practice Description and Summary, with Input from Task Force.

Management Practice & Description	Additional Information	Photos (from Coastal Georgia)
1. Living Shorelines Scale: shoreline Context: coastal; rural to urban Description: bioengineering combined with native vegetation; adjacent to estuarine waters. In Georgia, this typically includes oyster reef creation.	• Allows natural connections between aquatic environment and adjacent upland; preserves tidal exchange; sediment conservation; allows for marsh migration. • Permitting challenges are significant. It is easier to permit bulkheads than living shorelines. • There is a need for high-profile demonstration projects that the public can access.	
2. Wetland and Floodplain Restoration Scale: landscape, watershed, community, shoreline Context: coastal and upland; rural to urban Practices: thin-layer placement of sediment, hydrologic restoration such as plugging ditches, stream crossings, culvert upgrades, etc.		

Management Practice & Description	Additional Information	Photos (from Coastal Georgia)
3. Streambank Stabilization Scale: community, site Context: coastal and upland; suburban to urban Practices: Geo-textiles, staking, log structures, rip rap, stone structures.	• More pleasing “natural” look. • Can often use on-site materials. • Designed for habitat. • Education is needed. • Permitting may be an issue where this is used to stabilize natural channels.	
4. Land Preservation/Conservation Scale: landscape, watershed, community, shoreline Context: coastal and upland; rural to urban Practices: natural land and open space preservation, conservation easements, establishing parks and greenways along waterways/coasts, voluntary buyouts.	• The County should prioritize preservation of natural lands that will allow for marsh migration as sea levels rise. • Available SLAMM (Sea Level Affecting Marshes Model) data that identifies marsh migration potential could be used to identify areas the County can target for conservation. • Provides a lot of CRS credit.	
5. Policy Changes Scale: community Context: planning & development Practices: Shore Protection Act, Permitting, Setbacks and Buffers, stormwater utility fees, Low Impact development, Floodplain Development Codes, Zoning & Land use, buffers to allow marsh migration, development restrictions in floodplains, etc.	• Address permitting difficulties with Living Shoreline and the inherent “incentive” the MPA exemption for bulkheads creates.	

Management Practice & Description	Additional Information	Photos (from Coastal Georgia)
6. Green Stormwater Infrastructure Scale: community, site Context: coastal and upland; suburban to urban Practices: bioretention, bioswales, rain gardens, permeable pavement, stormwater planters, urban tree canopy	• This is becoming a popular option. There are a few demonstration projects in downtown St. Marys and at Camden County Cooperative Extension office • Reduces flooding potential by absorbing and infiltrating stormwater • Provides water quality treatment, reduces impervious surfaces and stormwater runoff, and provides ecological services.	
7. Stormwater Management – Real-time Controls Scale: watershed, site, storm sewer system (MS4) Context: coastal and upland; suburban to urban	• “Smart Controls” for ponds • Utilizing NWS forecasts, an automated control valve can release water from a stormwater pond leading up to storm to increase storage capacity • Or it can be used to delay release of water until downstream conditions allow • Case Study in Ormond Beach, FL, showed how flooding was mitigated during Hurricane Irma in 2017 from a series of lakes draining 550 acres.	
8. Tide Control Scale: watershed, storm sewer system (MS4) Context: coastal and upland; suburban to urban Practices: Tide gates, tide flaps, in-line check valve. Description: placed at the storm sewer system outlet to prevent tidal water from flowing back up into the storm sewer.	• Tide control structures allow for the storm sewer system to have capacity available for rain events during higher tide periods, and they prevent “sunny-day” flooding. • There is a regular maintenance requirement to keep the tide gates or flaps operational; they can be blocked open with debris and lose functionality.	

Management Practice & Description	Additional Information	Photos (from Coastal Georgia)
9. Sand / Dune Fencing Scale: shoreline Context: coastal; rural to urban Description: fencing used to force windblown sand to accumulate in a desired place and build up the dune, also used to prevent foot traffic from damaging the dune system.	• Inexpensive and more natural way to build dunes, but the timeframe for a mature dune is much longer. • It is an effective way of keeping foot traffic out of the dunes.	
10. Nearshore Placement Scale: shoreline Context: coastal; suburban to urban Description: placement of sand or natural materials near-shore, but not directly on the beach or shore to buffer wave energy and to allow natural shoaling processes to deposit additional sand and build the beach.	• This option may have more public acceptance as it mimics natural processes. • Has already been successful on Ft. Pulaski which is subject to erosion from shipping channel waves.	

Management Practice & Description	Additional Information	Photos (from Coastal Georgia)
11. Constructed Dunes Scale: shoreline Context: coastal; suburban to urban Description: restore dunes and block flow from low-lying beach access points, hardened structure beneath dunes.	- Proprietary product PermaShield™ has been used for structural support to build dunes on Tybee Island (Guardian Retention Systems). - Pedestrian and vehicle access can be allowed over the dune, if designed accordingly.	
12. Bulkheads / Sea Wall Scale: shoreline Context: coastal; suburban to urban Description: hard armoring of the shoreline. Can often be wood, concrete, or other hard building material. A wall is created at the upland/marsh interface and backfilled to raise upland.	- Hardened shorelines disrupt sediment movement and transport patterns. - Causes erosion on subject and neighboring properties. - Education is needed because contractors often recommend this solution. - Use allowed adjacent to the marsh, i.e. pools and patios, often requires a bulkhead and fill. - Are exempted in the Marshland Protection Act, which incentivizes this over other solutions.	

Management Practice & Description	Additional Information	Photos (from Coastal Georgia)
13. Rock Revetments & Jetties Scale: shoreline, beach Context: coastal; suburban to urban Description: hard armoring, expensive, designed to absorb wave energy and to reduce erosion. Can disrupt natural sediment transport.		
14. Rip Rap Scale: Shoreline, channels Context: coastal and upland; rural to urban Description: deploying smaller rocks of varying sizes to slow flow and stabilize eroding banks.	• Very common technique.	

The general preference of management practices and highlights of issues at each jurisdiction was discussed as part of the Mural breakout session at the August 2021 stakeholder meeting. These results included the following ideas and recommendations:

- General
 - Buffers from GADNR, USACE, etc.
- Barrier Islands
 - Living shorelines
 - Thin-layer placement
 - Sand/dune fencing
 - Constructed dunes (Little Cumberland Island)
- Kings Bay
 - Living shoreline along North River (utility pole area)
- St. Marys
 - Tide control
 - Sea wall (hybrid with living shoreline) in downtown
 - Repetitive loss property acquisition
 - Land acquisition for “spine” project
 - Protect tree canopy
 - Code/ordinance update: floodplain, freeboard, CSS, stormwater utility
 - Long-term mitigation strategy for North River Causeway
- Unincorporated County
 - Living shoreline at Todd Creek
 - Streambank stabilization and/or floodplain restoration at Flea Hill
 - Green stormwater infrastructure
 - A few new places were noted with flooding
- Woodbine
 - Flooding at riverfront park noted
- Kingsland
 - Primary issue is drainage system capacity issues
 - Combining stormwater management with recreation projects, such as recreation and fishing, stormwater pond east of Gross Road

One of the breakout groups discussed other management measures targeting policy and education opportunities. This discussion included the following ideas:

- Current residential building types are vulnerable to flooding
 - Slab on grade is very common, and it limits ability for retrofits
 - Additional freeboard should be included for a factor of safety
 - Homebuyer education is a current need
- Upstream land cover changes should be included in analysis.
 - Restore landscape absorption through habitat restoration / tree planting (grass lawns & tree ordinance)
- Siting recommendations for green infrastructure

- Identify zones where particular green infrastructure practices are preferred and will have highest level of effectiveness
- Invasive Species
 - Water hyacinth and other aquatic invasive species are clogging culverts and other stormwater infrastructures.
 - Removal and restoration will improve capacity and reduce stormwater flooding.

5.3. Funding Sources & Potential Partners

A list of funding sources and potential grant opportunities is provided below:

- Community Development Block Grants (CDBG), including, CDBG-DR; CDBG-MIT, CDBG-Unmet Needs, and general CDBG
- 319(h) Grant through DNR-EPD (U.S. EPA)
- Readiness and Environmental Protection Integration Program (REPI) through Department of Defense (DOD)
- Coastal Incentive Grant through DNR-CRD (NOAA)
- Army Corps of Engineers Flood Plain Management Services (FPMS)
- Communities of Coastal Georgia Foundation
- FEMA Public Assistance (after a storm)
- FEMA BRIC Program (Building Resilient Infrastructure and Communities), created to assist with resiliency
- National Fish and Wildlife Foundation (NFWF); National Coastal Resilience Fund Program
- Include the private sector to fund part of project(s)
- National League of Cities
- Creation of a Tax Allocation District (TAD) to fund part of the project(s)
- SPLOST

Based on the funding sources, many of these organizations would be ideal project partners or project leads, such as Army Corps of Engineers, FEMA, GEMA, Georgia DCA, and Georgia DNR. Other project partners or project leads can be associated with property ownership, such as GDOT, Georgia Power, and Camden County School System. A full list of potential project partners and project leads is presented below:

- Local Jurisdictions: Cities/County
- Naval Submarine Base Kings Bay
- National Park Service
- Army Corps of Engineers
- Emergency Management: FEMA/GEMA
- CDBG: Georgia DCA / HUD
- NOAA Grants: DNR-CRD / NOAA
- U.S. EPA Grants: DNR-EPD / U.S. EPA
- State Highways: GDOT
- Utilities: Georgia Power
- Schools: Camden County School System

- Private organizations and/or businesses
- Public: members of heavily flooded neighborhoods or representatives from HOA's
- Conservation Groups

5.4. Matrix Results & Implementation Plan

The scores from the matrix, as described in Section 5.1, were calculated for each project. The next series of figures and tables present the Resiliency Implementation Workplan project list by geographic area. The summary tables include a Site ID, Site Description, Priority, Potential Partners/Project Lead, Proposed Solution with initial steps and secondary steps if a drainage study or detailed assessment is needed first. The Priority is based on the calculated score from the matrix and corresponding rank for each jurisdiction separately (Figure 5.5). The projects were roughly split into thirds as high/medium/low priority. Little Cumberland Island consistently had the highest rankings due to low-lying areas and impacts from SLR and proximity of infrastructure to the shoreline, whereas City of Kingsland with primarily stormwater drainage issues had the lowest rankings. This was due to there not being impacts from SLR or flood zones, private ownership for properties with issues, and proximity of infrastructure being farther.

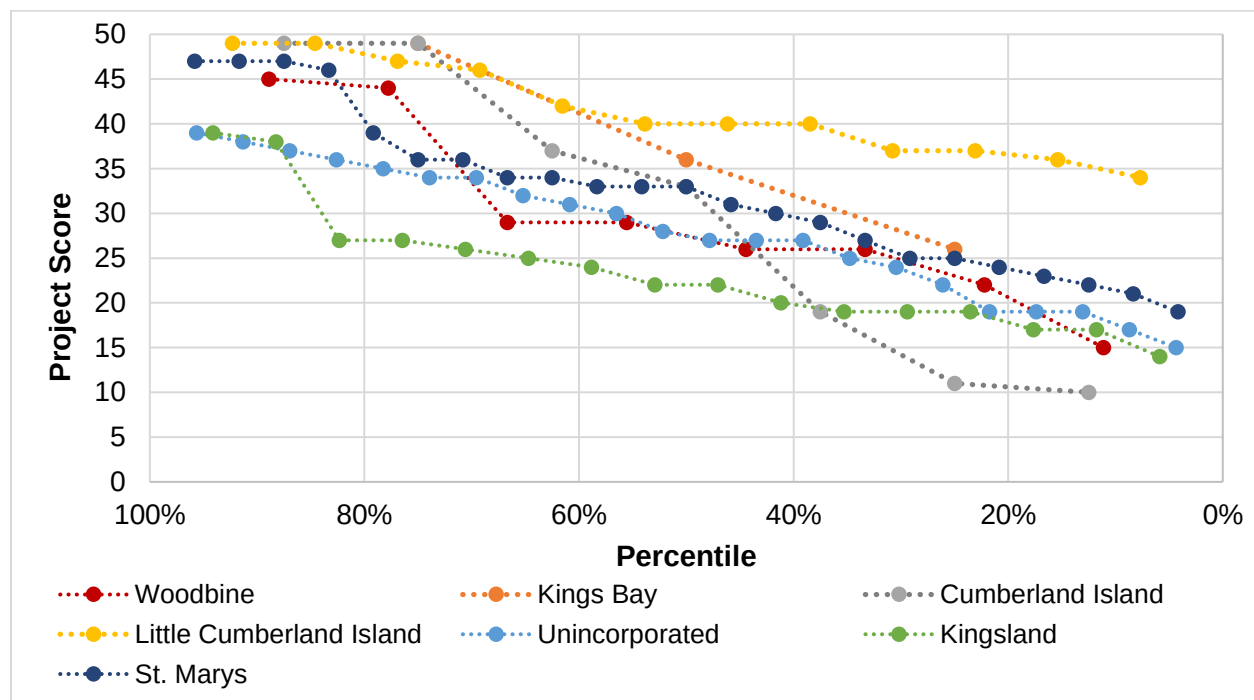


Figure 5.5. Ranking of Projects by Jurisdiction

This initial level of analysis is too early and broad to assign a specific cost, and in some cases a drainage study or detailed assessment is needed first and this would have a much smaller cost than the actual construction and implementation cost. The Potential Partners/Project Lead were identified based on property ownership and potential granting or coordinating agencies. The Proposed Solutions were developed based on: (1) feedback from the Stakeholder Committee on

the Shoreline/Resiliency Management Practices in Section 5.2., where there was a general interest in nature-based solutions, (2) feedback during interviews with each jurisdiction, and (3) desktop and/or field assessment of each site. The Site ID in the table can be used to locate the project in the subsequent map/figure. A detailed and larger-scale set of maps is included in Appendix D, and the detailed matrix results are presented in Appendix B.

5.4.1. Unincorporated Camden County

There were 22 vulnerable areas and flooding hotspots identified in Unincorporated Camden County. The proposed projects are presented in Figure 5.6 and Table 5.3. The highest priority projects include:

1. **CC3** (*New Post Rd/White Oak Creek*) – where stormwater floods New Post Road bridge on a regular basis, so flood warning signs are needed. A secondary step is to address the underlying issue with a drainage study and assess the integrity of the bridge and roadway.
2. **CC11** (*Flea Hill*) – was recently assessed by USACE as part of non-structural flood risk management study program, so a few next steps include land preservation/conservation for select properties, as well as explore potential for green infrastructure/detention, drainage improvements, tide control, and elevate/relocate infrastructure.
3. **CC8/CC12** (*Springhill Rd N/Bullhead Creek; Old Jefferson Hwy/Groover Rd*) – are two high priority areas with stormwater flooding, so a drainage study is recommended.
4. **CC2/CC6** (*3R Fish Camp; Bullhead Bluff/Settlers Bluff Rd*)– are two high priority communities/areas with riverine flooding, so a flood study is recommended.
5. **CC20** (*Cudjo Point/Fish Camp*) – is a location with a vulnerable demographic and repetitive loss properties, so land preservation/conservation is recommended for select properties. This area, along with three medium priority projects in the neighboring area of Dover Bluff and Piney Bluff (**CC17/CC18/CC19**), are primarily affected by storm surge. It is recommended that these sites also explore green infrastructure/detention, drainage improvements, tide control, and elevate/relocate infrastructure

Of the remaining projects, there is one medium priority project with a living shoreline at Crooked River State Park (**CC16**), one medium priority maintenance project to address beaver dams in Catfish Creek (**CC13**), two medium priority projects to pave dirt roads and repair ditches at Springhill Road North (**CC7**) and Bailey Mill Road (**CC22**), and eight more projects with either a drainage study due to stormwater flooding, flood study due to riverine flooding or storm surge, or land conservation/preservation.

Table 5.3. Unincorporated Camden County Project List – Resiliency Implementation Workplan.

Site ID	Site Description	Priority (Based on Rank)	Potential Partners; Grants	Proposed Solution (initial steps)	Proposed Solution (secondary steps)
CC3	New Post Road / White Oak Creek	High	GEMA, GDOT	Warning signage	Roadway/bridge vulnerability study/ drainage study
CC11	Flea Hill	High	DCA, GEMA; CDBG, BRIC,	Land preservation & conservation (buy-outs for select properties)	Green infrastructure/ detention, drainage improvements, tide control, elevate/relocate infrastructure
CC8	Springhill Rd North / Bullhead Creek	High	DCA, GEMA; CDBG, BRIC	Drainage Study	Drainage improvements / maintenance
CC12	Old Jefferson Hwy / Groover Rd	High			
CC6	Bullhead Bluff / Settlers Bluff Roads	High	USACE; FPMS	Flood Study	
CC2	3R Fish Camp	High			
CC20	Cudjo Point (Fish Camp)	High	DCA, GEMA, USACE; CDBG, BRIC, FPMS	Land preservation & conservation (buy-outs for select properties)	Green infrastructure/ detention, drainage improvements, tide control, elevate/relocate infrastructure
CC18	Dover Bluff Road	Medium			
CC19	Dover Bluff	Medium			
CC17	Piney Bluff	Medium			
CC13	Catfish Creek	Medium	USACE, CRD	Permitting/maintenance (beaver dams)	
CC7	Springhill Road North	Medium	EPD, GDOT; 319 Grant	Dirt road paving / repair ditches	
CC16	Crooked River State Park	Medium	CRD, USACE, NFWF; CIG, NCRF	Living shoreline	Streambank stabilization
CC5	Bailey Mill Rd / Satilla River	Medium	DCA, GEMA; CDBG, BRIC	Drainage Study	Drainage improvements / maintenance
CC14	Bristol Hammock	Medium	DCA, GEMA, USACE; CDBG, BRIC, FPMS	Land preservation & conservation (buy-outs for select properties)	Elevate/relocate infrastructure
CC22	Bailey Mill Rd	Medium	EPD, GDOT; 319 Grant	Dirt road paving / repair ditches	
CC15	Misty Harbor	Low	DCA, GEMA, USACE; CDBG, BRIC, FPMS	Flood Study	
CC21	New Post Road / Notta Rd	Low	DCA, GEMA; CDBG, BRIC	Drainage Study	Drainage improvements / maintenance

Site ID	Site Description	Priority (Based on Rank)	Potential Partners; Grants	Proposed Solution (initial steps)	Proposed Solution (secondary steps)
CC4	New Post Road / Kings Bay Rd	Low	GDOT, USACE; FPMS	Flood Study	
CC9	Old Jefferson Hwy / south of Hwy 110	Low			
CC1	Butler Johnson Rd / Taylor Ln	Low			
CC10	Hwy 40 near Hwy 110	Low	GDOT, USACE; FPMS	Flood Study	

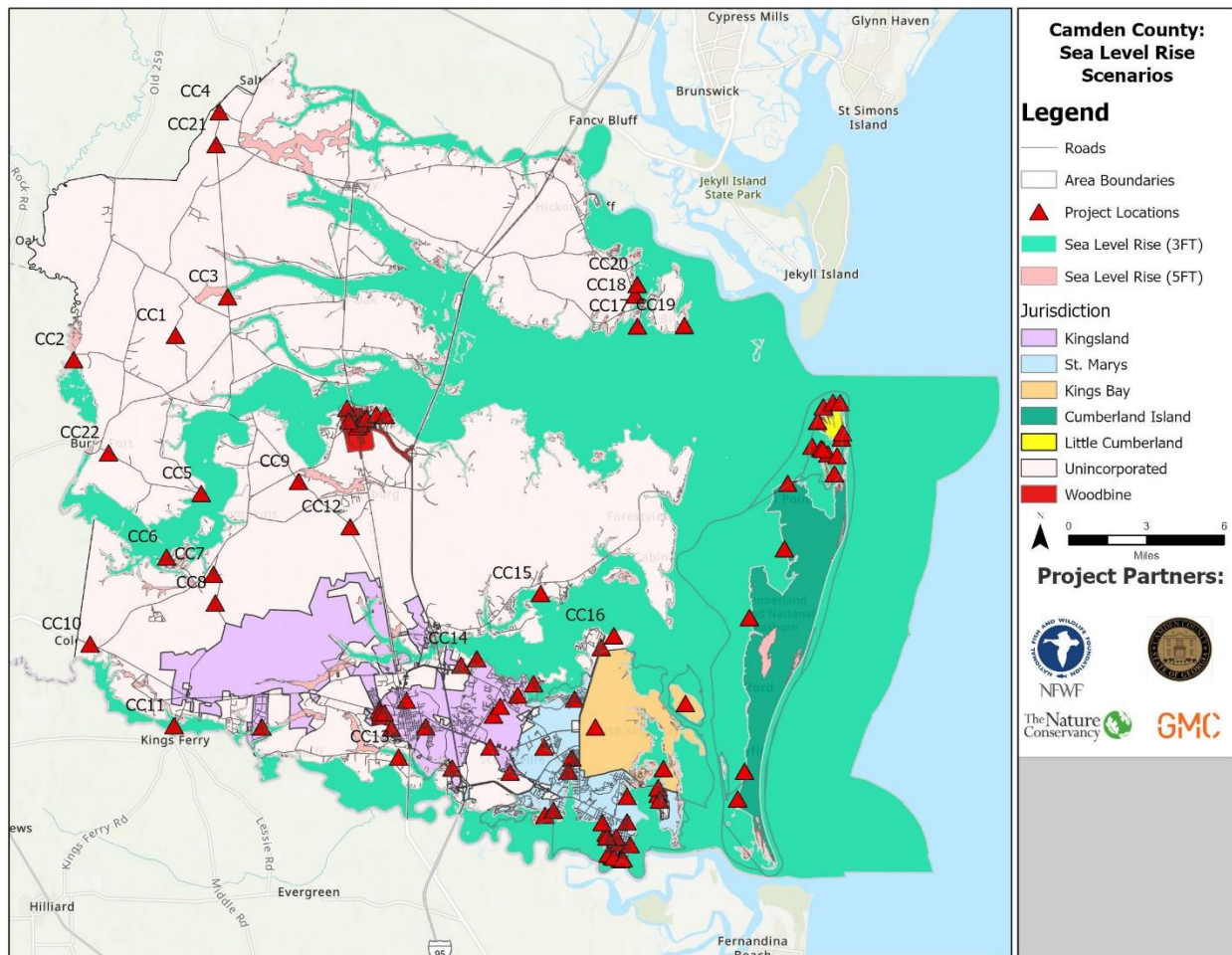


Figure 5.6. Map of Project Locations in Unincorporated Camden County

5.4.2. City of Kingsland

There were 16 vulnerable areas and flooding hotspots identified in the City of Kingsland. The proposed projects are presented in Table 5.4 and Figure 5.7. The matrix scores for Kingsland were mostly low due to much of the area being outside of the SFHA and limited presence of erosion and high tide flooding. The four highest priority projects include:

1. **KL12** (*Woodhaven/Meadows Culvert Crossing*)– is a project that can address flooding at the Wolf Bay, Meadows, and Woodhaven neighborhoods (**KL4/KL5/KL16**). A new canal has been designed but it needs help to permit, fund, and attain ROW.
2. **KL9** (*Creekwood Lift Station*)– this project, a lift station near Creekwood Drive, is subject to flooding, but the City is already taken steps to elevate this critical facility.
3. **KL10** (*Regional Detention along Gum Branch*)– the City is interested in pursuing projects that combine stormwater management with recreation. This project will create retention with a stormwater/fishing/recreation pond to handle the additional flow from the recent pipe upsizing under Gross Road. The stormwater pond can increase efficiency using real-time controls to release flow ahead of large storms and/or delay discharge until downstream channel has sufficient capacity.
4. **KL11** (*Summerfield Neighborhood*)– is the home to the only City-owned pond. This project is located in a bowl and has several repetitive loss properties, so a combination of buyouts and an updated drainage study are needed to preserve and conserve select properties, improve existing detention, and add green infrastructure elements through parks.

Of the remaining projects, there are recommendations for land preservation and conservation in the frequently flooded neighborhoods of Wolf Bay, Meadows, and Woodhaven (**KL4/KL5/KL16**) through buy-outs of select properties and then to transform that space into regional detention and green infrastructure/parks. Another common recommendation is drainage studies to determine an approach to best solve current and future flooding issues at SR 40, Gum Branch, Mariner’s Landing, May Branch, and Christina Lane (**KL15/KL8/KL14/KL6/KL3**). Due to the connectivity between SR40 (**KL15**) draining through Mariner’s Landing (**KL14**), these two projects can be completed concurrently. The pond at Mariners Landing may have potential for retrofitting with real-time control to increase storage prior to storm events. There were two areas identified with potential impacts to SLR where development is somewhat sparse – northeastern Laurel Island (**KL1**) and Northshore Drive (**KL2**). A policy-based management practice of increasing freeboard requirements to match those in unincorporated Camden County will help all future development in these areas and redevelopment citywide be more resilient.

Table 5.4. City of Kingsland Project List – Resiliency Implementation Workplan.

Site ID	Site Description	Priority (Based on Rank)	Potential Partners; Grants	Proposed Solution (initial steps)	Proposed Solution (secondary steps)
KL12	Woodhaven/Meadows Culvert Crossing	High	USACE, CRD, GDOT, DCA, GEMA; CDBG, FPMS, BRIC	New canal (permitting and ROW) – addresses KL4/KL5/KL16	

Site ID	Site Description	Priority (Based on Rank)	Potential Partners; Grants	Proposed Solution (initial steps)	Proposed Solution (secondary steps)
KL9	Creekwood Lift Station	High	GEMA, DCA; CDBG	Elevate lift station (project underway)	
KL10	Regional Detention (Gum Branch)	High	County, DCA, GEMA; CDBG-MIT, BRIC	Regional Detention (with real-time control)	
KL11	Summerfield Neighborhood	High	GEMA, DCA, USACE; BRIC, CDBG, FPMS	Land preservation & conservation (buy-outs for select properties)	Green infrastructure (parks), regional detention
KL15	SR 40 Flooding	Medium	GDOT, DCA, GEMA; CDBG, BRIC	Drainage Study (tie-in with KL14)	Other drainage improvements, detention, or green infrastructure
KL8	Gum Branch (Laurel Island)	Medium	USACE; FPMS	Drainage Study to identify most vulnerable areas to surge to protect	Tide control, stormwater system maintenance, drainage improvements
KL7	Canal Maintenance (Gum Branch)	Medium	USACE, CRD; FPMS	Permitting	Maintenance
KL13	The Lawn	Medium	CRD, NFWF, DCA; CIG, NCRF, CDBG	Land preservation & conservation	Add trails/boardwalk through wetlands
KL4	Wolf Bay Neighborhood	Medium	GEMA, DCA, USACE; BRIC, CDBG, FPMS	Land preservation & conservation (buy-outs for select properties)	Green infrastructure (parks), regional detention
KL5	Meadows Neighborhood	Med-Low			
KL16	Woodhaven Neighborhood	Med-Low			
KL1	Northeastern Laurel Island	Med-Low	County, CRD; CIG	Policy - Ordinance Update for additional freeboard	
KL2	Northshore Drive	Med-Low			
KL14	Mariners Landing	Low	DCA, GEMA; CDBG, BRIC	Drainage Study	Modify outlet structure and enhance with real-time control
KL6	May Branch	Low	DCA, GEMA; CDBG, BRIC	Drainage study	Green infrastructure, detention, or other drainage improvements
KL3	Christina Lane	Low	Private	Drainage study	Green infrastructure or other drainage improvements

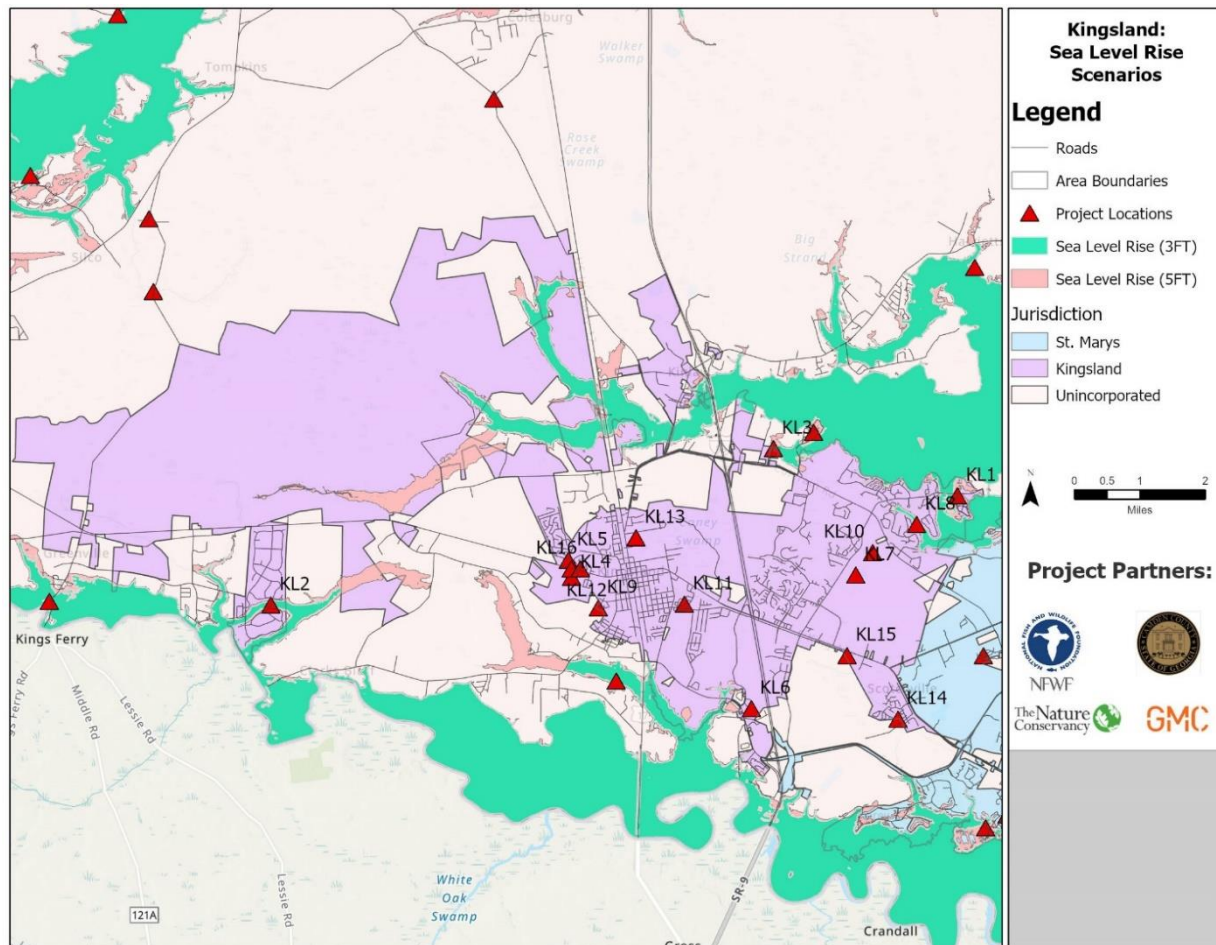


Figure 5.7. Map of Project Locations in City of Kingsland

5.4.3. City of St. Marys

There were 23 vulnerable areas and flooding hotspots identified in the City of St. Marys. Upon review of these areas, a couple could be combined into one project, so the result is ten proposed projects (Table 5.5 and Figure 5.8). The four highest priority projects include:

6. **SM7 (Downtown Spine)**– is a major preservation project where the City owns much of the low-lying central areas of downtown, but additional properties should be acquired and preserved to create a large regional detention-type facility. Depending on permitting, real-time control at this facility would enhance efficiency.
7. **SM1/SM2/SM3/SM4/SM9 (Downtown St. Marys Riverfront)** – these five projects were combined to address high tide flooding and storm surge in the downtown/riverfront area.
8. **SM19/SM22 (Borrell Blvd; North River Causeway)** – were two projects with concerns of bridge/causeway vulnerability to storm surge that could cause accessibility issues. These were combined under the first phase to conduct a roadway/bridge vulnerability study, but they will likely be set up as separate projects for implementation and repairs.
9. **SM13 (Dufour St)** – is a neighborhood with a vulnerable demographic. This area has flooding issues and is seeing marsh migration, where the marsh and creek are overtaking several lots.

Of the remaining projects, there are lower priority projects with recommendations for tide control at Nancy Drive and Shadowlawn (**SM5/SM6**), roadway/bridge vulnerability study for the Sugarmill bridge (**SM20**), land preservation and conservation for areas with repetitive loss properties and regular flooding at Ashley/Hall Streets, eastern downtown (Nancy Street), and Point Peter Place (**SM8/SM10/SM21**). In addition, there are several neighborhood drainage studies recommended to explore options for regional detention (with real-time control), green infrastructure (parks), and other drainage improvements. The first tier includes Colerain Oaks (**SM14**), which was a major recommendation from the 2008 Stormwater Master Plan, and the second tier includes Finley Street, Crooked River Plantation, Shadowlawn, Sugar Mill, Pagan St/Plantation Oaks Dr, and Spur 40 (**SM12/SM15/SM16/SM17/SM18/SM23**).

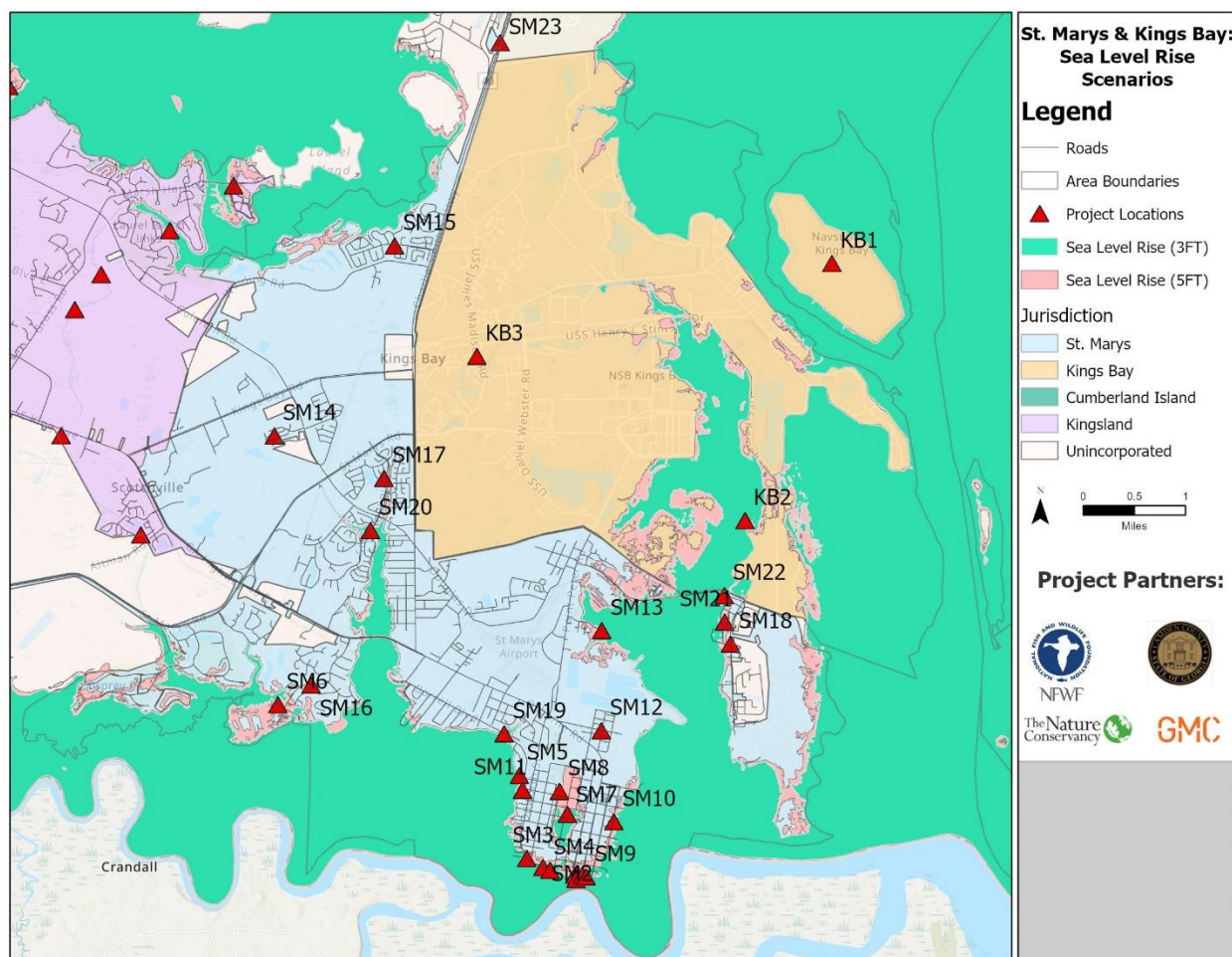


Figure 5.8. Map of Project Locations in City of St. Marys

Table 5.5. City of St. Marys Project List – Resiliency Implementation Workplan.

Site ID	Site Description	Priority (Based on Rank)	Potential Partners; Grants	Proposed Solution (initial steps)	Proposed Solution (secondary steps)
SM7	Downtown Spine	High	GEMA, NFWF, USACE; BRIC, NCRF, FPMS	Land acquisition, drainage study	Regional detention (real-time control), wetland restoration, floodplain restoration, tide control
SM1	Downtown St. Marys	High	GEMA, DCA, USACE, NPS, NFWF; BRIC, CDBG, FPMS, NCRF	Tide control; hybrid living shoreline/sea wall; partner with NPS	Policy, land conservation, relocation, elevate roadway
SM9	St. Marys Street (Lang's Marina)	High			
SM2	St. Marys Street (Marshwalk)	High			
SM3	St. Marys Street (Seminole)	High			
SM4	Downtown St. Marys (Commercial)	High			
SM22	North River Causeway	High	GDOT, GEMA; BRIC	Roadway/bridge vulnerability study	Elevate Causeway/Bridge
SM19	Borrell Blvd	High			
SM13	Dufour Street	High	GEMA, DCA, USACE; BRIC, CDBG, FPMS	Land preservation & conservation (buy-outs for select properties)	Green infrastructure (parks), regional detention, drainage improvements, tide control
SM5	Nancy Drive	Medium	GEMA, DCA; BRIC, CDBG	Tide control, drainage improvements, green infrastructure	elevate/relocate roadway; land preservation & conservation
SM6	Shadowlawn Neighborhood (King Tide)	Medium			
SM20	Sugarmill Bridge	Medium	GDOT, GEMA; BRIC	Roadway/bridge vulnerability study	
SM10	Eastern Downtown (Norris Street)	Medium	GEMA, DCA, USACE; BRIC, CDBG, FPMS	Land preservation & conservation (buy-outs for select properties)	Green infrastructure (parks), regional detention, drainage improvements, tide control
SM8	Ashley/Hall Streets	Medium			
SM21	Point Peter Place	Medium			
SM14	Colerain Oaks	Medium	GEMA, DCA; BRIC, CDBG	Drainage study	Regional Detention (with real-time control) and other drainage improvements
SM11	St. Marys Senior Care Center	Low	GEMA, DCA; BRIC, CDBG	Tide control, drainage improvements, green infrastructure	
SM15	Crooked River Plantation Neighborhood	Low	GEMA, DCA, USACE;	Drainage study	Regional detention (RTC), GI/LID, and drainage improvements

Site ID	Site Description	Priority (Based on Rank)	Potential Partners; Grants	Proposed Solution (initial steps)	Proposed Solution (secondary steps)
SM16	Shadowlawn Neighborhood	Low	BRIC, CDBG, FPMS		
SM23	Spur 40	Low			
SM12	Finley Street	Low			
SM18	Pagan St / Plantation Oaks Dr	Low			
SM17	Sugarmill Neighborhood	Low			

5.4.4. City of Woodbine

In the City of Woodbine, there were eight vulnerable areas and flooding hotspots identified. Upon review of these areas, a couple could be combined into one project, so the result is six proposed projects (Table 5.6 and Figure 5.9). Since most of the City drains to Dunn Branch, half of the projects are focused in this area. The first two projects associated with Dunn Branch are high priority and the third is medium priority:

1. **WB5** (*Dunn Branch Upstream*) – continue regular maintenance of this section of Dunn Branch (west of Brewster Street) using new Marsh Master equipment to keep debris and excessive vegetation from causing stormwater backups
2. **WB6** (*Dunn Branch Downstream*) – pursue permitting with USACE and DNR to allow access for maintenance and eventually permitting and design to improve downstream conveyance
3. **WB1/WB2/WB3** (*Hwy 17/8th-10th Street; Crestview Drive; Georgia/Camden Avenues*) – these three projects are located near the upper reach of Dunn Branch and can all be somewhat related to stormwater backups and flooding. It is recommended to complete a drainage study of these areas to explore the most effective solution to address regular flooding caused by intense rainfall events at these locations. Potential solutions include: upstream or in-line detention/regional detention that could be enhanced with real-time controls to manage the release of water, GI/LID, other drainage improvements with additional or larger pipes or ditches.

Next, as a medium priority project, it is recommended to pursue review and update of the City's flood ordinance to match the recent update from Camden County that added 3 feet of freeboard for construction in the special flood hazard area (100-year flood zone) and 1-foot above grade in the shaded-X zone (500-year flood zone). One reason is due to the SLR vulnerability identified for sections of Satilla River Landing Neighborhood (**WB8**). This neighborhood has infrastructure in place but is currently sparsely developed, so it will be important to protect future construction from the threat of SLR. This policy-based management practice will help all future development and redevelopment citywide to be more resilient, and it will match regulations in unincorporated Camden County.

Maintenance of ditches around Woodbine is a pressing issue, particularly a lack of maintenance on private property to the point where they are overgrown or silted in. Some ditches had been maintained, but when they were not maintained properly (i.e., invert at same elevation), they silted in quickly. This issue is most pronounced in the western section of the City (**WB7**). As a result, it is recommended to complete a condition assessment and mapping of all ditches and drainage infrastructure in the City and to identify priority ditches. Ditches in City right-of-way can be programmed for maintenance, and the City can pursue drainage easements to access the private ditches that are high priority. Due to the logistics and overall time to pursue drainage easements in priority areas citywide, this project ranked as lower priority. However, the initial condition assessment and stormwater infrastructure mapping to develop a plan for maintenance and easements to target should be programmed as a near-term goal.

Lastly, there was a small pond on Yvonne Avenue (**WB4**) that occasional floods and backs-up. This is located entirely on private property and has a smaller impact area compared to the other projects, so it was a lower priority project. It will need buy-in and support from property owners. A proposed solution is to do a drainage study of this pond and drainage area to determine if any GI/LID could be added, the pond outfall adjusted, or conveyance improvements upstream or downstream.

Table 5.6: City of Woodbine Project List – Resiliency Implementation Workplan.

Site ID	Site Description	Priority (Based on Rank)	Potential Partners; Grants	Proposed Solution (initial steps)	Proposed Solution (secondary steps)
WB5	Dunn Branch (upstream)	High	City only	Ongoing, regular maintenance	
WB6	Dunn Branch (downstream)	High	USACE, CRD; FPMS	Pursue permitting for ability to maintain channel	Pursue permitting for ability to modify channel to improve conveyance or access
WB1	Hwy 17 - 8th-10th Streets	Medium	GDOT, DCA, GEMA; CDBG, BRIC	Drainage Study	Upstream/in-line storage, regional detention (real-time control), GI/LID, and drainage improvements
WB2	Crestview Drive	Medium			
WB3	Georgia/Camden Avenues	Medium			
WB8	Satilla River Landing Neighborhood	Medium	County, CRD; CIG	Policy - Ordinance Update for additional freeboard	
WB4	Yvonne Avenue Pond	Low	Private	Drainage Study	Conveyance improvements; GI/LID
WB7	Western Woodbine Ditch Maintenance	Low	CRD, USACE; CIG, FPMS	Condition assessment & mapping of stormwater infrastructure; ranking of ditch priority	Drainage easements and maintenance for priority ditches

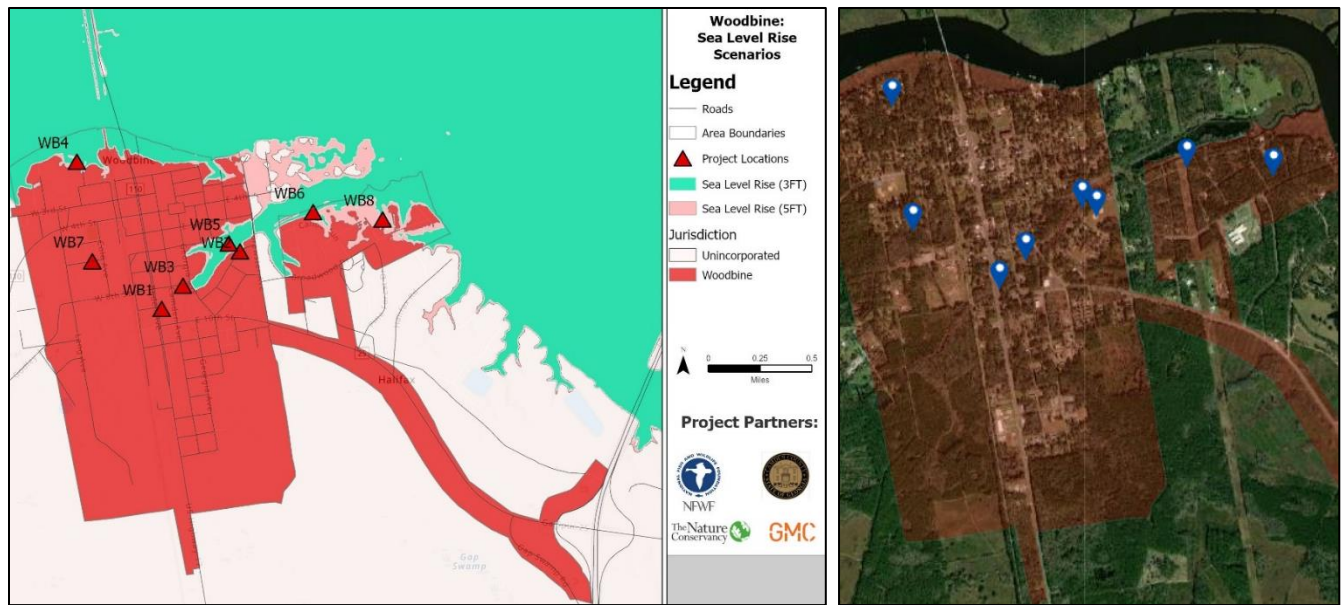


Figure 5.9: Map of Project Locations in City of Woodbine.

5.4.5. Naval Submarine Base Kings Bay

Within Naval Submarine Base Kings Bay, there were three areas of concern identified during stakeholder interviews. Two were general and the third, an erosion area affecting a utility pole, has recently been addressed (Table 5.7). The general projects included:

1. **KB1 (Dredge Capacity)** – the main channel for Kings Bay has dredging needs, and the space remaining for the three main dredge spoil locations is limited (~16-year lifespan estimate). Therefore, pursuing beneficial use needs to increase dredge capacity is a high priority. A study looking at other beneficial uses, including thin-layer placement, is recommended.
2. **KB3 (Stormwater Maintenance Needs)** – the majority of the stormwater issues are associated with blocked systems from sediment, debris, and/or vegetation, so these areas need maintenance. It is recommended as an initial step and near-term goal to conduct a condition assessment and stormwater infrastructure mapping to determine priority drainageways and develop a plan for maintenance.

The third project, **KB2**, was erosion taking place near a power pole along the North River. This pole has been moved, so vulnerability to a critical facility is no longer a concern, but this area could still pursue living shoreline to stabilize the erosional hotspot, which according to the historical shoreline change data (1930s-2000) was -0.8 to -0.6 m/yr. Due to the absence of risk on infrastructure, this project could be shifted to low priority. This area has very limited access, so use as a demonstration project is not ideal.

There are no areas currently affected by high tide flooding, and much of the infrastructure and roadways are located in higher elevation areas. There were only a couple of roads and parking lots that showed vulnerability under the 5-foot SLR scenario. While not identified as a specific project, the following locations should be considered in long-range resiliency planning:

1. Roadway and parking lot near James Monroe Avenue and USS Simon Lake Road South intersection.
2. Roadway along USS Kamehameha Avenue, just north of USS Francis Scott Key Drive

Table 5.7. Kings Bay Project List – Resiliency Implementation Workplan.

Site ID	Site Description	Priority (Based on Rank)	Potential Partners; Grants	Proposed Solution (initial steps)	Proposed Solution (secondary steps)
KB1	Dredge Capacity – Beneficial Use Needs	High	USACE, DOD, NPS; REPI, NFWF, FPMS	Explore and study alternate uses for dredge material (e.g., thin-layer placement, construction, etc.)	
KB3	Stormwater Maintenance Needs	High	USACE, DOD; REPI, FPMS	Condition assessment & mapping of stormwater infrastructure; ranking of ditch priority	Drainage easements and maintenance for priority ditches
KB2	North River Erosion – Utility Pole	Low	USACE, DOD, CRD	Living shoreline	
Other	Roadway Vulnerabilities under 5-ft SLR Scenario	Low	DOD, USACE; REPI	Identify and prioritize the most vulnerable roads and drainageway crossings	Based on prioritization, elevate roadway or other measures to protect when doing future work on those segments

5.4.6. Cumberland Island

Within Cumberland Island, there were seven vulnerable areas and flooding hotspots identified. Upon review of these areas, a couple could be grouped as one project, so the result is three proposed projects (Table 5.8 and Figure 5.10). The first two are high priority and the third is low priority due to limited exposure of resources and facilities.

1. **CI1/CI2** (*Cumberland Island Visitor's Center/Dock*) – these two projects are located in downtown St. Marys. Due to flooding hotspots identified in this area, the NPS should coordinate with and pursue a project with the City of St. Marys to make the riverfront more resilient and protected. Potential solutions include: tide control, hybrid sea wall with living shoreline, green infrastructure.
2. **CI3/CI4** (*Plum Orchard Docks; Southern Dock*) – these two erosion projects have the greatest exposure to historic structures on Cumberland Island, so they are both ranked high. A living shoreline is recommended at each site. It may be helpful for grant funding opportunities to group them as one project.
3. **CI5/CI6/CI7** (*Erosion along western side of Cumberland Island*) – these three erosion projects have limited exposure to structures and facilities so they are all lower priority. A living shoreline is recommended at each site. It may be helpful for grant funding opportunities to group them as one project.

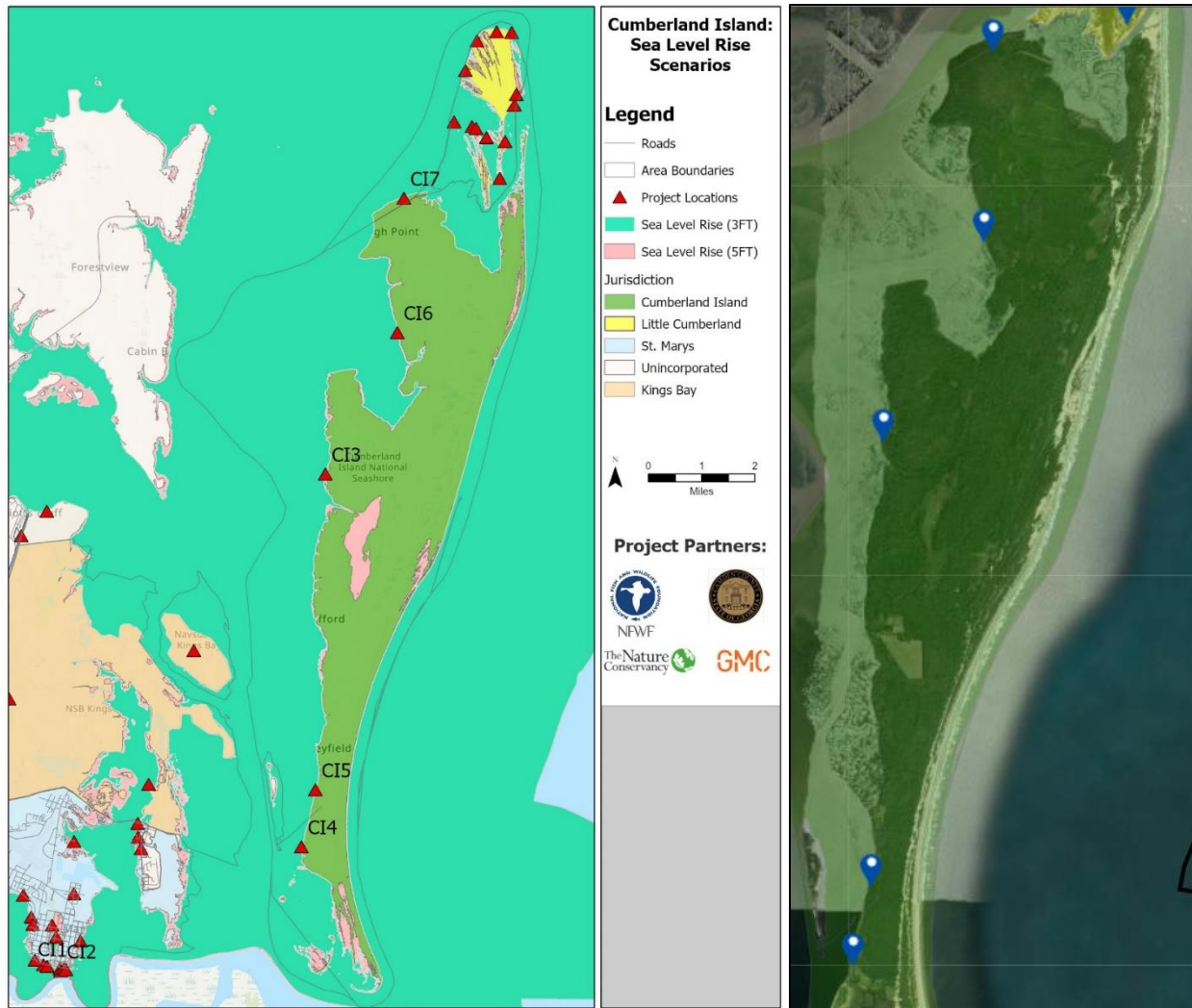


Figure 5.10. Map of Project Locations in Cumberland Island

Table 5.8. Cumberland Island Project List – Resiliency Implementation Workplan.

Site ID	Site Description	Priority (Based on Rank)	Potential Partners; Grants	Proposed Solution (initial steps)	Proposed Solution (secondary steps)
CI1	Cumberland Island Visitor's Center	High	City of St. Marys, USACE, NFWF; BRIC, NCRF	Partner with City of St. Marys on their efforts to design features to protect this area. Floodproof facilities/ utilities as allowable.	Pursue implementation via a combination of tide control, green infrastructure, sea wall/living shoreline.
CI2	Cumberland Island Docks (St. Marys)	High			
CI4	Historic Seawall Erosion - Southern Dock	High	CRD, USACE, NFWF; CIG, NCRF	Living Shoreline	Group CI3 & CI4 for implementation.
CI3	Plum Orchard Docks	High			

Site ID	Site Description	Priority (Based on Rank)	Potential Partners; Grants	Proposed Solution (initial steps)	Proposed Solution (secondary steps)
CI5	Southern-third Erosion	Low	CRD, USACE, NFWF; CIG, NCRF	Living Shoreline	Group CI5, CI6, & CI7 for implementation.
CI6	Northern-third Erosion	Low			
CI7	Northern End Erosion	Low			

5.4.7. Little Cumberland Island

Within Little Cumberland Island, there were 12 vulnerable areas and flooding hotspots identified. Upon review of these areas, a couple could be grouped as one project, so the result is eight proposed projects (Table 5.9 and Figure 5.12). The matrix scores for Little Cumberland Island were high across the board due to high presence of erosion and high tide flooding. The three highest priority projects include:

1. **LCI1 (Otter Trail)** – is the main roadway connecting the main dock access to the houses on the east and north, this road needs to be regularly maintained and stabilized until it becomes regularly impassible. As that time approaches, LCI HOA should pursue a new dock on the northern end of Christmas Creek for access.
2. **LCI6 (Shell Creek/General's Mound)** – is the site of a living shoreline on Little Cumberland Island, so this area should continue upgrading the existing living shoreline and other stabilization efforts.
3. **LCI3/LCI4/LCI5 (Brockington/Christmas/Shell Creeks)** – represent all of the major waterway access points to the trails and residences. Each of these waterways are experiencing erosion, siltation, oxbows, and breakthroughs, so it is important to coordinate with USACE if there is anything that can be done to maintain navigable channels. Some areas can be stabilized with living shorelines, oyster beds, and vegetation; an example living shoreline project installed on Little Cumberland Island is presented in Figure 5.11.



Figure 5.11. Living Shoreline at LCI6 (Shell Creek).
Photo Source: Georgia DNR-CRD

Of the remaining projects, there are recommendations for living shorelines or sand fencing to help stabilize existing conditions. A few areas might require more substantial stabilization, such as constructed dunes. **LCI8/LCI9/LCI10** could be pursued jointly to cover the northern end of the island, but LCI9 has higher priority due to the threat on the historic lighthouse. In some cases, relocation or creating a redundant trail/road is needed, such as with East Ridge Trail (**LCI2**) and seeking higher ground. Also, if the undermined duplex on Shell Creek (**LCI12**) is beyond saving, relocation may be warranted.

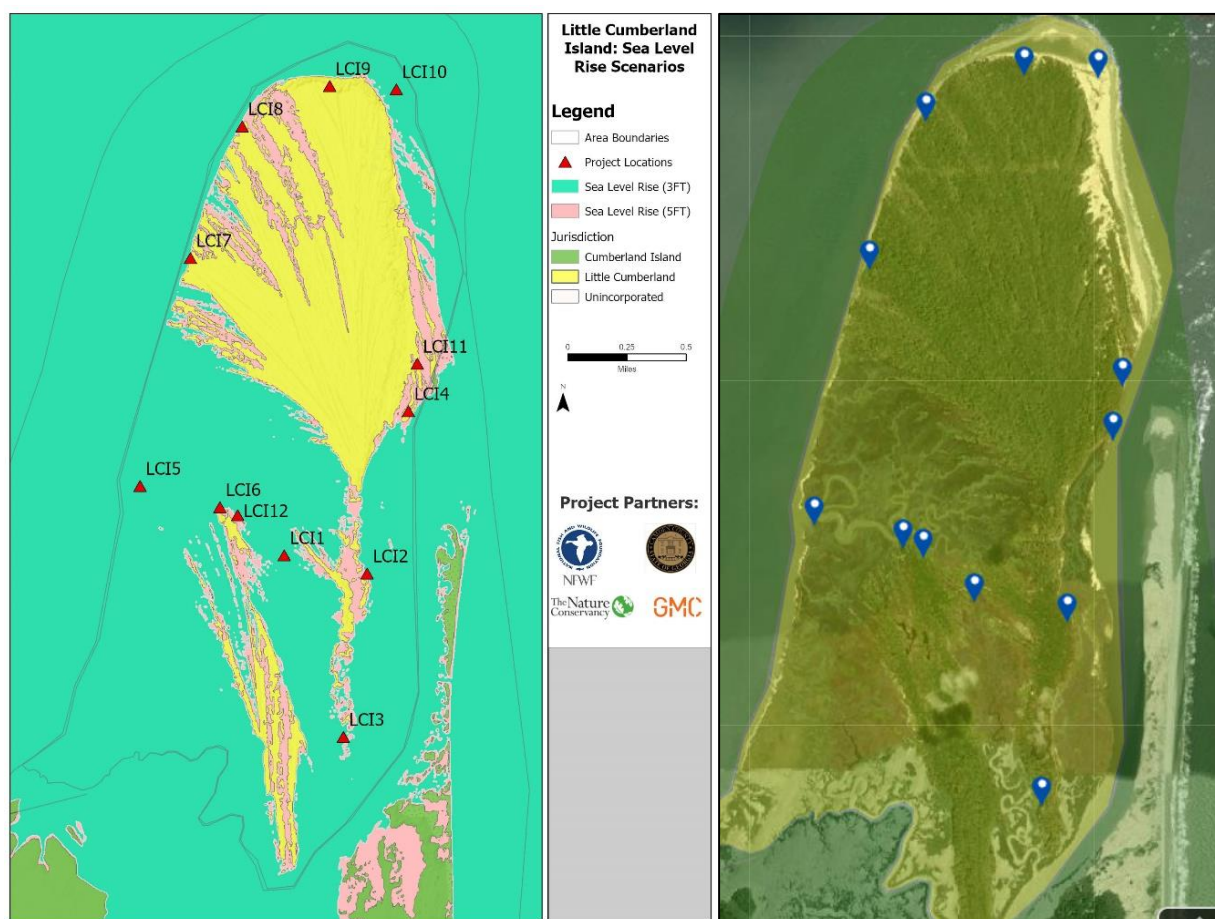


Figure 5.12. Map of Project Locations in Little Cumberland Island

Table 5.9. Little Cumberland Island Project List – Resiliency Implementation Workplan.

Site ID	Site Description	Priority (Based on Rank)	Potential Partners; Grants	Proposed Solution (initial steps)	Proposed Solution (secondary steps)
LCI1	Otter Trail	High	USACE, CRD	Regular Stabilization & Maintenance until Regularly Impassible	Pursue new dock on northern end of Christmas Creek
LCI6	Shell Creek, General's Mound	High	CRD, USFWS, USACE	Continue Living Shoreline and Stabilization	

Site ID	Site Description	Priority (Based on Rank)	Potential Partners; Grants	Proposed Solution (initial steps)	Proposed Solution (secondary steps)
LCI5	Shell Creek	High	USACE	Coordinate with USACE for navigable channels	Streambank Stabilization / Living Shoreline
LCI4	Christmas Creek	High			
LCI3	Brockington Creek	High			
LCI9	Historic Lighthouse/Bishop House	Medium	USACE, CRD, NFWF	Streambank Stabilization	Constructed Dune (combine with LCI8/LCI10)
LCI2	East Ridge Trail	Medium		Relocate Road/Trail	
LCI12	Shell Creek Duplex	Medium	USACE, CRD	Living Shoreline	Relocation
LCI7	West Side Erosion	Med-Low			
LCI11	Eastern Mid-Island	Med-Low	USACE, CRD, NFWF	Living Shoreline	Constructed Dune
LCI10	Northeastern Dunes (Ocean)	Med-Low	USACE, CRD, NFWF	Sand Fencing	Constructed Dune (combine LCI8/LCI9/LCI10 if able)
LCI8	Northwest Dunes	Med-Low			

5.5 Other Recommendations for Implementation

After presentation of the projects by jurisdiction and review of the issues and proposed solutions, there are a few additional recommendations to note and explore:

- Depending on the severity and frequency of flooding at several of the vulnerable areas, some may also need to explore a long-term relocation/retreat plan.
- There are a number of resiliency-based grants that can be explored for additional planning, drainage studies, design/permitting, and construction/implementation. It is recommended for each jurisdiction to start with the higher priority projects and begin to line up timelines for grant application
- An additional funding source that each jurisdiction should consider is a stormwater enterprise fund (e.g., stormwater utility) because many of the underlying issues for these projects are stormwater-related.
- An item that most jurisdictions in Camden County struggle with is maintenance of stormwater ditches and canals. Maintenance is challenging when they are excessively overgrown, lack equipment access, lack an easement, or cannot be touched due to being classified as jurisdictional waters. With the latter being the most restricting.
- Camden County could use a demonstration living shoreline project in a more accessible and higher-trafficked location
- Real-time stormwater controls for regional detention offers the ability to not only release stored water prior to large predicted rainfall events to gain additional storage, but it can also hold floodwaters until downstream capacity (and in some cases tidal conditions) are suitable for release.

- Update ordinances to include components that address resiliency and SLR. GADNR-CRD and UGA Carl Vinson Institute of Government created “Enhancing Coastal Resilience with Green Infrastructure” in 2020 that includes model ordinances related to resiliency and SLR. The specific model ordinances in this document include:
 - Model Flood Resilient Development and Building Ordinance
 - Model Enhanced Stormwater Resilience Ordinance
 - Model Sea Level Rise Ordinance
 - Model Tidal Flooding Resilience Ordinance
 - Model Coastal Resilience Ordinance

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Appendix A – Stakeholder Committee Meetings: Meeting Summaries

This appendix includes the meeting summaries from each Stakeholder Committee Meeting. The meeting summaries included in the appendix are as follows:

- Kickoff Meeting, May 18, 2021 – Pages 99-100
- Meeting #2, August 11, 2021 – Pages 101-103
- Meeting #3, November 16, 2021 – Pages 104-107
- Meeting #4, March 25, 2022 – Pages 108-109

Steering Committee Meeting #1 - Camden County Resiliency Implementation Workplan

5/18/2021 10:00-12:00pm via Zoom

Meeting Minutes

1. Introductions – Ashby Worley (TNC)

- Participants/Stakeholder Committee Members from:
 - Jurisdictions/Geographical Areas: Camden County, St. Marys, Kingsland, Woodbine, Kings Bay Naval Base, Little Cumberland Island, Cumberland Island
 - Other Stakeholders: The Nature Conservancy, Georgia Conservancy, St. Marys Riverkeeper, Southeast Regional Partnership for Planning and Sustainability, Georgia Sentinel Landscape, GA Dept. of Natural Resources-Coastal Resources Division, UGA Marine Extension and Georgia Sea Grant, UGA Camden County Cooperative Extension, Stetson University, and U.S. Army Corps of Engineers

2. Project Scope & Outline – Scott Pippin & Shana Jones (UGA)

- Funding through National Fish & Wildlife Foundation, National Coastal Resilience Fund
- Under “Community Capacity Building and Planning” Priority Area; will enable projects to pursue design/permitting/construction with subsequent grants (larger potential awards under NFWF NCRF.
- An overall goal is to set the stage with this project to ultimately receive between \$1-\$5 million in Restoration and Monitoring funding from NFWF.
- The project should also set the stage for other funding sources as well, including BRIC (FEMA), REPI (DoD), and other resilience grants likely forthcoming from NOAA. Corps of Engineers projects may be available also.

3. Initial results from local data & plans – Rob Brown (GMC)

- GMC reviewed existing local plans to look for strategies and management practices recommended for flood-related hazards and resiliency. Plans included:
 - Disaster Recovery and Redevelopment Plan, Comprehensive Plan, Camden Kings Bay Joint Land Use Study, Hazard Mitigation Plan, St. Marys Flood Resiliency Project, St. Marys Stormwater Masterplan, and USACOE South Atlantic Coastal Study.
- GMC reviewed historical sea level rise data from Fort Pulaski, GA, and Mayport, FL, and presented local SLR projections for Camden County.
- Preliminary GIS data analysis was presented for flood zones, storm surge, SLR, SLAMM, marsh migration, high-tide flooding, and shoreline change rate.
 - A subset of the SLAMM results were presented to show the loss of “dry land” with 1-m and 2-m SLR projections for each jurisdiction.
- Requested information from the group on other important datasets or plans.
 - The County’s Hazard Mitigation Plan is under final review for style, so the posted draft version is close to the final product.
 - DNR also has a dataset under statewide action plan for habitat overlapping with flood resiliency.
 - USACOE is in the process of creating a dataset of 10-year and 100-year events with SLR

4. **Draft public survey** - Shana Jones & Scott Pippin (UGA)

- A public survey will be a short and simple online survey for the public to share both current issues and their future vision for increasing resilience throughout the County.
- Topics include: rate threat of existing hazards and future hazards, preparedness, hazards observed, demographics (full- or part-time resident of which jurisdiction), and a mapping-based question to identify any areas within the County particularly vulnerable to environmental hazards or have been impacted by such hazards in the recent past.
- Presented to the group for feedback and shared via email.

5. **Stakeholder Engagement** – Ashby Worley (TNC)

- Stakeholder committee is this group; felt it was pretty comprehensive
- Focus Groups were targeted for four groups – large landowners, businesses, engineers/surveyors, and other (planned unit development, vulnerable landowners, faith community, and LMI/minority neighborhoods)
 - The Committee felt that groups missing were GA Power and School Board.

6. **Next steps** – Ashby Worley (TNC)

- Match Recording
- Next Meeting will be in August - TBD
- Round Robin on goals/interests and meeting type (in-person vs. virtual)

Steering Committee Meeting #2 - Camden County Resiliency Implementation Workplan

8/11/2021 1:30-3:00pm via Zoom

Meeting Minutes

1. **Public Survey Preliminary results and status** – Scott Pippin, UGA
 - 118 Responses as of Aug 5. Closing survey on Aug 31.
 - Shared via social media, public networks, public engagement event, and newspaper
 - Flooding is priority concern – storm driven events (i.e., hurricanes)
 - Future flooding is even bigger concern than present flooding
 - Community ranked level of preparedness (for community as a whole); results were split between “not prepared” and “prepared”; room for improvement.
 - Chuck asked if that was personally or as a community and what that meant.
 - Scott answered that it was as a community and that it was likely a messaging/communication problem.
 - Chuck added that the Resiliency Center could solve that.
2. **Environmental Resiliency Data** – Rob Brown, GMC
 - Conducted GIS analyses to assess general vulnerability of the community
 - Also using data from the flood awareness tool created by Camden County & TNC.
 - Flood zones reflect areas with coastal and riverine flooding but do not reflect stormwater flooding issues or drainage issues
 - SLAMM – some areas show as “Undeveloped Dry Land” that were actually “Developed” due to extensive tree canopy. These were combined for purposes of analysis and comparison to see the effect on “Dry Land.”
 - Loss of “Dry Land” due to SLR results were:
 - Lowest in Kingsland and highest in Woodbine and St. Marys. From a total acreage perspective, Unincorp. County area had the largest losses.
3. **Targeted Interview Results** – Rob Brown, GMC
 - Interview analysis:
 - Unincorp. County:
 - 26 total points identified on the map. Scattered across county.
 - All categories of flooding concerns were captured by these points.
 - Kingsland:
 - 16 points identified here.
 - No particular issues identified for erosion or king tide flooding.
 - Primary issue is stormwater (downstream drainage capacity at several locations), and some surge issues at Gum Branch.
 - Interest in combining stormwater management with recreation projects. (i.e., rec/fishing/stormwater pond east of Gross Rd)
 - Kings Bay
 - 2 points identified on map.

- Primary issue is dredge spoil; looking for projects to find alternative uses for this material.
 - No king tide issues on roads
 - Stormwater issues revolve around stormwater maintenance
- City of St Marys
 - 26 points identified on map.
 - Small scale erosion issues across the City, but one site of note is at the riverfront
 - Very concerned about king tide; riverfront/downtown
 - SLR: King tide effects will be increased; tide control on storm sewer
 - Surge: downtown riverfront, access to Cumberland Harbour and Point Peter
 - Stormwater: issues at several neighborhoods due to driveway culverts, flat topography; also identified several locations with vulnerable demographics
 - Identified projects:
 - downtown “spine” (property acquisition) - actively pursuing
 - Stormwater retention in Colerain Oaks (2008 Stormwater Masterplan) - actively pursuing
- Cumberland Island (5+ docks in St Marys)
 - Primary issues are few eroding banks and docks/ visitor center
 - Marsh elevation (SETS) to look at thin layer placement
- Little Cumberland Island
 - 12 points identified on map.
 - Issues all around; concerns included King tide/clear sky flooding, storm surge, and especially erosion.
 - Shell Creek/General’s Mound. Issues with docks.
 - Several Trails affected by stormwater; continuously spending money on sand to build trail elevation, but would like a more resilient solution.
 - Recent project of a living shoreline was identified.
- Q&A
 - Jared asked of LCI and CI knew if their erosion issues were affecting known archaeological sites – Jim said yes, and specifically that the west side – River Beach, and the north side – historic lighthouse, were vulnerable. Gary agreed and said they are monitoring these impacts and trying to come up with solutions.
 - Jared asked if the shoreline erosion data from the Coastal Hazards Portal was the same as the USGS data. Rob said no, that it was from Dr. CJ Jackson, a professor at Georgia Southern.

4. **Nature-Based Solutions & Management Practices for Coastal Resiliency** – Ashby Worley, TNC
 - Project solutions that are motivated by natural support and may also offer environmental, economic, social benefits while providing resiliency.
 - Examples include:
 - Living shorelines: reduce erosion and typically includes oyster reef creation
 - Stream, wetland, and floodplain restoration: hydrologic restoration; builds resiliency
 - Sand/dune fencing: used to build dunes to provide type of barrier from storm surge
 - Nearshore placement: placement of sand upshore to decrease storm/wave action to inland issue; provides buffer to inland communities.
 - Constructed dunes: restore dunes, block flow from low-lying beach access points.
 - Streambank stabilization: stabilizes streambanks; reduces erosion and can realign stream to natural hydrology.
 - Green Infrastructure: reduces flooding potential in communities by absorbing and infiltrating stormwater, and also helps clean stormwater.
 - Rip Rap: reduces erosion in streambeds or tidal ditches; stabilizes eroding banks. Traditional approach.
 - Rock revetment & jetties: designed to absorb wave energy and reduce erosion. Can disrupt natural sediment transport.
 - Tide control gate: placed at storm sewer system outlet to prevent tidal water from flowing back into the storm system.
 - Bulkhead/seawalls: hard armoring of shorelines to reduce erosion. Often disrupts sediment transport and connection with marsh.
 - Policy changes: shore protection act, permitting, setbacks and buffers to accommodate marsh migration or erosion, SWU fees, LID, Zoning and Land use, etc.
5. **Breakout Sessions for projects and practices** – All
 - Group activity conducted in Mural
6. **Focus Groups** – Ashby Worley, TNC
 - Suggestions for specific individuals to contact were typed into Chat
7. **Next Steps and Meeting** – Ashby Worley, TNC
 - Next meeting will be in November -TBD
 - Track Match! – anytime spent on this project.

Steering Committee Meeting # 3 - Camden County Resiliency Implementation Workplan

11/16/2021 10:00-11:30am via Zoom

Meeting Minutes

1. Stakeholder Committee & Intro

- New members present included: Sarah Long, Camden County, Deputy CRS Coordinator.
- It was mentioned that there is a new St. Marys Riverkeeper

2. Focus Groups

- Will try to meet with representatives from these groups and wrap in comments from each into the draft Plan
- Four major groups include: DNR, DOD, Insurance Industry, Homebuilders' industry
- All identified will be asked to review and provide feedback on draft plan (2022)
- There is a targeted interview with City of Woodbine in December
- Look out for other groups; i.e., neighborhood groups, local groups, etc.

3. Previous Meeting Recap

- Mural Exercise was used to add notes on potential management measures and additional flooding issue areas
- Management Measures
 - Nature-based ("green"): living shorelines, GI/LID; shoreline fencing on barrier islands (constructed dunes on Little Cumberland Island)
 - Conventional measures: seawalls, bulkheads, tide gates
- Review of results by jurisdiction
 - Barrier islands
 - Living shorelines
 - Thin layer replacement
 - Sand/dune fencing
 - Constructed dunes (LCI)
 - Kings Bay
 - Living shoreline at power pole erosion site
 - St Marys
 - Tide control
 - Sea wall (hybrid with living shorelines)
 - RL property acquisition & at "spine"
 - Codes/ordinances (freeboard, Coastal Stormwater Supplement)
 - Long-term mitigation strategy for North River Causeway
 - Unincorporated County
 - Living shoreline (Todd Creek)
 - Stream stabilization/floodplain restoration near Flea Hill
 - Green infrastructure in some areas
 - Woodbine
 - Flooding was noted at riverfront park
 - Kingsland
 - Drainage system capacity issues were main item raised

- Other measures: Policy and Education Opportunities
 - Residential building types vulnerable to flooding
 - Slab on grade is common and limits the ability for retrofits
 - Freeboard for factor of safety
 - Homebuyer education
 - Include upstream land cover change in analysis
 - Restore landscape absorption through habitat restoration/tree planting (conversion from grassed lawns & expand tree ordinance across larger footprint)
 - Siting green infrastructure
 - Identify zones where GI/LID practices are preferred and most beneficial
 - Invasive species
 - Water hyacinth and other aquatic invasive species are clogging stormwater systems
 - Removal and restoration will improve capacity & reduce flooding

4. Additional Management Measure: Real-time Stormwater Control

- Real-time Stormwater Controls = “Smart Controls” for ponds
- Control panel (base station) installed at ponds with connection to water level monitoring instruments and actuated outlet valve to control the release of stormwater from ponds
 - Water can be released ahead of storm to maximize storage and/or 24-48 hours after storm to delay release when downstream capacity is present.
 - Uses Wi-Fi and weather predictions to control the release of water. Web based dashboard to allow user(s) to override if needed. Storm forecast is tracked automatically (through cloud software).
- Case study presented for Ormond Beach, FL
 - Maximize flood storage in lake system; 550-acre watershed; pump station released 70 acre-feet ahead of Hurricane Irma to protect city from flooding
- Potential project locations:
 - St. Marys “spine” – downtown
 - Gum Branch, east of Gross Rd (Kingsland) – regional detention/recreation/ fishing pond
- Benefits of real-time controls:
 - Maximize storage efficiency and capacity
 - Reduce pond footprint while achieving similar benefit of pond without controls
- Q: How does it compare, economically, to conventional measures
 - A: Large initial/up-front cost: ~\$100k + annual management fee (~\$10k) for continuous monitoring and working with client. But can offset costs for construction of larger or new ponds elsewhere in watershed.

5. Prioritization Tool & Weighting

- Summary of what was used for project prioritization in Glynn County Shoreline Protection Plan (which was erosion focused + SLR)
- We will do something similar, but our focus for Camden County is more SLR
- 10 factors Used for Glynn (*Camden will have – 8 or 7*)

- Factors were based on feedback from stakeholders
- Factors (High): (Examples from Glynn Plan)
 - Sea Level Rise + Floodplain (NEW); this is a new dataset available for Camden County from Army Corps
 - Dataset includes floodplains for 1% and 10% annual exceedance probability (AEP) events plus NOAA SLR Projections for 2050, 2075, and 2100. A combination of these factors will be used to assign scoring for this factor, where scores will be 1-10 with 10= most points)
 - Type of infrastructure within buffer – importance of infrastructure to protect (i.e. major roads, residential, etc.)
 - Proximity to shoreline (or eroding channel)
- Factors (Moderate): (Examples from Glynn Plan)
 - Presence of erosion and rate (GA Southern Data or visual assessment); provide more weight if subject to both erosion or sediment
 - Higher score for projects with both erosion and flooding
 - Rate/Multiplier Table: *Suggest to combine proximity & erosion rate as a factor*
- Factors (Low): (Examples from Glynn Plan)
 - Vulnerable populations (Low & Moderate income via HUD Exchange; effects grant eligibility for CDBG funds)
 - Ease of construction (property ownership)
 - Protecting special habitats (adjacent habitat is eroding/vulnerable)
 - Target freshwater & riverine wetlands; special nesting habitat
 - Adjacent hard feature impacting natural functions
 - Current flooding frequency
 - Consideration from recent impacts (i.e., regular flooding/king tides, recent hurricanes, etc.)
 - *Suggest to increase value*
- Glynn County prioritization was scored by jurisdiction & organized based on immediate, near-term, and long-term prioritization. A similar approach is planned for Camden County
- Proposed factors and scoring system (7 factors)
 - High (3)
 - SLR + Floodplain (Army Corps Data)
 - Type of infrastructure
 - Current flooding frequency (*moved from Low*)
 - Moderate (1)
 - Erosion rate (*combine with proximity to key infrastructure*)
 - Low (3)
 - Low vulnerability
 - Ownership
 - Special habitat

- *Several committee members expressed that they were in favor of the system as it offers an objective assessment of projects*
- Committee's feedback on "Ownership" Factor
 - James was worried about scoring 0 points for private property under ownership. LCI is run by an association that would be happy to work jointly on projects, and that LCI should be labeled similar to "local government" instead
 - Christi said to think about "feasibility of project implementation" instead of "ownership" as a factor; proximity to adjacent landowners; private landowners may be more feasible
 - In general, City of St. Marys felt that private property work will require additional time and effort for projects based on their experience
 - Charles suggested to look for strong community interest in a project (while it is on private property, it may be an area where the community would be in favor of the project, area of repeated loss), or if there is strong interest from the community to maintain equipment or other features
 - Jessica suggested to consider adding a "write-in/institutional knowledge" column/criterion to rate areas with special considerations; such as where a private land might actually be feasible to construct on
 - Ashby: posed if the group felt that Ownership needed to be moved up to a slightly higher factor ranking
 - Bobby: would not move anything higher than moderate, because it starts to look political and you want to keep it objective.
 - James: felt it was fine where it is
 - Christi: didn't want ranking to be high; didn't want to decrease potential for projects being funded due to private ownership without full understanding of interest level

6. Grant Proposals / Submissions

- Opened discussion if any stakeholders were pursuing new grants during upcoming cycle.
- City of St Marys submitted grant proposal for stormwater CIPs through ARPA (state fiscal recovery funds); majority was for improving road crossings, culverts/pipes under and adjacent to roads/ditches; haven't really dug into resiliency pieces related to this plan
- James Hunter (LCI) spoke of a living shoreline project that was completed about a year ago and they need more of that

7. Match & Next Meeting

- Draft plan is underway and it will be shared in January
- February committee meeting (TBD) to discuss draft plan. Meet with other identified key stakeholders/focus groups as well
- March: Townhall meeting for the public
- Should have a final draft by ~April/May
- Grant Match Tracking:
 - Letters of match
 - Match tracking sheet for additional attendees
 - Due December
- Jared Lopes said that the Army Corps dataset should be available Nov 19th.

Steering Committee Meeting # 4 - Camden County Resiliency Implementation Workplan

3/25/2022 10:00-11:30am via Zoom

Meeting Minutes

Meeting Introduction & Project Timeline Update

- Highlighted remaining tasks; grant ends in June 2022

Camden County Draft Resiliency Workplan Presentation

- Rob presented a brief summary on the outline and layout of the Plan; see attached PowerPoint file for full details. The following feedback was received:
 - Jared Lopes: Kudos on the ranking system; thinks there is a lot of potential for future projects and funding through Army Corps' FPMS.
 - Christi Lambert: This will have great value. Survey could be reproduced in the future as well to see how opinions change, and the survey responses can be used in future planning.
 - Shawn Boatright: this plan is a good roadmap for future project planning. This highlights why the County needs a stormwater master plan and drainage study. This identifies areas of great concern into a list, so this will help with next steps to expand and have a countywide storm drainage plan. Might look for grant opportunities as well for project implementation.
 - Rob B: Many new funding opportunities are becoming available that are focused on resiliency, and some sources are having more money dedicated to resiliency.
 - Chuck White: Wood is working with the County on its Hazard Mitigation Plan and a flood plan, so while they are engaged, he will ask them to go through the mitigation activities from this plan and reevaluate the hazard mitigation plan and make sure they are listed there too, in order to be eligible for grant opportunities from FEMA/GEMA.
 - Scott Brazell: Richmond Hill is considering updating ordinances to include SLR, so that could be something to consider for Camden County as well. Camden County can take a large step forward with the outcomes from this plan.
 - Chuck White: commented that this plan, like the Hazard Mitigation Plan, should have a resolution to officially adopt it. He asked who will be the gatekeeper of the plan and lead revisions and annual review of the plan (e.g., individual or committee), and how will this plan be maintained over time. It needs to be a living document that updates as things change.
- Timeline: stakeholders asked to review plan within next 2-3 weeks and submit edits and comments by April 15th. They can send those to both Rob and Ashby and are welcome to reach out to either/both to set up a meeting to discuss any comments/questions.

Townhall Event

- Current plan is to hold two meetings open to public from 2-4pm and 6-8pm on May 3rd.
- The library is currently unavailable on May 3rd, so Ashby asked for ideas on other venues and help with advertising.
 - Shawn Boatright: venue possibility of the High School (auditorium); County can assist with advertising

- Chuck White: Coastal Pines Technical College may have a venue for ~70 people; they are big on public engagement.

NFWF- National Coastal Resilience Fund

- This was the funding source for this plan.
- Preproposals are due on April 21st (short 2-3 page summary and budget)
- Three categories with funding targeted around \$100K to \$1M.
 - Community capacity building and planning
 - Site assessment and preliminary design
 - Final design and permitting
- Total funding this year \$140M, where it was only \$40M last year.

Coastal Forest Strategies

- Matt Lee provided an update on this project and sought feedback from the group on other ideas to include or review:
 - St. Marys is looking at updating tree ordinance to include residential trees
 - Scott Brazell suggested including more information on planning for marsh migration, such as opportunities for marsh migration protection
 - Shalana McNamee is interested in species in the ROW and which to remove
 - Courtney Reich mentioned Jekyll Island is updating its Firewise standards as part of a current codes update project
 - Robert: can do inventories and assessments; they are in process of reviewing grant opportunities that will become available to municipalities; hope to have news before May. If interested, stick a line item in plans that might offer opportunity for this funding.
 - Ashby mentioned a coastal incentive grant that included a coastal Georgia canopy assessment.

Appendix B – Matrix Results for Resiliency Implementation Workplan

As a supplement to the tables presented in Chapter 5, the detailed list of matrix results and general notes for each project are presented in the following tables by jurisdiction.

Site ID	Project Name	General Notes	Infrastructure Type	Proximity to Infrastructure	Flood + SLR	Flood Frequency	Erosion	Vulnerable Population	Ownership	Adjacent/Threatened Species	Sum	Rank
Unincorporated Camden County												
CC1	Butler Johnson Rd / Taylor Ln	Stormwater flooding; dirt road	5	0	0	7	0	0	5	0	17	19
CC2	3R Fish Camp	Riverine flooding at 3R Fish Camp	7	10	5	7	0	0	0	5	34	6
CC3	New Post Road / White Oak Creek	Stormwater flooding at New Post Rd; paved road with bridge goes underwater during storm events; flood signs needed	7	10	5	7	0	0	5	5	39	1
CC4	New Post Road / Kings Bay Rd	Stormwater flooding in this area; flows east; dirt road	5	0	0	7	0	0	5	0	17	19
CC5	Bailey Mill Rd / Satilla River	Stormwater flooding; dirt road	5	5	5	7	0	0	0	5	27	12
CC6	Bullhead Bluff / Settlers Bluff Roads	Riverine flooding in this community/area	7	7	9	7	0	0	0	5	35	5
CC7	Springhill Road North	Sediment issues	5	0	5	3	5	0	5	5	28	11
CC8	Springhill Rd North / Bullhead Creek	Stormwater flooding in this general area	5	10	5	7	0	0	5	5	37	3
CC9	Old Jefferson Hwy / south of Hwy 110	Stormwater flooding	7	0	0	7	0	0	5	0	19	18
CC10	Hwy 40 near Hwy 110	Riverine flooding and flooding from hurricane events	10	0	0	3	0	0	2	0	15	22
CC11	Flea Hill	Riverine flooding & repetitive loss properties in this general area	7	7	9	7	0	3	0	5	38	2

Site ID	Project Name	General Notes	Infrastructure Type	Proximity to Infrastructure	Flood + SLR	Flood Frequency	Erosion	Vulnerable Population	Ownership	Adjacent/Threatened Species	Sum	Rank
CC12	Old Jefferson Hwy / Groover Rd	Stormwater flooding	7	7	5	7	0	0	5	5	36	4
CC13	Catfish Creek	Beaver dam flooding all through this area	7	1	9	3	0	5	0	5	30	10
CC14	Bristol Hammock	Storm surge flooding at Bristol Hammock	7	7	10	3	0	0	0	0	27	12
CC15	Misty Harbor	Storm surge flooding at Misty Harbor	7	7	5	3	0	0	0	0	22	17
CC16	Crooked River State Park	Crooked River State Park has significant erosion happening at fast pace on north end of park, creating dangerous cliffs	5	5	0	0	7	5	5	0	27	12
CC17	Piney Bluff	Storm surge flooding at Piney Bluff	5	5	9	3	0	3	0	0	25	15
CC18	Dover Bluff Road	Storm surge flooding	7	5	9	3	0	3	5	0	32	8
CC19	Dover Bluff	Dover Bluff has issues with stormwater, riverine, and tidal flooding	7	5	9	7	0	3	0	0	31	9
CC20	Cudjo Point (Fish Camp)	Cudjo Point (Fish Camp) has storm surge flooding, repetitive loss properties, and a vulnerable demographic (elderly)	7	7	10	7	0	3	0	0	34	6
CC21	New Post Road / Notta Rd	Intersection of New Post Rd and Notta Rd is prone to flooding from stormwater spilling over near King's Bay; dirt road	5	0	0	7	0	0	5	0	17	19
CC22	Bailey Mill Rd	Bailey Mill Rd is a dirt road that releases sediment and clogs ditches; constantly an issue; County applied for 319 grant to mitigate	5	0	0	7	7	0	5	0	24	16
City of Kingsland												
KL1	Northeastern Laurel Island	Northeastern side of Laurel Island has a future concern of SLR based on maps	7	7	5	0	0	0	0	0	19	11
KL2	Northshore Drive	Northshore Drive has a few areas vulnerable to SLR in southern third, little development here to date	7	5	5	0	0	3	0	0	20	10

Site ID	Project Name	General Notes	Infrastructure Type	Proximity to Infrastructure	Flood + SLR	Flood Frequency	Erosion	Vulnerable Population	Ownership	Adjacent/Threatened Species	Sum	Rank
KL3	Christina Lane	Christina Lane has a house with minor yard flooding; AE Zone & elevated	5	1	5	3	0	0	0	0	14	16
KL4	Wolf Bay Neighborhood	Wolf Bay Neighborhood has repetitive loss properties (some houses bought out for perpetual greenspace); flooded due to overwhelmed JD canal	7	3	0	7	0	5	0	0	22	8
KL5	Meadows Neighborhood	Meadows Neighborhood has repetitive loss properties (some houses bought out for perpetual greenspace); flooded due to overwhelmed JD canal	7	5	0	7	0	0	0	0	19	11
KL6	May Branch	May Branch: when creek is high, water flows through neighborhood (Princeton Place/Harvard Ct), City has done some pipe upsizing and plans for more	7	3	0	7	0	0	0	0	17	14
KL7	Canal Maintenance (Gum Branch)	Gum Branch Canal needs maintenance; one 48" pipe was upgraded to five under Gross Rd after flooding from Irma	10	3	1	3	0	0	2	5	24	7
KL8	Gum Branch (Laurel Island)	Gum Branch flowing through Laurel Island is City's only major area of concern due to storm surge	7	5	5	3	0	0	0	5	25	6
KL9	Creekwood Lift Station	Lift station affected by flooding; it is being elevated (Creekwood Drive/Circle); City is also rehabbing another lift station (unknown location) & 50+ manholes	10	10	0	3	0	5	5	5	38	2
KL10	Regional Detention (Gum Branch)	Proposed project to add a large retention/recreation/fishing pond to handle extra capacity of 48" pipes; trying to partner with PSA and use CDBG Unmet Needs Grant	10	3	1	3	0	0	5	5	27	3

Site ID	Project Name	General Notes	Infrastructure Type	Proximity to Infrastructure	Flood + SLR	Flood Frequency	Erosion	Vulnerable Population	Ownership	Adjacent/Threatened Species	Sum	Rank
KL11	Summerfield Neighborhood	Summerfield Drive Neighborhood (Summerbrook Trail) has repetitive loss properties; located in a bowl/need to elevate properties; only City-owned pond	7	10	0	7	0	3	0	0	27	3
KL12	Woodhaven/Meadows Culvert Crossing	Culvert capacity causes flooding at Woodhaven & Meadows Neighborhoods; difficult to increase capacity downstream due to JD wetlands (permitting & ROW issues); they do have an engineered solution to create a new canal but challenging to fund and implement	10	10	0	7	0	5	2	5	39	1
KL13	The Lawn	Proposed project, "The Lawn", that will have recreation land space and a nearby wetland; City interested in adding trails/boardwalk through wetland to combine recreation and stormwater projects	3	1	0	3	0	5	5	5	22	8
KL14	Mariner's Landing	Mariner's Landing (Drive) has a lot of flow through here with lack of downstream capacity, this is a private pond but they recently modified their outlet	7	7	0	3	0	0	0	0	17	14
KL15	SR 40 Flooding	Drainage backup along SR 40 due to limited capacity at Mariner's Landing	10	7	0	7	0	0	2	0	26	5
KL16	Woodhaven Neighborhood	Woodhaven Neighborhood floods due to overwhelmed JD canal	7	5	0	7	0	0	0	0	19	11
City of St. Marys												
SM1	Downtown St. Marys	Downtown St. Marys has storm surge and king tide flooding; concerned with impact on local economy; king tide flooding is 3-4 times per year with 4-5 cycles per event	10	7	10	7	5	3	5	0	47	1

Site ID	Project Name	General Notes	Infrastructure Type	Proximity to Infrastructure	Flood + SLR	Flood Frequency	Erosion	Vulnerable Population	Ownership	Adjacent/Threatened Species	Sum	Rank
SM2	St. Marys Street (Marshwalk)	King tide flooding on St. Marys Street near Marshwalk	7	10	10	7	0	3	2	0	39	5
SM3	St. Marys Street (Seminole)	King tide flooding on St. Mary Street near Seminole Ave	7	5	10	7	0	3	2	0	34	8
SM4	Downtown St. Marys (Commercial)	King tide flooding at commercial businesses, noted for restaurant '401W'	5	10	10	7	1	3	0	0	36	6
SM5	Nancy Drive	King tide flooding at Nancy Drive	5	7	9	7	0	3	2	0	33	10
SM6	Shadowlawn Neighborhood (King Tide)	Shadowlawn Neighborhood has some areas impacted from King tide flooding, but will increase with SLR	7	10	9	7	0	0	0	0	33	10
SM7	Downtown Spine	Proposed project, "Spine", City is looking to acquire properties and utilities going down Bartlett St and seek funding from FEMA BRIC; acquisition potential to address repetitive loss properties	7	10	10	7	0	3	5	5	47	1
SM8	Ashley/Hall Streets	A couple repetitive loss properties are located at Ashley & Hall Streets	5	5	5	7	0	3	0	5	30	14
SM9	St. Marys Street (Lang's Marina)	Shoreline erosion along western edge of St. Marys Street; City was looking at combination sea wall/living shoreline	5	10	10	7	7	3	5	0	47	1
SM10	Eastern Downtown (Norris Street)	Eastern side of downtown peninsula has concern with SLR and storm surge; 1 repetitive loss property on Norris Street	7	7	9	3	0	3	2	0	31	13
SM11	St. Marys Senior Care Center	St. Marys Senior Care Center has king tide flooding in yard; vulnerable demographic	7	3	4	3	0	3	5	0	25	17
SM12	Finley Street	Finley Street has observed stormwater flooding issues; vulnerable demographic	5	1	4	7	0	3	2	0	22	21
SM13	Dufour Street	Dufour Street has flooding issues (low/shallow ditches) and is seeing marsh	5	7	10	7	0	3	2	0	34	8

Site ID	Project Name	General Notes	Infrastructure Type	Proximity to Infrastructure	Flood + SLR	Flood Frequency	Erosion	Vulnerable Population	Ownership	Adjacent/Threatened Species	Sum	Rank
		migration (marsh and creek are overtaking several lots); vulnerable demographic										
SM14	Colerain Oaks	Colerain Oaks Neighborhood was a major project on 2008 Stormwater Masterplan; City is looking to add stormwater retention per that project suggestion	7	3	0	7	0	5	0	5	27	16
SM15	Crooked River Plantation Neighborhood	Crooked River Plantation Neighborhood has stormwater and flooding Issues; most issues are due to driveway culvert elevations, flat topography, poor drainage, inverted roadways, non-existent ditches	7	7	4	7	0	0	0	0	25	17
SM16	Shadowlawn Neighborhood	Shadowlawn Neighborhood has stormwater/flooding Issues; most issues are due to driveway culvert elevations, flat topography, poor drainage, inverted roadways, non-existent ditches; draining to full wetlands	7	5	4	7	0	0	0	0	23	20
SM17	Sugarmill Neighborhood	Sugarmill Neighborhood has stormwater/flooding Issues; most issues are due to driveway culvert elevations, flat topography, poor drainage, inverted roadways, non-existent ditches	7	5	0	7	0	0	0	0	19	23
SM18	Pagan St / Plantation Oaks Dr	Pagan St & Plantation Oaks Dr: County property draining to New Point Peter Road drains to the east through wetlands that has flooding, issues attributed to draining into wetlands and driveway culvert issues	5	5	4	7	0	0	0	0	21	22
SM19	Borrell Blvd	Borrell Blvd bridge is an area of concern to be cut off from surge (adjacent to railroad)	10	10	5	3	3	3	2	0	36	6

Site ID	Project Name	General Notes	Infrastructure Type	Proximity to Infrastructure	Flood + SLR	Flood Frequency	Erosion	Vulnerable Population	Ownership	Adjacent/Threatened Species	Sum	Rank
SM20	Sugarmill Bridge	Sugarmill bridge has some overtopping but not often, concern for the future with SLR	10	10	5	3	3	0	2	0	33	10
SM21	Point Peter Place	Road floods during king tide	5	7	10	7	0	0	0	0	29	15
SM22	North River Causeway	North River Causeway is an area of concern for access (bridge overtopped/cutoff); storm surge got to girders of bridge to Cumberland Harbour and Point Peter; rising water has impacted the structural integrity of this road (wavy/dips)	10	10	10	3	5	3	5	0	46	4
SM23	Spur 40	Spur 40 overtops here from stormwater	10	0	0	7	0	5	2	0	24	19
City of Woodbine												
WB1	Hwy 17 - 8th-10th Streets	Hwy 17 between 8th & 10th Streets floods frequently	10	7	0	7	0	5	0	0	29	3
WB2	Crestview Drive	Crestview Drive vicinity has occasional backups and flooded during Irma	7	7	0	7	0	5	0	0	26	5
WB3	Georgia/Camden Avenues	Stormwater backups on Georgia Ave & Camden Ave during heavy rain	7	7	0	7	0	5	0	0	26	5
WB4	Yvonne Avenue Pond	On occasion, stormwater backed-up at pond on Yvonne Avenue	5	5	9	3	0	0	0	0	22	7
WB5	Dunn Branch (upstream)	Dunn Branch needs regular maintenance, City can maintain and clear with Marsh Master equipment per DNR & USACE in area west of Brewster Avenue, also issues with Beavers/flow backups and flooding from intense rain (tidal)	7	10	9	7	0	5	2	5	45	1
WB6	Dunn Branch (downstream)	Per DNR & USACE, City cannot maintain area east of Brewster Avenue, issues with beavers and debris causes flow to back up	7	10	10	7	0	5	0	5	44	2

Site ID	Project Name	General Notes	Infrastructure Type	Proximity to Infrastructure	Flood + SLR	Flood Frequency	Erosion	Vulnerable Population	Ownership	Adjacent/Threatened Species	Sum	Rank
		and flood during intense rains, plus this is tidally influenced										
WB7	Western Woodbine Ditch Maintenance	General - there is a little flooding in western section of City due to lack of ditches on private property not being maintained (overgrown)	7	5	0	3	0	0	0	0	15	8
WB8	Satilla River Landing Neighborhood	Sections of Satilla River Landing Neighborhood on eastern side of City appear to be vulnerable to higher levels of sea level rise; infrastructure in place but very few houses to date, consider additional protection prior to building (even in Shaded X)	7	5	9	3	0	5	0	0	29	3
Naval Submarine Base Kings Bay												
KB1	Dredge Capacity - Beneficial Use Needs	They are approaching dredge capacity (within ~16 years), need to explore beneficial use to create more/extend capacity, Base is very concerned with space remaining at three main dredge spoil locations	10	10	10	7	0	5	2	5	49	1
KB2	North River Erosion - Utility Pole	There is an eroding shoreline at this site along north river and it exposed a GA Power utility pole; the pole has been moved but erosion is still present	0	0	5	3	5	5	5	3	26	3
KB3	Stormwater Maintenance Needs	Majority of flooding issues on base are due to maintenance issues, systems are blocked/clogged and in need of maintenance	7	7	5	7	0	5	5	0	36	2

Site ID	Project Name	General Notes	Infrastructure Type	Proximity to Infrastructure	Flood + SLR	Flood Frequency	Erosion	Vulnerable Population	Ownership	Adjacent/Threatened Species	Sum	Rank
Cumberland Island												
CI1	Cumberland Island Visitor's Center	There is king tide flooding at this site; flooding affects dock building, restrooms, sump pump and elevators	10	10	10	7	1	3	5	3	49	1
CI2	Cumberland Island Docks (St. Marys)	The docks had been damaged in hurricane, flooding/surge vulnerability	10	10	10	7	1	3	5	3	49	1
CI3	Plum Orchard Docks	Near Plum Orchard, erosion north of dock, will need to move it back, they are moving octagon building	10	10	1	3	1	0	5	3	33	4
CI4	Historic Seawall Erosion - Southern Dock	Concern with erosion near historic seawall at docks on Cumberland Island	10	10	5	3	1	0	5	3	37	3
CI5	Southern-quarter Erosion	Erosion area noted	5	5	0	3	1	0	5	0	19	5
CI6	Northern-quarter Erosion	Erosion area noted	1	0	1	3	1	0	5	0	11	6
CI7	Northern End Erosion	Erosion cutting into bank, highest point on the island, expand oyster beds	1	0	0	3	1	0	5	0	10	7
Little Cumberland Island												
LCI1	Otter Trail	Otter trail is a sandy trail with flooding, ditches created by vehicles/water	10	10	10	7	7	0	5	0	49	1
LCI2	East Ridge Trail	East Ridge Trail on east side has flooding during high tides that is impassible, which blocks 10-15 homes; much of housing stock within 1 mile. Flooding is happening more frequently.	10	5	10	7	3	0	5	0	40	6

Site ID	Project Name	General Notes	Infrastructure Type	Proximity to Infrastructure	Flood + SLR	Flood Frequency	Erosion	Vulnerable Population	Ownership	Adjacent/Threatened Species	Sum	Rank
LCI3	Brockington Creek	Brockington Creek has been changing course, parts of creek are caved or silted in, others have oxbows and breakthroughs; marsh migration on both sides. Dock here that is not too useful.	5	10	10	7	5	0	5	0	42	5
LCI4	Christmas Creek	Floodwaters from Christmas Creek are affecting Ocean Beach Trail by eroding into shoreline. Trail had to be re-routed multiple times due to excessive erosion that cut through higher ground.	7	10	10	7	7	0	5	0	46	4
LCI5	Shell Creek	Silting and access on Shell Creek is getting worse; this limits hours of access during the day to mid to high tide. Shifting of creek and oxbows are increasing. This creates concerns for emergency access.	10	10	10	7	7	0	5	0	49	1
LCI6	Shell Creek, General's Mound	Shell Creek General's Mound is the infrastructure/municipal headquarters. There are issues with high tide flooding at the dock; Otter Creek floods during 8-ft tides. A berm was built to reduce flooding and a living shoreline was installed.	10	10	10	7	5	0	5	0	47	3
LCI7	Western Side Erosion	Along western side of island, higher tide erosion has encroached on forests and some homes. The main access road is through the center of island.	5	5	10	3	3	0	5	5	36	11
LCI8	Northwest Dunes	When dunes on the northwest side of the island eroded, it caused flooding; flooding occurred 3 years ago.	5	5	10	3	1	0	5	5	34	12

Site ID	Project Name	General Notes	Infrastructure Type	Proximity to Infrastructure	Flood + SLR	Flood Frequency	Erosion	Vulnerable Population	Ownership	Adjacent/Threatened Species	Sum	Rank
LCI9	Historic Lighthouse/Bishop House	The historic lighthouse on the north end is at risk of dune erosion. Bishop house is also threatened. A large dune field that was there is disappearing.	10	7	5	3	5	0	5	5	40	6
LCI10	Northeastern Dunes (Ocean)	Large dunes on the northeastern corner of the island have been impacted by storms and a home was lost; others are risky due to dune erosion.	5	7	5	3	7	0	5	5	37	9
LCI11	Eastern Mid-Island Erosion	The eastern side of mid-island has property threatened by loss (migration) of beach; erosion is due to Christmas Creek and the high elevation.	5	7	5	3	7	0	5	5	37	9
LCI12	Shell Creek Duplex	A duplex is being undermined by Shell Creek.	5	10	10	3	7	0	5	0	40	6

Appendix C – Photos of Identified Projects

Following meetings with staff, GMC took photographs at most potential project locations or areas with issues. Field visits were conducted in Summer 2021 and Spring 2022. Representative photos of the conditions at most sites are presented in this appendix. The photos are organized by jurisdiction and presented chronologically based on the Project ID#:

Site ID	Project Name	Representative Photos	
Unincorporated Camden County			
CC2	3R Fish Camp		
CC3	New Post Road / White Oak Creek		

Site ID	Project Name	Representative Photos	
CC9	Old Jefferson Hwy / south of Hwy 110		
CC11	Flea Hill		

Site ID	Project Name	Representative Photos	
CC12	Old Jefferson Hwy / Groover Rd		
CC13	Catfish Creek		

Site ID	Project Name	Representative Photos	
CC14	Bristol Hammock	 	 

Site ID	Project Name	Representative Photos	
CC16	Crooked River State Park		
			

Site ID	Project Name	Representative Photos	
			
CC17	Piney Bluff		

Site ID	Project Name	Representative Photos	
CC18	Dover Bluff Road		
			

Site ID	Project Name	Representative Photos	
CC20	Cudjo Point (Fish Camp)		
CC22	Bailey Mill Rd		

Site ID	Project Name	Representative Photos	
Kingsland			
KL3	Christina Lane		
KL6	May Branch		

Site ID	Project Name	Representative Photos	
KL7	Canal Maintenance (Gum Branch)		
KL9	Creekwood Lift Station		

Site ID	Project Name	Representative Photos	
KL11	Summerfield Neighborhood		
KL12	Woodhaven/Meadows Culvert Crossing		

Site ID	Project Name	Representative Photos	
KL13	The Lawn		
KL14	Mariner's Landing		

Site ID	Project Name	Representative Photos	
St. Marys			
SM1	Downtown St. Marys		
SM2	St. Marys Street (Marshwalk)		

Site ID	Project Name	Representative Photos	
SM4	Downtown St. Marys (Commercial)		
SM5	Nancy Drive		

Site ID	Project Name	Representative Photos	
SM7	Downtown Spine		
SM9	St. Marys Street (Lang's Marina)		

Site ID	Project Name	Representative Photos	
SM10	Eastern Downtown (Norris Street)		
SM11	St. Marys Senior Care Center		

Site ID	Project Name	Representative Photos	
SM12	Finley Street		
SM13	Dufour Street		

Site ID	Project Name	Representative Photos	
SM15	Crooked River Plantation Neighborhood		
			

Site ID	Project Name	Representative Photos	
SM18	Pagan St / Plantation Oaks Dr		
SM19	Borrell Blvd		

Site ID	Project Name	Representative Photos	
SM20	Sugarmill Bridge		
SM21	Point Peter Place		

Site ID	Project Name	Representative Photos	
SM22	North River Causeway		
SM23	Spur 40		

Site ID	Project Name	Representative Photos	
Woodbine			
WB1	Hwy 17 - 8th-10th Streets		
WB3	Georgia/Camden Avenues		

Site ID	Project Name	Representative Photos	
WB5	Dunn Branch (upstream)		

Site ID	Project Name	Representative Photos	
WB6	Dunn Branch (downstream)		
WB7	Western Woodbine Ditch Maintenance		

Site ID	Project Name	Representative Photos	
Cumberland Island			
CI1	Cumberland Island Visitor's Center		
CI2	Cumberland Island Docks (St. Marys)		

Appendix D – Maps of Resiliency Implementation Workplan Projects

In addition to the tables and figures presented in Chapter 5, full-size (48" x 36") versions of the maps depicting the Resiliency Implementation Workplan projects were created for the major sections of the County. The maps are presented as follows:

1. Unincorporated Camden County
2. City of Kingsland
3. City of St. Marys / Kings Bay
4. City of Woodbine
5. Cumberland Island
6. Little Cumberland Island

Camden County: Sea Level Rise Scenarios

Legend

CamdenCoBoundary

Roads

Area Boundaries

Project Locations

Sea Level Rise (3FT)

Sea Level Rise (5FT)

Jurisdiction

Little Cumberland

St. Marys

Unincorporated

Woodbine

Kings Bay

Cumberland Island

Kingsland

N

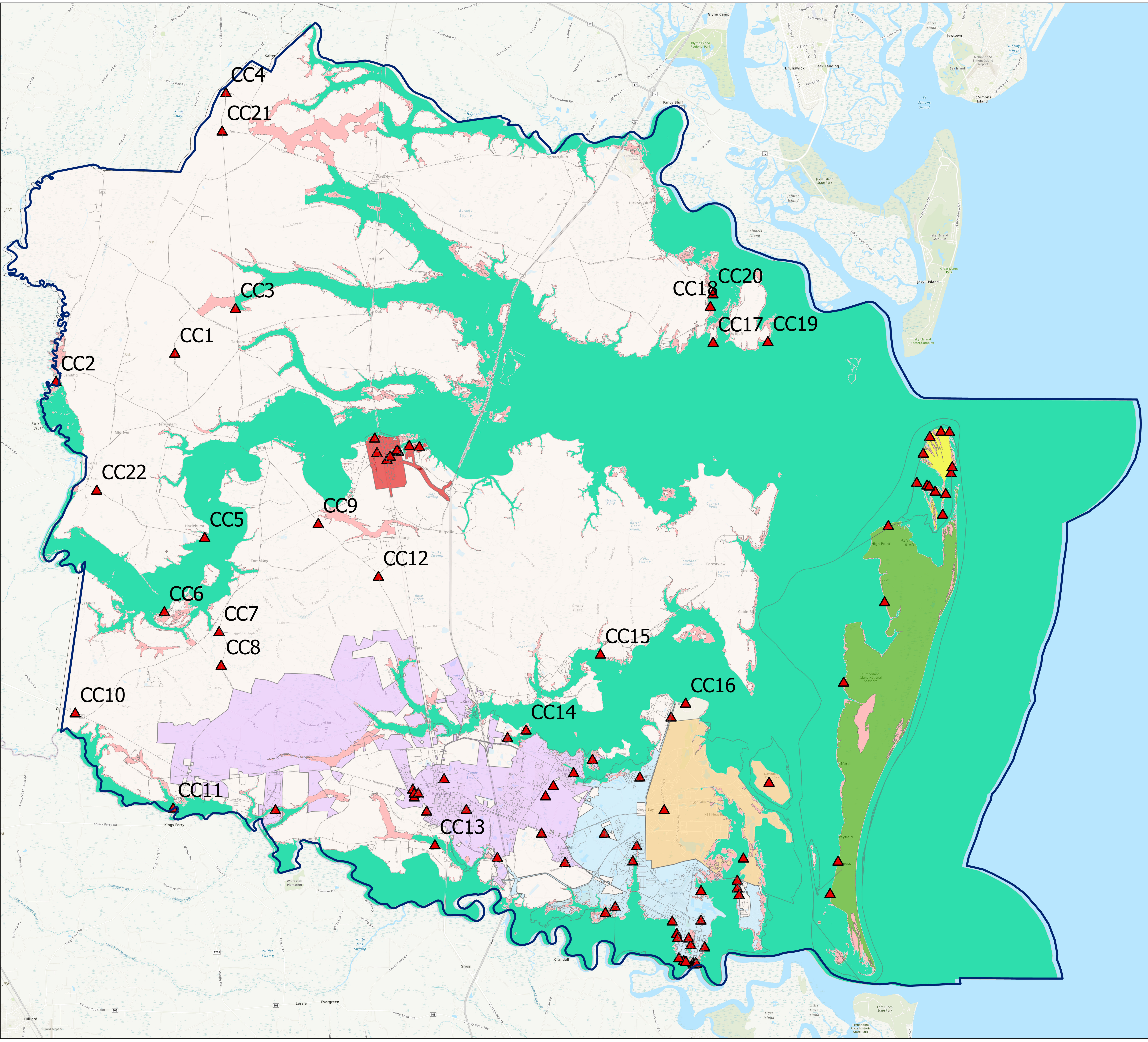


0 0.5 1 2 3 4
Miles

Project Partners:



NFWF



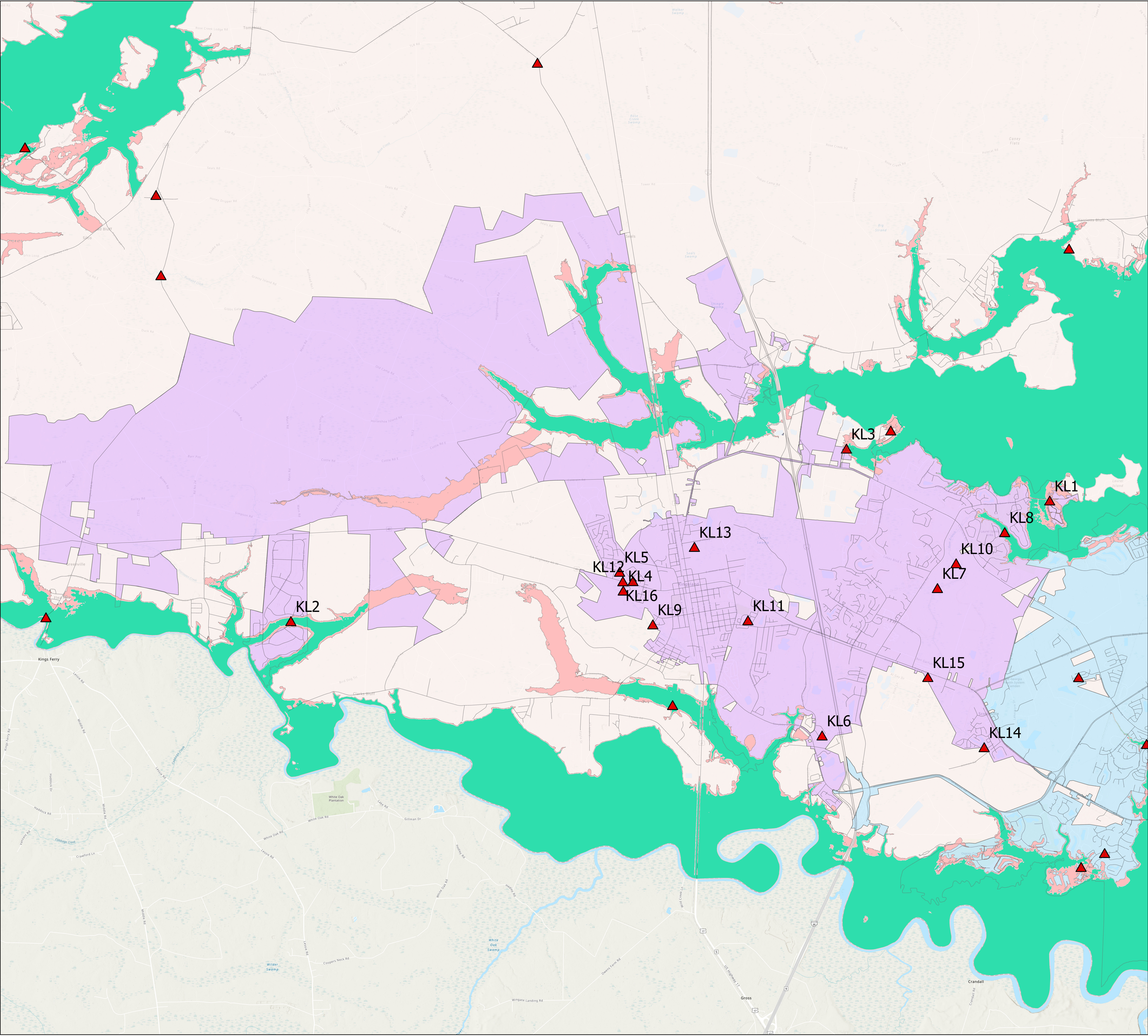
Kingsland: Sea Level Rise Scenarios

Legend

- Roads
 - Area Boundaries
 - ▲ Project Locations
 - Sea Level Rise (3FT)
 - Sea Level Rise (5FT)
- Jurisdiction**
- Kingsland
 - St. Marys
 - Unincorporated



Project Partners:



St. Marys & Kings Bay: Sea Level Rise Scenarios

Legend

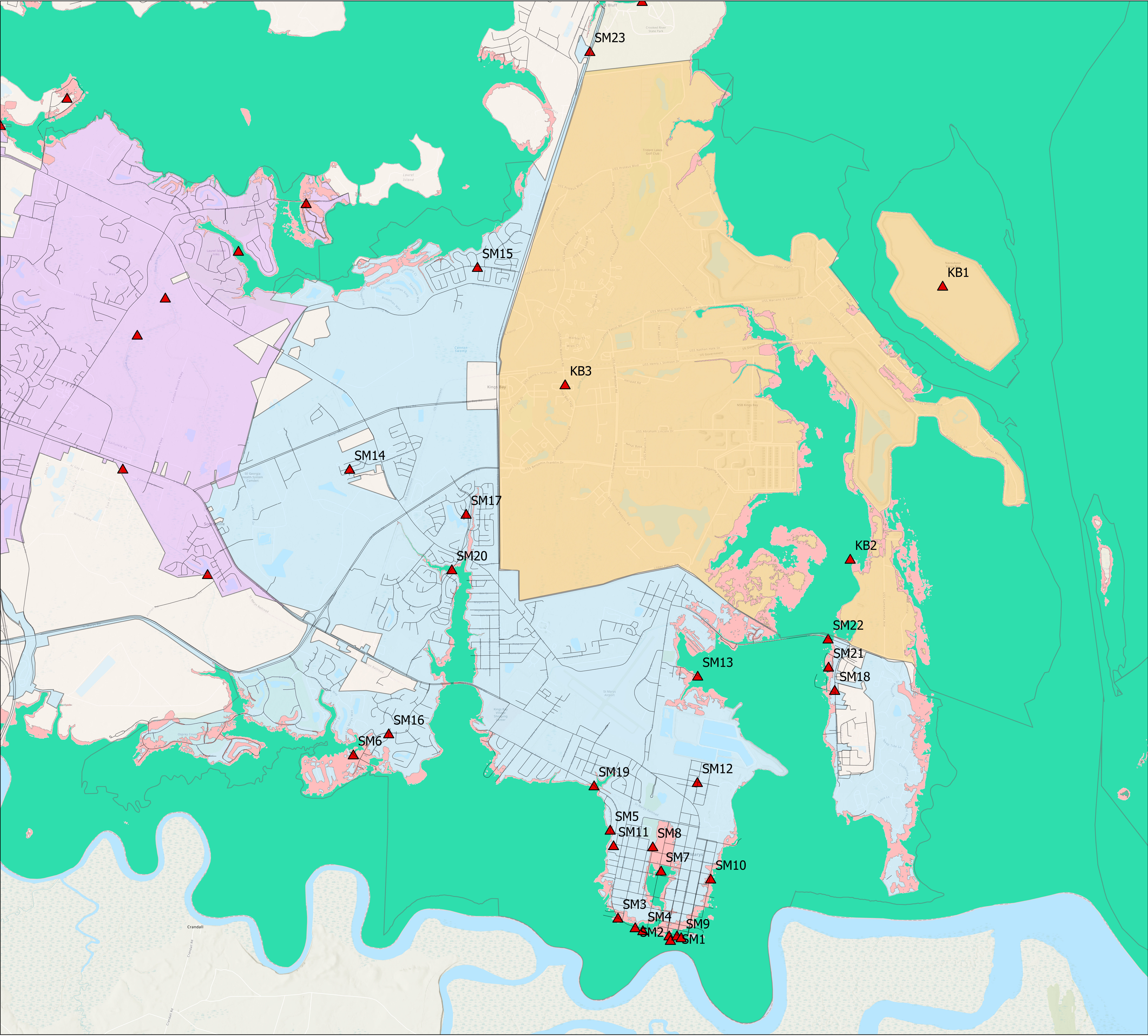
- Roads
- Area Boundaries
- ▲ Project Locations
- Sea Level Rise (3FT)
- Sea Level Rise (5FT)

Jurisdiction

- St. Marys
- Kings Bay
- Cumberland Island
- Kingsland
- Unincorporated



Project Partners:



Woodbine: Sea Level Rise Scenarios

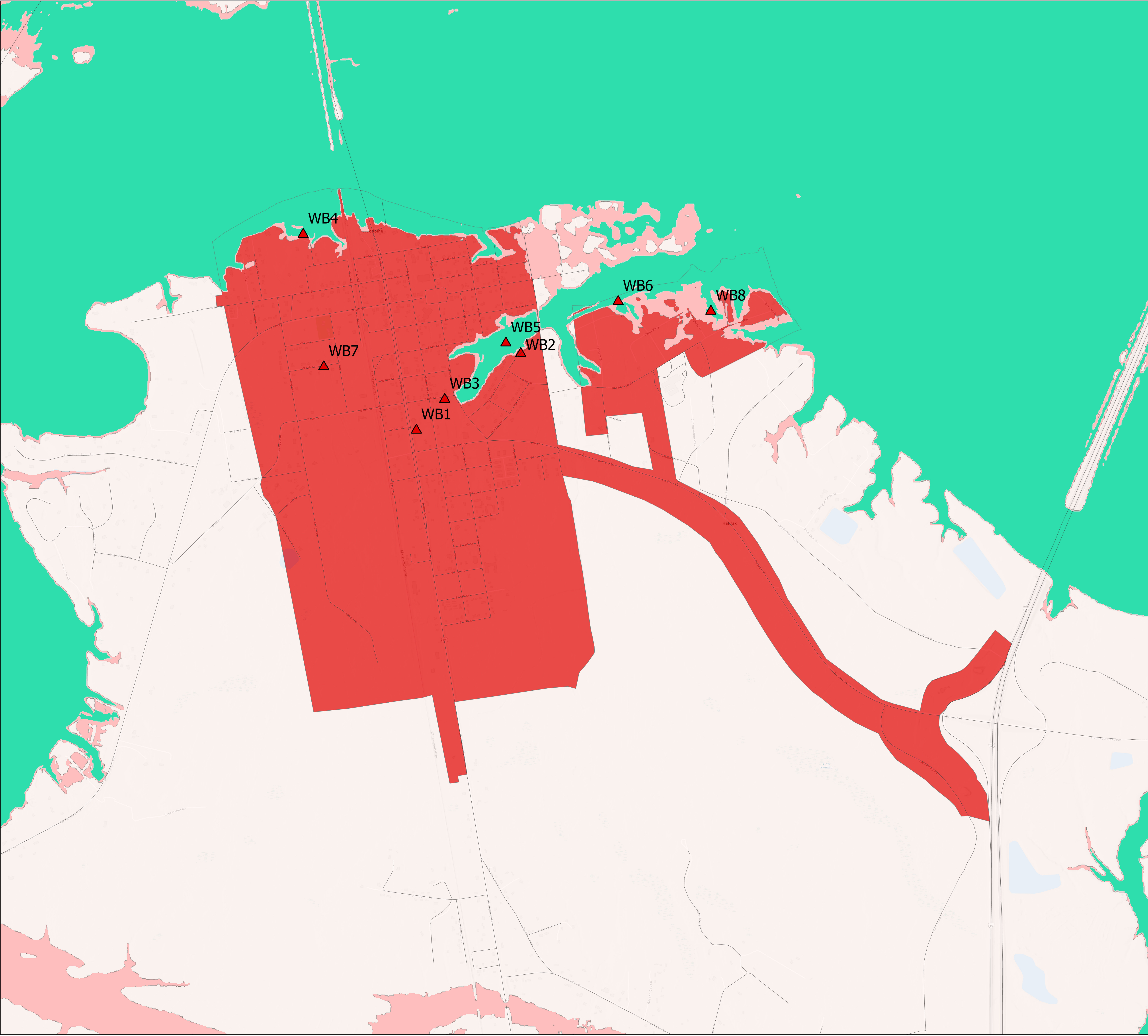
Legend

- Roads
- Area Boundaries
- ▲ Project Locations
- Sea Level Rise (3FT)
- Sea Level Rise (5FT)

- Jurisdiction**
- Unincorporated
 - Woodbine



Project Partners:

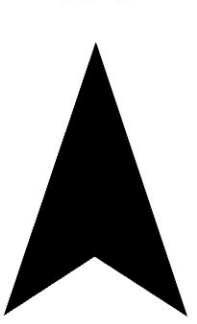


Cumberland Island: Sea Level Rise Scenarios

Legend

- Roads
- ▲ Project Locations
- Jurisdiction**
 - Little Cumberland
 - St. Marys
 - Unincorporated
 - Kings Bay
 - Cumberland Island
- Sea Level Rise (3FT)
- Sea Level Rise (5FT)

N



Project Partners:



Little Cumberland Island: Sea Level Rise Scenarios

Legend

— Roads

▲ Project Locations

Jurisdiction

■ Little Cumberland

□ Unincorporated

■ Cumberland Island

■ Sea Level Rise (3FT)

■ Sea Level Rise (5FT)

N



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Miles

Project Partners:

