

south atlantic coastal study (sacs) Tier 2 Economic Risk Assessment

FINAL REPORT AUGUST 2022



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Tier 2 Economic Risk Assessment Description

The South Atlantic Coastal Study (SACS) Tier 2 Economic Risk Assessment is an estimate of storm surge inundation risk to public and private property and critical infrastructure within the South Atlantic Division (SAD) area of responsibility (AOR). This includes all coastal and riverine areas within the zone of tidal influence in North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Puerto Rico, and the U.S. Virgin Islands. The risk is expressed as the expected annual damages (EAD) to structures and their contents described in dollars.

Risks are described as a range between the EAD under existing sea level conditions and the EAD assuming up to 3 feet of future sea level change. The EADs are presented in a geospatial format that can be aggregated by census block, census tract, census place, county, SACS planning reach, and state. The <u>Tier 2 Economic Risk</u> <u>Assessment Dashboard</u> can be accessed to view the results. Figure A is a screenshot of the Tier 2 Economic Risk Assessment Dashboard.



Figure ES-1: Tier 2 Economic Risk Assessment Dashboard Screenshot

Tier 2 Economic Risk Assessment Uses

The primary use of this risk assessment is to help inform coastal storm risk management (CSRM) planning-level decisions regarding the relative distribution of economic risk within the study area. This provides the economic risks associated with a CSRM problem or the achievable risk management from a CSRM measure or solution.

Tier 2 Economic Risk Assessment Key Findings

- **Distribution of Risk:** Nearly all the risk within the SACS study area is in the continental United States (CONUS), while 0.18 percent is located outside of the continental United States (OCONUS).
 - **Distribution of CONUS Risk**: More than 85 percent of the SAD CONUS risk is in Florida, and nearly 7.7 percent is in South Carolina. The remaining 7 percent is collectively in North Carolina, Georgia, Alabama, and Mississippi.
 - Distribution of OCONUS Risk: Nearly 90 percent of the SAD OCONUS risk is in Puerto Rico. The U.S. Virgin Islands (≈10.5 percent) constitutes the least economic risk, CONUS or OCONUS.
- Influence of Development Density on Risk
 - Areas with denser development tend to have greater economic risk when measured in strict dollar damage risk terms.
- Influence of Sea Level Rise and Physical Setting on Risk
 - Of the approximate 854 census places in the SACS AOR zone of tidal influence, nearly 171 have medium to high storm surge risk. That number increases to nearly 330 with sea level rise.
 - CONUS and OCONUS risk could potentially increase by 148 percent and 340 percent, respectively.
 - Risk in sheltered back bay areas is anticipated to increase significantly over time with sea level rise.
 - Areas with longer coastlines and/or tidally influenced rivers are more likely to have significant increases in risk over time.

Table ES-1: Economic Risk by Planning Reach as a Percentage of Total Expected Annual Damages for SACS Study Area

Planning Peach	Economic Risk as a Percentage of Expected Annual Damages			
Flamming Keach	Existing	Future with 3 Feet of Sea Level Rise		
Northern North Carolina (NC_01)	1.39%	1.70%		
Southern North Carolina (NC_02)	1.41%	1.18%		
Northern South Carolina (SC_03)	1.20%	1.05%		
Southern South Carolina (SC_04)	6.47%	5.54%		
Georgia (GA_05)	1.21%	1.40%		
Northeast Florida (FL_06)	3.79%	3.81%		
East Central Florida (FL_07)	3.56%	3.26%		
Southeast Florida (FL_08)	32.8%	40.9%		
Southern Florida (FL_09)	2.02%	2.11%		
Southwest Florida (FL_10)	27.2%	21.9%		
West Central Florida (FL_11)	13.2%	12.7%		

Dianning Reach	Economic Risk as a Percentage of Expected Annual Damages			
	Existing	Future with 3 Feet of Sea Level Rise		
Florida Big Bend (FL_12)	0.29%	0.21%		
Florida Panhandle (FL_13)	2.34%	1.94%		
Alabama (AL_14)	0.83%	0.64%		
Mississippi (MS_15)	2.19%	1.51%		
Northwest Puerto Rico (PR_1)	0.004%	0.006%		
North Central Puerto Rico (PR_2)	0.002%	0.003%		
Southern Puerto Rico (PR_3)	0.043%	0.062%		
Eastern Puerto Rico (PR_4)	0.050%	0.117%		
St. Croix (VI_1)	0.002%	0.004%		
St. Thomas (VI_2)	0.014%	0.014%		
St. John (VI 3)	0.003%	0.002%		

Note: These percentages reflect damage estimates due to storm surge inundation only, and not total damage associated with coastal storm hazards (e.g., wind). Existing risk estimates reflect 2010 asset inventories and shoreline conditions without sea level rise. Future risk estimates reflect the existing conditions with 2.3 feet and 3 feet of sea level rise for OCONUS and CONUS areas, respectively.



Figure ES-2: Tier 2 Economic Risk Assessment Dashboard for North Carolina

North Carolina Summary

- North Carolina has the third highest potential economic risk in SAD AOR.
- The state has potential for a significant increase in risk from sea level rise because it has many bays and a relatively large population.
- Risk tends to be more dispersed throughout relatively less-developed areas. More than 31 percent of the risk is not in a census place; this increases to nearly 35 percent with 3 feet of sea level rise.
- More than two-thirds of the state's risk is located in New Hanover, Carteret, Brunswick, and Dare counties.



Figure ES-3: Tier 2 Economic Risk Assessment Dashboard for South Carolina

South Carolina Summary

- South Carolina has the second highest potential economic risk in SAD AOR owing to its densely populated lower-lying areas in the southern part of the state.
- The risk is heavily concentrated in Charleston and Beaufort counties.
- With sea level rise, the risk in South Carolina increases by more than 200 percent. Over 73 percent of the risk is concentrated in more-populated census places.



Figure ES-4: Tier 2 Economic Risk Assessment Dashboard for Georgia

Georgia Summary

- Georgia has the fifth highest potential economic risk in SAD AOR.
- Approximately 83 percent of the risk in Georgia is concentrated in Chatham and Glynn counties.
- With 3 feet of sea level rise, it is anticipated that risk will see a greater increase in areas that are currently more populated.
- With sea level rise, the risk in Georgia increases by more than 250 percent.



Figure ES-5: Tier 2 Economic Risk Assessment Dashboard for Florida

Florida Summary

- Florida accounts for between 84 percent (existing conditions) and 87 percent (future conditions with sea level rise) of the coastal storm economic risk in SAD AOR owing to its large coastline, flat low-lying topography, significant population, and substantial development located in coastal areas.
- Risk is concentrated in Southeast Florida, Southwest Florida, West Central Florida, Northeast Florida, and East Central Florida.
- Under existing conditions, the risk in Southeast Florida is the greatest in SAD. Sea level rise will increase that risk by more than 200 percent.
- Miami-Dade, Broward, Lee, and Pinellas counties account for nearly two-thirds of the risk in the state of Florida.



Census Place Risk Rating <a>1-High <a>2-Med-High <a>3-Med <a>4-Low-Med <a>5-Low



Alabama Summary

- Alabama has the sixth largest potential risk in the SAD AOR.
- Risk is concentrated in Mobile and Baldwin counties.
- Orange Beach, Mobile, Gulf Shores, and Dauphin Island encompass nearly 68 percent of the potential risk in Alabama.
- Sea level rise will increase the risk by nearly 200 percent.



Census Place Risk Rating <a>href="https://www.selfacture.com">https://www.selfacture.com Census Place Risk Rating <a>href="https://www.selfacture.com"/>Census Place Risk Rating">https://www.selfacture.com Census Place Risk Rating <a>href="https://www.selfacture.com"/>Selfacture.com Census Place Rating <a>href="https://www.selfacture.com"/>Selfacture.com Census Place Risk Rating <a>href="https://www.selfacture.com"/>Selfacture.com Census Place Risk Rating <a>href="https://www.selfacture.com"/>Selfacture.com Census Place Rating <a>href="https://www.selfacture.com"/>Selfacture.com Census Place Rating <a>href="https://www.selfacture.com"/>Selfacture.com Census Place Rating <a>href="https://www.selfacture.com"/>Selfacture.com Census Place Rating <a>href="https://www.selfacture.co

Figure ES-7: Tier 2 Economic Risk Assessment Dashboard for Mississippi

Mississippi Summary

- Mississippi has the fourth highest potential economic risk in SAD AOR.
- All potential risk for Mississippi is located in Hancock, Harrison, and Jackson counties.
- More than 90 percent of the risk is concentrated in census places.
- With sea level rise, the risk in Mississippi increases by more than 150 percent.



Figure ES-8: Tier 2 Economic Risk Assessment Dashboard for Puerto Rico

Puerto Rico Summary

- Puerto Rico has the seventh highest potential economic risk in SAD AOR.
- Most of the risk is in San Juan and Cataño municipalities.
- Risk is dispersed in low-lying areas along the coastline and in the San Juan back bay areas.
- With sea level rise, the risk for Puerto Rico increases by more than 400 percent.



Figure ES-9: Tier 2 Economic Risk Assessment Dashboard for the U.S. Virgin Islands

U.S. Virgin Islands Summary

- The U.S. Virgin Islands have the least potential economic risk in SAD AOR.
- Majority of the risk is located in St. Thomas.
- Potential risk is anticipated to double with sea level rise.

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SECTION 1 Introduction

This report documents the methods, models, inputs, and assumptions used to estimate economic risk from storm surge inundation in support of the South Atlantic Coastal Study (SACS) as part of the Tier 2 Economic Risk Assessment. Economic risk is the combination of likelihood and harm to property, infrastructure, and other assets as a result of coastal storm events.

1.1 Economic Risk Description

The Tier 2 Economic Risk Assessment is an estimate of economic risk from storm surge inundation to infrastructure, and both public and private property. Damages are presented as consequences of annual exceedance probability (AEP) events, and risks are presented as the expected annual damages (EAD) for the series of storms.¹ Damage values are reflective of structure- and content-depreciated losses expressed in 2018 price levels.² Section 4 of this report discusses storm surge damages to structure- and content-depreciated values by census block. Additional information is available through the <u>Tier 2 Economic Risk Assessment</u> <u>Dashboard</u> within the SACS Geoportal. The risk for areas within the continental United States (CONUS) was estimated using Federal Emergency Management Agency's (FEMA) Hazus Flood Model (Hazus). FEMA's Flood Assessment Structure Tool (FAST) model was used to estimate storm surge risk for areas outside of the continental United States (OCONUS).

1.1.1 Conceptual Risk Framework and Definitions

This section provides details about the conceptual risk framework used in the SACS as it relates to the Tier 2 Economic Risk Assessment (ERA). Risk is conceptualized as a function of hazard, performance, exposure, vulnerability, and consequences, as shown in **Figure 1-1** (ER 1105-2-101).



Figure 1-1: Risk Conceptual Framework (ER 1105-2-101)

¹ CONUS areas used the 10-, 2-, 1-, and 0.2-percent AEP events in consequence and risk estimations. OCONUS areas used the 10-, 5-, 2-, 1-, and 0.2-percent AEP events in all consequence and risk estimations.

² It is recommended that damage values be adjusted to commensurate price levels of any comparison data using the method discussed in Section 1.4.

1.1.1.1 Hazard

In a general sense, hazard is anything that is a potential source of harm to a valued asset (e.g., human, animal, natural, economic, and social). In the context of the Tier 2 ERA, the key hazard is storm surge inundation and its increase as a result of sea level rise.³

1.1.1.2 Physical Setting / Performance

Performance is the system's reaction to a hazard, given the physical setting. It is the system's ability to manage the hazard loading conditions. Relevant system components include the topography, ground elevation, shoreline type, and the presence of existing risk management measures. The combination of the hazard and the physical setting results in the depth and extent of the flooding from any given AEP event.

1.1.1.3 Exposure

Exposure considers who and what may be harmed by a hazard. In the Tier 2 ERA, exposure is represented by the public and private property and critical infrastructure subject to harm from coastal-storm-induced storm surge flooding. The structure categories include residential, commercial, and public sector buildings and their contents. Exposure is defined by occupancy type, number of floors, construction type, foundation type, first-floor elevation, and structure- and content-depreciated replacement value.

1.1.1.4 Vulnerability

Vulnerability is defined as the susceptibility of harm to people, infrastructure, and the natural environment from a hazardous event. In the Tier 2 ERA, depth-damage functions, which associate flood depths with the proportion of structure and content value losses, were used to characterize vulnerability.

1.1.1.5 Consequences

Consequences are the potential impacts or harm that could result if/when the exposed elements are subject to hazards. In this case, the harm is represented by the dollar damage losses. Consequences should be described in terms that are meaningful to decision-makers, risk assessors, risk managers, and stakeholders.

1.2 Spatial Aggregation

Figure 1-2 shows the spatial distribution of economic risk by census block. The darker red colors correspond to greater concentrations of damages and risk. **Figure 1-3** provides an illustration of risk at the county level.

³ Wave attack and erosion hazards are also considered part of coastal storm risk but are beyond the scope of the Tier 2 ERA.





Figure 1-2: Example of Spatial Distribution of Economic Risk in Fort Myers / Cape Coral Area by Census Block



Figure 1-3: Example of Risk Distribution by County

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Damages can be presented at the following levels of spatial aggregation (from smallest to largest):

- Census Block
- Census Tract
- Census Place / Municipality / Estate
- County
- Planning Reach
- State / Territory

1.3 Tier 2 ERA Intended Uses and Limitations

The following is a list of the Tier 2 ERA's intended uses:

- Assess the spatial distribution of economic risk from coastal floods under existing and future sea level rise conditions.
- Assist in identification of potential high-risk areas.
- Assist in screening-level plan formulation decisions, such as measure affordability analysis.
- The risks estimated in the Tier 2 ERA are useful for screening-level planning but are not appropriate for informing investment decisions. Such decisions should be based on site-specific data and knowledge.
- Steps for using the Tier 2 ERA are as follows:
 - Step 1: Clearly define the coastal storm risk management (CSRM) problem.
 - Step 2: Determine the boundary condition for the problem impacts.
 - Step 3: Select census blocks within the impacted boundary. Aggregate damages or EAD, as needed.

The census block is the smallest spatial scale for presentation of the damages. Therefore, care and judgment should be used when trying to estimate the risk. The following considerations should be taken into account when trying to use this tool for entry-level CSRM planning activities:

- **Problems and Hazards** CSRM problems can be described in terms of inundation damages (surge), wave attacks, and erosion hazards. Inundation damages tend to have the greatest potential to occur over a larger area. Wave attacks and erosion hazards tend to be relatively more constrained in terms of spatial impact than inundation hazards. The Tier 2 ERA damages are based on the inundation hazard and do not account for wave and erosion effects. Users must factor in the limitations of using these data based on their local knowledge of hazards.
- **Spatial Extent of Damages** In some cases, the boundary of anticipated damages may be smaller than the entire census block.
- Hazard Land Interface Users must be cognizant of the relationship between the damages and the shoreline from which hazards are most likely to originate; in some cases, a census block may contain multiple shorelines. The census block flood source could be from an ocean-facing coastline, back bay, or surge promulgating up a river or Intracoastal Water Way (IWW). The Tier 2 ERA does not provide information about the flood source for a given census block. Best professional judgment is needed to determine the census block flood source. Users may choose to make proportional adjustments to risk estimates to avoid overstating damages that may arise from any potential problem.

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1.4 Price-Level Adjustments to EAD

The estimated economic risks captured by the Tier 2 ERA Dashboard reflect risks in 2018 price levels. This section outlines the procedure to update economic risk price levels and notes associated limitations.

Although the Tier 2 ERA captures risk associated with nonresidential structures in addition to residential structures, this price-level adjustment recommends applying the S&P/Case-Shiller U.S. Home Price Index⁴ to the tool's computed EADs (for both existing conditions and future conditions). This index was not formulated to capture price-level changes specific to depreciated real estate values or to regional or area variations to real estate price-level changes, nor was it formulated to capture commercial or industrial real estate price-level changed occupancy types within any area of interest. In addition, this index excludes data from Puerto Rico and the U.S. Virgin Islands in its calculation. Adjusting EADs to the desired price levels will diminish the accuracy of EADs over time. However, to account for significant price-level changes over the course of the SACS and in accordance with the Tier 2 ERA's intended use, the following procedure is recommended (an example is shown in **Table 1-1**).

Procedure:

- <u>Step 1</u>: Determine/aggregate EAD using the Tier 2 ERA for the impacted boundary.
- <u>Step 2</u>: Obtain the S&P/Case-Shiller Index value corresponding to January 2018, which can be obtained by navigating to the St. Louis Federal Reserve web page.⁵
- <u>Step 3</u>: Obtain the S&P/Case-Shiller Index value corresponding to the preferred new price-level year and month on the St. Louis Federal Reserve web page.
- <u>Step 4</u>: Calculate the price-level percentage change by dividing the index value obtained from Step 3 by the index value obtained in Step 2.
- <u>Step 5</u>: Multiply the price-level percentage change calculated from Step 4 by the EAD value determined in Step 1 to compute the updated EAD amount.

Existing Risk EAD for North Carolina in January 2018 Price Level	S&P Case-Shiller Index Value January 2018	S&P Case-Shiller Index Value February 2022	Price-Level Percentage Change	Existing Risk EAD for North Carolina in February 2022 Price Level
\$310 million	198.2	289.7	146%	\$453 million

Table 1-1: Example of Price-Level Adjustment for North Carolina from January 2018 to February 2022

There are limitations and challenges to adjusting economic risk price levels in addition to those referenced above; Tier 2 ERA users may determine one of the indices⁶ from **Table 1-2** is more appropriate than applying the S&P / Case-Shiller Index. Users should weigh the trade-offs between the pros and cons of each index in determining its appropriateness for areas of interest.

⁴ The S&P/Case-Shiller U.S. National Home Price Index values can be obtained from the Federal Reserve Economic Data (FRED) of St. Louis. The index reports monthly price changes for residential real estate by tracking repeat sales of single-family houses for the nine U.S. Census divisions using a 3-month moving average.

⁵ <u>https://fred.stlouisfed.org/series/CSUSHPISA</u>

⁶ All items listed in Table 3 are indices with the exception of Zillow Research Data, which provides monthly median home sale prices. These monthly median home prices can be used similarly to an index to update an area's risks to current price levels.

Index Name	Pros	Cons
Consumer Price Index for All Urban Consumers (CPI-U) ⁷ (Shelter in U.S. City Average)	 Applied in Flood Risk Management (FRM) for dam and levee safety updates Publicly accessible 	 Does not capture price changes specific to less-developed SACS planning reaches
Engineering News Record ⁸ (ENR)	 Currently used by the USACE Consequences Team of the Mapping, Modeling, Consequence (MMC) Product Center 	Subscription required
International Monetary Fund (IMF) Commercial Real Estate Prices for United States ⁹	 Closely tracks Commercial Real Estate prices for United States Publicly accessible 	 Does not capture prices for Puerto Rico or the U.S. Virgin Islands Index values are released on a quarterly basis for the period one year prior
National Association of Realtors ¹⁰	 All CONUS area risks can use the same index Updated releases are publicly accessible 	 Regional resolution encompasses Maryland to Texas, along with inland states No applicability to Puerto Rico or the U.S. Virgin Islands Need to obtain base index value for January 2018 – not publicly accessible
Puerto Rico (PR) Trading Economics ¹¹	Tailored for Puerto RicoPublicly accessible	 Index values are released for the period one year prior Not applicable to the U.S. Virgin Islands Subscription required
RSMeans	 Separate indices for Commercial versus Residential Regional Location Factors 	 Regional Location Factors do not align with SACS Planning Reaches Does not capture price changes specific to less-developed SACS Planning Reaches Subscription required
Zillow Research Data ¹²	Local area customizationPublicly accessible	 No applicability to Puerto Rico or the U.S. Virgin Islands Not an index

Table 1-2: Alternative Indices for Expected Annual Damages Price-Level Adjustments

Housing Data - Zillow Research

⁷ CPI for All Urban Consumers (CPI-U); Series Title: Shelter in U.S. city average, all urban consumers, seasonally adjusted. Series ID: CUSR0000SAH1

⁸ Building Cost Index History: https://www.enr.com/economics/historical_indices

⁹ Commercial Real Estate Prices for United States (COMREPUSQ159N) | FRED | St. Louis Fed (stlouisfed.org)

¹⁰ National Association of Realtors: Median Sales Price of Existing Single-Family Homes by Region: Existing-Home Sales (nar.realtor) ¹¹ Trading Economics obtains prices from the Statistical Institute of Puerto Rico.

¹² Zillow Research Data: Median Monthly Sale Price reported by Metropolitan Statistical Area (MSA).

SECTION 2 Hazus Methodology (CONUS)

Hazus Flood Model (Hazus) is a multi-hazard loss estimation methodology developed by FEMA for use by federal, state, region, and local governments, and private enterprises in planning for risk management, emergency preparedness, response, and recovery. Hazus uses Geographic Information Systems (GIS) technology to estimate physical, economic, and social impacts of disasters. Accessed through a user interface, Hazus is compartmentalized into separate models that allow for the analysis of earthquakes, flood, and hurricane winds. The methodology of each applies to nearly all aspects of the built environment and covers a wide range of physical, economic, and social impacts. Model results can be both tabulated and visualized graphically.

The Tier 2 ERA used Hazus to assess potential impacts of coastal flooding as part of the SACS. The analysis included only coastal flooding and omitted any riverine and precipitation contributions to flood water elevations.

The Hazus methodology can be applied at any of three levels of analysis:

- 1. Level 1 Relies on the extensive national databases embedded in the model. Applies default hazards, inventories, and damage functions.
- 2. Level 2 Combines user-specified local hazard, inventory, and damage functions with default databases.
- 3. Level 3 Involves extensive user-specified local hazard and inventory data as well as detailed engineering data.

As the level of analysis increases, the level of effort and data sophistication also increases, which decreases the level of uncertainty (**Figure 2-1**). Given the extent of the area of responsibility (AOR), a Level 1 analysis was applied. This was within scope and budget and ensured consistency between regions.



Figure 2-1: Levels of Hazus Analysis

The databases embedded within Hazus contain extensive information on demographics (population, employment, housing), building stock (residential, commercial, industrial), essential facilities (hospitals, schools, police stations, fire stations), transportation (highways, bridges, railways, tunnels, airports, ports, harbors, and ferry facilities), utilities (waste water, potable water, oil, gas, electric, communication), and highpotential loss facilities (dams and levees, nuclear, hazard material sites, and military installations). Using this information, users can determine general loss estimates for a region, including direct and indirect economic impacts. The Hazus methodology and software are flexible enough that locally developed inventories and other data that more accurately reflect the local environment can be substituted (Level 2 and Level 3 analyses), resulting in increased accuracy. A detailed description of the Hazus Flood Model can be found in the Hazus User Manual and the Hazus Technical Manual, which can be downloaded from the FEMA website: https://www.fema.gov/media-library/assets/documents/24609.

2.1 SACS Study Area

The SACS study area falls within the USACE South Atlantic Division (SAD) regional boundary and includes the tidally influenced coastal areas of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Puerto Rico, and the U.S. Virgin Islands (**Figure 2-2**). These areas represent approximately 65,000 miles of coastline. The blue area in the figure denotes the maximum of maximum (MOM) water inundation levels expected for a Category 5 hurricane.¹³ At present, the Hazus Flood Model does not include inventory data outside of the continental U.S. and could not be applied to Puerto Rico or the U.S. Virgin Islands.



Figure 2-2: SACS Study Area Boundary

¹³ Zachry, B. C., W. J. Booth, J. R. Rhome, and T. M. Sharon. 2015. "A national view of storm surge risk and inundation." *Weather, Climate, and Society* 7 (2): 109-117

2.2 Hazus Model Regions

Application of the Hazus Flood Model involves creating a study region over which the specified hazard and damages are assessed. Default Hazus data inventories are provided at the census block level, which allows for study regions that can range from large-scale (statewide) to small-scale (local community). For analysis of the SACS study area, each coastal county in each state was modeled individually. In some cases, the extent of coastal flooding from the maximum surge condition extended into adjacent counties. In those cases, several counties were grouped into a single study region to capture all related impacts. **Table 2-1** shows the study regions by county or group of counties for each state in the SACS study area.

State	Region	Coastal Counties Inland Countie	
North Carolina	1	Currituck	-
North Carolina	2	Camden	-
North Carolina	3	Pasquotank	-
North Carolina	4	Perquimans	-
North Carolina	5	Chowan, Hertfort, Bertie, Washington	Gates, Martin
North Carolina	6	Tyrell	-
North Carolina	7	Dare	-
North Carolina	8	Hyde	-
North Carolina	9	Beaufort	Pitt
North Carolina	10	Pamlico	-
North Carolina	11	Craven	-
North Carolina	12	Carteret	-
North Carolina	13	Onslow	-
North Carolina	14	Pender, New Hanover, Brunswick	Columbus, Bladen, Sampson
South Carolina	1	Horry, Georgetown	Marion, Florence, Williamsburg
South Carolina	2	Charleston, Colleton	Berkely, Dorchester
South Carolina	3	Beaufort, Jasper	Hampton
Georgia	1	Chatham	-
Georgia	2	Bryan	-
Georgia	3	Liberty	-
Georgia	4	McIntosh	-
Georgia	5	Glynn	-
Georgia	6	Camden	Charlton, Brantley
Alabama	1	Baldwin	Clarke, Washington, Monroe
Alabama	2	Mobile	-
Mississippi	1	Jackson	-
Mississippi	2	Harrison	-
Mississippi	3	Hancock	-
Florida	1	Nassau, Duval, St. Johns, Flagler, Volusia	-
Florida	2	Brevard	-
Florida	3	Indian River	-
Florida	4	St. Lucie, Martin	-
Florida	5	Palm Beach	-
Florida	6	Broward	-
Florida	7	Miami-Dade	-
Florida	8	Monroe	-

Table 2-1: Hazus Model Regions by State and County

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State	Region	Coastal Counties	Inland Counties	
Florida	9	Collier	_	
Florida	10	Lee	Henry, Glades	
Florida	11	Charlotte	Desoto	
Florida	12	Sarasota	_	
Florida	13	Manatee	_	
Florida	14	Hillsborough	-	
Florida	15	Pinellas	_	
Florida	16	Pasco	_	
Florida	17	Hernando	-	
Florida	18	Citrus	_	
Florida	19	Levy	_	
Florida	20	Dixie	_	
Florida	21	Taylor	-	
Florida	22	Jefferson	_	
Florida	23	Wakulla	Leon	
Florida	24	Franklin	Liberty	
Florida	25	Gulf	_	
Florida	26	Bay, Walton, Okaloosa	Washington	
Florida	27	Santa Rosa	-	
Florida	28	Escambia	-	

2.3 Hazus Flood Model Inputs

Hazus analysis of coastal flood hazards requires the user to supply certain information to characterize the shoreline and the specified flood hazard.

2.3.1 Coastal Flood Hazard

Coastal flood hazards in Hazus are calculated using a general approach and methods that are similar but more detailed than those currently used by FEMA to produce coastal Flood Insurance Rate Maps (FIRMs). However, flood hazard results may differ from those shown on a coastal FIRM owing to a larger range of AEP flood events, differing topographic data sources, simplification of some models applied to FIRM generation to allow estimation of flood hazards with less detailed input, and extension and improvement of other models by incorporation of more recent scientific developments.

2.3.2 Model Region

The region over which the coastal flood hazards are computed is specified by the user at the beginning of each analysis. Specification of the study region requires identification of the states, counties, census tracks, and census blocks that comprise the desired area of analysis. As previously discussed, for this study, each county was modeled individually, except in cases where adjacent counties required grouping because of the anticipated inland extent of the maximum flood hazard or shared forcing (coastal) boundaries. The Hazus model interface allows for the selection of each of these elements using a mapping feature. **Figure 2-3** shows an example of a single county model region (Currituck, North Carolina) and the associated selected census blocks. **Figure 2-4** shows a multiple county model region (and associated census blocks), which includes all Florida counties impacted by tidally driven flooding of the St. Johns River.



Figure 2-3: Example of a Single County Model Region, Census Block Selection (Currituck County, North Carolina)



Figure 2-4: Example of Multiple County Model Region, Census Block Selection (Florida Counties Impacted by St. Johns River)

2.3.3 Topography

Three options exist for specifying topographic (or bathymetric) data within Hazus: one or more digital elevation models (DEMs), a flood depth grid generated by the FEMA Flood Information Tool (FIT), or a user-generated flood depth grid. The latter two options are generally reserved for Level 2 and Level 3 analyses.

A DEM is a grid of evenly spaced ground elevation data. The Hazus model interface automatically identifies the U.S. Geological Survey (USGS) DEMs that are required to cover the extent of the county (or counties) being modeled. All DEMs are sourced from the USGS National Map and are in the USGS 30-meter standard format. USGS DEMs are produced from high-resolution lidar and provide suitable coverage of all areas modeled for the SACS AOR. While underlying datasets may vary in date, the resulting National Elevation Dataset provides seamless topography of the most up-to-date topographic information available.

For this study, DEMs for each model region were obtained using the optional tool within Hazus that determines the extent of DEM required for the specified model region and then reaches out to a USGS DEM library to identify and download applicable DEMs. **Figure 2-5** shows the combined DEM for Currituck, North Carolina. The left panel shows the DEM itself and the right panel shows the Currituck census tracks superimposed to show the extent of the DEM relative to the model region.

2.3.4 Shorelines

Within each specified Hazus model region, defined by the topographic extent of the input DEM, Hazus will automatically identify available shorelines across which coastal flooding will propagate. It is left to the user to manually select each shoreline and to identify the start and end points of each.¹⁴ **Figure 2-6** provides an example of shoreline generation (black lines) and selection (blue lines) for Currituck, North Carolina.



Figure 2-5: Example DEM Coverage (Currituck County, North Carolina)

¹⁴ Shorelines can be segmented in multiple small shorelines to preserve site-specific characteristics. However, segmentation of shorelines is not required and not necessary for a Level 1 analysis. For this study, shorelines were not segmented, thereby ensuring each shoreline was attributed with the same shore characterization (coastal) and hazard condition(s).



Figure 2-6: Example of Generated and Selected of Shorelines (Currituck County, North Carolina)

Shorelines in Hazus are specified in long segments. These segments were represented by a number of Flood Insurance Study (FIS) transects. The final elevation specified for a Hazus shoreline was an average of the applicable FIS transect elevations. Although there was some variability over the shoreline, an average was considered adequate for the extent. The most-significant differences in FIS flood elevations were generally between coastal shorelines and bay shorelines, which Hazus specifies as two different boundaries and could be assigned the appropriate coastal or bay value(s).

2.3.5 Coastal Flood Elevations

Hazus can assess hazards with AEPs ranging from 10 percent to 0.2 percent. For a Level 1 analysis, two inputs are required to characterize the flood conditions at each shoreline segment—the 1-percent AEP flood stillwater elevation (SWEL) and the 1-percent AEP wave setup. With this information, the model calculates and automatically populates flood elevation values for the 1-percent, 2-percent, and 0.2-percent AEP flood events using flood elevation ratios derived from FIS data and stored within the internal Hazus library. While these additional AEP water levels may be edited by the user, this is generally reserved for higher-level analyses. For the present study, the 1-percent AEP SWEL was taken from the FIS for each of the relevant counties. Because it was not always specified in each FIS, the 1-percent AEP wave setup was assumed to be included in the FIS values for all counties; therefore, the user input wave setup value was set to zero. This allowed for consistency between the model inputs for each of the model regions. **Table 2-2** provides the input SWEL values for each of the model regions for this study. The internally calculated 10-percent, 2-percent, and 1-percent AEP SWEL are also provided.

State	Pagion	Coastal	Hazus Shoreline	FEMA Surge Elevations (feet NAVD88)			
State	Region	Counties		1% AEP	10% AEP	2% AEP	0.2% AEP
North Carolina	1	Currituck	Ocean	7.0	4.5	6.2	8.6
North Carolina	1	Currituck	Вау	3.4	2.2	3.0	4.2
North Carolina	2	Camden	Вау	3.7	2.4	3.3	4.6
North Carolina	3	Pasquotank	Вау	3.7	2.4	3.3	4.6
North Carolina	4	Perquimans	Вау	3.7	2.4	3.3	4.6

Table 2-2: Flood Elevations by Annual Exceedance Probability for the Continental United States

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Chata	Region	Coastal		FEMA Surge Elevations (feet NAVD88)				
State		Counties	Hazus Shoreline	1% AEP	10% AEP	2% AEP	0.2% AEP	
North Carolina	5	Chowan	Вау	4.3	2.8	3.8	5.3	
North Carolina	5	Hertford	Вау	6.8	4.4	6.0	8.4	
North Carolina	5	Bertie	Вау	6.8	4.4	6.0	8.4	
North Carolina	5	Washington	Вау	5.6	3.6	4.9	6.9	
North Carolina	6	Tyrell	Вау	4.2	2.7	3.7	5.2	
North Carolina	7	Dare	Ocean (North)	7.9	5.1	7.0	9.7	
North Carolina	7	Dare	Ocean (South)	9.2	5.9	8.1	11.3	
North Carolina	7	Dare	Bay (Roanoke)	8.2	5.2	7.2	10.1	
North Carolina	7	Dare	Bay (Mainland)	4.6	2.9	4.0	5.7	
North Carolina	8	Hyde	Ocean	5.1	3.3	4.5	6.3	
North Carolina	9	Beaufort	Вау	6.4	4.1	5.6	7.9	
North Carolina	10	Pamlico	Вау	6.4	4.1	5.6	7.9	
North Carolina	11	Craven	Bay	7.8	5.0	6.9	9.6	
North Carolina	12	Carteret	Bay (Mainland)	7.9	5.1	77.0	9.7	
North Carolina	12	Carteret	Ocean (Cape)	6.0	3.8	5.3	7.4	
North Carolina	12	Carteret	Ocean (North)	5.2	3.3	4.6	6.4	
North Carolina	13	Onslow	Ocean	9.8	6.3	8.6	12.1	
North Carolina	14	Pender	Ocean	11.8	7.6	10.4	14.5	
North Carolina	14	New Hanover	Ocean	11.1	7.1	9.8	13.7	
North Carolina	14	Brunswick	Ocean	10.3	6.6	9.1	12.7	
South Carolina	1	Horry	Ocean	13.6	8.7	12.0	16.7	
South Carolina	1	Georgetown	Ocean	12.9	8.3	11.4	15.9	
South Carolina	2	Charleston	Ocean	11.1	7.1	9.8	13.7	
South Carolina	2	Colleton	Ocean	9.8	6.2	8.5	11.9	
South Carolina	3	Beaufort	Ocean	12.9	8.3	11.4	15.9	
South Carolina	3	Jasper	Ocean	12.9	8.3	11.4	15.9	
Georgia	1	Chatham	Ocean	9.6	6.1	8.4	11.8	
Georgia	2	Bryan	Ocean	9.4	6.0	8.3	11.6	
Georgia	3	Liberty	Ocean	9.4	6.0	8.3	11.6	
Georgia	4	McIntosh	Ocean	9.2	5.9	8.1	11.3	
Georgia	5	Glynn	Ocean	8.9	5.7	7.8	10.9	
Georgia	6	Camden	Ocean	8.9	5.7	7.8	10.9	
Alabama	1	Baldwin	Ocean	10.1	6.5	8.9	12.4	
Alabama	2	Mobile	Bay (Mainland)	11.0	7.0	9.7	13.5	
Alabama	2	Mobile	Ocean (Dauphin)	7.8	5.0	6.8	9.6	
Mississippi	1	Jackson	Ocean	14.8	9.5	13.0	18.2	
Mississippi	2	Harrison	Ocean	17.8	11.4	15.7	21.9	
Mississippi	3	Hancock	Ocean	17.9	11.5	15.8	22.0	
Florida	1	Nassau	Ocean	8.8	5.6	7.7	10.8	
Florida	1	Duval	Ocean	8.6	5.5	7.6	10.6	
Florida	1	St. Johns	Ocean	8.4	5.4	7.4	10.3	
Florida	1	Flagler	Ocean	7.2	4.6	6.3	8.9	
Florida	1	Volusia	Ocean	6.7	4.3	5.9	8.2	
Florida	2	Brevard	Ocean	8.5	5.4	7.5	10.5	
Florida	3	Indian River	Ocean	5.7	3.6	5.0	7.0	
Florida	4	St. Lucie	Ocean	7.7	4.9	6.8	9.5	
Florida	4	Martin	Ocean	7.2	4.6	6.3	839.0	
Florida	5	Palm Beach	Ocean	7.3	4.7	6.4	9.0	
Florida	6	Broward	Ocean	7.2	4.6	6.3	8.9	
Florida	7	Miami-Dade	Ocean (North)	6.7	4.3	5.9	8.2	
Florida	7	Miami-Dade	Bay (Biscayne)	8.2	5.2	7.2	10.1	
Florida	7	Miami-Dade	Ocean (South)	10.0	6.4	8.8	12.3	

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Chata		Coastal Counties	Hazus Shoreline	FEMA Surge Elevations (feet NAVD88)				
State	Region			1% AEP	10% AEP	2% AEP	0.2% AEP	
Florida	8	Monroe	Ocean (Gulf Side)	14.4	9.2	12.7	17.7	
Florida	8	Monroe	Ocean (North Keys)	9.4	6.0	8.3	11.6	
Florida	8	Monroe	Ocean (Key West)	9.2	7.2	8.1	11.3	
Florida	8	Monroe	Ocean (Central Keys)	8.6	5.5	7.6	10.6	
Florida	9	Collier	Ocean	8.8	5.6	7.7	10.8	
Florida	10	Lee	Ocean (Gasparilla)	9.7	6.2	8.5	11.9	
Florida	10	Lee	Ocean (Cayo)	9.4	6.0	8.3	11.6	
Florida	10	Lee	Ocean (Captiva/Sanibel)	11.2	7.2	9.9	13.8	
Florida	10	Lee	Ocean (Ft. Myer/Bonita)	12.8	8.2	11.3	15.7	
Florida	11	Charlotte	Ocean	11.5	7.4	10.1	14.1	
Florida	11	Charlotte	Вау	8.9	5.7	7.8	10.9	
Florida	12	Sarasota	Ocean	10.1	6.5	8.9	12.4	
Florida	13	Manatee	Ocean	8.9	5.7	7.8	10.9	
Florida	14	Hillsborough	Ocean	9.1	5.8	8.0	11.2	
Florida	15	Pinellas	Ocean	10.4	6.7	9.2	12.8	
Florida	15	Pinellas	Вау	9.7	6.2	8.5	11.9	
Florida	16	Pasco	Ocean	11.0	7.0	9.7	13.5	
Florida	17	Hernando	Ocean	11.6	7.4	10.2	14.3	
Florida	18	Citrus	Ocean	11.9	7.6	10.5	14.6	
Florida	19	Levy	Ocean	13.6	8.7	12.0	16.7	
Florida	20	Dixie	Ocean	13.7	8.8	12.1	16.9	
Florida	21	Taylor	Ocean	14.4	9.2	12.7	17.7	
Florida	22	Jefferson	Ocean	16.9	10.8	14.9	20.8	
Florida	23	Wakulla	Ocean	16.4	10.5	14.4	20.2	
Florida	24	Franklin	Ocean (West)	10.0	6.4	8.8	12.3	
Florida	24	Franklin	Ocean (Central)	11.8	7.6	10.4	14.5	
Florida	24	Franklin	Ocean (East)	12.9	8.3	11.4	15.9	
Florida	24	Franklin	Вау	12.7	8.1	11.2	15.6	
Florida	25	Gulf	Ocean	8.1	5.2	7.1	10.0	
Florida	26	Вау	Ocean	10.1	6.5	8.9	12.4	
Florida	26	Walton	Ocean	10.2	6.5	9.0	12.5	
Florida	26	Okaloosa	Ocean	10.4	6.7	9.2	12.8	
Florida	27	Santa Rosa	Ocean	7.8	5.0	6.9	9.6	
Florida	27	Santa Rosa	Вау	7.2	4.6	6.3	8.9	
Florida	28	Escambia	Ocean	10.5	6.7	9.2	12.9	

2.3.6 Significant Wave Height

As part of the flood impact analysis, Hazus requires specification of a significant wave height at the shoreline. The user may specify a value, or the default wave height will be internally calculated as the depth-limited wave height at each boundary. For the purposes of the Tier 2 ERA, wave heights were calculated internally as a depth-limited wave condition. The depth-limited wave height in Hazus is defined as Hs \leq 0.49 ds, where Hs is the wave height and ds is the local stillwater depth.

Each state (and sometimes each county) uses a unique format for presenting FIS results. Each FIS was assessed to determine whether wave height was included. Some documents included both with and without wave height elevations. Others did not specify. An examination of the nearest FIS with waves gave elevations consistent with the values where waves were not specified; therefore, it was assumed that waves were included unless otherwise stated.

Hazus also assumes a peak wave period corresponding to the calculated depth-limited wave height. Values for the peak wave period come from an internal lookup table where values vary by coast, county, and wave exposure.

2.3.7 Floodplain Delineation

Delineation of the floodplain for each of the flood hazards (10-percent, 2-percent, 1-percent, and 0.2-percent AEP) is required to begin the coastal flood damage assessment. This function is carried internally by Hazus. The user need only identify either a single hazard for delineation or all hazards for delineation. **Figure 2-7** shows an example of a 10-percent AEP floodplain for Currituck County, North Carolina. For contrast, **Figure 2-8** shows an example of a 0.2-percent floodplain for the multiple counties of Florida impacted by the St. Johns River.



Figure 2-7: Example of 10-Percent Annual Exceedance Probability Floodplain (Currituck County, North Carolina)


Figure 2-8: Example of a 0.2-Percent Annual Exceedance Probability Floodplain (Florida Counties Impacted by St. Johns River)

2.3.8 Hazus Structure Inventory

The default Hazus structure inventory allows the estimation of the amount of exposure and potential damage in the region. Inventory data include basic information on population, buildings, and facilities obtained from the United States Census and other national sources. The underlying spatial data is aggregated by census block as an inventory called the General Building Stock (GBS). **Table 2-3** provides details about the different FEMA occupancy types.

Damage Category	Occupancy Type Name	Description
Residential	RES1-1SNB	Single-Family Residential, one-story, no basement
Residential	RES1-1SWB	Single-Family Residential, one-story, with basement
Residential	RES1-2SNB	Single-Family Residential, two-story, no basement
Residential	RES1-2SWB	Single-Family Residential, two-story, with basement
Residential	RES1-3SNB	Single-Family Residential, three-story, no basement
Residential	RES1-3SWB	Single-Family Residential, three-story, with basement
Residential	RES1-SLNB	Single-Family Residential, split-level, no basement
Residential	RES1-SLWB	Single-Family Residential, split-level, with basement
Residential	RES2	Manufactured Home

Table 2-3:	Federal	Emergency	Management	Agency	Occupancy	Types
10010 2 5.	rcucrui	Lincigency	management	rigency	occupancy	rypes

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Damage Category	Occupancy Type Name	Description
Residential	RES3A	Multi-Family housing, two units
Residential	RES3B	Multi-Family housing, three to four units
Residential	RES3C	Multi-Family housing 5–10 units
Residential	RES3D	Multi-Family housing 10–19 units
Residential	RES3E	Multi-Family housing 20–50 units
Residential	RES3F	Multi-Family housing 50+ units
Residential	RES4	Average Hotel
Residential	RES5	Nursing Home
Residential	RES6	Nursing Home
Commercial	COM1	Average Retail
Commercial	COM2	Average Wholesale
Commercial	COM3	Average Personal and Repair Services
Commercial	COM4	Average Professional Technical Services
Commercial	COM5	Bank
Commercial	COM6	Hospital
Commercial	COM7	Average Medical Office
Commercial	COM8	Average Entertainment/Recreation
Commercial	COM9	Average Theater
Commercial	COM10	Garage
Industrial	IND1	Average Heavy Industrial
Industrial	IND2	Average light industrial
Industrial	IND3	Average Food/Drug/Chemical
Industrial	IND4	Average Metals/Minerals processing
Industrial	IND5	Average High Technology
Industrial	IND6	Average Construction
Commercial	AGR1	Average Agricultural
Commercial	REL1	Church
Public	GOV1	Average Government Services
Public	GOV2	Average Emergency Response
Public	EDU1	Average School
Public	EDU2	Average College/University

The GBS was used as the primary basis for the exposure reflected in all CONUS consequences and dollar damage risk estimates. GBS subtypes consider building occupancy, square footage, building count, valuation parameters, dollar exposure, depreciation parameters, depreciated exposure, and first-floor elevations. The GBS used for the SACS was based on data from the 2010 Census reflected at 2018 price levels. Depreciated losses were used to characterize economic risk.

Extracting data from Hazus is a lengthy and time-consuming process for a study area as large as the SACS. Even though the GBS was used in the risk estimates, the National Structure Inventory 2.0 (NSI 2.0)¹⁵ was used to describe the exposure in subsequent sections of this report and for the state appendices for all CONUS areas to efficiently provide a sense of the asset inventory profile, inclusive of vehicle values.

¹⁵ The National Structure Inventory (NSI) is a system of databases containing structure inventories of varying quality and spatial coverage. The purpose of the NSI databases is to facilitate storage and sharing of point-based structure inventories used in the assessment and analysis of natural hazards. Flood damage analysis is the primary usage, but sufficient data exists on each structure to compute damages caused by other hazard types (IWR-HEC).

2.4 Assumptions and Limitations

2.4.1 Hazard Conditions

Substantial effort to restore the sand dunes near the Cabo Rojo Salt Flats by the Puerto Rico Department of Natural Resources (PR DNER)

- Existing Conditions: All CONUS water levels are based on 10-, 2-, 1-, and 0.2-percent AEP events based on FEMA FIS.
- Future Conditions: To represent sea level rise, 3 feet were added to the existing condition water levels. The 3-foot (CONUS) value was based on National Oceanic and Atmospheric Administration (NOAA)/USGS tidal gauges with at least 30 to 40 years of data. Future projections show that all locations in the SACS study area are expected to see 3 feet of sea level rise (relative to 2020 levels) in approximately 50 years (2070) under the NOAA High and USACE High Scenarios and approximately 100 years (2120) under the USACE Intermediate Scenario.

2.4.2 Physical Setting / Performance

- Existing Conditions: Surface elevations were based on USGS DEMs that are model defaults for CONUS areas. Default shoreline boundaries were also used.
- Shorelines: Shorelines in Hazus are specified in long segments represented by several FIS transects. The final elevation specified for a Hazus shoreline was an average of the applicable FIS transect elevations. The most-significant differences in FIS flood elevations were generally between coastal shorelines and bay shorelines which Hazus specifies as two different boundaries and assigned the appropriate coastal or bay value(s) by default.
- Future Conditions: Same as existing condition. No shoreline migration was assumed as a result of sea level rise.

2.4.3 Exposure

- Existing Conditions: Structure inventory data for the model runs were based on the 2010 Census GBS at 2018 price levels. While the exposure descriptions were based on NSI 2.0 data to save time and provide an idea of the structure inventory profile, the Level 1 GBS Hazus defaults were used in the consequences and risk computations to estimate exposure.
- Future Conditions: The exposure is assumed to be constant and does not reflect future changes in development.

2.4.4 Vulnerability

Vulnerability is reflected in the default Hazus damage functions. No changes were made to these damage functions between existing and future conditions.

2.4.5 Consequences

Consequences are represented primarily as depreciated losses to structure and contents in dollars at 2018 price levels. Section 1.4 provides information on how to update consequences, expressed as EAD, to current price levels. There are also full replacement losses that will be made available based on need.

2.5 Hazus Flood Model Output

Hazus generates an enormous amount of output data. Data can be viewed graphically in the Hazus GIS interface, tabulated according to census block, or compiled by Hazus into summary reports. **Figure 2-9** provides a detailed breakdown of the summary reports (and thus the output types) available from Hazus.

2.5.1 Data Exported from Hazus

Hazus reports damages at the census block level. The GBS Economic Loss (by depreciated replacement) was applied to both the existing and future condition models for all four storm events.

2.5.2 Reporting of Hazus Outputs

Hazus outputs (from the individual model runs) were combined into geographic regions that match the SACS planning reaches. These are storm-specific (e.g., 10-, 2-, 1-, and 0.2-percent AEP) damages at the census block level for individual storms, thereby making it the highest level of detail available. These data are aggregated to multiple different geographic levels (census tracts, counties, and planning reaches) for easier interpretation.

Individual storms are bundled together into EAD. The calculation for this is:

$$EAD = \left(\frac{1}{10} - \frac{1}{50}\right) \frac{10\% AEP_{Damages} + 2\% AEP_{Damages}}{2} + \left(\frac{1}{50} - \frac{1}{100}\right) \frac{2\% AEP_{Damages} + 1\%_{Damages}}{2} \\ + \left(\frac{1}{100} - \frac{1}{500}\right) \frac{1\% AEP_{Damages} + 0.2\% AEP_{Damages}}{2} + \frac{1}{500} \left(0.2\% AEP_{Damages}\right)$$

This calculation is reported for depreciated and full losses for both the existing and future conditions, as well as the difference between existing and future conditions.

2.5.3 Hazus Model Error and Adjustments

For each EAD calculation, there is both a low and high value reported because of the numerical instability of the Hazus outputs. Sometimes, the damages from a more-intense storm would be less than a more-frequent less-intense storm. For example, sometimes the damages to a census block from the 1-percent AEP storm would be less than the 2-percent AEP storm.

The model produced expected results for the overwhelming majority of the study area. However, problem areas included the St. Johns River Basin, Tampa, the Florida Keys, and Miami-Dade. The problem typically corresponded with models that had extreme census block density, more-complicated shorelines, or a combination of both.

To adjust the results to be more realistic, a range of possible values (low-range method and high-range method) to express the confidence in Hazus outputs are reported. Both methods use results from the 10-percent AEP storm as a starting point and assume those to be accurate.¹⁶ This decision was made because the errors became more frequent and pronounced as the intensity of the storm increased. This observation supports the decision to use the 10-percent AEP storm as a baseline.

¹⁶ It was assumed that the 10-percent AEP storm event results were more likely to be accurate relative to the 2-, 1-, and 0.2-percent AEP events. This was because the 10-percent results were consistently more stable than the others.

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Summary Reports X	Summary Reports X	Summary Reports X
Inventory Buildings Lifelines Induced Losses Other	Inventory Buildings Lifelines Induced Losses Other	Inventory Buildings Lifelines Induced Losses Other
Please select the summary reportfs] to view:	Please select the summary report[s] to view.	Please select the summary report[s] to view:
Agriculture Products Dollar Exposure Building Stock Dollar Exposure By Building Type Building Stock Dollar Exposure By Doccupancy Transportation Systems Dollar Exposure Utility System Dollar Exposure Vehicle Dollar Exposure (Day) Vehicle Dollar Exposure (Night)	Building Damage By Building Type Building Damage By General Occupancy Building Damage By General Occupancy (Post-FIRM) Building Damage By General Occupancy (Pre-FIRM) Building Damage Count By General Occupancy Building Damage Count By General Occupancy Building Damage Count By General Occupancy (Pre-FIRM) Building Damage Count By General Occupancy (Pre-FIRM) Building Damage Count By General Occupancy (Pre-FIRM) Building Damage Count By General Occupancy (Pre-FIRM) Fire Station Damage & Functionality Police Station Damage & Functionality Police Station Damage & Functionality School Damage & Functionality	Highway Bridge Damage & Functionality Light Rail Bridge Damage & Functionality Potable Wrater Facility Damage Railroad Bridge Damage & Functionality Wastewater Facility Damage
View Olose Summary Reports X	View Close Summary Reports X	View Close Summary Reports X
Inventory Buildings Lifelines Induced Losses Other	Inventory Buildings Lifelines Induced Losses Other	Inventory Buildings Lifelines Induced Losses Other
Please select the summary report(s) to view:	Please select the summary report[s] to view.	Please select the summary report[s] to view.
Uebris Generaled	Annualized Direct Economic Losses for Buildings Depreciated Direct Economic Losses For Buildings Direct Economic Losses For Agriculture Products Direct Economic Losses For Buildings Direct Economic Losses For Transportation Direct Economic Losses For UDFs Direct Economic Losses For UDFs Direct Economic Losses For UDFs Direct Economic Losses For Vehicles (Day) Direct Economic Losses For Vehicles (Night) Indirect Economic Losses For Vehicles (Night) Indirect Economic Impact With Aid Indirect Economic Impact Without Aid Shelter Requirements	. Flood Global Risk Report Quick Assessment
View Close	View Close	View Close

Figure 2-9: Hazus Flood Model Output Option

SECTION 2 | FAST METHODOLOGY (OCONUS)

2.5.3.1 Low Range

The low range is a conservative approach to correct the issues that arose from the Hazus outputs. It adjusts the damages from an event such that it cannot be any less than a more-frequent less-severe event. Mathematically:

Corrected Low 2% AEP_{Damages} = Max(10% AEP_{Damages}, 2% AEP_{Damages}) Corrected Low 1% AEP_{Damages} = Max(10% AEP_{Damages}, 2% AEP_{Damages}, 1% AEp_{Damages}) Corrected Low 0.2% AEP_{Damages} = Max(10% AEP_{Damages}, 2% AEP_{Damages}, 1% AEP_{Damages}, 0.2% AEP_{Damages})

To illustrate this procedure, **Table 2-4** contains an example from a census block that has problematic damages from the raw Hazus output in the 0.2-percent AEP storm. This correction was done at the census block level. The low EAD calculation reported uses the corrected storm damage estimates.

Table 2-4: Example of Low-Range Census Block Damage Adjustment

	10-Percent AEP Damages	2-Percent AEP Damages	1-Percent AEP Damages	0.2-Percent AEP Damages
Problematic Census Block	\$50,000	\$250,000	\$400,000	\$100,000
Low Correction	\$50,000	\$250,000	\$400,000	\$400,000

2.5.3.2 High Range

The high range represents a more realistic approach of what damages would be without the calculation issue. The high range identifies individual census blocks where damages were corrected using the procedure outlined in the low-range methodology. The event damages for the problematic census block(s) were then calculated by applying a percentage change. The percentage change was the difference between the subject events for the total sum of the planning reach omitting problematic census blocks. This high-range method attempts to estimate what this value would have been if it had been correctly estimated in Hazus. In this context, 'reasonable' means that damages in a census block fits the following seven conditions:

> Existing 2% $AEP_{Damages} \ge Existing 10\% AEP_{Damages}$ Existing 1% $AEP_{Damages} \ge Existing 2\% AEP_{Damages}$ Existing 0.2% $AEP_{Damages} \ge Existing 1\% AEP_{Damages}$ Future 10% $AEP_{Damages} \ge Existing 10\% AEP_{Damages}$ Future 2% $AEP_{Damages} \ge Existing 2\% AEP_{Damages}$ Future 1% $AEP_{Damages} \ge Existing 1\% AEP_{Damages}$ Future 0.2% $AEP_{Damages} \ge Existing 0.2\% AEP_{Damages}$

To illustrate this procedure, **Table 2-5** contains an example from a census block that has problematic damages from the raw Hazus output in the 0.2-percent AEP storm. The low correction is provided for context. One-million is used for the 0.2-percent AEP storm because the average percent change from the 1-percent AEP to 0.2-percent AEP storm for reasonable census blocks from the planning reach is 150 percent. This value is then applied to the problematic census block. This correction was done at the census block level. The high EAD calculation reported uses the high corrected storm damage estimates.

	10-Percent AEP Damages	2-Percent AEP Damages	1-Percent AEP Damages	0.2-Percent AEP Damages	Percent Change from 1-Percent AEP Damages to 0.2-Percent AEP Damages
Problematic Census Block	\$50,000	\$250,000	\$400,000	\$100,000	-75%
Low Correction	\$50,000	\$250,000	\$400,000	\$400,000	0%
High Correction	\$50,000	\$250,000	\$400,000	\$1,000,000	150%
Planning Reach Total from Reasonable Census Blocks	\$10,000,000	\$75,000,000	\$100,000,000	\$250,000,000	150%

Table 2-5: Example of High-Range Census Block Damages Adjustment

For Planning Reach FL_06, in Northeast Florida, the 0.2-percent AEP storm would not correctly estimate damages in the whole region because of the complexity of the Hazus model's coastline inputs. As a result, there were no census blocks that were categorized as 'reasonable.' To address this planning reach, the percentage changes from reasonable census blocks in Planning Reach FL_07 were used. A similar problem presented itself in Planning Reach FL_09, the Florida Keys, owing to the intricacies of the islands' coastlines. In this instance, the percentage changes from reasonably representative census blocks in Planning Reach FL_08 were used.

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SECTION 3

FAST Methodology (OCONUS)

Damage estimates for Puerto Rico and the U.S. Virgin Islands were estimated using FEMA's FAST. FAST uses the same methodology as the Hazus application in an open-source python tool that allows users to define inputs. Since inputs for Puerto Rico and the U.S. Virgin Islands are unavailable in the Hazus application, FAST was used to estimate damages for these areas.

The FAST tool and supporting documentation can be downloaded from https://github.com/nhrap-hazus/FAST.

3.1 SACS OCONUS Study Area

The SACS study area outside of the continental U.S. includes Puerto Rico (including the main island and the islands of Culebra and Vieques), and the U.S. Virgin Islands (St. Croix, St. Thomas, and St. John). Puerto Rico is divided into four planning reaches for the purpose of the study, and the U.S. Virgin Islands is divided into three. **Figure 3-1** and **Figure 3-2** illustrate the delineation of planning reaches for the territories. Building density and home values for Puerto Rico and the U.S. Virgin Islands tend to be lower than the majority of the CONUS study area, which results in lower damages, as shown in Section 4.2.8.



Figure 3-1: Puerto Rico Planning Reaches



Figure 3-2: U.S. Virgin Islands Planning Reaches

3.2 FAST Inputs

The FAST tool requires the user to provide a gridded raster of flood depths, and a point-based structure inventory to calculate structure-specific estimated damages. Damages are calculated based on depth-damage functions, which are identical to the functions used in the Hazus application. Additional documentation on methodology for damages and depth-damage functions can be found here: https://www.fema.gov/media-librarydata/20130726-1820-25045-8292/hzmh2_1_fl_tm.pdf.

3.2.1 Coastal Flood Depths

Coastal flood depths were developed by USACE Jacksonville District Coastal Engineering and the USACE Engineering Research and Development Center Coastal and Hydraulics Laboratory (ERDC) for the 10-, 5-, 2-, 1-, and 0.2-percent AEP events for existing and future conditions. Future conditions used a mean sea level rise of 2.33 feet based on NOAA tidal gauge data. The AEP water levels were developed as part of the Coastal Hazard System (CHS). CHS consists of the combination of high-fidelity numerical model simulations of coastal hazards using CSTORM with a probabilistic coastal hazard assessment. These CHS AEP points were loaded into ArcGIS Pro and water surface elevations for each AEP storm were contoured using 100-foot by 100-foot grid cells. For further reference, refer to ERDC/CHL LR-19-9 *Calibration and Validation of the Puerto Rico/U.S. Virgin Island Domain Model Setup for the South Atlantic Coastal Study (SACS).*¹⁷

¹⁷ Owensby, M. B., M. A. Bryant, T. J. Hesser, L. A. Provost, T. C. Massey. 2019. *Calibration and Validation of the Puerto Rico/U.S. Virgin Island Domain Model Setup for the South Atlantic Coastal Study (SACS)*.

Volume 19, Issue 9. U.S. Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory.

3.2.2 Structure Inventory

GIS point-based structure inventory data used in the FAST tool were obtained from FEMA for Puerto Rico and the U.S. Virgin Islands. These data were developed by FEMA contractors to be used in future GBS data for the Hazus application. FEMA obtained building footprints that were developed by Compass Joint Venture using NOAA lidar data, Terrasolid software, and ArcGIS Pro. Building footprints were processed in ArcGIS Pro, and compared against Open Street Map building footprints, and then combined to reconcile differences between the datasets. Additional building footprints obtained from the U.S. Virgin Islands GIS Division and CoreLogic Parcel-Point data were also used to verify the footprint dataset. NOAA lidar data were used to obtain first-floor foundation heights.

Tax assessor parcel data from the U.S. Virgin Islands Office of Tax Assessor were then merged with footprints to create building attributes for each structure. Structure values and content values are in fiscal year (FY) 2018 price levels. Homeland Infrastructure Foundation-Level Data (HIFLD), which are publicly available, were used to aid in defining structure occupancy types for public structures, including wastewater treatment plants, cultural structures, governors' mansions, pharmacies, places of worship, public schools, solid waste facilities, and major state government buildings.

Replacement values were estimated based on each structure's square footage and the cost-per-square-foot value published by structure type within Hazus 4.0. FAST schema attributes assigned to parcel data points and used in the calculation of estimated damages include latitude and longitude coordinates, building replacement value, content replacement value, occupancy type, number of stories, square footage, foundation type, and first-floor height.

3.3 FAST Outputs

FAST produces a CSV file containing each structure point and associated flood damages. Separate CSV files are produced for each flood depth raster (associated with the 10-, 5-, 2-, 1-, and 0.2-percent AEP events). EAD for each structure was calculated using Reimann Sum midpoint method, represented by the following equation:

$$\begin{split} EAD_{i} &= \left(\frac{1}{10} - \frac{1}{20}\right) \frac{(10\% \, AEP \, Damages_{i} + 5\% \, AEP \, Damages_{i})}{2} \\ &+ \left(\frac{1}{20} - \frac{1}{50}\right) \frac{(5\% \, AEP Damages_{i} + 2\% \, AEP Damages_{i})}{2} \\ &+ \left(\frac{1}{50} - \frac{1}{100}\right) \frac{(2\% \, AEP \, Damages_{i} + 1\% \, AEP \, Damages_{i})}{2} \\ &+ \left(\frac{1}{100} - \frac{1}{500}\right) \frac{(1\% \, AEP \, Damages_{i} + 0.2\% \, AEP \, Damages_{i})}{2} \end{split}$$

Where *i* represents each structure point in the data, and damages represent the FAST model damage estimates for the 10-, 5-, 2-, 1-, and 0.2-percent AEPs.

Flood depth grids were ensured to be monotonically increasing for all five storm frequency events for both Puerto Rico and the U.S. Virgin Islands by completing a raster calculation between each increasing frequency event, for both existing and future conditions. Because of some instability within the FAST model code, and not due to actual flood depth rasters, damages for the 1-percent AEP event, for the existing condition only, were higher than damages for the 0.2-percent AEP event for 5 percent of all structures in Puerto Rico. This phenomenon was not present in future damages, nor in damages for the U.S. Virgin Islands. To correct for this instability in existing damage estimates, damages were adjusted as detailed in Section 2.5.3. For example, for a structure with \$6,000 in damages for the 1-percent AEP event, and \$0 in damages for the 0.2-percent event, damages for the 0.2-percent AEP event were modified to \$6,000. The decision to not project increasing

SECTION 3 | FAST METHODOLOGY (OCONUS)

damages for these structures for the 0.2-percent AEP event was based on the fact that a large portion of structures had equivalent damages for both the 1-percent and 0.2-percent AEP events in the model output.

Structure point coordinates and their associated damage estimates were projected in ArcGIS Pro and summed by census block, to maintain consistency with Hazus output. Damage estimates for both territories are reported by census block at the most finite level, and not by structure, in this report and in other supporting documents for SACS. The summation equation for damages is:

$$\sum_{i=1}^{N} EAD_{ij}$$

Where EAD is an array of structure-census block pairs, with i representing the structure ID and j representing the census block ID. FAST damage estimates by planning reach for Puerto Rico and the U.S. Virgin Islands are shown in Sections 4.2.7 and 4.2.8.

SECTION 4 Tier 2 ERA Results

The following sections provide greater detail about the results generated by the Tier 2 ERA. The results are divided into CONUS and OCONUS sections. These sections are further subdivided into states and territories with results displayed according to each planning reach (**Table 4-1**).

4.1 Census Place and Census Block Risk Ratings

For the purpose of the SACS, each census block was associated with a census place based on whether the centroid of the census block fell within the spatial boundary of the census place. Each census block and census place were assigned a risk rating using the Jenks Natural Breaks Classification method using five categories (Low Risk, Low-Med Risk, Med Risk, Med-High Risk, and High Risk). Relative risk classifications are shown in **Table 4-2, Table 4-3,** and **Table 4-4**.

State/Territory	Location ID	Regions Included	SACS Planning Reaches Included
North Carolina	NC	Northern and Southern North Carolina	NC_01, NC_02
South Carolina	SC	Northern and Southern South Carolina	SC_03, SC_04
Georgia	GA	Coastal Georgia	GA_05
Florida	NC_FL	Northeast Florida + Central Eastern Florida	FL_06, FL_07
Florida	SE_FL	Southeast Florida + Florida Keys	FL_08, FL_09
Florida	SW_FL	Southwest Florida + Central Western Florida	FL_10, FL_11
Florida	NW_FL	Northwest Florida + Panhandle	FL_12, FL_13
Alabama	AL	Alabama Gulf Coast	AL_14
Mississippi	MS	Mississippi Gulf Coast	MS_15
Puerto Rico	PR	Entire Island	PR_1, PR_2, PR_3, PR_4
U.S. Virgin Islands	VI	St. Croix, St. Thomas, and St. Johns	VI_1, VI_2, VI_3

Table 4-1: Census Block and Census Place Reference Information

Table 4-2: Census Place and Census Block Relative Risk Classification (North Carolina, South Carolina, and Georgia)

Location	Diak	Census	Places	Census Blocks	
ID	RISK	Low Bound	Upper Bound	Low Bound	Upper Bound
NC	5-Low Risk	\$0	\$868,054	\$0	\$53,460
NC	4-Low-Med Risk	\$868,055	\$2,555,902	\$53,461	\$189,656
NC	3-Med Risk	\$2,555,903	\$5,529,913	\$189,657	\$449,380
NC	2-Med-High Risk	\$5,529,914	\$10,932,263	\$449,381	\$928,714
NC	1-High Risk	\$10,932,264	\$21,678,824	\$928,715	\$2,219,828
SC	5-Low Risk	\$0	\$2,873,266	\$0	\$153,497
SC	4-Low-Med Risk	\$2,873,267	\$7,143,391	\$153,498	\$626,376
SC	3-Med Risk	\$7,143,392	\$16,848,232	\$626,377	\$1,555,433
SC	2-Med-High Risk	\$16,848,233	\$30,338,470	\$1,555,434	\$3,643,573
SC	1-High Risk	\$30,338,471	\$159,517,266	\$3,643,574	\$7,950,298
GA	5-Low Risk	\$0	\$405,404	\$0	\$89,414

Location		Census	Places	Census Blocks		
ID	RISK	Low Bound	Upper Bound	Low Bound	Upper Bound	
GA	4-Low-Med Risk	\$405,405	\$1,156,700	\$89,415	\$345,745	
GA	3-Med Risk	\$1,156,701	\$5,071,574	\$345,746	\$917,546	
GA	2-Med-High Risk	\$5,071,575	\$10,455,369	\$917,547	\$2,122,817	
GA	1-High Risk	\$10,455,370	\$17,655,097	\$2,122,818	\$3,867,182	

Table 4-3: Census Place and Census Block Relative Risk Classification (Florida)

Location	Bield	Census	Places	Census Blocks	
ID	KISK	Low Bound	Upper Bound	Low Bound	Upper Bound
NC_FL	5-Low Risk	\$0	\$4,302,834	\$0	\$194,288
NC_FL	4-Low-Med Risk	\$4,302,835	\$13,396,028	\$194,289	\$759,084
NC_FL	3-Med Risk	\$13,396,029	\$33,828,360	\$759,085	\$1,883,226
NC_FL	2-Med-High Risk	\$33,828,361	\$85,664,628	\$1,883,227	\$4,804,731
NC_FL	1-High Risk	\$85,664,629	\$146,727,598	\$4,804,732	\$9,487,968
SE_FL	5-Low Risk	\$0	\$9,751,620	\$0	\$347,099
SE_FL	4-Low-Med Risk	\$9,751,621	\$29,919,046	\$347,100	\$1,391,360
SE_FL	3-Med Risk	\$29,919,047	\$67,198,148	\$1,391,361	\$3,841,991
SE_FL	2-Med-High Risk	\$67,198,149	\$125,317,350	\$3,841,992	\$8,162,685
SE_FL	1-High Risk	\$125,317,351	\$230,881,672	\$8,162,686	\$24,130,836
SW_FL	5-Low Risk	\$0	\$17,385,488	\$0	\$217,874
SW_FL	4-Low-Med Risk	\$17,385,489	\$49,273,971	\$217,875	\$879,172
SW_FL	3-Med Risk	\$49,273,972	\$143,610,097	\$879,173	\$2,177,417
SW_FL	2-Med-High Risk	\$143,610,098	\$377,235,741	\$2,177,418	\$5,290,732
SW_FL	1-High Risk	\$377,235,742	\$850,989,725	\$5,290,733	\$13,777,025
NW_FL	5-Low Risk	\$0	\$632,633	\$0	\$101,611
NW_FL	4-Low-Med Risk	\$632,634	\$2,107,110	\$101,612	\$424,871
NW_FL	3-Med Risk	\$2,107,111	\$5,162,109	\$424,872	\$1,225,472
NW_FL	2-Med-High Risk	\$5,162,110	\$14,495,171	\$1,225,473	\$3,233,121
NW_FL	1-High Risk	\$14,495,172	\$25,005,189	\$3,233,122	\$8,887,716

Table 4-4: Census Place and Census Block Relative Risk Classification (Alabama, Mississippi, Puerto Rico, and U.S. Virgin Islands)

Location	Diak	Census	Places	Census Blocks	
ID	RISK	Low Bound	Upper Bound	Low Bound	Upper Bound
AL	5-Low Risk	\$0	\$651,795	\$0	\$71,714
AL	4-Low-Med Risk	\$651,796	\$1,882,442	\$71,715	\$284,364
AL	3-Med Risk	\$1,882,443	\$4,071,672	\$284,365	\$802,130
AL	2-Med-High Risk	\$4,071,673	\$16,494,782	\$802,131	\$1,898,268
AL	1-High Risk	\$16,494,783	\$34,342,479	\$1,898,269	\$3,791,713
MS	5-Low Risk	\$0	\$2,356,759	\$0	\$78,128
MS	4-Low-Med Risk	\$2,356,760	\$6,290,590	\$78,129	\$303,355
MS	3-Med Risk	\$6,290,591	\$11,095,510	\$303,356	\$803,090
MS	2-Med-High Risk	\$11,095,511	\$19,122,654	\$803,091	\$1,935,359
MS	1-High Risk	\$19,122,655	\$31,777,546	\$1,935,360	\$5,193,739
PR	5-Low Risk	\$0	\$6,000	\$0	\$7,016
PR	4-Low-Med Risk	\$6,001	\$62,000	\$7,017	\$26,559
PR	3-Med Risk	\$62,001	\$182,000	\$26,560	\$63,794

Location	Diek	Census	s Places	Census Blocks	
ID	RISK	Low Bound	Upper Bound	Low Bound	Upper Bound
PR	2-Med-High Risk	\$182,001	\$591,000	\$63,795	\$135,347
PR	1-High Risk	\$591,001	\$14,047,000	\$135,348	\$245,025
VI	5-Low Risk	\$0	\$1,878	\$0	\$10,000
VI	4-Low-Med Risk	\$1,879	\$5,326	\$10,001	\$37,000
VI	3-Med Risk	\$5,327	\$14,521	\$37,001	\$93,264
VI	2-Med-High Risk	\$14,522	\$48,834	\$93,265	\$133,289
VI	1-High Risk	\$48,835	\$1,265,777	\$133,290	\$332,598

	EXISUI	g Census Place R	isk kaung by	state/ terntory		
State/Territory Name	1-High Risk	2-Med-High Risk	3-Med Risk	4-Low-Med Risk	5-Low Risk	Total
Alabama	1	2	2	3	17	25
Florida	12	16	44	102	330	503
Georgia	1	5	8	6	10	30
Mississippi	5	2	4	6	6	23
North Carolina	5	2	16	26	74	123
Puerto Rico	2	4	12	16	23	57
South Carolina	3	1	7	8	28	47
U.S. Virgin Islands	12	3	4	3	8	29
Total	41	35	96	169	494	825

Existing Census Place Risk Rating by State/Territory

Future Census Place Risk Rating by State/Territory

State/Territory Name 1-High Risk 2-Med-High Risk 3-Med Risk 4-Low-Med Risk 5-Low Risk Total

Alabama	3	2	2	8	10	25
Florida	36	39	85	106	238	503
Georgia	10	3	10	1	6	30
Mississippi	7	3	5	3	5	23
North Carolina	9	21	16	27	50	123
Puerto Rico	13	8	12	12	12	57
South Carolina	6	5	10	6	20	47
U.S. Virgin Islands	18	4	2	5	2	29
Total	102	85	140	168	341	825

Existing Census Block Risk Rating by State/Territory

State/Territory Name 1-High Risk 2-Med-High Risk 3-Med Risk 4-Low-Med Risk 5-Low Risk Total

Alabama	4	11	37	176	2339	2567
Florida	65	336	1245	6405	105368	113419
Georgia	4	14	56	242	4690	5006
Mississippi	1	26	149	538	4861	5575
North Carolina	22	81	271	936	9558	10868
Puerto Rico	8	25	55	232	3360	3680
South Carolina	22	57	192	828	12964	14063
U.S. Virgin Islands	5	1	5	6	26	43
Total	131	551	2010	9363	143166	155221

Future Census Block Risk Rating by State/Territory

State/Territory Name 1-High Risk 2-Med-High Risk 3-Med Risk 4-Low-Med Risk 5-Low Risk Total

Alabama	5	24	83	336	2119	2567
Florida	282	968	3192	14513	94464	113419
Georgia	20	49	168	498	4271	5006
Mississippi	9	58	244	863	4401	5575
North Carolina	118	254	631	1695	8170	10868
Puerto Rico	52	151	303	654	2520	3680
South Carolina	63	145	419	1502	11934	14063
U.S. Virgin Islands	10	2	9	7	15	43
Total	559	1651	5049	20068	127894	155221

Figure 4-1: Number of Census Places and Census Blocks Within Each Relative Risk Category by State or Territory

4.2 Distribution of Risk by Region, State, and Territory Summary

As shown in Table 4-2, Table 4-3, and Table 4-4, the distribution of the risk is as follows:

- CONUS/OCONUS Nearly all of the risk is in the CONUS, while 0.12 percent is in the OCONUS areas.
- More than 86 percent of the CONUS risk is in Florida and 7 percent is in South Carolina. The remaining 6 percent is located within North Carolina, Georgia, Alabama, and Mississippi.
- Nearly 90 percent of the OCONUS Risk is in Puerto Rico. The U.S. Virgin Islands constitutes the least economic risk across the entire study area.

As previously noted, most of the CONUS risk is located in Florida with South Carolina as a distant second. This is attributable to the distribution of population, development, and amount of shoreline exposed to coastal storms, all of which is greatest in Florida. Nearly 85 percent of the CONUS risk is distributed among counties along the coast of Southeast Florida, Southwest Florida, West Central Florida, and Southern South Carolina. The following subsections provide numerous graphs and tables that describe the economic risks for the CONUS and OCONUS areas.



Figure 4-2: Tier 2 Economic Risk Assessment South Atlantic Division Area of Responsibility Overview



Figure 4-3: CONUS Tier 2 Economic Risk Summary



Figure 4-4: OCONUS Tier 2 Economic Risk Summary

4.2.1 North Carolina

4.2.1.1 Planning Reach NC_01: Northern North Carolina Coast

This section describes dollar damage storm surge risk for Planning Reach NC_01, the northern-most coastal region of North Carolina. All estimates shown are in FY 2018 price levels. Figure 4-5 displays the number, occupancy type, and total value (structure + content + vehicle value) in Planning Reach NC_01 in the 0.2-percent AEP event flood extent, based on the NSI 2.0 structure inventory data for the northern North Carolina coast. Figure 4-6 provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. Figure 4-7 provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event for each census place.



Figure 4-5: Planning Reach NC_01 Exposure Details

There are approximately 262,000 structures with a total estimated exposure value of more than \$127 billion. Most of the assets and asset values are single-family residential, multi-family residential, and commercial.

Northern North Carolina has a significant amount of shoreline that is susceptible to oceanside and back bay flood hazards. This planning reach has the greatest number of counties that are potentially impacted given its proximity to the Albemarle and Pamlico Sounds. As a result, there is a wide spatial distribution in the risk, with 18 counties, 82 census places, and approximately 3 million acres impacted. In addition, there is also significant distribution of risk to more rural areas (approximately 47 percent). The number of medium- to high-risk census blocks increases by 266 percent between existing and future conditions with sea level rise. Overall risk for the planning reach ranges between \$154 million and \$465 million. Of the 15 counties impacted, the greatest risk is located in Carteret, Dare, Beaufort, Craven, and Hyde counties. Of the 82 exposed census places, Morehead City, New Bern, Fairfield Harbour, Beaufort, and Manteo have the greatest risk.



Figure 4-6: Planning Reach NC_01 Risk Details

					Consequences 8	& Risk per AEP Eve	nt by Census Plac	e				
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing Risk	% of Future Risk
Morehead City	\$19,190,000	\$100,440,000	\$61,400,000	\$176,020,000	\$105,010,000	\$213,050,000	\$187,000,000	\$301,540,000	\$5,601,567	\$15,670,516	7.75%	7.22%
New Bern	\$17,160,000	\$93,920,000	\$56,960,000	\$163,230,000	\$87,480,000	\$218,360,000	\$149,850,000	\$326,220,000	\$4,935,346	\$15,031,568	6.83%	6.92%
Fairfield Harbour	\$13,550,000	\$70,540,000	\$44,980,000	\$132,970,000	\$68,650,000	\$168,940,000	\$125,660,000	\$234,490,000	\$3,939,399	\$11,732,639	5.45%	5,40%
Beaufort	\$7,510,000	\$46,610,000	\$25,310,000	\$122,940,000	\$60,860,000	\$167,190,000	\$123,210,000	\$240,460,000	\$2,729,081	\$10,342,952	3.77%	4.76%
Manteo	\$21,120,000	\$72,510,000	\$47,680,000	\$119,900,000	\$65,820,000	\$145,660,000	\$110,880,000	\$197,320,000	\$4,247,026	\$10,788,468	5.87%	4.97%
Atlantic Beach	\$20,090,000	\$71,000,000	\$48,650,000	\$113,560,000	\$63,420,000	\$137,700,000	\$101,320,000	\$202,160,000	\$4,172,104	\$10,403,477	5.77%	4.79%
Belhaven	\$18,140, <mark>000</mark>	\$60,310,000	\$41,670,000	\$99,340,000	\$53,980,000	\$120,990,000	\$9 1,380,000	\$166,880,000	\$3,638,144	\$8,973,870	5.03%	4.13%
Duck	\$9,160,000	\$59,150,000	\$27,740,000	\$92,760,000	\$41,400,000	\$115,170,000	\$70,850,000	\$164,410,000	\$2, <mark>412,939</mark>	\$8,562,863	3.34%	3.94%
Hatteras	\$20,480,000	\$56,690,000	\$36,820,000	\$92,290,000	\$4 <mark>8,140,000</mark>	\$111,920,000	\$81,530,000	\$153,280,000	\$3,39 <mark>8,360</mark>	\$8,348,349	4.70%	3.85%
Avon	\$12,000,000	\$55,500,000	\$25,670,000	\$9 <mark>0,590,000</mark>	\$36,090,000	\$109,860,000	\$61,060,000	\$150,220,000	\$2,326,062	\$8,186,828	3.22%	3.77%
Kitty Hawk	\$23,760,000	\$57,390,000	\$46,300,000	\$8 <mark>8,780,000</mark>	\$59, <mark>650,000</mark>	\$107,950,000	\$9 <mark>0,090,000 </mark>	\$146,330,000	\$4,109, <mark>994</mark>	\$8,141,331	5.68%	3.75%
Southern Shores	\$7,960,000	\$51,640,000	\$35,780,000	\$84,900,000	\$47,540,000	\$103,510,000	\$81,970,000	\$140,040,000	\$2,8 <mark>47,754</mark>	\$7,658,100	3.94%	3.53%
Kill Devil Hills	\$4,180,000	\$34,610,000	\$19,130,000	\$79,230,000	\$30,690,000	\$101,590,000	\$8 <mark>8,990,000</mark>	\$150,000,000	\$1,838,009	\$6,765,787	2.54%	3.12%
Wanchese	\$12,9 <mark>00,000</mark>	\$48,160,000	\$27,490,000	\$76,490,000	\$36,960,000	\$95,210,000	\$66,440,000	\$129,740,000	\$2, <mark>4</mark> 84,999	\$7,004,867	3.44%	3.23%
Elizabeth City	\$3,340,000	\$41,270,000	\$10,100,000	\$75,650,000	\$13,790,000	\$101,660,000	\$25,530,000	\$174,730,000	\$868,054	\$7,019,617	1.20%	3.23%
Nags Head	\$5,860,000	\$27,660,000	\$15,700,000	\$74,000,000	\$23,160,000	\$94,560,000	\$74,540,000	\$139,210,000	\$1,596,470	\$6,125,803	2.21%	2.82%
Washington	\$4,750,000	\$28,750,000	\$11,620,000	\$60,990,000	\$19,390,000	\$92,130,000	\$42,670,000	\$164,800,000	\$1,145,240	\$5,708,868	1.58%	2.63%
Frisco	\$9,930,000	\$37,450,000	\$19,220,000	\$60,950,000	\$27,260,000	\$73,900,000	\$46,130,000	\$100,950,000	\$1,783,882	\$5,511,550	2.47%	2.54%
River Road	\$9,630,000	\$34,720,000	\$21,830,000	\$54,700,000	\$31,270,000	\$67,030,000	\$49,810,000	\$96,570,000	\$1 ,947,849	\$5,035,128	2.69%	2.32%
Oriental	\$2,270,000	\$30,200,000	\$9,180,000	\$51,820,000	\$19,070,000	\$61,090,000	\$41,710,000	\$82,360,000	\$925,716	\$4,584,055	1.28%	2.11%
Emerald Isle	\$4,770,000	\$19,500,000	\$12,710,000	\$48,430,000	\$18,150,000	\$66,650,000	\$39,410,000	\$116,810,000	\$1,163,872	\$4,261,439	1.61%	1.96%
Ocracoke	\$ <mark>8,460,000</mark>	\$36,250,000	\$17,310,000	\$47,720,000	\$23,210,000	\$53,560,000	\$36,250,000	\$66,060,000	\$1,542,238	\$4,475,379	2.13%	2.06%
Buxton	\$6,070,000	\$19,090,000	\$14,620,000	\$44,760,000	\$20,390,000	\$62,260,000	\$47,370,000	\$86,990,000	\$1,368,490	\$3,860,676	1.89%	1.78%
River Bend	\$4,980,000	\$24,270,000	\$14,770,000	\$43,050,000	\$22,080,000	\$51,860,000	\$40,070,000	\$67,490,000	\$1,303,310	\$3,779,028	1.80%	1.74%
Davis	\$7,650,000	\$22,170,000	\$12,090,000	\$36,060,000	\$16,560,000	\$43,720,000	\$28,030,000	\$60,510,000	\$1,168,048	\$3,265,999	1.62%	1.50%
Engelhard	\$8,490,000	\$22,120,000	\$15,760,000	\$35,990,000	\$19,120,000	\$43,650,000	\$23,660,000	\$59,590,000	\$1,361,813	\$3,255,563	1.88%	1.50%
Columbia	\$3,300,000	\$23,220,000	\$8,880,000	\$32,600,000	\$12,470,000	\$34,610,000	\$19,550,000	\$37,530,000	\$762,030	\$2,931,223	1.05%	1.35%
Gloucester	\$200,000	\$21,690,000	\$6,490,000	\$32,120,000	\$20,370,000	\$38,960,000	\$31,640,000	\$53,180,000	\$673,491	\$2,982,461	0.93%	1.37%
Pine Knoll Shores	\$2,270,000	\$14,550,000	\$7,850,000	\$31,050,000	\$13,190,000	\$44,890,000	\$27,850,000	\$77,340,000	\$730,321	\$2,846,210	1.01%	1.31%
Marshallberg	\$6,550,000	\$17,330,000	\$13,360,000	\$28,620,000	\$18,180,000	\$35,880,000	\$30,770,000	\$50,930,000	\$1,211,465	\$2,610,365	1.68%	1.20%
Hobucken	\$3,490,000	\$16,000,000	\$5,890,000	\$26,060,000	\$8,200,000	\$31,590,000	\$13,900,000	\$43,120,000	\$562,037	\$2,355,654	0.78%	1.09%
Manns Harbor	\$6,080,000	\$18,940,000	\$10,310,000	\$25,460,000	\$13,110,000	\$29,260,000	\$18,740,000	\$39,950,000	\$937,636	\$2,406,407	1.30%	1.11%
Harkers Island	\$3,370,000	\$14,840,000	\$10,650,000	\$24,550,000	\$15,120,000	\$31,990,000	\$25,420,000	\$43,710,000	\$903,445	\$2,248,187	1.25%	1.04%
Cedar Point	\$5,100,000	\$15,260,000	\$10,810,000	\$23,640,000	\$14,430,000	\$28,140,000	\$22,310,000	\$37,690,000	\$953,633	\$2,153,112	1.32%	0.99%
Swan Quarter	\$3,160,000	\$13,960,000	\$8,800,000	\$22,700,000	\$10,900,000	\$27,520,000	\$15,450,000	\$37,560,000	\$713,968	\$2,052,276	0.99%	0.95%
Total	\$316,920,000	\$1,377,710,000	\$803,530,000	\$2,413,920,000	\$1,185,110,000	\$3.032.010.000	\$2,131,040,000	\$4,340,170,000	\$72,303,792	\$217.080.615	100.00%	100.00%

Figure 4-7: Planning Reach NC_01 Consequences and Risk Details (top 35 of 82 census places)

4.2.1.2 Planning Reach NC_02: Southern North Carolina Coast

This section describes dollar damage storm surge risk for Planning Reach NC_02, the southern-most coastal region of North Carolina. All estimates shown are in FY 2018 price levels. **Figure 4-8** displays the number, occupancy type, and total value (structure + content + vehicle value) in Planning Reach NC_02 in the 0.2-percent AEP event flood extent, based on the NSI 2.0 structure inventory data for the southern North Carolina coast. **Figure 4-9** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-10** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.



Figure 4-8: Planning Reach NC_02 Exposure Details

There are approximately 268,000 structures with a total estimated exposure value of more than \$139 billion. Most of the assets and asset values are single-family residential, multi-family residential, and commercial. The exposure includes seven counties, 43 census places, 3,700 census blocks, and 777,000 acres.

Southern North Carolina has a primarily ocean-facing shoreline that is susceptible to flood hazards. Hazards propagate over shorelines located in New Hanover, Brunswick, Onslow, and Pender counties. Maximum surge depths modeled range from 6.3 to 14.5 feet in existing conditions to 9.3 to 17.5 feet in future conditions.

Overall risk for the planning reach ranges between \$155 million and \$324 million, with most of the risk in the four counties mentioned above. Of the seven counties exposed, the greatest risk is located in New Hanover, Brunswick, Onslow, and Pender counties. Of the 43 exposed census places, Oak Island, Wilmington, Carolina Beach, Wrightsville Beach, Holden Beach, Ocean Isle Beach, and Surf City have the greatest risk, accounting for approximately 70 percent of the census place risk. The distribution of risk is more concentrated in urban areas than in Planning Reach NC_01, with only approximately 16 percent of the risk in rural areas. The number of medium- to high-risk census blocks increases by 96 percent between existing and future conditions with sea level rise.



Figure 4-9: Planning Reach NC_02 Risk Details

					Consequences &	Risk per AEP Event	by Census Place					
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
				•							Risk	Risk
Oak Island	\$118,880,000	\$280,310,000	\$244,090,000	\$465,730,000	\$323,280,000	\$578,420,000	\$505,190,000	\$862,500,000	\$21,678,822	\$42,549,415	16.64%	15.70%
Wilmington	\$32,820,000	\$198,960,000	\$184,350,000	\$371,750,000	\$256,710,000	\$475,050,000	\$442,740,000	\$719,880,000	\$14,577,910	\$33,284,290	11.19%	12.29%
Carolina Beach	\$46,080,000	\$185,9 <mark>40,000</mark>	\$163,3 <mark>90,000</mark>	\$339,640,000	\$233,830,000	\$432,550,000	\$380,870,000	\$614,340,000	\$13,58 <mark>4,988</mark>	\$30,299,086	10.42%	11,18%
Wrightsville Beach	\$89,480,000	\$172,450,000	\$161,670,000	\$275,860,000	\$212,010,000	\$333,830,000	\$313,170,000	\$451,920,000	\$14,642,471	\$25,028,170	11.24%	9.24%
Ocean Isle Beach	\$26,260,000	\$112,460,000	\$89,010,000	\$223,420,000	\$164,820,000	\$282,110,000	\$254,110,000	\$412,250,000	\$8,063,093	\$19,565,254	6.19%	7.22%
Holden Beach	\$63,470,000	\$131,620,000	\$120,650,000	\$222,640,000	\$161,070,000	\$275,350,000	\$252,800,000	\$388,870,000	\$10,932,264	\$20,093,487	8.39%	7.42%
Surf City	\$44,000,000	\$90,210,000	\$86,100,000	\$200,270,000	\$19,750,000	\$265,760,000	\$249,470,000	\$368,750,000	\$ <mark>8</mark> ,209,297	\$17,223,021	6.30%	6.36%
Bald Head Island	\$12,060,000	\$46,100,000	\$34,390,000	\$114,600,000	\$80,290,000	\$136,040,000	\$128,930,000	\$186,930,000	\$3,527,558	\$9,347,542	2.71%	3.45%
Topsail Beach	\$29,980,000	\$61,370,000	\$56,960,000	\$100,830,000	\$78,340,000	\$148,650,000	\$138,550,000	\$211,430,000	\$5,298,458	\$9,599,472	4.07%	3.54%
Sunset Beach	\$11,870,000	\$41,790,000	\$40,770,000	\$92,280,000	\$58,860,000	\$132,400,000	\$117,750,000	\$190,590,000	\$3,545,776	\$8,157,745	2.72%	3.01%
Sea Breeze	\$8,840,000	\$40,130,000	\$36,460,000	\$82,880,000	\$54,290,000	\$105,730,000	\$98,240,000	\$157,990,000	\$3,071,853	\$7,234,125	2.36%	2.67%
Myrtle Grove	\$26,700,000	\$55,720,000	\$52,970,000	\$76,650,000	\$64,380,000	\$85,240,000	\$82,610,000	\$113,420,000	\$4,525,721	\$7,124,705	3.47%	2.63%
North Topsail Beach	\$17,540,000	\$38,290,000	\$36,510,000	\$68,450,000	\$51,640,000	\$85,660,000	\$81,020,000	\$118,930,000	\$3,293,712	\$6,096,537	2.53%	2.25%
St. James	\$0	\$34,640,000	\$29,420,000	\$67,680,000	\$42,890,000	\$88,590,000	\$77,580,000	\$136,280,000	\$2,174,799	\$6,045,890	1.67%	2.23%
Jacksonville	\$12,850,000	\$33,790,000	\$28,050,000	\$64,020,000	\$38,330,000	\$86,720,000	\$72,480,000	\$152,960,000	\$2,555,902	\$5,930,039	1.96%	2.19%
Sneads Ferry	\$10,290,000	\$24,530,000	\$21,170,000	\$35,940,000	\$27,960,000	\$43,070,000	\$38,900,000	\$58,270,000	\$1,850,792	\$3,334,695	1.42%	1.23%
Caswell Beach	\$8,010,000	\$15,510,000	\$14,780,000	\$28,920,000	\$21,070,000	\$42,640,000	\$36,610,000	\$67,900,000	\$1,394,940	\$2,712,547	1.07%	1.00%
Leland	\$5,430,000	\$12,710,000	\$11,660,000	\$27,430,000	\$16,080,000	\$37,030,000	\$33,880,000	\$63,920,000	\$1,090,732	\$2,461,169	0.84%	0.91%
Kings Grant	\$4,420,000	\$11,570,000	\$10,570,000	\$23,640,000	\$15,440,000	\$30,390,000	\$28,250,000	\$45,090,000	\$960,990	\$2,072,285	0.74%	0.76%
Kure Beach	\$30,000	\$1,380,000	\$1,030,000	\$19,550,000	\$3,990,000	\$28,830,000	\$25,190,000	\$44,240,000	\$234,627	\$1,458,759	0.18%	0.54%
Silver Lake	\$1,010,000	\$3,350,000	\$3,030,000	\$18,100,000	\$4,980,000	\$27,600,000	\$24,390,000	\$54,130,000	\$368,333	\$1,523,070	0.28%	0.56%
Shallotte	\$3,160,000	\$10,400,000	\$9,240,000	\$17,880,000	\$12,270,000	\$22,250,000	\$19,920,000	\$32,470,000	\$772,246	\$1,616,853	0.59%	0.60%
Southport	\$3,740,000	\$9,850,000	\$8,630,000	\$17,370,000	\$11,650,000	\$21,880,000	\$19,480,000	\$33,560,000	\$760,099	\$1,573,436	0.58%	0.58%
Piney Green	\$3,030,000	\$8,220,000	\$6,730,000	\$15,540,000	\$9,580,000	\$20,690,000	\$17,580,000	\$32,620,000	\$615,837	\$1,410,797	0.47%	0.52%
Half Moon	\$3,810,000	\$10,240,000	\$8,810,000	\$15,240,000	\$11,310,000	\$17,900,000	\$16,320,000	\$24,350,000	\$747,729	\$1,402,930	0.57%	0.52%
Swansboro	\$2,060,000	\$4,470,000	\$3,850,000	\$6,770,000	\$4,920,000	\$8,180,000	\$7,330,000	\$11,680,000	\$344,040	\$627,118	0.26%	0.23%
Calabash	\$0	\$3,540,000	\$3,150,000	\$6,370,000	\$4,290,000	\$7,960,000	\$7,130,000	\$11,330,000	\$224,400	\$568,244	0.17%	0.21%
Hightsville	\$2,200,000	\$3,920,000	\$3,710,000	\$6,010,000	\$4,580,000	\$7,740,000	\$6,980,000	\$12,600,000	\$337,327	\$572,673	0.26%	0.21%
Castle Hayne	\$280,000	\$1,370,000	\$1,190,000	\$5,640,000	\$2,080,000	\$9,260,000	\$8,020,000	\$20,600,000	\$131,491	\$515,182	0.10%	0.19%
Wrightsboro	\$2,990,000	\$3,950,000	\$3,850,000	\$4,890,000	\$4,260,000	\$5,550,000	\$5,340,000	\$7,960,000	\$363,552	\$474,689	0.28%	0.18%
Skippers Corner	\$430,000	\$1,510,000	\$1,390,000	\$3,810,000	\$2,340,000	\$5,640,000	\$5,040,000	\$11,830,000	\$131,792	\$354,300	0.10%	0.13%
Navassa	\$670,000	\$1,520,000	\$1,400,000	\$3,310,000	\$1,940,000	\$4,880,000	\$4,320,000	\$11,210,000	\$133,473	\$321,193	0.10%	0.12%
Varnamtown	\$830,000	\$1,320,000	\$1,220,000	\$2,160,000	\$1,500,000	\$2,670,000	\$2,390,000	\$4,070,000	\$116,118	\$198,214	0.09%	0.07%
Belville	\$120,000	\$620,000	\$580,000	\$1,650,000	\$1,000,000	\$2,420,000	\$2,120,000	\$4,320,000	\$52,575	\$147,794	0.04%	0.05%
Pumpkin Center	\$0	\$40,000	\$30,000	\$60,000	\$40,000	\$80,000	\$70,000	\$200,000	\$2,157	\$6,131	0.00%	0.00%
Total	\$593 340 000	\$1,653,800,000	\$1 480 810 000	\$3,026,980,000	\$2 101 770 000	\$3 858 760 000	\$3 504 770 000	\$5,639,390,000	\$130 315 874	\$270 930 857	100.00%	100.00%

Figure 4-10: Planning Reach NC_02 Consequences and Risk Details (top 35 of 43 census places)

4.2.2 South Carolina

4.2.2.1 Planning Reach SC_03: Northern South Carolina Coast

This section describes dollar damage storm surge risk for Planning Reach SC_03, the northern-most coastal region of South Carolina. All estimates shown are in FY 2018 price levels. **Figure 4-11** displays the number, occupancy type, and total value (structure + content + vehicle value) in Planning Reach SC_03 in the 0.2-percent AEP event flood extent, based on the NSI 2.0 structure inventory data for the northern South Carolina coastal region. **Figure 4-12** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-13** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.



Figure 4-11: Planning Reach SC_03 Exposure Details

There are approximately 169,000 structures with a total estimated exposure value of more than \$129 billion. Most of the assets and asset values are single-family residential, multi-family residential, and commercial. Multi-family residential buildings comprise approximately 41 percent of the exposure value, but only 22 percent of the total assets. The exposure extent includes four counties, 16 census places, 4,068 census blocks, and approximately 800,000 acres.

Northern South Carolina has a primarily ocean-facing shoreline that is susceptible to flood hazards. Hazards propagate over shorelines located in Horry and Georgetown counties. Maximum surge depths modeled range from 8.3 to 16.7 feet in existing conditions to 11.3 to 19.7 feet in future conditions.

Overall risk for the planning reach ranges between \$133 million and \$286 million. Of the four counties exposed, the greatest risk is in Horry and Georgetown counties. There is potential for relatively small coastal flood impacts in Williamsburg and Marion counties. Of the 15 exposed census places, most of the census place risk is concentrated in North Myrtle Beach, Garden City, Socastee, Murrells Inlet, Georgetown, Surfside Beach, Little River, and Myrtle Beach. North Myrtle Beach accounts for approximately 40 percent of the census place risk. In addition, approximately 50 percent of risk tends to be in more rural areas. The number of medium- to high-risk census blocks increases by 117 percent between existing and future conditions with sea level rise.

SC_03 : Northern	South Carolina	\sim
\$132,504,874 Existing Risk	\$286,330,137 Future Risk	
695,024 # Acres Impacted	4013 # Census Blocks Impacted	
2 # Counties Impacted	15 # Census Places Impacted	

Existing Maximum Surge Elevation per Return Period Event by County

(ft)

12.00 8.70

EC_100Yr EC_500Yr

13.60 16.70

County	# Census Blocks	Acres	Existing Risk	Future Risk	
Horry	2750	331,473	\$69,243,881	\$147,486,866	
Georgetown	1263	363,550	\$63,260,993	\$138,843,271	
Total	4013	695,024	\$132,504,874	\$286,330,137	

Future Maximum Surge Elevation per Return Period Event by County (ft)

Shoreline FC_10Yr FC_50Yr FC_100Y FC_500Yr

11.70 15.00 16.60

11.30 14.40 15.90 18.90

19.70

Coastal

Counties

Ocean

Georgetown Ocean

Horry

Existing Risk by Census Block CB Risk Rating # Census Blocks Acres Existing Risk 2-Med-High 1,376 \$15,053,443 41 21,541 \$39,530,235 3-Med 4-Low-Med 146 27,222 \$42.008.394 5-Low 44.884 \$35,912,802

4013 695,024 \$132,504,874

Total

	Future Risk b	y Census	Block
CB Risk Rating	# Census Blocks	Acres	Future Risk
1-High	5	838	\$21,303,570
2-Med-High	27	8,849	\$56,701,340
3-Med	72	30,173	\$70,201,420
4-Low-Med	237	28,138	\$72,068,665
5-Low	3672	627,025	\$66,055,142
Total	4013	695,024	\$286,330,137

Census Places with Greatest Risk

Ocean

Reach

Coastal Counties

Horry

Shoreline EC_10Yr EC_50Yr

Georgetown Ocean 8.30 11.40 12.90 15.90





Census Place Risk Rating •2-Med-High •3-Med •4-Low-Med •5-Low



Figure 4-12: Planning Reach SC_03 Risk Details

					insequences or n	in permit eren		-				
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
											Risk	Risk
				-								
North Myrtle Beach	\$119,750,000	\$294,790,000	\$340,600,000	\$632,430,000	\$508,960,000	\$849,710,000	\$940,260,000	\$1,253,730,000	\$30,339,966	\$55,423,304	45.82%	39.80%
Garden City	\$22,490,000	\$68,910,000	\$74,390,000	\$180,310,000	\$126,900,000	\$251,400,000	\$251,730,000	\$508,660,000	\$6,900,481	\$16,183,494	10.42%	11.62%
Socastee	\$25,870,000	\$54,530,000	\$58,360,000	\$151,390,000	\$98,500,000	\$236,470,000	\$241,850,000	\$492,050,000	\$5,997,154	\$14,075,633	9.06%	10.11%
Murrells Inlet	\$20,880,000	\$65,850,000	\$67,970,000	\$141,990,000	\$107,600,000	\$195,330,000	\$205,360,000	\$340,150,000	\$6,094,976	\$12,824,353	9.20%	9.21%
Georgetown	\$6,850,000	\$24,830,000	\$24,200,000	\$114,860,000	\$38,670,000	\$166,280,000	\$98,070,000	\$291,380,000	\$2,300,381	\$9,407,488	3.47%	6.76%
Surfside Beach	\$14,890,000	\$39,820,000	\$42,000,000	\$98,250,000	\$70,950,000	\$134,080,000	\$135,360,000	\$213,610,000	\$3,936,635	\$8,501,083	5.94%	6.11%
Little River	\$30,980,000	\$49,710,000	\$51,840,000	\$84,440,000	\$66,030,000	\$109,060,000	\$110,970,000	\$165,480,000	\$4,832,256	\$7,764,750	7.30%	5.58%
Myrtle Beach	\$5,390,000	\$17,830,000	\$21,630,000	\$75,520,000	\$49,500,000	\$117,200,000	\$113,020,000	\$299,690,000	\$2,314,098	\$6,967,657	3.49%	5.00%
Pawleys Island	\$10,450,000	\$31,550,000	\$32,680,000	\$65,270,000	\$49,820,000	\$86,250,000	\$89,510,000	\$127,870,000	\$2,873,266	\$5,742,447	4.34%	4.12%
Forestbrook	\$1,080,000	\$5,240,000	\$5,800,000	\$19,230,000	\$11,540,000	\$32,330,000	\$33,250,000	\$76,030,000	\$607,380	\$1,822,736	0.92%	1.31%
Briarcliffe Acres	\$0	\$270,000	\$270,000	\$570,000	\$400,000	\$820,000	\$870,000	\$1,340,000	\$21,044	\$52,470	0.03%	0.04%
Atlantic Beach	\$0	\$0	\$0	\$10,000	\$10,000	\$20,000	\$30,000	\$180,000	\$293	\$1,498	0.00%	0.00%
Bucksport	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$10,210,000	\$0	\$61,434	0.00%	0.04%
Conway	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$60,860,000	\$0	\$365,280	0.00%	0.26%
Red Hill	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$7,940,000	\$0	\$47,646	0.00%	0.03%
Total	\$258,630,000	\$653,330,000	\$719,740,000	\$1,564,270,000	\$1,128,880,000	\$2,178,950,000	\$2,220,280,000	\$3,849,180,000	\$66,217,930	\$139,241,273	100.00%	100.00%

Consequences & Risk per AEP Event by Census Place

Figure 4-13: Planning Reach SC_03 Consequences and Risk Details

4.2.2.2 Planning Reach SC_04: Southern South Carolina Coast

This section describes dollar damage storm surge risk for Planning Reach SC_04, the southern-most coastal region of South Carolina. All estimates shown are in FY 2018 price levels. **Figure 4-14** displays the number, occupancy type, and total value (structure + content + vehicle value) in Planning Reach SC_04 in the 0.2-percent AEP event flood extent, based on the NSI 2.0 structure inventory data for the southern South Carolina coastal region. **Figure 4-15** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-16** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.



Figure 4-14: Planning Reach SC_04 Exposure Details

There are approximately 342,000 structures with a total estimated exposure value of more than \$224 billion. Most of the assets and asset values are single-family residential, multi-family residential, and commercial. Single-family residences comprise 80 percent of the buildings and 53 percent of the exposed value. Commercial buildings comprise 25 percent of the exposure value, and 9 percent of the assets. Multi-family residential buildings comprise approximately 15 percent of the exposure value, and 8 percent of the assets. The exposure extent includes seven counties, 33 census places, 9,995 census blocks, and approximately 1.5 million acres.

Southern South Carolina has a primarily ocean-facing shoreline that is susceptible to flood hazards. Hazards propagate over shorelines located in Beaufort, Jasper, Colleton, and Charleston counties. Maximum surge depths modeled range from 6.2 to 15.9 feet in existing conditions to 9.2 to 18.9 feet in future conditions.

Overall risk for the planning reach ranges between \$715 million and \$1.5 billion. Of the seven counties exposed, the greatest risk is in Charleston, Beaufort, Berkely, and Dorchester counties. There is potential for relatively smaller coastal flood impacts in Colleton, Jasper, and Hampton counties. Of the 33 exposed census places, most of the census place risk is concentrated in Charleston (approximately 26 percent), Hilton Head Island (26 percent), and Mount Pleasant (approximately 25 percent). In addition, approximately 22 percent of risk tends to be in more rural areas. The number of mediumto high-risk census blocks increases by 135 percent between existing and future conditions with sea level rise.

Reach

SC_04 : Southern South Carolina

715,346,341	\$1,520,479,050
Existing Risk	Future Risk
1,285,034	9121
# Acres Impacted	# Census Blocks Impacted
4	32
# Counties Impacted	# Census Places Impacted

County	# Census Blocks	Acres	Existing Risk	Future Risk		
Charleston	6337	468,781	\$440,226,198	\$967,007,993		
Beaufort	2228	377,581	\$267,995,582	\$531,701,420		
Colleton	302	241,371	\$3,862,522	\$13,884,566		
Jasper	254	197,302	\$3,262,039	\$7,885,071		
Total	9121	1,285,034	\$715,346,341	\$1,520,479,050		

(ft)

11.30 14.40 15.90 18.90

Existing & Euture Bick by County

CB Risk Rating	# Census Blocks	Acres	Existing Risk		
1-High	22	25,347	\$121,862,362		
2-Med-High	47	21,724	\$103,957,926		
3-Med	145	45,677	\$140,541,493		
4-Low-Med	647	174,607	\$196,425,649		
5-Low	8260	1,017,680	\$152,558,911		
Total	9121	1 285 034	\$715 346 341		

Future Risk by Census Block

55

115

1176

7452

46,412 \$368,279,536

37,071 \$267,451,253

217,799 \$356,127,519 899,146 \$220,166,746

323 84.606 \$308,453,996

9121 1,285,034 \$1,520,479,050

CB Risk Rating # Census Blocks Acres Future Risk

1-High

3-Med

5-Low

Total

2-Med-High

4-Low-Med

Existing Maximum Surge Elevation per Return Period Event by County Future Maximum Surge Elevation per Return Period Event by County

			(ft)					(ft)				
Coastal Counties	Shoreline	EC_10Yr	EC_50Yr	EC_100Yr	EC_500Yr		Coastal Counties	Shoreline	FC_10Yr	FC_50Yr	FC_100Y r	FC_500Yr
Jasper	Ocean	8.30	11.40	12.90	15.90		Jasper	Ocean	11.30	14.40	15.90	18.90
Colleton	Ocean	6.20	8.50	9.70	11.90		Colleton	Ocean	9.20	11.50	12.70	14.90
Charleston	Ocean	7.10	9.80	11.10	13.70		Charleston	Ocean	10.10	12.80	14.10	16.70
Beaufort	Ocean	8.30	11.40	12.90	15.90		Reaufort	Ocean	11 30	14.40	15.90	18.90

Census	Places	with	Greatest Risk	
census	i nucco		Orcutest mish	

Existing Risk ● Future Risk ● Risk Change



Figure 4-15: Planning Reach SC_04 Risk Details

V

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St.	Matthews	Manning K	Cades Indianto ingstree Nes	wn mith
Orang	geburg 📑	Lake Marion	Trio	s Hills
Bamberg	Ta Holly	St Stepl	hen	Georgeto
	St George	Moncks Coner	Francis Marion National For	est
Hampton	Walterboro	Ose et Hannan North Charles	ton	
Esul	Hendersonville	Charles Holly Jod	to	
Ridgeland	Coosiw River Morgan I sufort Isand			
o Savannah	Hiton Head Island			
Tybe: Wassaw National Wildlife Refuge	elsland			

Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
				•							RISK	RISK
Charleston	\$529,020, <mark>0</mark> 00	\$1,668,090,000	\$1,512,180,000	\$3,619,400,000	\$2,332,760,0 <mark>0</mark> 0	\$4,734,490,000	\$4,273,900,000	\$6,809,940,000	\$135,851,6 <mark>9</mark> 4	\$313,061,830	24.24%	26.15%
Hilton Head Island	\$560,620,000	\$1,920,140,000	\$1,926,600,000	\$3,568,200,000	\$2,701,730,000	\$4,441,860,000	\$4,347,010,000	\$6,061,050,000	\$159,517,270	\$313,722,508	28.46%	26.21%
Mount Pleasant	\$671,390,000	\$1,873,680,000	\$1,744,290,000	\$3,398,670,000	\$2,459,770,000	\$4,129,910,000	\$3,936,620,000	\$5,829,560,000	\$151,108,218	\$300,038,210	26.96%	25.06%
Kiawah Island	\$51,770,000	\$215,830,000	\$173,860,000	\$459,520,000	\$252,690,000	\$571,320,000	\$421,040,000	\$757,550,000	\$14,694,439	\$38,998,283	2.62%	3.26%
North Charleston	\$85,740,000	\$235,380,000	\$217,120,000	\$409,590,000	\$298,110,000	\$563,140,000	\$510,570,000	\$868,630,000	\$18,944,094	\$38,125,975	3.38%	3.18%
James Island	\$29,070,000	\$108,660,000	\$94,350,000	\$372,450,000	\$187,600,000	\$456,190,000	\$391,080,000	\$616,590,000	\$9,443,675	\$28,912,526	1.68%	2.42%
Folly Beach	\$88,620,000	\$204,390,000	\$188,320,000	\$333,930,000	\$259,810,000	\$409,600,000	\$415,160,000	\$541,900,000	\$16,848,227	\$30,139,767	3.01%	2.52%
Isle of Palms	\$13,050,000	\$150,770,000	\$41,000,000	\$291,710,000	\$208,340,000	\$405,680,000	\$340,260,000	\$600,790,000	\$6,284,429	\$26,410,468	1.12%	2.21%
Seabrook Island	\$46,420,000	\$138,030,000	\$132,230,000	\$261,670,000	\$208,000,000	\$320,530,000	\$332,950,000	\$435,380,000	\$11,676,818	\$22,792,519	2.08%	1.90%
Port Royal	\$24,240,000	\$128,300,000	\$133,090,000	\$245,300,000	\$193,450,000	\$324,000,000	\$342,410,000	\$444,120,000	\$10,754,586	\$21,751,647	1.92%	1.82%
Sullivan's Island	\$31,780,000	\$97,590,000	\$75,900,000	\$175,420,000	\$102,800,000	\$215,310,000	\$164,080,000	\$284,580,000	\$6,599,614	\$15,439,558	1.18%	1.29%
Beaufort	\$16,920,000	\$79,230,000	\$85,890,000	\$155,790,000	\$127,120,000	\$241,010,000	\$252,220,000	\$410,810,000	\$7,197,690	\$14,811,379	1.28%	1.24%
Edisto Beach	\$5,530,000	\$19,150,000	\$13,060,000	\$128,440,000	\$24,400,000	\$149,250,000	\$134,820,000	\$196,480,000	\$1,839,043	\$9,067,684	0.33%	0.76%
Burton	\$2,710,000	\$8,870,000	\$9,790,000	\$43,580,000	\$17,440,000	\$66,670,000	\$67,050,000	\$124,210,000	\$1,109,202	\$3,661,480	0.20%	0.31%
Hollywood	\$6,480,000	\$19,500,000	\$17,890,000	\$39,600,000	\$25,710,000	\$51,660,000	\$47,640,000	\$84,440,000	\$1,581,017	\$3,534,047	0.28%	0.30%
Meggett	\$5,030,000	\$18,650,000	\$16,720,000	\$35,270,000	\$24,590,000	\$43,010,000	\$40,730,000	\$57,410,000	\$1,423,086	\$3,065,263	0.25%	0.26%
Shell Point	\$4,520,000	\$16,010,000	\$15,600,000	\$30,910,000	\$25,220,000	\$39,820,000	\$41,760,000	\$56,920,000	\$1,360,618	\$2,729,339	0.24%	0.23%
McClellanville	\$8,870,000	\$14,680,000	\$14,130,000	\$28,050,000	\$17,810,000	\$36,820,000	\$31,790,000	\$51,790,000	\$1,340,357	\$2,491,789	0.24%	0.21%
Hardeeville	\$860,000	\$7,460,000	\$7,740,000	\$23,320,000	\$14,720,000	\$34,250,000	\$34,250,000	\$66,280,000	\$720,154	\$2,054,396	0.13%	0.17%
Bluffton	\$1,010,000	\$4,220,000	\$4,510,000	\$20,210,000	\$10,420,000	\$39,570,000	\$39,570,000	\$109,730,000	\$575,225	\$2,093,493	0.10%	0.17%
Awendaw	\$2,060,000	\$6,320,000	\$5,650,000	\$12,940,000	\$8,450,000	\$16,930,000	\$15,610,000	\$28,270,000	\$506,601	\$1,157,771	0.09%	0.10%
Rockville	\$1,840,000	\$5,340,000	\$4,960,000	\$9,660,000	\$6,920,000	\$11,870,000	\$11,040,000	\$15,670,000	\$425,445	\$849,146	0.08%	0.07%
Ravenel	\$810,000	\$3,880,000	\$3,440,000	\$9,510,000	\$5,850,000	\$12,040,000	\$11,260,000	\$17,350,000	\$309,145	\$796,472	0.06%	0.07%
Ridgeland	\$110,000	\$2,870,000	\$2,720,000	\$9,130,000	\$5,850,000	\$13,830,000	\$13,890,000	\$25,940,000	\$262,801	\$805,790	0.05%	0.07%
Jacksonboro	\$270,000	\$1,170,000	\$840,000	\$2,820,000	\$1,450,000	\$4,240,000	\$3,160,000	\$6,630,000	\$80,194	\$251,422	0.01%	0.02%
Yemassee	\$120,000	\$920,000	\$980,000	\$2,560,000	\$1,740,000	\$3,450,000	\$3,450,000	\$5,100,000	\$85,176	\$214,454	0.02%	0.02%
Laurel Bay	\$10,000	\$40,000	\$30,000	\$670,000	\$60,000	\$2,880,000	\$2,870,000	\$10,000,000	\$19,638	\$117,434	0.00%	0.01%
Total	\$2,188,870,000	\$6,949,170,000	\$6,442,890,000	\$13,688,320,00	\$9,522,810,000	\$17,339,330,00	\$16,226,190,000	\$24,517,120,000	\$560,558,456	\$1,197,094,650	100.00%	100.00%

Consequences & Risk per AEP Event by Census Place

Figure 4-16: Planning Reach SC_04 Consequences and Risk Details
4.2.3 Georgia

4.2.3.1 Planning Reach GA_05: Coastal Georgia

This section describes dollar damage storm surge risk for Planning Reach GA_05, the coastal region of Georgia. All estimates shown are in FY 2018 price levels. **Figure 4-17** displays the number, occupancy type, and total value (structure + content + vehicle value) in Planning Reach GA_05 in the 0.2-percent AEP event flood extent, based on the NSI 2.0 structure inventory data for the Georgia coastal region. **Figure 4-18** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-19** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.

There are approximately 216,000 structures with a total estimated exposure value of more than \$131 billion. Most of the assets and asset values are single-family residential, multi-family residential, and commercial. Single-family residences comprise 76 percent of the buildings and 44 percent of the exposed value. Commercial buildings comprise 9 percent of the exposure value, and 32 percent of the assets. Multi-family residential buildings comprise 9 percent of the exposure value, and 32 percent of the assets. Multi-family residential buildings comprise approximately 12 percent of the exposure value, and 13 percent of the assets. The exposure extent includes eight counties, 31 census places, 5,006 census blocks, and approximately 1.2 million acres.

Coastal Georgia has a primarily ocean-facing shoreline that is susceptible to flood hazards. Hazards propagate over shorelines located in Chatham, Glynn, Camden, Bryan, Liberty, and McIntosh counties. Maximum surge depths range from 5.7 to 11.8 feet in existing conditions to 8.7 to 14.8 feet in future conditions.

Overall risk for the planning reach ranges between \$134 million and \$383 million. Of the eight counties exposed, the greatest risk is in Chatham, Glynn, Camden, Bryan, Liberty, and McIntosh counties. There is potential for relatively smaller coastal flood impacts in Charlton and Brantley counties. Of the 31 exposed census places, the top five highest-risk population centers include St. Simons, Skidaway Island, Wilmington Island, Savannah, and Brunswick. In addition, 28 to 29 percent of risk tends to be in more rural areas. The number of medium- to high-risk census blocks increases by 220 percent between existing and future conditions with sea level rise.



Figure 4-17: Planning Reach GA_05 Exposure Details



Figure 4-18: Planning Reach GA_05 Risk Details

Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing Risk	% of Future Risk
St. Simons	\$61,830,000	\$271,000,000	\$193,840,000	\$621,980,000	\$289,950,000	\$842,760,000	\$641,020,000	\$1,219,540,000	\$17,655,097	\$53,731,097	18.71%	19.43%
Skidaway Island	\$43,390,000	\$132,420,000	\$105,650,000	\$363,570,000	\$167,720,000	\$565,150,000	\$409,140,000	\$837,820,000	\$10,455,368	\$31,769,426	11.08%	11.49%
Wilmington Island	\$25,860,000	\$97,890,000	\$75,890,000	\$276,060,000	\$131,770,000	\$485,220,000	\$348,050,000	\$735,230,000	\$7,724,060	\$25,117,810	8.19%	9.08%
Savannah	\$30,630,000	\$115,040,000	\$76,130,000	\$257,860,000	\$137,630,000	\$362,290,000	\$290,540,000	\$741,800,000	\$7,635,885	\$23,914,950	8.09%	8.65%
Brunswick	\$2,020,000	\$92,830,000	\$65,020,000	\$229,070,000	\$105,660,000	\$326,130,000	\$243,360,000	\$524,260,000	\$6,219,421	\$20,107,203	6.59%	7.27%
Whitemarsh Island	\$28,160,000	\$95,430,000	\$77,020,000	\$177,130,000	\$111,390,000	\$233,200,000	\$195,380,000	\$347,910,000	\$6,766,450	\$15,976,360	7.17%	5.78%
St. Marys	\$16,280,000	\$79,630,000	\$50,840,000	\$174,650,000	\$86,270,000	\$244,380,000	\$180,050,000	\$407,040,000	\$4,797,446	\$15,687,918	5.08%	5.67%
Tybee Island	\$21,760,000	\$64,500,000	\$50,530,000	\$133,140,000	\$79,620,000	\$185,910,000	\$151,420,000	\$269,630,000	\$4,768,475	\$11,866,566	5.05%	4.29%
Georgetown	\$18,880,000	\$68,110,000	\$53,460,000	\$128,260,000	\$79,630,000	\$167,120,000	\$141,430,000	\$268,870,000	\$4,724,944	\$11,614,682	5.01%	4.20%
Montgomery	\$29,000,000	\$64,510,000	\$56,180,000	\$121,850,000	\$69,860,000	\$162,820,000	\$125,880,000	\$256,810,000	\$5,071,574	\$11,069,715	5.37%	4.00%
Isle of Hope	\$10,090,000	\$45,200,000	\$32,890,000	\$106,590,000	\$57,110,000	\$144,970,000	\$118,970,000	\$215,310,000	\$3,110,755	\$9,201,429	3.30%	3.33%
Country Club Estates	\$11,460,000	\$43,200,000	\$32,220,000	\$82,760,000	\$45,660,000	\$106,610,000	\$94,660,000	\$174,500,000	\$2,887,394	\$7,460,144	3.06%	2.70%
Dutch Island	\$15,720,000	\$49,890,000	\$40,310,000	\$80,990,000	\$56,730,000	\$98,400,000	\$87,920,000	\$120,860,000	\$3,481,006	\$7,251,005	3.69%	2.62%
Garden City	\$1,090,000	\$17,150,000	\$10,600,000	\$58,370,000	\$27,160,000	\$82,320,000	\$65,180,000	\$137,940,000	\$1,156,700	\$4,884,815	1.23%	1.77%
Richmond Hill	\$2,980,000	\$12,430,000	\$9,300,000	\$53,000,000	\$19,470,000	\$82,220,000	\$60,960,000	\$194,490,000	\$1,078,805	\$4,790,320	1.14%	1.73%
Thunderbolt	\$11,640,000	\$34,260,000	\$28,940,000	\$50,170,000	\$38,040,000	\$56,770,000	\$52,520,000	\$67,240,000	\$2,425,919	\$4,542,459	2.57%	1.64%
Midway	\$0	\$530,000	\$20,000	\$38,050,000	\$12,100,000	\$60,670,000	\$39,760,000	\$89,150,000	\$348,243	\$2,814,393	0.37%	1.02%
Port Wentworth	\$950,000	\$11,570,000	\$7,700,000	\$32,950,000	\$15,200,000	\$47,240,000	\$37,800,000	\$78,010,000	\$749,261	\$2,838,200	0.79%	1.03%
Dock Junction	\$3,460,000	\$11,580,000	\$8,960,000	\$25,430,000	\$12,330,000	\$34,950,000	\$26,340,000	\$62,810,000	\$811,458	\$2,301,459	0.86%	0.83%
Pooler	\$0	\$3,820,000	\$1,090,000	\$22,040,000	\$5,510,000	\$38,140,000	\$26,730,000	\$92,970,000	\$258,705	\$2,046,742	0.27%	0.74%
Kingsland	\$1,730,000	\$9,080,000	\$6,030,000	\$21,900,000	\$10,000,000	\$35,670,000	\$23,070,000	\$73,840,000	\$569,371	\$2,114,638	0.60%	0.76%
Henderson	\$0	\$6,840,000	\$2,750,000	\$21,300,000	\$9,020,000	\$32,110,000	\$25,020,000	\$49,140,000	\$354,966	\$1,816,333	0.38%	0.66%
Talahi Island	\$2,790,000	\$10,810,000	\$8,370,000	\$21,200,000	\$12,740,000	\$29,700,000	\$24,100,000	\$47,350,000	\$747,597	\$1,937,998	0.79%	0.70%
Darien	\$1,840,000	\$5,730,000	\$4,920,000	\$9,360,000	\$6,070,000	\$11,430,000	\$9,420,000	\$15,720,000	\$405,404	\$848,155	0.43%	0.31%
Riceboro	\$10,000	\$480,000	\$270,000	\$3,430,000	\$1,060,000	\$4,940,000	\$3,640,000	\$9,580,000	\$43,802	\$275,598	0.05%	0.10%
Woodbine	\$300,000	\$1,160,000	\$770,000	\$3,360,000	\$1,590,000	\$5,850,000	\$3,460,000	\$16,990,000	\$82,143	\$352,023	0.09%	0.13%
Vernonburg	\$10,000	\$590,000	\$360,000	\$1,580,000	\$770,000	\$2,100,000	\$1,710,000	\$3,190,000	\$33,700	\$132,727	0.04%	0.05%
Hinesville	\$0	\$0	\$0	\$320,000	\$0	\$1,020,000	\$440,000	\$5,230,000	\$2,622	\$55,164	0.00%	0.02%
Flemington	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$10,000	\$12	\$189	0.00%	0.00%
Kings Bay Base	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$10,000	\$0	\$72	0.00%	0.00%
Total	\$361,880,000	\$1,345,680,000	\$1,000,060,000	\$3,116,370,000	\$1,590,060,000	\$4,450,090,000	\$3,427,970,000	\$7,063,250,000	\$94,366,583	\$276,519,590	100.00%	100.00%

Consequences & Risk per AEP Event by Census Place

Figure 4-19: Planning Reach GA_05 Consequences and Risk Details

4.2.4 Florida

4.2.4.1 Planning Reach FL_06: Northeast Florida Coast

This section describes coastal storm dollar damage risk for Planning Reach FL_06, which includes the Northeast Florida coastline. All estimates shown are in FY 2018 price levels. **Figure 4-20** displays the number, occupancy type, and total value (structure + content + vehicle value) in FL_06 in the 0.2-percent AEP event flood extent, based on the NSI 2.0 structure inventory data for the Northeast Florida coastal region. **Figure 4-21** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-22** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.



Figure 4-20: Planning Reach FL_06 Exposure Details

There are approximately 814,000 structures with a total estimated exposure value of more than \$478 billion. Most of the assets and asset values are single-family residential, multi-family residential, and commercial. Single-family residences comprise 77 percent of the buildings and 48 percent of the exposed value. Commercial buildings comprise 8 percent of the exposure value, and 28 percent of the assets. Multi-family residential buildings comprise approximately 16 percent of the exposure value, and 12 percent of the assets. The exposure extent includes eight counties, 56 census places, 9,988 census blocks, and approximately 1.3 million acres.

Coastal Northeast Florida has a primarily ocean-facing shoreline, riverine, and intracoastal waterways that are susceptible to coastal flood hazards. Flood hazards propagate over shorelines located in Nassau, Duval, St. Johns, Flagler, and Volusia counties. Maximum surge depths modeled range from 4.3 to 10.8 feet in existing conditions to 7.3 to 13.8 feet in future conditions. As illustrated in **Figure 4-21**, the risk is also present in communities along the St. Johns River and the Atlantic Intracoastal Waterway.

Overall risk for the planning reach ranges between \$415 million and \$1 billion. Of the eight counties exposed, the greatest risk is in Duval, St. Johns, Volusia, Flagler, and Nassau counties. There is potential for relatively smaller coastal flood impacts in Putnam and Lake counties. Of the 55 exposed census places, the top five highest-risk population centers include Jacksonville (approximately 34 percent), Palm Valley (approximately 15 percent), St. Augustine, New Smyrna, and Daytona Beach. In addition, 12 percent of the risk is distributed in more rural areas. The number of medium- to high-risk census blocks increases by 178 percent between existing and future conditions with sea level rise.



Figure 4-21: Planning Reach FL_06 Risk Details

				Con	sequences & Risk	per AEP Event by	Census Place					
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
				•							Risk	Risk
Jacksonville	\$897,600,000	\$1,960,820,000	\$1,602,190,000	\$3,462,560,000	\$1,999,560,000	\$4,457,970,000	\$3,451,270,000	\$5,484,110,000	\$146,727,600	\$307,290,625	39.79%	33.52%
Paim Valley	\$313,750,000	\$1,097,560,000	\$868,080,000	\$1,463,960,000	\$1,114,230,000	\$1,582,810,000	\$1,489,530,000	\$1,953,130,000	\$70,579,306	\$135,749,980	19.14%	14.81%
St. Augustine	\$118,280,000	\$520,720,000	\$444,660,000	\$741,430,000	\$534,830,000	\$850,180,000	\$712,640,000	\$1,048,780,000	\$33,828,363	\$68,140,471	9.17%	7.43%
New Smyrna Beach	\$57,510,000	\$316,360,000	\$157,670,000	\$580,680,000	\$281,050,000	\$664,570,000	\$501,850,000	\$836,780,000	\$14,941,565	\$49,790,549	4.05%	5.43%
Daytona Beach	\$54,640,000	\$243,160,000	\$117,220,000	\$547,820,000	\$198,430,000	\$615,840,000	\$387,350,000	\$758,940,000	\$11,572,590	\$44,471,788	3.14%	4.85%
Ormond Beach	\$24,530,000	\$196,500,000	\$76,540,000	\$413,440,000	\$144,660,000	\$461,840,000	\$290,900,000	\$568,080,000	\$7,471,829	\$34,031,884	2.03%	3.71%
Jacksonville Beach	\$44,070,000	\$128,180,000	\$91,730,000	\$405,490,000	\$129,310,000	\$589,990,000	\$403,440,000	\$727,240,000	\$9,476,368	\$33,050,520	2.57%	3.60%
Port Orange	\$26,260,000	\$162,150,000	\$81,910,000	\$397,150,000	\$121,000,000	\$459,530,000	\$260,740,000	\$565,790,000	\$7,392,202	\$31,887,486	2.00%	3.48%
South Daytona	\$14,630,000	\$146,740,000	\$49,070,000	\$355,350,000	\$87,710,000	\$401,410,000	\$233,120,000	\$493,960,000	\$4,982,330	\$28,431,884	1.35%	3.10%
Palm Coast	\$97,120,000	\$191,700,000	\$133,820,000	\$288,870,000	\$168,050,000	\$393,200,000	\$302,300,000	\$497,990,000	\$13,231,476	\$27,193,208	3.59%	2.97%
Holly Hill	\$3,640,000	\$106,530,000	\$11,590,000	\$276,180,000	\$65,400,000	\$314,210,000	\$177,220,000	\$386,530,000	\$2,320,662	\$21,839,359	0.63%	2.38%
Atlantic Beach	\$22,950,000	\$100,820,000	\$49,270,000	\$265,890,000	\$102,230,000	\$379,420,000	\$264,640,000	\$466,840,000	\$5,642,146	\$22,217,661	1.53%	2.42%
Neptune Beach	\$15,270,000	\$38,580,000	\$28,350,000	\$159,320,000	\$38,580,000	\$230,250,000	\$159,890,000	\$283,960,000	\$3,193,519	\$12,491,058	0.87%	1.36%
Edgewater	\$5,110,000	\$56,490,000	\$19,830,000	\$144,440,000	\$41,790,000	\$188,900,000	\$88,420,000	\$232,570,000	\$2,007,047	\$11,853,861	0.54%	1.29%
Flagler Beach	\$41,230,000	\$100,510,000	\$73,720,000	\$140,130,000	\$92,190,000	\$164,370,000	\$135,110,000	\$203,240,000	\$6,607,549	\$13,024,355	1.79%	1.42%
St. Augustine Beach	\$4,120,000	\$12,610,000	\$45,400,000	\$116,900,000	\$58,110,000	\$146,880,000	\$112,790,000	\$181,590,000	\$3,407,826	\$8,176,971	0.92%	0.89%
World Golf Village	\$6,590,000	\$48,230,000	\$25,430,000	\$98,440,000	\$48,230,000	\$131,350,000	\$95,930,000	\$161,590,000	\$2,417,548	\$8,510,175	0.66%	0.93%
Fernandina Beach	\$7,250,000	\$46,450,000	\$30,250,000	\$94,880,000	\$50,930,000	\$132,760,000	\$99,240,000	\$163,360,000	\$2,704,376	\$8,303,766	0.73%	0.91%
Fruit Cove	\$6,980,000	\$36,500,000	\$23,230,000	\$85,960,000	\$36,500,000	\$126,090,000	\$82,570,000	\$155,170,000	\$2,148,264	\$7,391,392	0.58%	0.81%
Butler Beach	\$14,060,000	\$43,080,000	\$39,250,000	\$75,780,000	\$57,950,000	\$121,350,000	\$104,490,000	\$164,480,000	\$3,477,638	\$7,213,712	0.94%	0.79%
Sawgrass	\$14,060,000	\$44,270,000	\$26,710,000	\$65,590,000	\$41,340,000	\$76,610,000	\$77,970,000	\$106,050,000	\$2,604,406	\$6,046,624	0.71%	0.66%
Villano Beach	\$9,870,000	\$30,430,000	\$17,040,000	\$44,960,000	\$23,710,000	\$51,730,000	\$35,100,000	\$63,970,000	\$1,587,087	\$4,088,524	0.43%	0.45%
Hastings	\$7,110,000	\$27,790,000	\$20,510,000	\$40,710,000	\$27,790,000	\$45,310,000	\$40,220,000	\$55,750,000	\$1,699,626	\$3,685,414	0.46%	0.40%
Oak Hill	\$6,400,000	\$19,230,000	\$12,890,000	\$34,140,000	\$16,470,000	\$39,490,000	\$26,570,000	\$49,220,000	\$1,141,984	\$2,956,064	0.31%	0.32%
Daytona Beach Shores	\$6,830,000	\$20,950,000	\$10,380,000	\$30,840,000	\$13,460,000	\$35,510,000	\$19,980,000	\$43,710,000	\$981,085	\$2,808,434	0.27%	0.31%
Glencoe	\$1,080,000	\$17,180,000	\$8,550,000	\$30,040,000	\$13,240,000	\$32,220,000	\$23,170,000	\$39,600,000	\$686,851	\$2,566,968	0.19%	0.28%
Nocatee	\$13,500,000	\$21,100,000	\$18,790,000	\$28,040,000	\$21,100,000	\$32,180,000	\$27,780,000	\$39,610,000	\$1,742,472	\$2,632,421	0.47%	0.29%
Ormond-by-the-Sea	\$740,000	\$10,430,000	\$4,140,000	\$23,960,000	\$7,370,000	\$28,210,000	\$15,760,000	\$34,670,000	\$378,177	\$1,959,134	0.10%	0.21%
St. Augustine Shores	\$2,410,000	\$9,730,000	\$7,370,000	\$21,380,000	\$10,750,000	\$27,710,000	\$21,790,000	\$34,040,000	\$655,307	\$1,805,541	0.18%	0.20%
Yulee	\$4,120,000	\$11,090,000	\$8,110,000	\$17,050,000	\$10,890,000	\$21,430,000	\$16,710,000	\$26,370,000	\$727,634	\$1,560,969	0.20%	0.17%
St. Augustine South	\$2,330,000	\$7,710,000	\$4,730,000	\$16,910,000	\$7,920,000	\$24,780,000	\$17,120,000	\$30,490,000	\$480,030	\$1,477,095	0.13%	0.16%
Ponce Inlet	\$3,370,000	\$10,340,000	\$9,400,000	\$15,770,000	\$13,550,000	\$18,400,000	\$20,100,000	\$23,020,000	\$800,082	\$1,428,699	0.22%	0.16%
Beverly Beach	\$2,330,000	\$9,140,000	\$5,700,000	\$13,430,000	\$8,030,000	\$15,470,000	\$11,420,000	\$19,020,000	\$491,077	\$1,223,496	0.13%	0.13%
Crescent Beach	\$2,740,000	\$8,380,000	\$5,530,000	\$12,630,000	\$9,730,000	\$14,900,000	\$14,670,000	\$18,600,000	\$534,557	\$1,149,669	0.14%	0.13%
Nassau Village-Ratliff	\$200,000	\$1,730,000	\$990,000	\$4,690,000	\$1,850,000	\$6,690,000	\$4,690,000	\$8,230,000	\$97,217	\$389,158	0.03%	0.04%
Total	\$1.852.680.000	\$5,803,190,000	\$4.130.050.000	\$10.514.810.000	\$5.597.940.000	\$12,883,560,000	\$9.726.490.000	\$15.926.480.000	\$368.737.796	\$916.838.915	100.00%	100.00%

Figure 4-22: Planning Reach FL_06 Consequences and Risk Details (top 35 of 56 census places)

4.2.4.2 Planning Reach FL_07: Central Eastern Florida Coast

This section describes dollar damage storm surge risk for Planning Reach FL_07, which includes the central eastern portion of the Florida coastline. All estimates shown are in FY 2018 price levels. Figure 4-23 displays the number, occupancy type, and total value (structure + content + vehicle value) in Planning Reach FL_07 in the 0.2-percent AEP event flood extent, based on the NSI 2.0 structure inventory data for the Central Eastern Florida coastal region. Figure 4-24 provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. Figure 4-25 provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.

There are approximately 464,000 structures with a total estimated exposure value of more than \$289 billion. Most of the assets and asset values are single-family residential, multi-family residential, and commercial. Single-family residences comprise 77 percent of the buildings and 47 percent of the exposed value. Commercial buildings comprise approximately 9 percent of the assets and 23 percent of the exposed value. Multi-family residential buildings comprise approximately 11 percent of the assets and 24 percent of the exposed value. The exposure extent includes four counties, 54 census places, 5,562 census blocks, and approximately 295,000 acres.

The Central Eastern Florida Coast has ocean-facing, back bay, and riverine shorelines that are susceptible to coastal flood hazards. Storm surge can propagate over shorelines located in Brevard, Martin, Indian River, and St. Lucie counties. Maximum surge depths modeled range from 3.6 to 10.5 feet in existing conditions to 6.6 to 13.5 feet in future conditions. As illustrated in **Figure 4-24**, the risk is also present in communities along the Indian River Lagoon. Overall risk for the planning reach ranges between \$394 million and \$893 million. Of the four counties exposed, the coastal storm risk is located in the coastal communities of Brevard, Martin, Indian River, and St. Lucie counties. Of the 53 exposed census places, the top five highest-risk population centers include Merritt Island (approximately 27 percent), Indian Harbour Beach (approximately 7 percent), Cocoa Beach, Palm City, and Vero Beach. In addition, 17 percent of the risk tends to be distributed in more rural areas. The number of medium- to high-risk census blocks increases by 152 percent between existing and future conditions with sea level rise.



\$289bn



Figure 4-23: Planning Reach FL 07 Exposure Details

39,929

8,419

2.150

1.688

1,142

836

Commercial

Industrial

Religion

Agriculture

Government

Education

23,080

22,485

4.194

1.549

34,388

13,827

4,820

2,405

3,317

1.182

9,950

4,933

1,089,952

781,411

16.990

5.253

764,384

236,951



Figure 4-24: Planning Reach FL_07 Risk Details

				Conse	quences & Risk p	er AEP Event by Ce	ensus Place					
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
				•							Risk	Risk
Merritt Island	\$368,110,000	\$1,463,320,000	\$967,370,000	\$2,186,350,000	\$1,503,040,000	\$2,455,690,000	\$2,313,830,000	\$2,852,290,000	\$85,664,630	\$196,135,552	26.95%	27.07%
Indian Harbour Beach	\$117,090,000	\$359,920,000	\$268,770,000	\$539,180,000	\$371,170,000	\$626,740,000	\$546,150,000	\$783,320,000	\$23,395,354	\$49,000,646	7.36%	6.76%
Cocoa Beach	\$96,380,000	\$271,240,000	\$209,660,000	\$450,510,000	\$279,600,000	\$536,600,000	\$450,940,000	\$695,260,000	\$18,512,307	\$40,120,629	5.82%	5.54%
Palm City	\$68,940,000	\$231,750,000	\$138,460,000	\$404,930,000	\$196,180,000	\$515,270,000	\$359,500,000	\$751,160,000	\$12,907,415	\$36,635,182	4.06%	5.06%
Vero Beach	\$15 <mark>4,140,000</mark>	\$313,010,000	\$219,280,000	\$375,780,000	\$283,190,000	\$420,130,000	\$358,080,000	\$558,900,000	\$20,731,169	\$36,563,968	6.52%	5.05%
Fort Pierce	\$57,740,000	\$234,660,000	\$160,360,000	\$362,090,000	\$213,090,000	\$427,900,000	\$325,480,000	\$560,310,000	\$13,396,027	\$32,892,408	4.21%	4.54%
Port St. Lucie	\$33,050,000	\$122,520,000	\$83,560,000	\$293,660,000	\$113,960,000	\$439,030,000	\$255,270,000	\$882,650,000	\$7,640,959	\$27,364,667	2.40%	3.78%
Hutchinson Island South	\$127,620,000	\$221,530,000	\$174,180,000	\$289,840,000	\$211,820,000	\$334,880,000	\$324,470,000	\$442,590,000	\$16,795,493	\$27,574,611	5.28%	3.81%
South Patrick Shores	\$67,210,000	\$204,030,000	\$137,470,000	\$270,600,000	\$195,450,000	\$310,210,000	\$297,320,000	\$394,960,000	\$12,418,360	\$25,500,896	3.91%	3.52%
Satellite Beach	\$56,370,000	\$173,300,000	\$141,690,000	\$253,300,000	\$206,020,000	\$305,390,000	\$303,230,000	\$409,050,000	\$12,305,366	\$23,532,589	3.87%	3.25%
Gifford	\$53,360,000	\$156,840,000	\$102,280,000	\$208,910,000	\$138,540,000	\$243,390,000	\$195,150,000	\$320,500,000	\$9,155,151	\$19,788,058	2.88%	2.73%
Stuart	\$18,150,000	\$91,990,000	\$42,270,000	\$207,850,000	\$69,600,000	\$303,000,000	\$174,750,000	\$517,780,000	\$4,302,834	\$18,867,586	1.35%	2.60%
Indian River Shores	\$57,110,000	\$139,870,000	\$85,350,000	\$201,130,000	\$113,920,000	\$233,210,000	\$154,260,000	\$298,290,000	\$8,077,195	\$18,533,612	2.54%	2.56%
Titusville	\$34,990,000	\$102,190,000	\$76,010,000	\$191,140,000	\$105,660,000	\$257,830,000	\$191,140,000	\$359,240,000	\$6,915,921	\$17,165,216	2.18%	2.37%
Hobe Sound	\$35,900,000	\$127,300,000	\$80,610,000	\$188,900,000	\$106,860,000	\$208,910,000	\$169,760,000	\$255,530,000	\$7,046,217	\$17,005,927	2.22%	2.35%
Cape Canaveral	\$44,890,000	\$140,210,000	\$101,370,000	\$185,710,000	\$142,350,000	\$239,060,000	\$244,220,000	\$452,820,000	\$9,103,557	\$18,832,661	2.86%	2.60%
Florida Ridge	\$40,350,000	\$118,130,000	\$71,370,000	\$153,890,000	\$91,410,000	\$172,300,000	\$127,980,000	\$201,730,000	\$6,416,128	\$14,410,087	2.02%	1.99%
South Beach	\$49,290,000	\$107,130,000	\$72,010,000	\$141,040,000	\$87,510,000	\$164,800,000	\$119,940,000	\$209,840,000	\$6,720,744	\$13,376,372	2.11%	1.85%
Melbourne	\$29,340,000	\$71,210,000	\$73,750,000	\$125,700,000	\$96,270,000	\$150,730,000	\$145,400,000	\$211,080,000	\$6,232,042	\$11,129,216	1.96%	1.54%
Sewall's Point	\$29,210,000	\$84,650,000	\$54,460,000	\$119,500,000	\$74,940,000	\$145,540,000	\$106,720,000	\$178,120,000	\$4,935,566	\$11,142,488	1.55%	1.54%
Vero Beach South	\$15,230,000	\$76,150,000	\$37,260,000	\$119,120,000	\$52,740,000	\$142,610,000	\$88,110,000	\$189,520,000	\$3,290,517	\$10,826,281	1.04%	1.49%
Port Salerno	\$13,080,000	\$54,650,000	\$32,380,000	\$102,910,000	\$48,170,000	\$129,160,000	\$90,660,000	\$196,310,000	\$2,958,105	\$9,158,087	0.93%	1.26%
North River Shores	\$6,140,000	\$34,990,000	\$17,640,000	\$66,670,000	\$28,130,000	\$86,030,000	\$56,750,000	\$120,570,000	\$1,633,667	\$5,897,204	0.51%	0.81%
Grant-Valkaria	\$16,810,000	\$44,330,000	\$33,340,000	\$65,150,000	\$42,340,000	\$74,940,000	\$62,580,000	\$93,540,000	\$2,929,603	\$5,940,301	0.92%	0.82%
Orchid	\$13,070,000	\$40,200,000	\$21,750,000	\$59,180,000	\$28,970,000	\$68,150,000	\$35,100,000	\$83,820,000	\$1,972,565	\$5,387,430	0.62%	0.74%
Cocoa	\$14,200,000	\$34,070,000	\$27,960,000	\$48,190,000	\$34,770,000	\$55,640,000	\$48,190,000	\$75,990,000	\$2,428,270	\$4,486,767	0.76%	0.62%
Palm Bay	\$12,020,000	\$29,770,000	\$23,310,000	\$44,820,000	\$30,400,000	\$53,240,000	\$45,790,000	\$73,530,000	\$2,078,848	\$4,128,907	0.65%	0.57%
White City	\$3,300,000	\$19,340,000	\$11,220,000	\$44,600,000	\$17,790,000	\$60,490,000	\$39,840,000	\$98,660,000	\$1,035,596	\$3,916,952	0.33%	0.54%
Wabasso Beach	\$9,320,000	\$31,800,000	\$18,700,000	\$42,820,000	\$25,450,000	\$48,900,000	\$45,580,000	\$75,370,000	\$1,717,937	\$4,090,562	0.54%	0.56%
River Park	\$2,310,000	\$11,500,000	\$6,580,000	\$40,150,000	\$10,360,000	\$61,120,000	\$33,520,000	\$117,680,000	\$684,441	\$3,523,225	0.22%	0.49%
Jensen Beach	\$3,390,000	\$15,990,000	\$9,680,000	\$31,250,000	\$14,000,000	\$46,980,000	\$27,070,000	\$104,130,000	\$860,129	\$3,093,886	0.27%	0.43%
St. Lucie Village	\$10,120,000	\$18,300,000	\$16,090,000	\$26,990,000	\$17,990,000	\$30,780,000	\$26,350,000	\$37,910,000	\$1,450,356	\$2,450,275	0.46%	0.34%
Patrick AFB	\$1,830,000	\$10,390,000	\$7,730,000	\$23,720,000	\$11,870,000	\$30,940,000	\$26,820,000	\$58,440,000	\$688,532	\$2,113,156	0.22%	0.29%
Port St. John	\$2,680,000	\$12,490,000	\$8,690,000	\$22,890,000	\$12,800,000	\$31,590,000	\$22,890,000	\$48,370,000	\$750,746	\$2,104,507	0.24%	0.29%
Wabasso	\$5,710,000	\$14,290,000	\$8,250,000	\$20,060,000	\$10,370,000	\$24,590,000	\$13,190,000	\$39,100,000	\$771,412	\$1,930,874	0.24%	0.27%
Total	\$1.668.450.000	\$5.183.060.000	\$3.540.860.000	\$7.908.530.000	\$4.986.730.000	\$9.435.770.000	\$7.826.030.000	\$12,748,360,000	\$317.923.159	\$724.620.785	100.00%	100.00%

Figure 4-25: Planning Reach FL_07 Consequences and Risk Details (top 35 of 54 census places)

4.2.4.3 Planning Reach FL_08: Southeast Florida Coast

This section describes dollar damage storm surge risk for Planning Reach FL_08, which includes the Southeast Florida coastline. All estimates shown are in FY 2018 price levels. **Figure 4-26** displays the number, occupancy type, and total value (structure + content + vehicle value) in Planning Reach FL_08 in the 0.2-percent AEP event flood extent, based on the NSI 2.0 structure inventory data for the Southeast Florida coastal region. **Figure 4-27** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-28** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.

There are approximately 2 million structures with a total estimated exposure value of more than \$1.1 trillion. Most of the assets and asset values are single-family residential, multi-family residential, and commercial. Single-family residences comprise 72 percent of the buildings and 39 percent of the exposed value. Commercial buildings comprise approximately 15 percent of the assets and 35 percent of the exposed value. Multi-family residential buildings comprise approximately 10 percent of the assets and 18 percent of the exposed value. The exposure extent includes three counties, 140 census places, 49,233 census blocks, and approximately 863,000 acres.

The Southeast Florida Coast has ocean-facing, back bay, and riverine shorelines and canal structures that are susceptible to coastal flood hazards. Storm surge can propagate over shorelines located in Palm Beach, Broward, and Miami-Dade counties. Maximum surge depths modeled range from 4.3 to 12.3 feet in existing conditions to 7.3 to 15.3 feet in future conditions. As illustrated in **Figure 4-27**, coastal flood risk can penetrate further inland owing to the rivers and canal infrastructure.

Overall risk for the planning reach ranges between \$3.6 billion and \$11.2 billion. Of the three counties exposed, the coastal storm risk is located in the coastal communities and low-lying areas in Palm Beach, Broward, and Miami-Dade counties. Of the 139 exposed census places, the highest-risk population centers include Miami, Pembroke Pines, Fort Lauderdale, Hialeah, Doral, Miramar, and Miami Beach. In addition, 7 percent of the risk tends to be distributed in more rural areas. The number of medium- to high-risk census blocks increases by 326 percent between existing and future conditions with sea level rise.





Figure 4-26: Planning Reach FL_08 Exposure Details



Figure 4-27: Planning Reach FL_08 Risk Details

				(Consequences & I	Risk per AEP Event l	by Census Place					
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
				•							Risk	Risk
Miami	\$1,254,190,000	\$4,933,390,000	\$2,542,960,000	\$7,549,430,000	\$3,524,330,000	\$9,216,000,000	\$5,760,400,000	\$12,135,620,000	\$230,881,670	\$692,823,409	8.36%	8.25%
Pembroke Pines	\$0	\$3,897,780,000	\$2,066,740,000	\$7,185,120,000	\$3,306,900,000	\$8,566,390,000	\$6,410,330,000	\$10,441,190,000	\$161,23 <mark>0</mark> ,149	\$618,980,015	5.83%	7.37%
Fort Lauderdale	\$827,160,000	\$4,153,490,000	\$2,365,160,000	\$6,736,060,000	\$3,563,030,000	\$8,120,970,000	\$6,211,480,000	\$10,457,760,000	\$208,867,565	\$605,110,841	7.56%	7.21%
Hialeah	\$957,100,000	\$4,353,960,000	\$2,394,720,000	\$5,912,100,000	\$3,609,540,000	\$6,773,890,000	\$5,316,270,000	\$7,883,580,000	\$210,429,262	\$548,468,044	7.62%	6.53%
Doral	\$873,590,000	\$4,025,350,000	\$2,285,830,000	\$5,192,920,000	\$3,424,460,000	\$5,673,220,000	\$4,758,810,000	\$6,191,600,000	\$197,187,029	\$482,900,793	7.14%	5.75%
Miramar	\$0	\$2,923,890,000	\$1,667,480,000	\$5,119,000,000	\$2,506,160,000	\$6,024,840,000	\$4,621,67 <mark>0,000</mark>	\$7,285,290,000	\$125, <mark>317,350</mark>	\$445,240,108	4.54%	5.30%
Miami Beach	\$1,568,420,000	\$3,211,130,000	\$2,385,930,000	\$4,374,450,000	\$2,772,240,000	\$5,003,600,000	\$4,090,390,000	\$5,853,880,000	\$219,593,263	\$405,4 <mark>53,613</mark>	7.95%	4.83%
Davie	\$105,620,000	\$2,442,700,000	\$1,191,240,000	\$4,241,410,000	\$2,068,530,000	\$5,156,560,000	\$3,795,710,000	\$6,459,200,000	\$9 9,220,789	\$373,736,262	3.59%	4.45%
Hollywood	\$259,490,000	\$1,819,820,000	\$1,001,010,000	\$3,424,700,000	\$1,549,600,000	\$4,384,850,000	\$3,01 <mark>3,960,000</mark>	\$6,287,050,000	\$87,457,214	\$304,083,536	3.16%	3.62%
Plantation	\$1,250,000	\$1,657,970,000	\$349,090,000	\$3,409,180,000	\$1,303,020,000	\$4,362,620,000	\$2,938,180,000	\$5,771,350,000	\$45,117,233	\$293,626,871	1.63%	3.50%
Cutler Bay	\$416,480,000	\$2,084,990,000	\$1,1 <mark>41,200,000</mark>	\$3,080,160,000	\$1,570,180,000	\$3,592,210,000	\$2,4 <mark>90,860,000</mark>	\$4,311,470,000	\$97,092,176	\$28 <mark>0,204,817</mark>	3.51%	3.34%
Weston	\$0	\$1,326,540,000	\$432,250,000	\$2,949,570,000	\$1,001,210,000	\$3,909,410,000	\$2,5 <mark>01,800,000</mark>	\$5,369,640,000	\$43,471,746	\$253,195,922	1.57%	3.01%
Homestead	\$311,630,000	\$1,776,880,000	\$1,509,370,000	\$2,640,990,000	\$1,908,110,000	\$3,056,210,000	\$3,02 <mark>0,390,000</mark>	\$3,611,830,000	\$115,683,950	\$239,096,334	4.19%	2.85%
Miami Gardens	\$108,400,000	\$1,540,740,000	\$730,320,000	\$2,524,020,000	\$1, 181,940,000	\$2,984,510,000	\$2,099,380,000	\$3,820,800,000	\$60,435,699	\$225,005,475	2.19%	2.68%
Miami Lakes	\$425,190,000	\$1,667,740,000	\$1,003,860,000	\$2,099,710,000	\$1,4 <mark>47,180,000</mark>	\$2,273,180,000	\$1, 954,100,000	\$2,512,610,000	\$86,932,720	\$196,733,855	3.15%	2.34%
Tamiami	\$297,120,000	\$1,494,950,000	\$743,110,000	\$2,031,390,000	\$1, <mark>213,970,000</mark>	\$2,311,540,000	\$1,823,280,000	\$2,628,800,000	\$67,198,149	\$187,792,104	2.43%	2.24%
Sunrise	\$0	\$575,240,000	\$28,060,000	\$1,911,520,000	\$304,830,000	\$2,771,130,000	\$1,569,220,000	\$4,260,310,000	\$13,424,589	\$159,525,872	0.49%	1.90%
Aventura	\$536,110,000	\$1,420,460,000	\$938,040,000	\$1,881,730,000	\$1,162,610,000	\$2,126,810,000	\$1,695,940,000	\$2,470,210,000	\$84,297,353	\$175,462,093	3.05%	2.09%
Pompano Beach	\$216,320,000	\$976,890,000	\$525,650,000	\$1,715,860,000	\$831,890,000	\$2,162,980,000	\$1,531,220,000	\$3,222,590,000	\$48,981,965	\$155,094,975	1.77%	1.85%
Kendale Lakes	\$16,350,000	\$1,036,160,000	\$463,450,000	\$1,659,510,000	\$790,720,000	\$1,950,990,000	\$1,400,370,000	\$2,366,980,000	\$37,028,507	\$147,884,171	1.34%	1.76%
Cooper City	\$0	\$873,160,000	\$407,960,000	\$1,592,690,000	\$732,810,000	\$1,935,910,000	\$1,407,320,000	\$2,422,910,000	\$33,397,077	\$138,561,273	1.21%	1.65%
The Hammocks	\$0	\$886,600,000	\$404,380,000	\$1,590,720,000	\$638,690,000	\$1,918,820,000	\$1,298,760,000	\$2,488,180,000	\$31,737,952	\$139,252,187	1.15%	1.66%
Country Club	\$293,400,000	\$1,195,800,000	\$620,670,000	\$1,580,060,000	\$1,030,110,000	\$1,789,730,000	\$1,437,700,000	\$2,098,700,000	\$57,565,501	\$147,633,693	2.08%	1.76%
Oakland Park	\$78,070,000	\$868,630,000	\$428,070,000	\$1,459,740,000	\$729,230,000	\$1,784,610,000	\$1,325,650,000	\$2,258,800,000	\$36,906,481	\$130,048,828	1.34%	1.55%
Kendall	\$20,410,000	\$671,930,000	\$258,030,000	\$1,371,710,000	\$487,700,000	\$1,807,670,000	\$1,014,590,000	\$2,705,940,000	\$22,901,345	\$121,105,803	0.83%	1.44%
Fountainebleau	\$195,580,000	\$974,400,000	\$505,910,000	\$1,344,630,000	\$819,330,000	\$1,529,370,000	\$1,200,770,000	\$1,760,050,000	\$45,170,400	\$123,809,696	1.63%	1.47%
Dania Beach	\$175,570,000	\$895,570,000	\$552,710,000	\$1,276,830,000	\$805,500,000	\$1,481,030,000	\$1,193,540,000	\$1,801,000,000	\$46,309,026	\$117,415,583	1.68%	1.40%
North Miami	\$311,170,000	\$740,000,000	\$530,160,000	\$1,038,420,000	\$646,860,000	\$1,219,350,000	\$884,230,000	\$1,533,100,000	\$47,430,989	\$96,500,298	1.72%	1.15%
University Park	\$198,660,000	\$785,270,000	\$450,190,000	\$1,024,670,000	\$657,400,000	\$1,140,170,000	\$934,820,000	\$1,280,340,000	\$39,727,367	\$95,460,993	1.44%	1.14%
Kendall West	\$36,810,000	\$637,390,000	\$301,830,000	\$1,010,460,000	\$486,730,000	\$1,174,600,000	\$864,230,000	\$1,425,920,000	\$24,623,409	\$90,097,504	0.89%	1.07%
Lauderhill	\$1,690,000	\$293,700,000	\$15,670,000	\$967,230,000	\$212,580,000	\$1,395,600,000	\$802,110,000	\$2,127,880,000	\$7,496,912	\$80,603,613	0.27%	0.96%
Hallandale Beach	\$181,070,000	\$658,420,000	\$386,510,000	\$966,580,000	\$603,780,000	\$1,122,940,000	\$910,780,000	\$1,383,350,000	\$35,532,514	\$88,235,405	1.29%	1.05%
Jupiter	\$112,450,000	\$466,630,000	\$233,290,000	\$956,670,000	\$364,240,000	\$1,295,860,000	\$824,460,000	\$2,028,540,000	\$23,225,607	\$85,547,257	0.84%	1.02%
Sunny Isles Beach	\$286,800,000	\$663,430,000	\$465,730,000	\$877,950,000	\$584,420,000	\$978,510,000	\$801,550,000	\$1,135,190,000	\$42,498,961	\$81,661,396	1.54%	0.97%
Hialeah Gardens	\$147,990,000	\$593,170,000	\$315,970,000	\$764,300,000	\$507,240,000	\$861,510,000	\$699,350,000	\$987,660,000	\$28,900,686	\$71,799,213	1.05%	0.85%
Total	\$10 214 090 000	\$58 524 170 000	\$31,642,550,000	\$93.461.490.000	\$48 347 070 000	\$111 857 590 000	\$82,603,620,000	\$140 779 320 000	\$2 763 272 605	\$8 398 151 852	100.00%	100.00%

Figure 4-28: Planning Reach FL_08 Consequences and Risk Details (top 35 of 140 census places)

4.2.4.4 Planning Reach FL_09: Florida Keys

This section describes dollar damage storm surge risk for Planning Reach FL_09, which includes the Florida Keys. All estimates shown are in FY 2018 price levels. **Figure 4-29** displays the number, occupancy type, and total value (structure + content + vehicle value) in Planning Reach FL_09 in the 0.2-percent AEP event flood extent, based on the NSI 2.0 structure inventory data for the Florida Keys coastal region. **Figure 4-29** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-31** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.

There are approximately 93,000 structures with a total estimated exposure value of more than \$60 billion. Most of the assets and asset values are single-family residential, multi-family residential, and commercial. Single-family residences comprise 64 percent of the buildings and 37 percent of the exposed value. Commercial buildings comprise approximately 12 percent of the assets and 22 percent of the exposed value. Multi-family residential buildings comprise approximately 20 percent of the assets and 36 percent of the exposed value. The exposure extent includes one county, nine census places, 1,359 census blocks, and approximately 67,200 acres.

The Florida Keys has shorelines that are susceptible to coastal flood hazards from the Atlantic Ocean, Gulf of Mexico, and Florida Bay. Storm surge can propagate over shorelines located along the Gulf, as well as North Keys, Key West, and the Central Keys. Maximum surge depths modeled range from 5.5 to 17.7 feet in existing conditions to 8.5 to 20.7 feet in future conditions. Overall risk for the planning reach ranges between \$223 million and \$577 million and is located in Monroe County, Florida. Of the eight exposed census places, the highest-risk population centers include Key West (47 percent), Marathon (18 percent), Islamorada (16 percent), and Key Largo (12 percent). Approximately 10 percent of the risk tends to be distributed in more rural areas. The number of medium- to high-risk census blocks increases by 187 percent between existing and future conditions with sea level rise.



Multi-Family Residential \$21bn (35.65%)

Figure 4-29: Planning Reach FL_09 Exposure Details

60K (64.07%)

Reach					\sim						E	xisting Ri	sk by Census Block				The state	Pompano I
FL_09) : Florida Ke	ys		3	County	# Census	Existing & Futu Acres Exist	ure Risk by Count ting Risk Futu	/ re Risk		CB Risk Rating	# Census	Blocks Acres Existing Risk	Golden Gate	1 84		1	Sunrise Lauden
\$222,9 Existing 67,182 # Acres	02,091 Risk Impacted	\$576,934 Future Ris 1359 # Census	4,452 k Blocks Impa	cted	Monroe Total	Blocks 135 135	9 67,182 9 67,182	\$222,902,091 \$222,902,091	\$576,934,452 \$576,934,452		2-Med-High 3-Med 4-Low-Med 5-Low Total		2 385 \$12,926,401 28 3,957 \$57,912,459 116 7,561 \$75,043,633 1213 \$52,726 \$77,019,598 1359 67,182 \$222,902,091	Marco	Big Cypre Big Cypre	ss National Preserve ss Wildlife Management Area	Everglades Wildlife Management Area	Davie Hollywoo Miramar I North Miami Hialeah
1 # Count Existing M Coastal Counties	iies Impacted Maximum Surge Ele Shoreline	8 # Census vation per F EC_10Yr I	Places Impa Return Peric EC_50Yr EC	cted d Event by Co _100Yr EC_50	ounty (ft) Fur ^{DYr} Coa <u>C</u> ou	ture Maxin stal nties	mum Surge Eleva Shoreline	tion per Return P FC_10Yr FC_	eriod Event by 50Yr FC_100Y r	y County (ft) FC_500Yr	Futu CB Risk Rating # Co	ure Risk b Tensus Bloo	y Census Block cks Acres Future Risk			Broad 71-	We Lei Hom	stchester Kendall Coral Gabl sure City estead
Monroe	Ocean-Central Key	5.50	7.60	8.60 10	0.60 Mor	nroe	Ocean-Central Key	ys 8.50 1	0.60 11.60	13.60	2-Med-High		21 3,831 \$115,88 9,180			101	1	1 10 10 10
Monroe	Ocean-Guir Side Ocean-Key West	9.20 5.90	8.10	9.20 1	1.30 Mor Mor	nroe nroe	Ocean-Gulf Side Ocean-Key West	12.20 1 8.90 1	5.70 17.40 1.10 12.20	20.70 14.30	3-Med 4-Low-Med		60 4,603 \$128,855,368 268 6,079 \$179,273,564			Everglades Natio	nal Park	
Census Places	swith Greatest Risk sk ● Future Risk (\$0.17bn	Risk Cha	nge		Exis	ting Risk I Rt \$22M (9.7:	Distribution by Pc Category Iral	opulation Center Census Place S201M (90.28%)		Future Risk \$49.92M (8.	Distribution by Popula Category Rural 55%) Cens 5527	ation Cen sus Place 7.02M (91	iter .35%)		Grine Ary	For Marat O Straits of Florid	a	
	\$0.25bn \$0.08bn	5	50.05bn 50.09bn 50.04bn	s s	0.04bn 0.08bn 0.04bn	2	003bn 006bn 003bn	North Kay La		Tavorpig	Kau Calanu B	aach						G
	,			0	Islands	I.	, ,				,		,	Census Plac	re Risk Rati	Med-High = 3-Me	ed @4-Low-Med	5-Low

Figure 4-30: Planning Reach FL_09 Risk Details

				Conseque	ences & Risk per /	AEP Event by Censu	s Place					
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
				•							Risk	Risk
Key West	\$398,180,000	\$1,761,310,000	\$844,650,000	\$2,683,990,000	\$1,206,180,000	\$3,439,080,000	\$1,842,190,000	\$4,311,800,000	\$75,841,103	\$248,058,807	37.69%	47.07%
Marathon	\$225,200,000	\$642,020,000	\$466,860,000	\$1,077,420,000	\$661,780,000	\$1,281,530,000	\$1,001,480,000	\$1,517,820,000	\$41,9 <mark>81,819</mark>	\$94,802,053	20.86%	17.99%
Islamorada, Village of Islands	\$188,380,000	\$617,950,000	\$450,190,000	\$902,040,000	\$666,610,000	\$1,152,330,000	\$1,006,660,000	\$1,447,460,000	\$39,832,075	\$8 <mark>4,366,162</mark>	19.79%	16.01%
Key Largo	\$1 <mark>40,640,000</mark>	\$476,650,000	\$35,410,000	\$692,160,000	\$503,720,000	\$855,860,000	\$777,560,000	\$1,155,120,000	\$29,919,045	\$64,844,977	14.87%	12.30%
Tavemier	\$23,850,000	\$98,220,000	\$45,940,000	\$164,050,000	\$65,700,000	\$195,740,000	\$101,010,000	\$233,830,000	\$4,215,448	\$14,476,844	2.09%	2.75%
North Key Largo	\$26,620,000	\$75,880,000	\$76,110,000	\$116,780,000	\$101,530,000	\$167,610,000	\$143,700,000	\$262,840,000	\$6,265,926	\$11,375,917	3.11%	2.16%
Key Colony Beach	\$16,590,000	\$34,380,000	\$30,300,000	\$64,170,000	\$45,470,000	\$78,440,000	\$68,730,000	\$97,210,000	\$2,848,404	\$5,551,973	1.42%	1.05%
Layton	\$2,430,000	\$27,930,000	\$3,550,000	\$38,350,000	\$3,880,000	\$43,650,000	\$4,960,000	\$50,430,000	\$321,908	\$3,538,462	0.16%	0.67%
Total	\$1,021,890,000	\$3,734,340,000	\$2,253,010,000	\$5,738,960,000	\$3,254,870,000	\$7,214,240,000	\$4,946,290,000	\$9,076,510,000	\$201,225,728	\$527,015,195	100.00%	100.00%

Figure 4-31: Planning Reach FL_09 Consequences and Risk Details

4.2.4.5 Planning Reach FL_10: Southwest Florida Coast

This section describes dollar damage storm surge risk for Planning Reach FL_10, which includes the Southwest Florida coast. All estimates shown are in FY 2018 price levels. **Figure 4-32** displays the number, occupancy type, and total value (structure + content + vehicle value) in Planning Reach FL_10 in the 0.2-percent AEP event flood extent, based on the NSI 2.0 structure inventory data for the Southwest Florida coast. **Figure 4-33** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-34** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.

There are approximately 936,000 structures with a total estimated exposure value of more than \$620 billion. Most of the assets and asset values are single-family residential, multi-family residential, and commercial. Single-family residences comprise 70 percent of the buildings and 44 percent of the exposed value. Commercial buildings comprise approximately 8 percent of the assets and 21 percent of the exposed value. Multi-family residential buildings comprise approximately 19 percent of the assets and 30 percent of the exposed value. The exposure extent includes eight counties, 103 census places, 25,029 census blocks, and approximately 2.4 million acres.

Coastal Southwest Florida has ocean-facing, back bay, and riverine shorelines that are susceptible to coastal flood hazards. Storm surge can propagate over the shorelines located in Lee, Collier, Charlotte, Sarasota, and Manatee counties. Maximum surge depths modeled range from 5.6 to 15.7 feet in existing conditions to 8.6 to 18.7 feet in future conditions. Overall risk for the planning reach ranges between \$3 billion and \$6 billion. Of the eight counties exposed, the coastal storm risk is located primarily in Lee, Collier, Charlotte, Sarasota, and Manatee counties. Of the 103 exposed census places, the highest-risk population centers include Cape Coral (36 percent), Bonita Springs, Iona, Marco Island, and Port Charlotte. In addition, 18 to 21 percent of the risk in this planning reach tends to be distributed in more rural areas. The number of medium- to high-risk census blocks increases by 112 percent between existing and future conditions with sea level rise.



L_10 :	Southwest Florid	da		\sim	
1	\$3,010,001,677 Existing Risk	\$6,00 Future	6,808,77! Risk	5	
	1,870,403 # Acres Impacted	23837 # Cens	v us Blocks I	mpacted	
	5 # Counties Impacted	97 # Cens	us Places I	mpacted	
Existi	' ng Maximum Surge Elevat	ion per Re	turn Perio	d Event by	County (ff
Existi Coastal Counties	' ng Maximum Surge Elevat Shoreline	ion per Re EC_10Yr	turn Perio EC_50Yr	d Event by EC_100Yr	County (ff EC_500Yr
Existin Coastal Counties Sarasota	ng Maximum Surge Elevat Shoreline Ocean	ion per Re EC_10Yr 6.50	turn Perio EC_50Yr 8.90	d Event by EC_100Yr 10.10	County (ff EC_500Yr 12.40
Existii Coastal Counties Garasota Manatee	ng Maximum Surge Elevat Shoreline Ocean Ocean	ion per Re EC_10Yr 6.50 5.70	turn Perio EC_50Yr 8.90 7.80	d Event by EC_100Yr 10.10 8.90	County (ff EC_500Yr 12.40 10.90
Existin Coastal Counties Sarasota Manatee Lee	ng Maximum Surge Elevat Shoreline Ocean Ocean Ocean-Captiva/Sanabo	EC_10Yr 6.50 5.70 21 7.20	EC_50Yr 8.90 7.80 9.90	d Event by EC_100Yr 10.10 8.90 11.20	County (ff EC_500Yr 12.40 10.90 13.80
Existin Coastal Counties Sarasota Manatee Lee Lee	ng Maximum Surge Elevat Shoreline Ocean Ocean Ocean-Captiva/Sanabo Ocean-Cayo	EC_10Yr 6.50 5.70 1 7.20 6.00	turn Perior EC_50Yr 8.90 7.80 9.90 8.30	d Event by EC_100Yr 10.10 8.90 11.20 9.40	County (ff EC_500Yr 12.40 10.90 13.80 11.60
Existin Coastal Counties Sarasota Manatee Lee Lee Lee	ng Maximum Surge Elevat Shoreline Ocean Ocean-Captiva/Sanabo Ocean-Cayo Ocean-Ft Myer/ Bonita	EC_10Yr 6.50 5.70 1 7.20 6.00 8.20	turn Perior EC_50Yr 8.90 7.80 9.90 8.30 11.30	d Event by EC_100Yr 10.10 8.90 11.20 9.40 12.75	County (ff EC_500Yr 12.40 10.90 13.80 11.60 15.70
Existin Coastal Counties Sarasota Manatee Lee Lee Lee Lee Lee	ng Maximum Surge Elevat Shoreline Ocean Ocean-Captiva/Sanabo Ocean-Captiva/Sanabo Ocean-Cayo Ocean-Ft Myer/ Bonita	EC_10Yr 6.50 5.70 21 7.20 6.00 8.20 6.20	turn Perior EC_50Yr 8.90 7.80 9.90 8.30 11.30 8.50	d Event by EC_100Yr 10.10 8.90 11.20 9.40 12.75 9.67	County (fr EC_500Yr 12.40 10.90 13.80 11.60 15.70 11.90
Existin Coastal Counties Sarasota Manatee Lee Lee Lee Lee Lee Collier	ng Maximum Surge Elevat Shoreline Ocean Ocean-Captiva/Sanabe Ocean-Capto Ocean-Gaptiva/Sanabe Ocean-Gaptiva/Sanabe Ocean-Gaparila Ocean-Gaparila	EC_10Yr 6.50 5.70 ≥1 7.20 6.00 1 8.20 6.20 5.60	turn Perior EC_50Yr 8.90 7.80 9.90 8.30 11.30 8.50 7.70	d Event by EC_100Yr 10.10 8.90 11.20 9.40 12.75 9.67 8.80	County (fr EC_500Yr 12.40 10.90 13.80 11.60 15.70 11.90 10.80
Existii Coastal Counties Sarasota Manatee Lee Lee Lee Lee Collier Charlotte	ng Maximum Surge Elevat Shoreline Ocean Ocean-Captiva/Sanabe Ocean-Cayo Ocean-Ft Myer/ Bonitz Ocean-Gasparilla Ocean-Basya	EC_10Yr 6.50 5.70 1 7.20 6.00 1 8.20 6.20 5.60 5.70	turn Perior EC_50Yr 8.90 7.80 9.90 8.30 11.30 8.50 7.70 7.80	d Event by EC_100Yr 10.10 8.90 11.20 9.40 12.75 9.67 8.80 8.90	County (ff EC_500Yr 12.40 10.90 13.80 11.60 15.70 11.90 10.80 10.90

		childring or	ratare rask by co	Juney
ounty	# Census Blocks	Acres	Existing Risk	Future Risk
	biocito			•
96	9654	393,682	\$2,022,342,883	\$3,720,129,906
ollier	3220	1,038,452	\$362,749,508	\$895,806,084
harlotte	4102	192,002	\$340,772,804	\$685,718,178
arasota	4350	160,771	\$159,001,046	\$420,544,557
lanatee	2511	85,496	\$125,135,436	\$284,610,050
otal	23837	1,870,403	\$3,010,001,677	\$6,006,808,775
Jtai	23037	1,070,403	\$3,010,001,077	\$0,000,80

Existing & Euture Rick by County

Coastal Counties	Shoreline	FC_10Yr	FC_50Yr	FC_100Y r	FC_500Yr
Sarasota	Ocean	9.50	11.90	13.10	15.40
Manatee	Ocean	8.70	10.80	11.90	13.90
Lee	Ocean-Captiva/Sanabel	10.20	12.90	14.20	16.80
Lee	Ocean-Cayo	9.00	11.30	12.40	14.60
Lee	Ocean-Ft Myer/ Bonita	11.20	14.30	15.75	18.70
Lee	Ocean-Gasparilla	9.20	11.50	12.67	14.90
Collier	Ocean	8.60	10.70	11.80	13.80
Charlotte	Bay	8.70	10.80	11.90	13.90
Charlotte	Ocean	10.40	13.10	14.50	17.10

Cen



Census Place Risk Rating • 1-High • 3-Med • 4-Low-Med • 5-Low

Figure 4-33: Planning Reach FL_10 Risk Details

				Conseque	nces & Risk per A	EP Event by Census	Place					
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
				•							Risk	Risk
Cape Coral	\$3,514,340,000	\$10,875,090,000	\$10,280,600,000	\$17,695,210,000	\$14,001,020,000	\$21,052,990,000	\$20,297,430,000	\$26,347,160,000	\$850,989,727	\$1,578,841,928	37.45%	36.25%
Bonita Springs	\$610,600,000	\$1,613,900,000	\$1,580,380,000	\$3,358,580,000	\$2,421,430,000	\$4,442,820,000	\$4,378,740,000	\$6,215,820,000	\$143,610,100	\$292,974,153	6.32%	6.73%
lona	\$632,060,000	\$1,406,800,000	\$1,377,950,000	\$2,234,160,000	\$1,786,920,000	\$2,623,000,000	\$2,590,630,000	\$3,257,640,000	\$118,917,704	\$199,959,504	5.23%	4.59%
Marco Island	\$490,470,000	\$1,353,380,000	\$1,150,560,000	\$1,962,550,000	\$1,431,320,000	\$2,289,360,000	\$1,976,590,000	\$2,850,740,000	\$96,135,594	\$180,163,168	4.23%	4.14%
Port Charlotte	\$345,510,000	\$1,086,780,000	\$1,021,830,000	\$1,904,550,000	\$1,402,970,000	\$2,325,990,000	\$2,151,310,000	\$2,964,880,000	\$85,343,973	\$167,902,570	3.76%	3.86%
Sanibel	\$421,920,000	\$1,118,220,000	\$946,930,000	\$1,778,080,000	\$1,258,280,000	\$2,088,640,000	\$1,824,210,000	\$2,596,050,000	\$81,758,858	\$159,117,742	3.60%	3.65%
Fort Myers Beach	\$368,570,000	\$1,026,030,000	\$919,170,000	\$1,629,350,000	\$1,221,170,000	\$1,912,980,000	\$1,770,350,000	\$2,375,810,000	\$77,719,068	\$145,833,730	3.42%	3.35%
Cypress Lake	\$430,380,000	\$1,009,690,000	\$1,007,840,000	\$1,591,820,000	\$1,324,480,000	\$1,868,150,000	\$1,918,830,000	\$2,320,110,000	\$85,998,137	\$142,753,816	3.78%	3.28%
Naples	\$290,230,000	\$990,990,000	\$803,880,000	\$1,541,460,000	\$1,058,390,000	\$1,839,180,000	\$1,602,260,000	\$2,366,460,000	\$66,919,005	\$139,755,795	2.95%	3.21%
North Fort Myers	\$395,430,000	\$830,650,000	\$846,960,000	\$1,302,830,000	\$1,116,910,000	\$1,559,160,000	\$1,572,460,000	\$1,995,830,000	\$73,418,441	\$117,857,201	3.23%	2.71%
McGregor	\$313,700,000	\$709,640,000	\$707,970,000	\$1,127,040,000	\$940,800,000	\$1,323,150,000	\$1,363,980,000	\$1,643,300,000	\$61,060,999	\$100,869,817	2.69%	2.32%
Punta Gorda	\$226,750,000	\$739,490,000	\$543,860,000	\$1,126,030,000	\$794,120,000	\$1,311,450,000	\$1,140,410,000	\$1,640,950,000	\$47,535,781	\$101,899,553	2.09%	2.34%
Fort Myers	\$194,570,000	\$503,180,000	\$525,140,000	\$1,069,710,000	\$774,130,000	\$1,550,290,000	\$1,550,140,000	\$2,344,980,000	\$47,681,684	\$96,295,483	2.10%	2.21%
Villas	\$56,420,000	\$569,420,000	\$590,800,000	\$956,020,000	\$924,640,000	\$1,178,500,000	\$1,342,460,000	\$1,521,730,000	\$45,218,196	\$85,540,481	1.99%	1.96%
Sarasota	\$187,410,000	\$560,380,000	\$490,900,000	\$939,770,000	\$670,790,000	\$1,145,290,000	\$1,029,710,000	\$1,527,880,000	\$41,802,284	\$84,184,625	1.84%	1.93%
Rotonda	\$190,720,000	\$555,690,000	\$555,340,000	\$931,970,000	\$741,880,000	\$1,108,120,000	\$1,075,590,000	\$1,396,350,000	\$45,749,563	\$82,518,234	2.01%	1.89%
Englewood	\$133,880,000	\$447,690,000	\$359,920,000	\$826,880,000	\$494,010,000	\$1,084,820,000	\$875,070,000	\$1,456,090,000	\$31,248,705	\$73,619,301	1.38%	1.69%
Siesta Key	\$179,730,000	\$372,750,000	\$335,090,000	\$591,760,000	\$436,070,000	\$694,340,000	\$626,420,000	\$866,780,000	\$29,950,989	\$52,988,867	1.32%	1.22%
Longboat Key	\$124,350,000	\$377,790,000	\$303,750,000	\$546,240,000	\$409,520,000	\$652,750,000	\$575,420,000	\$823,130,000	\$25,782,800	\$50,507,295	1.13%	1.16%
Whiskey Creek	\$50,190,000	\$311,330,000	\$321,960,000	\$494,440,000	\$427,790,000	\$580,540,000	\$620,160,000	\$721,430,000	\$24,064,209	\$44,257,176	1.06%	1.02%
Estero	\$47,180,000	\$172,200,000	\$164,360,000	\$477,180,000	\$263,170,000	\$994,920,000	\$955,560,000	\$2,271,080,000	\$17,385,490	\$50,942,218	0.77%	1.17%
Cortez	\$140,320,000	\$299,700,000	\$206,790,000	\$455,540,000	\$249,880,000	\$535,610,000	\$347,470,000	\$666,720,000	\$19,252,882	\$41,306,753	0.85%	0.95%
St. James City	\$95,960,000	\$270,610,000	\$241,920,000	\$429,680,000	\$321,440,000	\$504,510,000	\$466,110,000	\$626,530,000	\$20,414,984	\$38,458,899	0.90%	0.88%
Bradenton	\$69,300,000	\$204,480,000	\$150,930,000	\$393,130,000	\$228,460,000	\$501,140,000	\$408,880,000	\$724,690,000	\$14,075,886	\$34,730,339	0.62%	0.80%
Lochmoor Waterway Estates	\$133,320,000	\$243,120,000	\$245,680,000	\$386,120,000	\$271,310,000	\$453,360,000	\$393,330,000	\$563,180,000	\$21,190,288	\$34,558,271	0.93%	0.79%
Laurel	\$20,670,000	\$138,400,000	\$112,410,000	\$377,050,000	\$177,860,000	\$519,270,000	\$434,050,000	\$690,540,000	\$10,090,775	\$31,318,990	0.44%	0.72%
Lely Resort	\$0	\$144,340,000	\$54,130,000	\$366,780,000	\$150,520,000	\$460,760,000	\$374,070,000	\$572,220,000	\$6,035,439	\$29,860,352	0.27%	0.69%
Venice	\$42,930,000	\$157,720,000	\$128,810,000	\$356,380,000	\$192,940,000	\$566,520,000	\$427,090,000	\$1,097,270,000	\$11,816,088	\$34,029,018	0.52%	0.78%
Holmes Beach	\$70,330,000	\$195,230,000	\$174,650,000	\$315,880,000	\$231,800,000	\$381,610,000	\$336,030,000	\$477,860,000	\$14,775,209	\$28,325,644	0.65%	0.65%
Fort Myers Shores	\$88,590,000	\$201,180,000	\$205,140,000	\$297,060,000	\$258,380,000	\$320,290,000	\$319,060,000	\$350,310,000	\$17,015,239	\$26,401,239	0.75%	0.61%
Grove City	\$59,020,000	\$166,550,000	\$149,270,000	\$264,600,000	\$198,350,000	\$310,790,000	\$287,550,000	\$386,570,000	\$12,589,493	\$23,685,264	0.55%	0.54%
North Port	\$0	\$150,000	\$20,000	\$251,270,000	\$280,000	\$424,070,000	\$317,230,000	\$1,020,920,000	\$1,907,274	\$21,256,171	0.08%	0.49%
Palmetto	\$20,170,000	\$136,590,000	\$87,490,000	\$241,590,000	\$143,330,000	\$328,210,000	\$232,190,000	\$471,570,000	\$7,423,799	\$22,118,932	0.33%	0.51%
Lely	\$7,180,000	\$127,960,000	\$85,240,000	\$233,910,000	\$135,710,000	\$278,300,000	\$236,750,000	\$345,660,000	\$6,765,920	\$20,225,105	0.30%	0.46%
Punta Rassa	\$49,630,000	\$139,970,000	\$125,140,000	\$222,310,000	\$166,320,000	\$260,980,000	\$241,090,000	\$324,140,000	\$10,561,350	\$19,896,073	0.46%	0.46%
Total	\$10,001,830,000	\$29,057,090,000	\$26,802,810,000	\$48,676,930,000	\$36,626,390,000	\$59,471,860,000	\$56,058,630,000	\$77,822,380,000	\$2,272,205,933	\$4,354,953,707	100.00%	100.00%

Figure 4-34: Planning Reach FL_10 Consequences and Risk Details (top 35 of 103 census places)

4.2.4.6 Planning Reach FL_11: West Central Florida Coast

This section describes dollar damage storm surge risk for Planning Reach FL_11, which includes the West Central Florida Coast. All estimates shown are in FY 2018 price levels. **Figure 4-35** displays the number, occupancy type, and total value (structure + content + vehicle value) in Planning Reach FL_11 in the 0.2-percent AEP event flood extent, based on the NSI 2.0 structure inventory data for the West Central Florida Coast. **Figure 4-36** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-37** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.

There are approximately 900,000 structures with a total estimated exposure value of more than \$593 billion. Most of the assets and asset values are single-family residential, multi-family residential, and commercial. Single-family residences comprise 72 percent of the buildings and 37 percent of the exposed value. Commercial buildings comprise approximately 10 percent of the assets and 29 percent of the exposed value. Multi-family residential buildings comprise approximately 15 percent of the assets and 26 percent of the exposed value. The exposure extent includes six counties, 83 census places, 15,074 census blocks, and approximately 657,000 acres.

West Central Florida has ocean-facing, back bay, and riverine shorelines that are susceptible to coastal flood hazards. Storm surge can propagate over the shorelines located in Pinellas, Hillsborough, Pasco, Citrus, Hernando, and Levy counties. Maximum surge depths modeled range from 5.8 to 16.7 feet in existing conditions to 8.8 to 19.7 feet in future conditions. Overall risk for the planning reach ranges between \$1.5 billion and \$3.5 billion. Of the six counties exposed, the coastal storm risk is located primarily in Pinellas, Hillsborough, Pasco, and Citrus counties. Of the 83 exposed census places, the highest-risk population centers include St. Petersburgh (29 percent), Tampa, and Clearwater. Census place risk is fairly dispersed except for St. Petersburg, which accounts for close to one-third of the risk for the census places within this planning reach. In addition, 9 to 10 percent of the risk in this planning reach tends to be distributed in more rural areas. The number of medium- to high-risk census blocks increases by 150 percent between existing and future conditions with sea level rise.



Figure 4-35: Planning Reach FL_11 Exposure Details

Reach		\sim					
FL_11 : Central	West Florida	\sim	County	Exi # Census Blocks	isting & Fut Acres	ure Risk by Coun Existing Risk	ty Future
			Pinellas	8093	131,463	\$1,027,479,523	Ť
\$1,463,511,347	\$3,488,137,824		Hillsborough	3365	114,010	\$165,790,080	
Existing Risk	Future Risk		Pasco	2024	51,837	\$118,179,438	
657.040	15074		Citrus	983	114,340	\$116,411,348	
657,049	15074		Hernando	229	69,796	\$23,055,673	
# Acres Impacted	# Census Blocks Impacted		Levy	380	175,603	\$12,595,285	
6	81		Total	15074	657,049	\$1,463,511,347	\$
# Counties Impacted	# Census Places Impacted						

ounty	# Census Blocks	Acres	Existing Risk	Future Risk	CB Ris
nellas	8093	131,463	\$1,027,479,523	\$2,336,531,126	1-Hig
llsborough	3365	114,010	\$165,790,080	\$536,045,161	2-Mee
isco	2024	51,837	\$118,179,438	\$293,623,711	3-Mee
trus	983	114,340	\$116,411,348	\$248,921,108	4-Low
ernando	229	69,796	\$23,055,673	\$45,485,149	5-Low
vy	380	175,603	\$12,595,285	\$27,531,569	Total
otal	15074	657,049	\$1,463,511,347	\$3,488,137,824	

	Existing Risk by Census Block							
CB Risk Rating	# Census Blocks	Acres	Existing Risk					
1-High	18	3,035	\$139,504,250					
2-Med-High	70	10,386	\$217,920,599					
3-Med	218	27,665	\$294,601,889					
4-Low-Med	1041	86,354	\$422,526,902					
5-Low	13727	529,609	\$388,957,707					
Total	15074	657,049	\$1,463,511,347					

Existing Maximum Surge Elevation per Return Period Event by County

			(11)		
Coastal Counties	Shoreline	EC_10Yr	EC_50Yr	EC_100Yr	EC_500Yr
Pinellas	Bay	6.20	8.50	9.70	11.90
Pinellas	Ocean	6.70	9.20	10.40	12.80
Pasco	Ocean	7.00	9.70	11.00	13.50
Levy	Ocean	8.70	12.00	13.60	16.70
Hillsborough	Ocean	5.80	8.00	9.10	11.20
Hernando	Ocean	7.40	10.20	11.60	14.30
Citrus	Ocean	7.60	10.50	11.90	14.60

			·/		
Coastal Counties	Shoreline	FC_10Yr	FC_50Yr	FC_100Y r	FC_500Yr
Pinellas	Bay	9.20	11.50	12.70	14.90
Pinellas	Ocean	9.70	12.20	13.40	15.80
Pasco	Ocean	10.00	12.70	14.00	16.50
Levy	Ocean	11.70	15.00	16.60	19.70
Hillsborouah	Ocean	8.80	11.00	12.10	14.20

10.60 13.50

10.40 13.20 14.60 17.30

14.90

17.60

Hernando Ocean

Ocean

Citrus

Future Maximum Surge Elevation per Return Period Event by County

(f+)

CB Risk Rating	# Census Blocks	Acres	Future Risk
1-High	70	12,726	\$679,713,481
2-Med-High	205	27,464	\$665,339,643
3-Med	489	57,962	\$646,148,283
4-Low-Med	2263	100,420	\$952,727,052
5-Low	12047	458,477	\$544,209,365

Future Risk by Census Block

15074 657,049 \$3,488,137,824

Census Places with Greatest Risk



Total

Figure 4-36: Planning Reach FL_11 Risk Details

Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing Risk	% of Future Risk
St. Dataschuse	\$1.000 E70.000	£5 105 520 000	£4.405.250.000	* \$2.056.640.000	£5 709 420 000	\$16 162 220 000	te 412.000.000	\$22,440,220,000	¢277 225 724	¢050,400,400	20.629/	29.709/
St. Petersburg	\$1,908,570,000	\$5,195,550,000	\$4,405,250,000	\$0,036,640,000	\$5,790,430,000	\$10,102,220,000	\$0,412,000,000	\$22,440,230,000	\$377,233,724	\$050,400,405	6 2 2 9/	20.79%
Gleanwater	\$255,740,000	\$1,229,620,000	\$814,800,000	\$1,439,040,000	\$1,451,240,000	\$2,040,050,000	\$2,733,300,000	\$0,070,790,000	\$60,285,820	\$151 204 479	5.62%	5.12%
Clearwater	\$356,540,000	\$940,180,000	\$811,920,000	\$1,439,040,000	t cos 220,000	\$2,030,000,000	\$1,512,590,000	\$3,897,330,000	\$09,505,029	\$151,504,476	3.03%	5.1270
Town in Country	\$09,150,000	\$562,220,000	\$566,520,000	\$1,549,700,000	\$665,220,000	\$2,654,600,000	\$1,447,750,000	\$3,594,950,000	\$34,104,331	\$129,510,616	2.11%	4.50%
Su Pele Deach	\$272,560,000	\$670,250,000	\$571,020,000	\$961,560,000	\$750,750,000	\$1,984,200,000	\$1,017,100,000	\$2,665,160,000	\$49,275,971	\$105,916,959	4.00%	3.52%
South Pasadena	\$251,650,000	\$614,970,000	\$554,060,000	\$924,940,000	\$695,220,000	\$1,805,420,000	\$961,970,000	\$2,462,970,000	\$45,464,102	\$97,245,646	5.09%	3.29%
Guitport	\$224,930,000	\$601,460,000	\$521,220,000	\$905,150,000	\$675,500,000	\$1,769,080,000	\$956,690,000	\$2,412,950,000	\$44,269,451	\$95,100,790	5.59%	3.22%
Crystal River	\$249,630,000	\$581,110,000	\$521,430,000	\$867,160,000	\$664,050,000	\$1,703,260,000	\$939,230,000	\$2,324,610,000	\$45,057,793	\$91,540,606	3.66%	3.10%
East Lake	\$76,040,000	\$384,970,000	\$247,540,000	\$816,400,000	\$402,640,000	\$1,152,730,000	\$807,210,000	\$1,539,630,000	\$22,649,693	\$/1,/48,60/	1.84%	2.43%
Treasure Island	\$211,060,000	\$514,140,000	\$469,660,000	\$779,670,000	\$604,040,000	\$1,517,010,000	\$855,090,000	\$2,071,050,000	\$40,143,016	\$81,728,727	3.26%	2.77%
Oldsmar	\$60,550,000	\$294,110,000	\$210,590,000	\$685,940,000	\$371,310,000	\$1,307,740,000	\$681,710,000	\$1,838,400,000	\$19,330,778	\$65,434,022	1.57%	2.22%
Pinellas Park	\$49,630,000	\$241,920,000	\$182,890,000	\$652,700,000	\$317,270,000	\$1,402,180,000	\$798,390,000	\$2,228,780,000	\$17,862,973	\$65,040,943	1.45%	2.20%
Tarpon Springs	\$209,960,000	\$445,980,000	\$395,910,000	\$652,310,000	\$508,090,000	\$1,303,920,000	\$704,840,000	\$1,721,000,000	\$35,018,463	\$69,255,189	2.84%	2.34%
Palm Harbor	\$138,250,000	\$348,570,000	\$298,590,000	\$629,380,000	\$423,310,000	\$1,174,310,000	\$660,670,000	\$1,628,200,000	\$26,744,437	\$62,602,490	2.17%	2.12%
Hudson	\$122,580,000	\$396,670,000	\$329,440,000	\$595,970,000	\$438,040,000	\$1,192,140,000	\$618,540,000	\$1,626,230,000	\$27,380,546	\$63,173,578	2.22%	2.14%
Apollo Beach	\$55,360,000	\$290,300,000	\$167,750,000	\$568,810,000	\$328,200,000	\$1,110,040,000	\$594,370,000	\$1,514,280,000	\$16,283,876	\$56,285,434	1.32%	1.91%
Largo	\$89,830,000	\$275,200,000	\$232,340,000	\$469,140,000	\$358,500,000	\$1,098,810,000	\$542,300,000	\$1,536,080,000	\$20,531,585	\$51,225,460	1.67%	1.73%
Indian Rocks Beach	\$124,020,000	\$311,550,000	\$271,320,000	\$467,190,000	\$348,040,000	\$901,140,000	\$495,940,000	\$1,231,930,000	\$23,278,530	\$48,990,418	1.89%	1.66%
Holiday	\$26,090,000	\$172,510,000	\$146,890,000	\$461,570,000	\$261,690,000	\$894,560,000	\$556,160,000	\$1,543,990,000	\$13,344,787	\$44,981,669	1.08%	1.52%
Homosassa	\$114,130,000	\$299,810,000	\$256,810,000	\$450,740,000	\$332,800,000	\$878,470,000	\$471,420,000	\$1,198,370,000	\$21,946,860	\$47,371,926	1.78%	1.60%
Ruskin	\$68,240,000	\$263,930,000	\$212,240,000	\$445,670,000	\$294,680,000	\$869,770,000	\$458,400,000	\$1,186,570,000	\$17,682,169	\$45,556,790	1.44%	1.54%
Madeira Beach	\$107,460,000	\$286,710,000	\$247,160,000	\$434,080,000	\$320,220,000	\$859,960,000	\$453,240,000	\$1,173,180,000	\$21,018,506	\$45,779,447	1.71%	1.55%
Seminole	\$156,050,000	\$316,930,000	\$307,060,000	\$419,430,000	\$357,940,000	\$908,970,000	\$441,650,000	\$1,134,420,000	\$25,933,214	\$46,538,192	2.10%	1.58%
Feather Sound	\$100,050,000	\$260,380,000	\$212,850,000	\$381,750,000	\$275,290,000	\$727,930,000	\$391,030,000	\$998,240,000	\$18,402,832	\$40,134,851	1.49%	1.36%
New Port Richey	\$76,180,000	\$227,050,000	\$192,580,000	\$380,630,000	\$261,050,000	\$845,450,000	\$418,760,000	\$1,245,040,000	\$16,574,941	\$41,290,724	1.35%	1.40%
Bear Creek	\$66,600,000	\$176,820,000	\$153,850,000	\$266,590,000	\$199,420,000	\$519,810,000	\$282,500,000	\$709,140,000	\$13,077,125	\$28,000,676	1.06%	0.95%
Harbor Bluffs	\$61,010,000	\$162,310,000	\$138,350,000	\$242,300,000	\$179,350,000	\$468,870,000	\$254,200,000	\$639,890,000	\$11,806,820	\$25,455,594	0.96%	0.86%
Redington Shores	\$59,340,000	\$158,600,000	\$136,990,000	\$238,530,000	\$177,540,000	\$465,590,000	\$251,540,000	\$635,150,000	\$11,645,344	\$25,078,043	0.95%	0.85%
West Lealman	\$52,450,000	\$166,260,000	\$144,110,000	\$233,870,000	\$180,610,000	\$543,210,000	\$256,500,000	\$765,980,000	\$11,746,518	\$26,659,917	0.95%	0.90%
Port Richey	\$48,160,000	\$143,220,000	\$117,290,000	\$230,410,000	\$159,970,000	\$489,550,000	\$233,470,000	\$681,740,000	\$10,044,774	\$24,593,230	0.82%	0.83%
Weeki Wachee Gardens	\$73,260,000	\$155,910,000	\$141,480,000	\$224,680,000	\$177,460,000	\$416,130,000	\$251,400,000	\$568,050,000	\$12,404,258	\$23,499,922	1.01%	0.80%
Homosassa Springs	\$36,200,000	\$115,510,000	\$114,230,000	\$216,120,000	\$169,230,000	\$431,270,000	\$261,890,000	\$626,650,000	\$9,683,754	\$21,987,960	0.79%	0.74%
Dunedin	\$44,480,000	\$128,700,000	\$104,080,000	\$202,520,000	\$140,910,000	\$400,820,000	\$208,080,000	\$548,630,000	\$8,981,168	\$21,161,158	0.73%	0.72%
North Redington Beach	\$50,030,000	\$133,680,000	\$115,490,000	\$201,040,000	\$149,690,000	\$392,470,000	\$212,020,000	\$535,420,000	\$9,816,729	\$21,140,152	0.80%	0.72%
Bardmoor	\$25,140,000	\$76,700.000	\$60,560,000	\$191,380,000	\$92,830,000	\$345,320,000	\$230,180,000	\$544,790,000	\$5,946,699	\$18,058,396	0.48%	0.61%
Total	\$5,848,500,000	\$17,163,760,000	\$14,214,870,000	\$28,628,080,000	\$19,566,460,000	\$56,556,680,000	\$30,391,910,000	\$78,343,820,000	\$1,232,060,457	\$2,953,907,259	100.00%	100.00%

Consequences & Risk per AEP Event by Census Place

Figure 4-37: Planning Reach FL_11 Consequences and Risk Details (top 35 of 83 census places)

4.2.4.7 Planning Reach FL_12: Northwest Florida Coast

This section describes dollar damage storm surge risk for Planning Reach FL_12, which includes the Northwest Florida Coast. All estimates shown are in FY 2018 price levels. **Figure 4-38** displays the number, occupancy type, and total value (structure + content + vehicle value) in Planning Reach FL_12 in the 0.2-percent AEP event flood extent, based on the NSI 2.0 structure inventory data for the Northwest Florida Coast. **Figure 4-39** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-40** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.

There are approximately 34,000 structures with a total estimated exposure value of more than \$11 billion. Most of the assets and asset values are single-family residential, multi-family residential, and commercial. Single-family residences comprise 54 percent of the buildings and 54 percent of the exposed value. Commercial buildings comprise approximately 5 percent of the assets and 16 percent of the exposed value. Multi-family residential buildings comprise approximately 38 percent of the assets and 21 percent of the exposed value. The exposure extent includes five counties, nine census places, 1,269 census blocks, and approximately 586,000 acres.

Northwest Florida has ocean-facing, back bay, and riverine shorelines that are susceptible to coastal flood hazards. Storm surge can propagate over the shorelines located in Wakulla, Taylor, Jefferson, and Dixie counties. Maximum surge depths modeled range from 8.8 to 20.8 feet in existing conditions to 11.8 to 23.8 feet in future conditions. Overall risk for the planning reach ranges between \$38.3 million and \$56.2 million. Of the five counties exposed, the coastal storm risk is located primarily in Wakulla, Dixie, and Taylor counties. Of the nine exposed census places, the highest-risk population centers include Panacea (42 percent), and Steinhatchee (34 percent). Northwest Florida is the most rural planning reach in the state, with 70 to 72 percent of the storm surge risk is distributed in more rural areas. The number of medium- to high-risk census blocks increases by 75 percent between existing and future conditions with sea level rise.



Figure 4-38: Planning Reach FL_12 Exposure Details



Figure 4-39: Planning Reach FL_12 Risk Details

	Consequences & Risk per AEP Event by Census Place											
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
											Risk	Risk
				•								
Panacea	\$25,000,000	\$52,070,000	\$56,240,000	\$88,150,000	\$75,620,000	\$106,770,000	\$110,290,000	\$140,230,000	\$4,873,585	\$7,852,935	43.26%	42.11%
Steinhatchee	\$17,790,000	\$40,630,000	\$44,150,000	\$71,030,000	\$60,350,000	\$87,120,000	\$89,490,000	\$113,090,000	\$3,778,418	\$6,285,588	33.5 <mark>4%</mark>	33.71%
Horseshoe Beach	\$6,190,000	\$11,850,000	\$17,990,000	\$26,290,000	\$22,560,000	\$33,250,000	\$29,590,000	\$45,650,000	\$1,438,474	\$2,230,472	12.77%	11.96%
St. Marks	\$4,960,000	\$9,650,000	\$10,640,000	\$16,350,000	\$14,310,000	\$19,760,000	\$20,870,000	\$25,960,000	\$931,431	\$1,455,072	8.27%	7.80%
Crawfordville	\$0	\$0	\$660,000	\$3,760,000	\$2,040,000	\$18,210,000	\$26,880,000	\$71,430,000	\$208,980	\$761,151	1.86%	4.08%
Sopchoppy	\$70,000	\$170,000	\$200,000	\$340,000	\$270,000	\$760,000	\$1,290,000	\$2,320,000	\$21,942	\$42,733	0.19%	0.23%
Fanning Springs	\$60,000	\$130,000	\$140,000	\$240,000	\$200,000	\$280,000	\$290,000	\$360,000	\$12,472	\$20,638	0.11%	0.11%
Total	\$54,070,000	\$114,500,000	\$130,020,000	\$206,160,000	\$175,350,000	\$266,150,000	\$278,700,000	\$399,040,000	\$11,265,302	\$18,648,589	100.00%	100.00%

Figure 4-40: Planning FL_12 Consequences and Risk Details

4.2.4.8 Planning Reach FL_13: Florida Panhandle

This section describes dollar damage storm surge risk for Planning Reach FL_13, which includes the coastal areas along the Florida Panhandle. All estimates shown are in FY 2018 price levels. **Figure 4-41** displays the number, occupancy type, and total value (structure + content + vehicle value) in Planning Reach FL_13 in the 0.2-percent AEP event flood extent, based on the NSI 2.0 structure inventory data for the Florida Panhandle. **Figure 4-42** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-43** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.

There are approximately 379,000 structures with a total estimated exposure value of over \$225 billion. Most of the assets and asset values are singlefamily residential, multi-family residential, and commercial. Single-family residences comprise 75 percent of the buildings and 44 percent of the exposed value. Commercial buildings comprise approximately 9 percent of the assets and 27 percent of the exposed value. Multi-family residential buildings comprise approximately 14 percent of the assets and 20 percent of the exposed value. The exposure extent includes nine counties, 60 census places, 6,052 census blocks, and approximately 735,000 acres.

The Florida Panhandle has ocean-facing, back bay, and riverine shorelines that are susceptible to coastal flood hazards. Storm surge can propagate over the shorelines located in Bay, Escambia, Franklin, Gulf, Santa Rosa, and Walton counties. Maximum surge depths modeled range from 4.6 to 15.9 feet in existing conditions to 7.6 to 18.9 feet in future conditions. Overall risk for the planning reach ranges between \$259 million and \$532 million. Of the nine counties exposed, the coastal storm risk is located primarily in Okaloosa, Bay, Walton, and Escambia counties. Of the 60 exposed census places, the highest-risk population centers include Miramar Beach, Destin, Upper Grand Lagoon, Panama City, Fort Walton Beach, and Lynn Haven. Census place risk is broadly distributed among the remaining census places in this planning reach. Approximately 41 to 45 percent of the storm surge risk is distributed in more rural areas. The number of medium- to high-risk census blocks increases by 122 percent between existing and future conditions with sea level rise.



Figure 4-41: Planning Reach FL_13 Exposure Details



Figure 4-42: Planning Reach FL_13 Risk Details

	Consequences & Risk per AEP Event by Census Place											
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
				•							NISK	NI3K
Miramar Beach	\$115,330,000	\$335,630,000	\$292,820,000	\$561,580,000	\$395,800,000	\$672,450,000	\$608,860,000	\$895,980,000	\$25,005,189	\$50,123,600	18.04%	16.63%
Destin	\$85,630,000	\$226,960,000	\$189,630,000	\$418,090,000	\$272,210,000	\$522,430,000	\$467,210,000	\$748,190,000	\$17,212,043	\$37,081,770	12,42%	12,30%
Upper Grand Lagoon	\$68,080,000	\$199,380,000	\$168,410,000	\$311,990,000	\$230,830,000	\$374,150,000	\$352,700,000	\$555,030,000	\$14,495,172	\$28,712,440	10.46%	9.53%
Panama City	\$53,510,000	\$169,610,000	\$140,850,000	\$289,690,000	\$197,250,000	\$358,270,000	\$317,430,000	\$529,470,000	\$12,158,699	\$26,231,267	8.77%	8.70%
Fort Walton Beach	\$49,380,000	\$125,800,000	\$109,320,000	\$242,840,000	\$150,010,000	\$309,230,000	\$281,710,000	\$525,890,000	\$9,935,324	\$21,896,863	7.17%	7.27%
Lynn Haven	\$34,210,000	\$113,680,000	\$94,350,000	\$205,670,000	\$134,550,000	\$260,780,000	\$227,740,000	\$376,630,000	\$8,189,419	\$18,407,333	5.91%	6.11%
Niceville	\$46,510,000	\$99,410,000	\$90,110,000	\$150,600,000	\$112,850,000	\$175,600,000	\$163,100,000	\$221,430,000	\$7,910,630	\$13,662,404	5.71%	4.53%
Pensacola	\$5,820,000	\$56,540,000	\$31,320,000	\$140,140,000	\$85,800,000	\$207,450,000	\$177,910,000	\$278,830,000	\$3,481,080	\$12,109,936	2.51%	4.02%
Callaway	\$25,370,000	\$67,480,000	\$58,100,000	\$106,440,000	\$77,060,000	\$125,770,000	\$114,530,000	\$166,940,000	\$5,010,465	\$9,622,730	3.61%	3.19%
Warrington	\$16,490,000	\$50,790,000	\$44,960,000	\$98,270,000	\$66,900,000	\$124,030,000	\$111,820,000	\$169,480,000	\$3,956,262	\$8,590,165	2.85%	2.85%
Pretty Bayou	\$11,590,000	\$46,340,000	\$37,430,000	\$91,330,000	\$56,100,000	\$117,040,000	\$101,960,000	\$166,150,000	\$3,264,771	\$8,014,493	2.36%	2.66%
Ocean City	\$17,040,000	\$35,150,000	\$31,400,000	\$76,800,000	\$41,280,000	\$118,400,000	\$95,090,000	\$150,870,000	\$3,035,701	\$6,835,062	2.19%	2.27%
Lake Lorraine	\$18,040,000	\$35,920,000	\$32,300,000	\$73,310,000	\$41,540,000	\$105,780,000	\$88,100,000	\$134,120,000	\$3,077,650	\$6,492,197	2.22%	2.15%
Shalimar	\$9,880,000	\$25,080,000	\$21,020,000	\$53,120,000	\$30,890,000	\$66,920,000	\$60,060,000	\$84,830,000	\$1,978,557	\$4,503,479	1.43%	1.49%
St. George Island	\$9,900,000	\$26,230,000	\$22,560,000	\$51,450,000	\$37,060,000	\$64,510,000	\$60,310,000	\$85,120,000	\$2,107,117	\$4,456,766	1.52%	1.48%
Port St. Joe	\$1,680,000	\$19,230,000	\$9,920,000	\$42,830,000	\$20,740,000	\$58,070,000	\$42,980,000	\$96,780,000	\$958,783	\$3,799,502	0.69%	1.26%
Lower Grand Lagoon	\$6,980,000	\$20,010,000	\$18,640,000	\$40,140,000	\$26,430,000	\$55,800,000	\$39,760,000	\$137,490,000	\$1,593,876	\$3,934,121	1.15%	1.31%
Parker	\$11,770,000	\$23,930,000	\$21,070,000	\$37,890,000	\$26,770,000	\$48,320,000	\$41,850,000	\$74,940,000	\$1,911,366	\$3,545,445	1.38%	1.18%
Midway	\$2,170,000	\$17,060,000	\$8,050,000	\$35,370,000	\$13,950,000	\$46,820,000	\$29,580,000	\$68,470,000	\$752,923	\$3,106,900	0.54%	1.03%
Panama City Beach	\$3,130,000	\$15,160,000	\$13,120,000	\$33,050,000	\$20,270,000	\$44,710,000	\$36,510,000	\$98,200,000	\$1,117,284	\$3,084,835	0.81%	1.02%
Navarre	\$3,970,000	\$16,930,000	\$10,470,000	\$32,780,000	\$15,040,000	\$43,020,000	\$28,240,000	\$70,560,000	\$934,960	\$2,962,699	0.67%	0.98%
Apalachicola	\$5,300,000	\$15,320,000	\$13,940,000	\$28,140,000	\$19,050,000	\$37,000,000	\$32,400,000	\$67,130,000	\$1,206,904	\$2,614,305	0.87%	0.87%
Carrabelle	\$4,670,000	\$12,610,000	\$12,070,000	\$26,790,000	\$18,050,000	\$35,300,000	\$33,420,000	\$59,670,000	\$1,094,009	\$2,387,159	0.79%	0.79%
Mexico Beach	\$820,000	\$6,080,000	\$4,840,000	\$23,600,000	\$8,990,000	\$34,620,000	\$28,400,000	\$58,500,000	\$501,777	\$1,968,921	0.36%	0.65%
Gulf Breeze	\$6,530,000	\$14,880,000	\$10,920,000	\$22,740,000	\$12,500,000	\$26,770,000	\$19,070,000	\$35,760,000	\$979,082	\$2,074,192	0.71%	0.69%
Cinco Bayou	\$2,730,000	\$8,490,000	\$6,940,000	\$22,400,000	\$11,000,000	\$30,390,000	\$26,370,000	\$42,510,000	\$678,976	\$1,875,484	0.49%	0.62%
Valparaiso	\$4,760,000	\$11,220,000	\$9,790,000	\$21,120,000	\$13,410,000	\$27,780,000	\$24,410,000	\$42,940,000	\$898,352	\$1,906,831	0.65%	0.63%
Wright	\$4,800,000	\$9,510,000	\$8,510,000	\$18,460,000	\$11,130,000	\$25,740,000	\$21,970,000	\$45,390,000	\$807,613	\$1,714,994	0.58%	0.57%
Milton	\$4,250,000	\$12,410,000	\$8,740,000	\$17,880,000	\$11,220,000	\$20,610,000	\$16,490,000	\$25,920,000	\$764,182	\$1,641,943	0.55%	0.54%
West Pensacola	\$1,430,000	\$8,860,000	\$5,630,000	\$15,840,000	\$10,960,000	\$19,880,000	\$16,840,000	\$26,000,000	\$510,535	\$1,403,429	0.37%	0.47%
Mary Esther	\$4.820.000	\$8,950,000	\$8,230,000	\$14,630,000	\$9.880.000	\$18,700,000	\$15,920,000	\$28,860,000	\$748.084	\$1,358,141	0.54%	0.45%
Navarre Beach	\$1,640,000	\$10,370,000	\$7.070.000	\$14,560,000	\$11,000,000	\$17,350,000	\$15,620,000	\$48,320,000	\$577.099	\$1,516,786	0.42%	0.50%
Laguna Beach	\$2,150,000	\$10,460.000	\$9,200.000	\$14,530.000	\$13,680,000	\$18,660.000	\$20,880,000	\$39,520,000	\$748,957	\$1,477,629	0.54%	0.49%
East Milton	\$1,500.000	\$7,480,000	\$4.240.000	\$13,470,000	\$6.390.000	\$16.570.000	\$11,370,000	\$21,860,000	\$376.823	\$1,185.863	0.27%	0.39%
Ferry Pass	\$3,490,000	\$7,270,000	\$7,140,000	\$12,050,000	\$9,440,000	\$14,840,000	\$14,310,000	\$19,210,000	\$632,633	\$1,082,248	0.46%	0.36%
Total	\$645,370,000	\$1,870,230,000	\$1,563,110,000	\$3,359,590,000	\$2,220,030,000	\$4,243,760,000	\$3,744,920,000	\$6,196,990,000	\$138,612,297	\$301,381,932	100.00%	100.00%

Figure 4-43: Planning Reach FL_13 Consequences and Risk Details (top 35 of 60 census places)
4.2.5 Alabama

4.2.5.1 Planning Reach AL_14: Alabama Gulf Coast

This section describes dollar damage storm surge risk for Planning Reach AL_14, which includes the Alabama Gulf Coast. All estimates shown are in FY 2018 price levels. **Figure 4-44** displays the number, occupancy type, and total value (structure + content + vehicle value) in Planning Reach AL_14 in the 0.2-percent AEP event flood extent, based on the NSI 2.0 structure inventory data for the Alabama Gulf Coast. **Figure 4-45** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-46** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.

There are approximately 190,000 structures with a total estimated exposure value of more than \$113 billion. Most of the assets and asset values are single-family residential, multi-family residential, and commercial. Single-family residences comprise 78 percent of the buildings and 45 percent of the exposed value. Commercial buildings comprise approximately 10 percent of the assets and 30 percent of the exposed value. Multi-family residential buildings comprise approximately 9 percent of the assets and 15 percent of the exposed value. The exposure extent includes five counties 26 census places, 2,567 census blocks, and approximately 477,000 acres.

The Alabama Gulf Coast has ocean-facing, back bay, and riverine shorelines that are susceptible to coastal flood hazards. Storm surge can propagate over the shorelines located in Mobile and Baldwin counties. Maximum surge depths modeled range from 5.0 to 13.5 feet in existing conditions to 8.0 to 16.5 feet in future conditions. Overall risk for the planning reach ranges between \$91 million and \$175 million. Of the five counties exposed, the coastal storm risk is located primarily in Baldwin and Mobile counties. Of the 26 exposed census places, the highest-risk population centers include Orange Beach (36 percent), Mobile (25 percent), and Gulf Shores (18 percent). Census place risk is broadly distributed among the remaining census places in this planning reach. Approximately 41 to 45 percent of the storm surge risk is distributed in more rural areas. The number of medium- to high-risk census blocks increases by 115 percent between existing and future conditions with sea level rise.



Figure 4-44: Planning Reach AL_14 Exposure Details



Figure 4-45: Planning Reach AL_14 Risk Details

	Consequences & Risk per AEP Event by Census Place											
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
				•							Risk	Risk
Orange Beach	\$245,470,000	\$402,710,000	\$376,730,000	\$532,070,000	\$441,630,000	\$589,130,000	\$583,180,000	\$757,620,000	\$34,244,419	\$49,899,160	46.63%	35.53%
Mobile	\$67,760,000	\$175,540,000	\$1 <mark>61,380,000</mark>	\$405,900,000	\$241,750,000	\$562,670,000	\$495,150,000	\$864,950,000	\$15, <mark>124,133</mark>	\$35,551,119	20.59%	25.31%
Gulf Shores	\$28,630,000	\$128,890,000	\$109,670,000	\$294,950,000	\$1 <mark>87,050,000</mark>	\$389,900,000	\$321,970,000	\$596,590,000	\$9,694,610	\$25,517,781	13.20%	18.17%
Dauphin Island	\$13,540,000	\$57,290,000	\$39,620,000	\$88,350,000	\$56,610,000	\$104,920,000	\$84,700,000	\$138,660,000	\$3,340,512	\$8,043,813	4.55%	5.73%
Bayou La Batre	\$11,640,000	\$34,420,000	\$31,880,000	\$65,170,000	\$44,710,000	\$79,020,000	\$71,480,000	\$110,540,000	\$2,733,102	\$5,684,371	3.72%	4.05%
Saraland	\$6,800,000	\$15,560,000	\$14,310,000	\$32,450,000	\$21,260,000	\$43,170,000	\$38,970,000	\$73,210,000	\$1,341,378	\$2,909,581	1.83%	2.07%
Bon Secour	\$12,920,000	\$22,640,000	\$20,330,000	\$29,490,000	\$24,960,000	\$32,780,000	\$37,430,000	\$47,740,000	\$1,882,291	\$2,813,627	2.56%	2.00%
Spanish Fort	\$5,880,000	\$11,940,000	\$11,010,000	\$18,510,000	\$13,970,000	\$22,060,000	\$20,300,000	\$29,190,000	\$978,075	\$1,684,646	1.33%	1.20%
Perdido Beach	\$1,690,000	\$7,700,000	\$6,150,000	\$13,760,000	\$9,280,000	\$17,050,000	\$14,810,000	\$20,220,000	\$517,215	\$1,202,557	0.70%	0.86%
Chickasaw	\$3,140,000	\$7,190,000	\$6,690,000	\$12,640,000	\$9,100,000	\$15,310,000	\$14,270,000	\$21,010,000	\$595,011	\$1,120,126	0.81%	0.80%
Foley	\$1,850,000	\$6,350,000	\$5,190,000	\$12,000,000	\$7,690,000	\$15,780,000	\$13,260,000	\$20,600,000	\$456,210	\$1,060,270	0.62%	0.75%
Lillian	\$2,840,000	\$6,100,000	\$5,300,000	\$10,330,000	\$7,050,000	\$13,720,000	\$11,320,000	\$17,120,000	\$483,371	\$935,202	0.66%	0.67%
Point Clear	\$1,770,000	\$4,400,000	\$4,070,000	\$8,470,000	\$5,610,000	\$10,660,000	\$9,730,000	\$14,810,000	\$362,917	\$742,488	0.49%	0.53%
Daphne	\$2,950,000	\$4,700,000	\$4,750,000	\$8,320,000	\$5,710,000	\$10,620,000	\$9,050,000	\$14,410,000	\$437,803	\$744,910	0.60%	0.53%
Magnolia Springs	\$1,190,000	\$4,210,000	\$3,190,000	\$6,720,000	\$5,350,000	\$8,770,000	\$7,610,000	\$10,170,000	\$284,848	\$610,619	0.39%	0.43%
Stockton	\$1,080,000	\$4,110,000	\$3,370,000	\$5,530,000	\$4,590,000	\$5,780,000	\$5,620,000	\$6,070,000	\$269,784	\$501,459	0.37%	0.36%
Satsuma	\$1,480,000	\$3,110,000	\$2,880,000	\$5,450,000	\$3,930,000	\$6,990,000	\$6,300,000	\$14,560,000	\$261,419	\$519,051	0.36%	0.37%
Creola	\$830,000	\$1,710,000	\$1,570,000	\$2,880,000	\$2,100,000	\$3,670,000	\$3,360,000	\$5,580,000	\$143,491	\$263,966	0.20%	0.19%
Elberta	\$430,000	\$1,430,000	\$1,190,000	\$2,690,000	\$1,720,000	\$3,790,000	\$2,960,000	\$5,180,000	\$103,908	\$243,391	0.14%	0.17%
Fairhope	\$540,000	\$1,190,000	\$820,000	\$2,020,000	\$1,270,000	\$2,720,000	\$2,480,000	\$4,490,000	\$84,829	\$190,400	0.12%	0.14%
Prichard	\$330,000	\$540,000	\$530,000	\$1,030,000	\$630,000	\$1,380,000	\$1,260,000	\$2,370,000	\$50,150	\$95,243	0.07%	0.07%
Belle Fontaine	\$370,000	\$550,000	\$440,000	\$830,000	\$470,000	\$1,010,000	\$840,000	\$1,480,000	\$44,338	\$77,365	0.06%	0.06%
Grand Bay	\$0	\$0	\$0	\$210,000	\$90,000	\$320,000	\$260,000	\$710,000	\$2,334	\$16,551	0.00%	0.01%
Mount Vernon	\$40,000	\$80,000	\$80,000	\$120,000	\$100,000	\$130,000	\$130,000	\$170,000	\$6,711	\$10,953	0.01%	0.01%
Total	\$413,170,000	\$902,360,000	\$811,150,000	\$1,559,890,000	\$1,096,630,000	\$1,941,350,000	\$1,756,440,000	\$2,777,450,000	\$73,442,859	\$140,438,649	100.00%	100.00%

Figure 4-46: Planning Reach AL_14 Consequences and Risk Details

4.2.6 Mississippi

4.2.6.1 Planning Reach MS_15: Mississippi Gulf Coast

This section describes dollar damage storm surge risk for Planning Reach MS_15, which includes the Mississippi Gulf Coast. All estimates shown are in FY 2018 price levels. **Figure 4-47** displays the number, occupancy type, and total value (structure + content + vehicle value) in MS_15 in the 0.2-percent AEP event flood extent, based on the NSI 2.0 structure inventory data for the Mississippi Gulf Coast. **Figure 4-48** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-49** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.

There are approximately 154,000 structures with a total estimated exposure value of more than \$84 billion. Most of the assets and asset values are single-family residential, multi-family residential, and commercial. Single-family residences comprise 80 percent of the buildings and 51 percent of the exposed value. Commercial buildings comprise approximately 8 percent of the assets and 31 percent of the exposed value. Multi-family residential buildings comprise approximately 10 percent of the assets and 10 percent of the exposed value. The exposure extent includes three counties, 23 census places, 5,575 census blocks, and approximately 491,000 acres.

The Mississippi Gulf Coast has ocean-facing, back bay, and riverine shorelines that are susceptible to coastal flood hazards. Storm surge can propagate over the shorelines located in Jackson, Harrison, and Hancock counties. Maximum surge depths modeled range from 9.5 to 22.0 feet in existing conditions to 12.5 to 25.0 feet in future conditions. Overall risk for the planning reach ranges between \$243 million and \$414 million. All Mississippi Gulf coastal storm risk is in Jackson, Harrison, and Hancock counties. Of the 23 exposed census places, the highest-risk population centers include Pascagoula, Biloxi, Gulfport, Bay St. Louis, Moss Point, Gautier, and Pass Christian. Census place risk is broadly distributed among the remaining census places for this planning reach. Approximately 10 percent of the storm surge risk is distributed in more rural areas. The number of medium- to high-risk census blocks increases by 77 percent between existing and future conditions with sea level rise.





Figure 4-48: Planning Reach MS_15 Risk Details

					Consequences 8	Risk per AEP Even	t by Census Place					
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
				•							Risk	Risk
Pascagoula	\$47,690,000	\$196,290,000	\$259,710,000	\$735,530,000	\$584,750,000	\$1,019,470,000	\$979,630,000	\$1,499,650,000	\$24,734,410	\$59,126,090	11.31%	15.82%
Biloxi	\$146,380,000	\$296,570,000	\$361,920,000	\$573,820,000	\$502,480,000	\$753,400,000	\$852,150,000	\$1,312,210,000	\$31,777,553	\$52,336,944	14.53%	14.00%
Gulfport	\$109,38 <mark>0,000</mark>	\$220,880,000	\$291,200,000	\$499,740,000	\$437,650,000	\$691,970,000	\$816,710,000	\$1,272,850,000	\$26,317,902	\$45,192,563	12.03%	12.09%
Moss Point	\$104,170,000	\$178,600,000	\$212,690,000	\$355,360,000	\$303,130,000	\$409,870,000	\$442,360,000	\$612,690,000	\$19,122,655	\$30,502,200	8.74%	8.16%
Bay St. Louis	\$160,810,000	\$227,440,000	\$247,470,000	\$336,140,000	\$301,020,000	\$4 <mark>43,560,000</mark>	\$519,930,000	\$682,960,000	\$23,392,037	\$32,320,294	10. <mark>6</mark> 9%	8.65%
Gautier	\$73,850,000	\$127,050,000	\$143,750,000	\$273,280,000	\$214,830,000	\$375,480,000	\$3 <mark>94,990,000</mark>	\$693,330,000	\$13,728,581	\$24,922,575	6.28%	6.67%
Pass Christian	\$86, <mark>040,000</mark>	\$152,560,000	\$17 <mark>9,210,000</mark>	\$258,630,000	\$2 <mark>39,210,000</mark>	\$325,740,000	\$367,630,000	\$475,770,000	\$15,868,067	\$23,528,774	7.25%	6.30%
Waveland	\$41,740,000	\$95,400,000	\$131,540,000	\$205,900,000	\$190,670,000	\$263,320,000	\$298,380,000	\$384,440,000	\$1 1,095,509	\$17,760,117	5.07%	4.75%
Gulf Park Estates	\$63,400,000	\$104,980,000	\$113,710,000	\$167,650,000	\$156,090,000	\$217,880,000	\$244,020,000	\$438,290,000	\$10,521,791	\$16,336,971	4.81%	4.37%
D'Iberville	\$22,800,000	\$54,260,000	\$69,410,000	\$145,460,000	\$117,830,000	\$197,460,000	\$199,360,000	\$319,310,000	\$6,290,594	\$12,410,388	2.88%	3.32%
St. Martin	\$23,050,000	\$55,000,000	\$62,720,000	\$104,550,000	\$87,910,000	\$132,520,000	\$141,960,000	\$191,740,000	\$5,387,690	\$9,247,632	2.46%	2.47%
Pearlington	\$53,720,000	\$76,380,000	\$81,070,000	\$91,850,000	\$88,620,000	\$108,640,000	\$132,020,000	\$156,870,000	\$7,385,754	\$9,106,597	3.38%	2.44%
Ocean Springs	\$25,210,000	\$42,480,000	\$45,080,000	\$82,050,000	\$60,510,000	\$114,120,000	\$103,720,000	\$309,190,000	\$4,205,272	\$8,275,715	1.92%	2.21%
Escatawpa	\$13,010,000	\$33,900,000	\$39,430,000	\$81,390,000	\$63,960,000	\$110,890,000	\$117,350,000	\$177,010,000	\$3,576,512	\$7,080,283	1.63%	1.89%
Diamondhead	\$17,740,000	\$32,810,000	\$44,260,000	\$77,260,000	\$67,190,000	\$102,620,000	\$121,850,000	\$159,060,000	\$4,036,304	\$6,666,251	1.84%	1.78%
Kiln	\$37,070,000	\$45,750,000	\$50,220,000	\$63,160,000	\$59,190,000	\$72,060,000	\$76,180,000	\$86,840,000	\$4,731,000	\$5,842,075	2.16%	1.56%
Long Beach	\$6,690,000	\$12,050,000	\$15,890,000	\$39,770,000	\$28,160,000	\$71,190,000	\$93,400,000	\$183,460,000	\$1,798,115	\$4,013,236	0.82%	1.07%
Henderson Point	\$12,710,000	\$22,060,000	\$26,730,000	\$39,540,000	\$35,480,000	\$49,330,000	\$54,440,000	\$70,910,000	\$2,356,761	\$3,530,416	1.08%	0.94%
Helena	\$550,000	\$3,660,000	\$5,170,000	\$25,050,000	\$14,870,000	\$45,780,000	\$49,770,000	\$65,780,000	\$688,477	\$2,079,835	0.31%	0.56%
Gulf Hills	\$3,720,000	\$11,880,000	\$9,400,000	\$22,130,000	\$12,920,000	\$27,910,000	\$20,020,000	\$40,150,000	\$807,483	\$1,964,079	0.37%	0.53%
Vancleave	\$5,060,000	\$8,690,000	\$9,400,000	\$13,820,000	\$11,890,000	\$17,380,000	\$18,250,000	\$26,420,000	\$842,651	\$1,285,359	0.39%	0.34%
DeLisle	\$460,000	\$920,000	\$1,070,000	\$2,050,000	\$1,700,000	\$3,210,000	\$4,670,000	\$10,200,000	\$110,229	\$220,275	0.05%	0.06%
Wade	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$40,000	\$12	\$225	0.00%	0.00%
Total	\$1,055,250,000	\$1,999,610,000	\$2,401,050,000	\$4,194,130,000	\$3,580,060,000	\$5,553,800,000	\$6,048,790,000	\$9,169,170,000	\$218,775,359	\$373,748,894	100.00%	100.00%

Figure 4-49: Planning Reach MS_15 Consequences and Risk Details

4.2.7 Puerto Rico

4.2.7.1 Planning Reach PR_1: Northwest Puerto Rico Coast

This section describes dollar damage storm surge risk for Planning Reach PR_1, which includes the Northwest Puerto Rico Coast. All estimates shown are in FY 2018 price levels. Figure 4-50 displays the number, occupancy type, and total value (structure + content value) in PR_1 in the 0.2-percent AEP event flood extent, based on the FEMA structure inventory data for the Northwest Puerto Rico Coast. Figure 4-51 details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. Figure 4-52 provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.

There are approximately 3,508 structures with a total estimated exposure value of more than \$625 million. Most of the assets and asset valued are single-family residential and multi-family residential. Single-family residences comprise 93 percent of the buildings and 75 percent of the exposed value. Multi-family residential buildings comprise approximately 6 percent of the assets and 22 percent of the exposed value. The exposure extent includes eight municipalities, nine census places, 321 census blocks, and approximately 8,000 acres.

Municipalities along the Northwest Puerto Rico coast with shorelines that are susceptible to coastal flood hazards include Rincon, Mayaguez, Isabela, Hatillo, Camuy, Anasco, Aguadilla, and Aguada. Maximum flood depths modeled range from 6 to 11 feet in existing conditions to 7.7 to 13.2 feet in future conditions. Overall risk for the planning reach ranges between \$403 thousand and \$1.7 million. Of the eight exposed municipalities, most of the coastal storm risk is in Mayaguez, Anasco, and Rincon. Of the nine exposed census places, the highest-risk population centers include Mayaguez (78 percent), La Playa (12 percent), and Stella (8 percent). Approximately 74 percent of the storm surge risk is distributed in more rural areas in existing conditions. However, the proportion of the risk located in rural areas is expected to diminish to approximately 35 percent owing to significant risk increases in more populated places. The number of medium- to high-risk census blocks increases by 300 percent between existing and future conditions with sea level rise.



of Buildings by General Occupancy

Est. Exposure Value by General Occupancy



Exposure Statistics by General Occupancy

General Occupancy	# of Bldgs	Est. Total Exposure Value
Single Family Residential	3,264	\$468,575,072
Multi-Family Residential	215	\$135,975,394
Commercial	26	\$17,542,615
Education	2	\$2,474,901
Industrial	1	\$280,863

Figure 4-50: Planning Reach PR_1 Exposure Details



Figure 4-51: Planning Reach PR_1 Risk Details

						Consequences	& Risk per AE	P Event by Cens	sus Place					
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_20Yr	FC_DL_20Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
													Risk	Risk
Mayagüez zona urbana	\$30,000	\$1,790,000	\$140,000	\$3,750,000	\$460,000	\$10,570,000	\$1,240,000	\$20,150,000	\$8,740,000	\$66,750,000	\$61,222	\$854,238	56.51%	77.52%
La Playa comunidad	\$0	\$110,000	\$0	\$350,000	\$20,000	\$1,660,000	\$120,000	\$3,340,000	\$1,970,000	\$11,670,000	\$9,450	\$127,158	8.72%	11.54%
Stella comunidad	\$0	\$780,000	\$420,000	\$850,000	\$520,000	\$970,000	\$570,000	\$1,070,000	\$610,000	\$1,210,000	\$3 <mark>5,064</mark>	\$86,904	3 <mark>2.37%</mark>	7.89%
Aguadilla zona urbana	\$0	\$10,000	\$0	\$30,000	\$0	\$180,000	\$0	\$640,000	\$260,000	\$3,690,000	\$1,050	\$25,348	0.97%	2.30%
Rincón zona urbana	\$0	\$40,000	\$10,000	\$40,000	\$20,000	\$50,000	\$20,000	\$60,000	\$30,000	\$80,000	\$1,179	\$4,697	1.09%	0.43%
Camuy zona urbana	\$0	\$0	\$0	\$0	\$0	\$10,000	\$0	\$10,000	\$90,000	\$700,000	\$374	\$3,055	0.35%	0.28%
Hatillo zona urbana	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$10,000	\$0	\$110,000	\$0	\$527	0.00%	0.05%
Añasco zona urbana	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$12	0.00%	0.00%
Total	\$30,000	\$2,730,000	\$570,000	\$5,020,000	\$1,020,000	\$13,440,000	\$1,950,000	\$25,280,000	\$11,700,000	\$84,210,000	\$108,339	\$1,101,939	100.00%	100.00%

Figure 4-52: Planning Reach PR_1 Consequences and Risk Details

4.2.7.2 Planning Reach PR_2: North Central Puerto Rico Coast

This section describes dollar damage storm surge risk for Planning Reach PR_2, which includes the North Central Puerto Rico Coast. All estimates shown are in FY 2018 price levels. Figure 4-53 displays the number, occupancy type, and total value (structure + content value) in Planning Reach PR_2 in the 0.2-percent AEP event flood extent, based on FEMA structure inventory data for the North Central Puerto Rico Coast. Figure 4-54 provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. Figure 4-55 provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.

There are approximately 1,875 structures with a total estimated exposure value of more than \$330 million in this planning reach. Most of the assets and asset values are single-family residential and multi-family residential. Single-family residences comprise 97 percent of the buildings and 81 percent of the exposed value. Multi-family residential buildings comprise approximately 3 percent of the assets and 17 percent of the exposed value. The exposure extent includes five counties, five census places, 221 census blocks, and approximately 11,000 acres.

Municipalities along the North Central Puerto Rico Coast with shorelines that are susceptible to coastal flood hazards include Vega Baja, Vega Alta, Manati, Barceloneta, and Arecibo. Maximum flood depths modeled range from 6 to 11 feet in existing conditions to 7.7 to 13.2 feet in future conditions. Overall risk for the planning reach ranges between \$203 thousand and \$939 thousand. Of the five exposed municipalities, most of the coastal storm risk is in Arecibo and Vega Baja. Of the five exposed census places, the riskiest population centers include Arecibo (68 percent), Vega Baja (20 percent), and Barceloneta (11 percent).

Approximately 47 percent of the storm surge risk is distributed in more rural areas in existing conditions. However, the proportion of the risk located in rural areas is expected to increase to approximately 53 percent in future conditions. The number of census blocks with medium- to high-risk census blocks increases from one to nine between existing and future conditions with sea level rise.



of Buildings by General Occupancy

Est. Exposure Value by General Occupancy



Exposure Statistics by General Occupancy

General Occupancy	# of Bldgs	Est. Total Exposure Value
Single Family Residential	1,811	\$267,697,663
Multi-Family Residential	60	\$56,287,829
Commercial	3	\$4,964,536
Education	1	\$809,122

Figure 4-53: Planning Reach PR_2 Exposure Details

SOUTH ATLANTIC COASTAL STUDY (SACS) | TIER 2 ECONOMIC RISK ASSESSMENT



Figure 4-54: Planning Reach PR_2 Risk Details

SECTION 4 | TIER 2 ERA RESULTS

					(Consequences &	& Risk per AEP	Event by Censi	us Place					
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_20Yr	FC_DL_20Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
													Risk	Risk
Arecibo zona urbana	\$200,000	\$1,640,000	\$590,000	\$2,140,000	\$1,020,000	\$3,400,000	\$1,430,000	\$4,850,000	\$2,730,000	\$14,100,000	\$73,403	\$295,094	75.47%	67.51%
Vega Baja zona urbana	\$0	\$0	\$0	\$0	\$0	\$140,000	\$0	\$1,850,000	\$2,920,000	\$16,680,000	\$11,698	\$86,294	12.03%	19.74%
Barceloneta zona urbana	\$0	\$40,000	\$0	\$150,000	\$100,000	\$590,000	\$320,000	\$1,170,000	\$1,4 <mark>80,000</mark>	\$4,500,000	\$10,863	\$47,475	11.17%	10.86%
Breñas comunidad	\$0	\$0	\$0	\$0	\$0	\$110,000	\$0	\$250,000	\$320,000	\$970,000	\$1,291	\$8,264	1.33%	1.89%
Total	\$200,000	\$1,680,000	\$590,000	\$2,290,000	\$1,120,000	\$4,240,000	\$1,750,000	\$8,120,000	\$7,450,000	\$36,250,000	\$97,255	\$437,127	100.00%	100.00%

Figure 4-55: Planning Reach PR_2 Consequences and Risk Details

4.2.7.3 Planning Reach PR_3: Southern Puerto Rico Coast

This section describes dollar damage storm surge risk for Planning Reach PR_3, which includes the Southern Puerto Rico Coast. All estimates shown are in FY 2018 price levels. **Figure 4-56** displays the number, occupancy type, and total exposure value (structure + content value) in Planning Reach PR_3 in the 0.2-percent AEP event flood extent, based on FEMA structure inventory data for the Southern Puerto Rico Coast. **Figure 4-57** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-58** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.

There are approximately 12,000 structures with a total estimated exposure value of more than \$2 billion in this planning reach. Most of the assets and asset values are single-family residential and multi-family residential structures. Single-family residences comprise 96 percent of the buildings and 85 percent of the exposed value. Multi-family residential buildings comprise approximately 4 percent of the assets and 14 percent of the exposed value. The exposure extent includes 12 counties, 18 census places, 799 census blocks, and approximately 48,000 acres.

All 12 municipalities along the southern and southwestern coast of Puerto Rico have shorelines that are susceptible to coastal flood hazards (**Figure 4-57**). Maximum flood depths modeled range from 6 to 13 feet in existing conditions to 9 to 15 feet in future conditions. Overall risk for the planning reach ranges between \$5.3 million and \$16.6 million in EAD. Of the 12 exposed municipalities, most of the coastal storm risk is in Salinas (31 percent), Cabo Rojo (12 percent), Ponce (11 percent), Santa Isabel (9 percent), Lajas (8 percent), Guayama (7 percent), Juana Diaz (7 percent) and Guayanilla (5 percent). Of the 18 exposed census places, the highest-risk population centers include Ponce (25 percent), Playita (20 percent), Playita Cortada (13 percent), Potala Pastillo (11 percent), Guanica (10 percent), and La Parguera (7 percent).

Approximately 77 percent of the storm surge risk is distributed in more rural areas in existing conditions. However, the proportion of the risk located in rural areas is expected to diminish to approximately 66 percent owing to significant risk increases in more populated places. The number of census blocks with medium- to high-risk census blocks increases by 280 percent between existing and future conditions with sea level rise.



\$0.5bn \$0.0bn \$0.0bn Single Family Residential Single Family Residential Single Family Residential

of Buildings by General Occupancy

Est. Exposure Value by General Occupancy



Exposure Statistics by General Occupancy

15K

10K

5K

0K

General Occupancy	# of Bldgs	Est. Total Exposure Value
Single Family Residential	11,667	\$1,417,180,462
Multi-Family Residential	499	\$240,523,789
Commercial	18	\$11,492,480
Education	2	\$1,618,244
Industrial	1	\$776,164

Figure 4-56: Planning Reach PR_3 Exposure Details

\$0.10M

Jauca comunidad

\$0.10M

Las Ochenta

comunidad



Existing Maximum Flood Elevation per Return Period Event by County (ft)

Census Places with Greatest Risk

Existing Risk ● Future Risk ● Risk Change

Coastal	EC_10	EC_20Yr	EC_50Yr	EC_100Y	EC_500Y
Counties	Yr			r	r
Arroyo	7.34	7.90	8.81	9.37	10.53
Cabo Rojo	8.03	8.94	10.46	11.29	12.85
Guanica	7.43	7.87	8.87	9.60	10.98
Guayama	7.95	8.46	9.37	10.02	11.42
Guayanilla	7.85	8.43	9.23	9.81	10.98
Juana Diaz	7.41	7.96	8.85	9.41	10.54
Lajas	8.02	8.58	9.56	10.27	11.60
Patillas	6.93	7.51	8.50	9.17	10.48
Penuelas	7.85	8.38	9.17	9.69	10.80
Ponce	8.48	9.31	10.45	11.22	12.72
Salinas	8.06	8.57	9.56	10.24	11.66
Santa Isabel	7.60	8.32	9.42	10.26	11.76

Future Maximum Flood Elevation per Return Period Event by County (ft)

Coastal Counties	FC_10Yr	FC_20Yr	FC_50Y r	FC_100 Yr	FC_500Yr
Arroyo	9.37	10.18	11.09	11.68	12.84
Cabo Rojo	11.29	11.32	12.58	13.31	14.59
Guanica	9.60	10.13	11.16	11.89	13.20
Guayama	10.02	10.75	11.70	12.35	13.69
Guayanilla	9.81	10.76	11.60	12.11	13.27
Juana Diaz	9.41	10.26	11.08	11.62	12.69
Lajas	10.27	10.90	11.87	12.56	13.83
Patillas	9.17	9.80	10.76	11.41	12.72
Penuelas	9.69	10.68	11.46	11.98	12.98
Ponce	11.22	11.54	12.72	13.52	15.10
Salinas	10.24	10.88	11.80	12.47	13.86
Santa Isabel	10.26	10.54	11.62	12.43	13.90



comunidad

comunidad



\$0.24M

Arroyo zona urbana Pole Ojea comunidad

\$0.41M

La Parguera

comunidad

Figure 4-57: Planning Reach PR_3 Risk Details

				Co	nsequences & Ris	k per AEP Event by	Census Place					
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
				•							Risk	Risk
Ponce zona urbana	\$550,000	\$5,500,000	\$2,220,000	\$19,870,000	\$4,260,000	\$30,270,000	\$13,610,000	\$59,800,000	\$19 <mark>0,743</mark>	\$1,431,242	14.92%	25.47%
Playita comunidad	\$610,000	\$6,120,000	\$4,530,000	\$15,000,000	\$6,950,000	\$20,210,000	\$13,960,000	\$31,280,000	\$318,327	\$1,117,468	24.90%	19.89%
Playita Cortada comunidad	\$110,000	\$2,420,000	\$1,300,000	\$10,070,000	\$3,310,000	\$15,580,000	\$11,270, <mark>0</mark> 00	\$29,790,000	\$112,265	\$708,861	8.78%	12.62%
Potala Pastillo comunidad	\$150,000	\$2,120,000	\$1,210,000	\$8,210,000	\$2,540,000	\$13,360,000	\$7,850,000	\$29,560,000	\$95,763	\$606,549	7.49%	10.80%
Guánica zona urbana	\$90,000	\$2,010,000	\$920,000	\$7,550,000	\$1,730,000	\$12,360,000	\$6,740,000	\$26,320,000	\$72,282	\$552,659	5.65%	9.84%
La Parguera comunidad	\$3,000,000	\$2,890,000	\$3,690,000	\$5,040,000	\$4, <mark>020,000</mark>	\$6,250,000	\$6,880,000	\$8,690,000	\$344,423	\$408,401	26.94%	7.27%
Arroyo zona urbana	\$10,000	\$790,000	\$240,000	\$3,310,000	\$560,000	\$5,160,000	\$1,670,000	\$10,640,000	\$19,052	\$236,470	1.49%	4.21%
Pole Ojea comunidad	\$110,000	\$870,000	\$870,000	\$2,540,000	\$1,530,000	\$3,250,000	\$2,660,000	\$4,660,000	\$54,311	\$179,503	4.25%	3.19%
Jauca comunidad	\$10,000	\$340,000	\$250,000	\$1,310,000	\$480,000	\$2,290,000	\$1,510,000	\$6,100,000	\$18,089	\$103,158	1.41%	1.84%
Las Ochenta comunidad	\$90,000	\$220,000	\$240,000	\$1,060,000	\$370,000	\$2,150,000	\$1,500,000	\$5,900,000	\$21,461	\$84,824	1.68%	1.51%
Puerto Real comunidad	\$80,000	\$430,000	\$250,000	\$1,030,000	\$390,000	\$1,430,000	\$850,000	\$2,640,000	\$17,110	\$78,719	1.34%	1.40%
El Combate comunidad	\$0	\$110,000	\$30,000	\$660,000	\$60,000	\$1,100,000	\$300,000	\$2,090,000	\$2,837	\$44,462	0.22%	0.79%
Jobos comunidad	\$0	\$0	\$0	\$380,000	\$20,000	\$890,000	\$530,000	\$3,070,000	\$2,326	\$29,481	0.18%	0.52%
Boquerón comunidad	\$0	\$50,000	\$10,000	\$370,000	\$50,000	\$600,000	\$1,070,000	\$1,760,000	\$4,848	\$27,397	0.38%	0.49%
Central Aguirre comunidad	\$10,000	\$70,000	\$60,000	\$90,000	\$70,000	\$110,000	\$120,000	\$130,000	\$4,497	\$8,162	0.35%	0.15%
Salinas zona urbana	\$0	\$0	\$0	\$20,000	\$0	\$30,000	\$20,000	\$120,000	\$92	\$1,171	0.01%	0.02%
Fuig comunidad	\$0	\$0	\$0	\$0	\$0	\$10,000	\$0	\$10,000	\$0	\$100	0.00%	0.00%
Palmas comunidad	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$19	0.00%	0.00%
Total	\$4,820,000	\$23,940,000	\$15,820,000	\$76,510,000	\$26,340,000	\$115,050,000	\$70,540,000	\$222,560,000	\$1,278,426	\$5,618,646	100.00%	100.00%

Figure 4-58: Planning Reach PR_3 Consequences and Risk Details

4.2.7.4 Planning Reach PR_4: Northeastern Puerto Rico Coast

This section describes dollar damage storm surge risk for Planning Reach PR_4, which includes Northeastern Puerto Rico as well as the islands of Culebra and Vieques. All estimates shown are in FY 2018 price levels. **Figure 4-59** displays the number, occupancy type, and total exposure value (structure + content value) in Planning Reach PR_4 in the 0.2-percent AEP event flood extent, based on FEMA structure inventory data for Northeastern Puerto Rico. **Figure 4-60** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-61** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.

Planning Reach PR_4 has the highest number of structures, and the highest total exposure value of all of the reaches on the island. It also contains the metropolitan area of San Juan, which has more commercial, industrial, and government structures than other reaches in Puerto Rico. There are approximately 33,000 structures with a total estimated exposure value of more than \$7.4 billion in this planning reach. Most of the assets and asset values are single-family residential and multi-family residential structures. Single-family residences comprise 91 percent of the buildings and 66 percent of the exposed value. Multi-family residential buildings comprise approximately eight percent of the assets and 31 percent of the exposed value. The exposure extent includes 19 municipalities, 28 census places, 2,339 census blocks, and approximately 65,000 acres.

All 19 municipalities along the northeast coast of Puerto Rico have shorelines that are susceptible to coastal flood hazards (**Figure 4-60**). Maximum flood depths modeled range from 1.5 to 14 feet in existing conditions to 5.1 to 16 feet in future conditions. Overall risk for the planning reach ranges between \$5.5 million and \$32 million in EAD. Of the 19 exposed municipalities, most of the coastal storm risk is in San Juan, Catano, Toa Baja, Carolina, and Loiza. Of the 27 exposed census places, the highest-risk population centers include San Juan (51 percent), Catano (20 percent), and Carolina (7 percent).

Approximately 23 percent of the storm surge risk is distributed in more rural areas in existing conditions. However, the proportion of the risk located in rural areas is expected to diminish to approximately 12 percent owing to significant risk increases in more populated places. The number of census blocks with medium to high risk increases by 715 percent between existing and future conditions with sea level rise.



of Buildings by General Occupancy

Est. Exposure Value by General Occupancy



Figure 4-59: Planning Reach PR_4 Exposure Details

Reach PR_04 : Northeast Puerto Rico

Existing Maximum Flood Elevation per Return Period Event by County (ft)

Coastal Counties	EC_10 Yr	EC_20Yr	EC_50Yr	EC_100Y r	EC_500Y r
Bayamon	1.55	2.37	3.86	5.12	8.03
Canovanas	2.65	3.72	5.72	7.27	9.92
Carolina	8.34	8.96	10.04	10.89	12.73
Catano	8.04	8.82	10.34	11.38	13.86
Ceiba	8.68	9.48	10.97	11.94	13.93
Dorado	7.83	8.64	10.20	11.31	13.46
Fajardo	8.55	9.40	10.66	11.55	13.40
Guaynabo	7.54	8.16	9.32	10.10	11.87
Humacao	7.75	8.22	9.05	9.70	10.80
Loiza	8.62	9.38	10.67	11.58	13.26
Luquillo	8.04	8.88	10.42	11.43	13.48
Maunabo	7.77	8.41	9.30	9.92	11.07
Naguabo	8.22	8.93	9.89	10.55	11.79
Rio Grande	9.05	9.97	11.38	12.43	14.31
San Juan	8.52	9.20	10.39	11.19	12.81
Toa Baja	7.95	8.59	9.81	10.65	12.64
Trujillo Alto	1.72	2.55	3.98	4.99	7.43
Vieques	8.08	8.75	9.70	10.28	11.84
Yabucoa	8.22	8.90	9.83	10.46	11.63

(ft)

r Yr

11.34 12.93

10.46 11.63

10.69 11.59

10.28 10.99 11.94 12.52

10.65 11.01 12.29

13.12

10.95 12.43 13.42

11.61 12.90 13.72

12.73

11.71 13.18 14.14

11.15 12.07 12.70

4.83 6.50 7.91

5.12

7.27 5.77 7.75 9.14 11.76

10.89 11.43 12.69 13.68

11.38

11.94 11.61

11.31

11.55 11.57 12.81 13.70

10.10

970 10.51 11 29 11.89

11.58

11.43 11.26

9.92

10.55 11.13 12.09 12.73

12.43

11.19 11.46 12.63 13.42

499 412 5 4 5 6.66

10.46

FC_10Yr FC_20Yr FC_50Y FC_100 FC_500Yr

10.97

15.68

16.21

16.10

15.25

15.53

14.22

13.03

15.37

15.75

13.39

13.94

16.27

15.05

14.98

9.69

14.00

13.85

13.95

14.11

12.41

13.69

12.22

13.12

Coastal

Counties

Bayamon

Carolina

Catano

Dorado

Fajardo

Guaynabo

Humacao

Loiza

Luquillo

Maunabo

Naguabo

San Juan

Toa Baja

Vieques

Yabucoa

Truiillo Alto

Rio Grande

Ceiba

Canovanas

	Existing & Fi	uture Risk by Cou	nty
#	Acres	Existing Risk	Future Risk
Censu	s		
Blocks			

58 1, 15 2, 54 4, 625 4, 366 6, 24 1, 8 2,	073 9 130 7 731 9 738 1 837 9 209 6 55 9	\$120,371 \$42,499 \$209,282 \$866,886 \$481,410 \$82,983 \$42,895	\$388,78 \$144,114 \$661,899 \$14,401,819 \$2,353,669 \$191,260 \$127,998
58 1, 15 2, 54 4, 625 4, 366 6, 24 1,	073 9 130 7 731 9 738 \$1 837 9 209	\$120,371 \$42,499 \$209,282 \$666,886 \$481,410 \$82,983	\$388,78 \$144,114 \$661,899 \$14,401,819 \$2,353,669 \$191,266
58 1, 15 2, 54 4, 625 4, 366 6,	073 9 130 7 731 9 738 \$1 837 9	\$120,371 \$42,499 \$209,282 \$66,886 \$481,410	\$388,78 \$144,114 \$661,899 \$14,401,819 \$2,353,669
58 1, 15 2, 54 4, 625 4,	073 9 130 7 731 9 738 \$1	\$120,371 \$42,499 \$209,282 ,866,886	\$388,78 \$144,114 \$661,899 \$14,401,815
58 1, 15 2, 54 4,	073 5 130 731 5	\$120,371 \$42,499 \$209,282	\$388,78 \$144,114 \$661,89
58 1, 15 2,	073 5 130	\$120,371 \$42,499	\$388,78 \$144,114
58 1,	073	\$120,371	\$388,78
245 8,	648	\$390,368	\$1,944,30
110 2,	964	236,997	\$1,329,615
110	814 9	148,295	\$1,376,81
54 14,	500	209,750	\$981,966
51 2,	827	\$61,939	\$316,154
12 1,	811 📔 🖇	154,499	\$257,057
293 2,	710 \$1	,093,934	\$5,402,779
282 6,	003	281,914	\$1,972,59
	282 6, 293 2, 12 1,	282 6,003 9 293 2,710 \$1 12 1,811 9	282 6,003 \$281,914 293 2,710 \$1,093,934 12 1,811 \$154,499

Census Places with Greatest Risk

County

V

● Existing Risk ● Future Risk ● Risk Change



Census Place Risk Rating •1-High •2-Med-High •3-Med •4-Low-Med •5-Low



Figure 4-60: Planning Reach PR 4 Risk Details

Consequences & Risk per AEP Event by Census Place														
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_20Yr	FC_DL_20Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
				-									Risk	Risk T
San Juan zona urbana	\$4,840,000	\$62,630,000	\$9,740,000	\$98,880,000	\$22,710,000	\$193,440,000	\$43,830,000	\$290,560,000	\$151,000,000	\$598,030,000	\$1,966,655	\$14,397,929	47.30%	51.41%
Cataño zona urbana	\$3,660,000	\$23,660,000	\$7,130,000	\$34,890,000	\$13,79 <mark>0,000</mark>	\$69,040,000	\$23,710,000	\$109,370,000	\$71, <mark>980,000</mark>	\$262,490,000	\$1,15 <mark>4,099</mark>	\$5,401,579	27.76%	19.29%
Carolina zona urbana	\$770,000	\$4,400,000	\$1,440,000	\$7,220,000	\$2,680,000	\$19,490,000	\$4,540,000	\$40,870,000	\$13,830,000	\$201,580,000	\$226,344	\$1,963,998	5.44%	7.01%
Guaynabo zona urbana	\$250,000	\$2,920,000	\$460,000	\$5,710,000	\$1,470,000	\$17,790,000	\$3,740,000	\$35,070,000	\$20,100,000	\$101,340,000	\$166,660	\$1,376,812	4.01%	4.92%
Levittown comunidad	\$20,000	\$1,000,000	\$430,000	\$1,550,000	\$890,000	\$6,000,000	\$1,640,000	\$20,680,000	\$19,080,000	\$148,960,000	\$127,039	\$989,286	3.06%	3.53%
Punta Santiago comunidad	\$0	\$1,880,000	\$80,000	\$4,690,000	\$870,000	\$13,570,000	\$2,870,000	\$23,940,000	\$2,870,000	\$55,060,000	\$57,988	\$942,099	1.39%	3.36%
Fajardo zona urbana	\$0	\$2,150,000	\$450,000	\$4,490,000	\$2,070,000	\$11,950,000	\$4,290,000	\$17,280,000	\$4,290,000	\$29,930,000	\$115,785	\$749,098	2.78%	2.67%
Ingenio comunidad	\$0	\$140,000	\$0	\$1,050,000	\$140,000	\$6,480,000	\$1,520,000	\$16,010,000	\$16,470,000	\$50,280,000	\$82,280	\$520,668	1.98%	1.86%
Palmas del Mar comunidad	\$0	\$2,580,000	\$1,140,000	\$3,460,000	\$1,660,000	\$4,620,000	\$2,430,000	\$5,620,000	\$2,430,000	\$7,940,000	\$110,406	\$377,113	2.66%	1.35%
Vieques comunidad	\$0	\$70,000	\$0	\$370,000	\$30,000	\$3,190,000	\$250,000	\$8,330,000	\$250,000	\$28,720,000	\$3,865	\$270,505	0.09%	0.97%
Dorado zona urbana	\$20,000	\$570,000	\$150,000	\$950,000	\$420,000	\$2,630,000	\$810,000	\$5,720,000	\$3,670,000	\$23,220,000	\$36,358	\$249,257	0.87%	0.89%
Loíza zona urbana	\$0	\$280,000	\$50,000	\$770,000	\$230,000	\$2,760,000	\$790,000	\$5,580,000	\$790,000	\$18,850,000	\$17,324	\$219,326	0.42%	0.78%
Las Croabas comunidad	\$0	\$470,000	\$200,000	\$870,000	\$350,000	\$2,310,000	\$740,000	\$3,680,000	\$740,000	\$7,450,000	\$24,520	\$155,854	0.59%	0.56%
Playa Fortuna comunidad	\$0	\$130,000	\$20,000	\$420,000	\$110,000	\$1,480,000	\$450,000	\$2,900,000	\$450,000	\$10,000,000	\$8,715	\$116,003	0.21%	0.41%
Vieques zona urbana	\$0	\$830,000	\$550,000	\$990,000	\$740,000	\$1,320,000	\$920,000	\$1,640,000	\$920,000	\$2,090,000	\$49,020	\$110,362	1.18%	0.39%
Luquillo zona urbana	\$0	\$90,000	\$70,000	\$90,000	\$90,000	\$700,000	\$120,000	\$2,550,000	\$120,000	\$12,100,000	\$6,220	\$91,653	0.15%	0.33%
Campanilla comunidad	\$0	\$0	\$0	\$0	\$0	\$50,000	\$0	\$370,000	\$290,000	\$3,670,000	\$1,154	\$19,061	0.03%	0.07%
San Isidro comunidad	\$0	\$0	\$0	\$0	\$10,000	\$50,000	\$100,000	\$340,000	\$100,000	\$2,740,000	\$1,491	\$14,999	0.04%	0.05%
Bayamón zona urbana	\$0	\$20,000	\$0	\$60,000	\$10,000	\$190,000	\$70,000	\$340,000	\$120,000	\$760,000	\$1,514	\$12,859	0.04%	0.05%
Río Grande zona urbana	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$20,000	\$0	\$1,850,000	\$0	\$7,582	0.00%	0.03%
Sabana Seca comunidad	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$1,790,000	\$4	\$7,244	0.00%	0.03%
Suárez comunidad	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$20,000	\$0	\$1,570,000	\$0	\$6,473	0.00%	0.02%
Trujillo Alto zona urbana	\$0	\$0	\$0	\$0	\$0	\$30,000	\$0	\$130,000	\$180,000	\$500,000	\$713	\$3,875	0.02%	0.01%
Esperanza comunidad	\$0	\$0	\$0	\$10,000	\$0	\$20,000	\$0	\$60,000	\$0	\$280,000	\$0	\$2,456	0.00%	0.01%
Santa Bárbara comunidad	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$40,000	\$0	\$195	0.00%	0.00%
Bajandas comunidad	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$30,000	\$0	\$138	0.00%	0.00%
Luis M. Cintrón comunidad	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$15	0.00%	0.00%
Total	\$9,560,000	\$103,820,000	\$21,910,000	\$166,470,000	\$48,270,000	\$357,110,000	\$92,820,000	\$591,080,000	\$309,680,000	\$1,571,270,000	\$4,158,154	\$28,006,439	100.00%	100.00%

Figure 4-61: Planning Reach PR_4 Consequences and Risk Details

4.2.8 U.S. Virgin Islands

4.2.8.1 Planning Reach VI_1: St. Croix

This section describes dollar damage storm surge risk for Planning Reach VI_1, which includes St. Croix. All estimates shown are in FY 2018 price levels. **Figure 4-62** displays the number, occupancy type, and total exposure value (structure + content value) in VI_1 in the 0.2-percent AEP event flood extent, based on FEMA structure inventory data for St. Croix. **Figure 4-63** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-64** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.

There are approximately 24,000 structures with a total estimated exposure value of more than \$16 billion in this planning reach. Most of the assets and asset valued are single-family residential, multi-family residential, commercial, and industrial structures. Single-family residences comprise 78 percent of the buildings and 60 percent of the exposed value. Multi-family residential buildings comprise approximately 8 percent of the assets and 12 percent of the exposed value. Commercial buildings comprise approximately 6 percent of the assets and 11 percent of the exposed value. Industrial buildings comprise approximately 5 percent of the assets and 11 percent of the exposed value. The exposure extent includes 13 census places, 18 census estates, and approximately 42,000 acres.

Maximum flood depths modeled range from 7.9 to 11.3 feet in existing conditions to 10.2 to 13.7 feet in future conditions. Overall risk for the planning reach ranges between \$187 thousand and \$1 million in EAD. Of the 18 exposed estates, the highest-risk population centers include Estate La Press Valley¹⁸ (51 percent), Estate Catherine's Hope (20 percent), and Estate Whim¹⁹ (7 percent). The number of census blocks with medium to high risk increases by 400 percent between existing and future conditions with sea level rise.

¹⁸ Christiansted is located on the northeast side of St. Croix and corresponds with Estate La Press Valley.

¹⁹ Frederiksted is located on the west side of St. Croix and corresponds with Estate Whim.



Number of Structures by General Occupancy

Est Exposure Value by General Occupancy



Figure 4-62: Planning Reach VI 1 Exposure Details

\$1,901,600,000

\$1,744,400,000

\$1,667,000,000

\$594,000,000

\$209.200.000

\$96,500,000

\$72,100,000

VI_01	St. Croix			\sim	/	County	# Ce Ble	
\$186,5	35	\$1,029,	235	41,72	2	St Croix		
Existing	Risk	Future R	isk	# Acre	s Impacted	Total		
18 # Consu	r Block	1 # Counti	ior Imp	2 # Con	us Places Im			
# censu	Ficher Melen Fichel Ficher							
Existing	Maximum F	lood Eleva	ation per	Return Pe	riod Event by	3-Me	d	
		Cou	nty (ft)			4-Lo	w-N	
Coastal	EC_10	EC_20Yr	EC_50Yr	EC_100Y	EC_500Y	5-Lo	w	
Counties	Yr			r	r	Tota	1	
St Croix	7.93	8.49	9.40	9.99	11.26			
Future M	aximum Flo	od Elevati	on per Re	eturn Perio	od Event by	CB Ri	sk R	
Constal	EC 101/2	EC 20Ve	EC FOV	FC 100	EC EDOVe	1-Hig	h	
Counties	FC_TUYF	FC_201F	rC_501	rc_100 Vr	FC_3004F	3-Me	d	
						4-Lov	v-M	
St Croix	10.17	10.71	11.61	12.18	13.68	5.1.00		

Census Places with Greatest Risk

Reach





Census



Existing & Future Risk by County Acres Existing Risk Future Risk



Buck Island Channel Frederikst

Census Block Risk Rating • 1-High • 3-Med • 4-Low-Med

Earthstar Geographics SIO, © 2022 TomTom, © 2022 Microsoft Corporation, © Op

Figure 4-63: Planning Reach VI_1 Risk Details

Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_20Yr	FC_DL_20Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
													Risk	Risk
Estate La Press Valley	\$0	\$820,000	\$0	\$2,080,000	\$290,000	\$5,750,000	\$800,000	\$9,790,000	\$4,870,000	\$23,100,000	\$32,532	\$398,982	17.44%	38.76%
Estate Catherines Hope	\$340,000	\$1,980,000	\$710,000	\$2,720,000	\$1,320,000	\$3,860,000	\$1,850,000	\$4,670,000	\$3,300,000	\$6,190,000	\$93,264	\$302,149	50.00%	29.36%
Estate Whim	\$10,000	\$590,000	\$100,000	\$810,000	\$450,000	\$1,230,000	\$600,000	\$1,560,000	\$1,060,000	\$3,370,000	\$22,641	\$99,218	12.14%	9.64%
Estate Rose Hill	\$70,000	\$500,000	\$130,000	\$630,000	\$280,000	\$860,000	\$370,000	\$1,020,000	\$630,000	\$1,400,000	\$18,337	\$69,883	9.83%	6.79%
Estate St. Peters	\$0	\$200,000	\$0	\$410,000	\$110,000	\$800,000	\$290,000	\$1,330,000	\$780,000	\$3,360,000	\$8,027	\$62,778	4.30%	6.10%
Estate Parasol	\$20,000	\$180,000	\$40,000	\$220,000	\$80,000	\$300,000	\$110,000	\$360,000	\$190,000	\$450,000	\$5,386	\$24,526	2.89%	2.38%
Estate Montpellier East	\$0	\$90,000	\$10,000	\$130,000	\$60,000	\$250,000	\$90,000	\$460,000	\$210,000	\$1,330,000	\$3,474	\$21,972	1.86%	2.13%
Estate Wheel of Fortune	\$0	\$10,000	\$0	\$20,000	\$0	\$290,000	\$10,000	\$550,000	\$80,000	\$1,710,000	\$391	\$18,697	0.21%	1.82%
Estate Granard	\$0	\$50,000	\$0	\$90,000	\$10,000	\$160,000	\$50,000	\$240,000	\$100,000	\$380,000	\$1,138	\$11,704	0.61%	1.14%
Estate Strawberry Hill	\$0	\$60,000	\$0	\$80,000	\$20,000	\$100,000	\$50,000	\$130,000	\$80,000	\$360,000	\$1,081	\$9,368	0.58%	0.91%
Estate Little Princess North	\$0	\$0	\$0	\$0	\$0	\$60,000	\$0	\$160,000	\$30,000	\$380,000	\$139	\$4,113	0.07%	0.40%
Estate Bettys Hope	\$0	\$0	\$0	\$10,000	\$0	\$60,000	\$0	\$110,000	\$30,000	\$380,000	\$125	\$4,016	0.07%	0.39%
Estate St. John	\$0	\$0	\$0	\$0	\$0	\$10,000	\$0	\$40,000	\$0	\$310,000	\$0	\$1,829	0.00%	0.18%
Total	\$440,000	\$4,480,000	\$990,000	\$7,200,000	\$2,620,000	\$13,730,000	\$4,220,000	\$20,420,000	\$11,360,000	\$42,720,000	\$186,535	\$1,029,235	100.00%	100.00%

Consequences & Risk per AEP Event by Census Place

Figure 4-64: Planning Reach VI_1 Consequences and Risk Details

4.2.8.2 Planning Reach VI_2: St. Thomas

This section describes dollar damage storm surge risk for Planning Reach VI_2, which includes St. Thomas. All estimates shown are in FY 2018 price levels. **Figure 4-65** displays the number, occupancy type, and total exposure value (structure + content value) in VI_2 in the 0.2-percent AEP event flood extent, based on FEMA structure inventory data for St. Thomas. **Figure 4-66** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-67** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.

There are approximately 17,000 structures with a total estimated exposure value of over \$14 billion in this planning reach. Most of the assets and asset values are single-family residential, multi-family residential, and commercial structures. Single-family residences comprise 77 percent of the buildings and 60 percent of the exposed value. Multi-family residential buildings comprise approximately 9 percent of the assets and 14 percent of the exposed value. Commercial buildings comprise approximately 9 percent of the exposed value. The exposure extent includes 11 census places, 19 census blocks, and approximately 13,000 acres.

Maximum flood depths modeled range from 7.9 to 11.3 feet in existing conditions to 10.2 to 13.7 feet in future conditions. Overall risk for the planning reach ranges between \$1.6 million and \$3.8 million in EAD. Of the 19 exposed estates, the highest-risk population centers include Estate Nazareth (37 percent), Estate Demarara (30 percent), Estate Constant (18 percent) and Estate Charlotte Amalie²⁰ (5 percent). The number of census blocks with medium to high risk increases by 22 percent between existing and future conditions with sea level rise.

²⁰ Charlotte Amalie is comprised of Estate Constant, Estate Charlotte Amalie, and Estate Thomas.



Number of Structures by General Occupancy

Est Exposure Value by General Occupancy



General Occupancy % of % Exposure Exposure Value Buildings Value Single-Family Residential 8.94% 16.28% 2,265,300,000 Commercial Multi-Family Residential 1,900,300,000 8.68% 13.66% Education 1.75% 4.20% \$584,900,000 Industrial 2.73% 4.05% \$563,600,000 Government 0.40% 0.95% \$131,800,000 Religion 0.25% 0.50% \$70,200,000 Agriculture 0.01% 0.02% \$2,800,000

Exposure Statistics by General Occupancy

Figure 4-65: Planning Reach VI_2 Exposure Details



Figure 4-66: Planning Reach VI_2 Risk Details

	Consequences & Risk per AEP Event by Census Place													
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_20Yr	FC_DL_20Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
													NISK	×
Estate Nazareth	\$4,260,000	\$10,390,000	\$5,200,000	\$12,580,000	\$6,890,000	\$16,700,000	\$8,720,000	\$19,900,000	\$13,490,000	\$27,250,000	\$584,934	\$1,385,103	36.95%	36.63%
Estate Demarara	\$2,770,000	\$4,750,000	\$3,040,000	\$6,810,000	\$3,4 <mark>90,000</mark>	\$16,060,000	\$4, <mark>040,000</mark>	\$24,620,000	\$9,980,000	\$46,730,000	\$337,202	\$1,121,001	21.30%	29.64%
Estate Contant	\$2,670,000	\$5,690,000	\$2,960,000	\$6,150,000	\$4,080,000	\$7,280,000	\$4,900,000	\$8,450,000	\$5,930,000	\$13,940,000	\$33 <mark>4,635</mark>	\$665,802	21.14%	17.61%
Estate Charlotte Amalie	\$230,000	\$1,780,000	\$400,000	\$1,970,000	\$1,050,000	\$2,260,000	\$1,710,000	\$2,450,000	\$2,120,000	\$2,790,000	\$66,668	\$201,500	4.21%	5.33%
Estate Thomas	\$1,260,000	\$1,660,000	\$1,310,000	\$1,750,000	\$1,420,000	\$1,890,000	\$1,550,000	\$1,990,000	\$1,800,000	\$4,570,000	\$133,289	\$185,388	8.42%	4.90%
Estate Frydenhoj	\$500,000	\$710,000	\$520,000	\$760,000	\$630,000	\$970,000	\$710,000	\$1,210,000	\$880,000	\$2,200,000	\$55,824	\$87,319	3.53%	2.31%
Estate Frenchman Bay	\$620,000	\$720,000	\$640,000	\$750,000	\$670,000	\$800,000	\$700,000	\$840,000	\$770,000	\$1,160,000	\$63,848	\$76,294	4.03%	2.02%
Estate Tabor and Harmony	\$0	\$170,000	\$0	\$240,000	\$40,000	\$500,000	\$160,000	\$950,000	\$410,000	\$2,050,000	\$3,942	\$40,388	0.25%	1.07%
Estate Ross	\$10,000	\$50,000	\$20,000	\$60,000	\$40,000	\$90,000	\$40,000	\$310,000	\$70,000	\$1,490,000	\$2,316	\$14,062	0.15%	0.37%
Estate Inner Brass Island	\$0	\$20,000	\$0	\$30,000	\$10,000	\$50,000	\$10,000	\$80,000	\$50,000	\$260,000	\$506	\$4,441	0.03%	0.12%
Estate Elizabeth	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$80,000	\$0	\$311	0.00%	0.01%
Total	\$12,320,000	\$25,940,000	\$14,090,000	\$31,100,000	\$18,320,000	\$46,600,000	\$22,540,000	\$60,800,000	\$35,500,000	\$102,520,000	\$1,583,164	\$3,781,609	100.00%	100.00%

Figure 4-67: Planning Reach VI_2 Consequences and Risk Details

4.2.8.3 Planning Reach VI_3: St. John

This section describes dollar damage storm surge risk for Planning Reach VI_3, which includes St. Johns. All estimates shown are in FY 2018 price levels. **Figure 4-68** displays the number, occupancy type, and total exposure value (structure + content value) in Planning Reach VI_3 in the 0.2-percent AEP event flood extent, based on FEMA structure inventory data for St. John. **Figure 4-69** provides details for existing and future conditions on maximum surge depths per AEP event, risk distribution by county, census place, and census block, and identifies the census places with the greatest flood risk. **Figure 4-70** provides a more detailed and comprehensive tabular account of the existing and future consequences per AEP event per census place.

There are approximately 3,622 structures with a total estimated exposure value of more than \$2 billion in this planning reach. Most of the assets and asset values are single-family residential, multi-family residential, and commercial structures. Single-family residences comprise 72 percent of the buildings and 62 percent of the exposed value. Multi-family residential buildings comprise approximately 19 percent of the assets and 26 percent of the exposed value. Commercial buildings comprise approximately 5 percent of the assets and 8 percent of the exposed value. The exposure extent includes five census places, six census blocks, and approximately 14,000 acres.

Maximum flood depths modeled range from 8 to 12 feet in existing conditions to 10 to 14 feet in future conditions. Overall risk for the planning reach ranges between \$343 thousand and \$579 thousand in EAD. Of the 11 exposed estates, the highest-risk population centers include Estate Number 1 of Trunk Bay (52 percent), Estate San Soucci (20 percent), Estate Chocolate Hole and Great Cruz Bay²¹ (18 percent), and Estate Concordia A and Estate Hope²² (5 percent).

The number of census blocks with medium to high risk increases by 400 percent between existing and future conditions with sea level rise.

 $^{^{\}rm 21}$ Cruz Bay consists of Estate San Soucci and Estate Chocolate Hole and Great Cruz Bay.

²² Coral Bay consist of Estate Concordia A and Estate Hope.



Number of Structures by General Occupancy

Est Exposure Value by General Occupancy



Exposure Statistics by General Occupancy

General Occupancy	% of Buildings	% Exposure Value	 Exposure Value 		
Single-Family Residential	71.62%	61.80%	\$1,466,700,000		
Multi-Family Residential	19.05%	25.88%	\$614,200,000		
Commercial	5.36%	8.09%	\$192,000,000		
Industrial	1.52%	1.34%	\$31,800,000		
Religion	0.77%	1.01%	\$23,900,000		
Government	0.52%	0.88%	\$20,800,000		
Education	0.69%	0.67%	\$15,900,000		
Agriculture	0.47%	0.33%	\$7,900,000		

Figure 4-68: Planning Reach VI_3 Exposure Details

Reach	\sim	Ex	isting & Fu	ture Risk by Cou	nty					
VI_03 : St. Johns	Count	y # Census Blocks	Acres	Existing Risk	Future F	Risk				
	St Joh	ns 6	13,861	\$343,000	1	\$579,356				
\$343,000	Total	6	13,861	\$343,000	\$	579,356		Existing Risk by C	ensus Blo	ock
Existing Risk						CI	8 Risk Rating	# Census Blocks	Acres	Existing Ris
\$579,356						1-	High	1	7,764	\$260,00
Future Risk	Culotine Mar	den an Classed		Datum Daviad	Frank bu	4-	Low-Med	3	1,583	\$73,00
13,861	Existing ivia:	amum Fiood	County (ft)	Low	2	4,514	\$10,00			
# Acres Impacted	Coastal	EC 10 EC 2	OVr EC 50	Vr EC 100V EC	500V	То	tal	6	13,861	\$343,00
6 # Census Blocks Impacted	Counties	Yr	on cc_so	r r						
1	St John	8.05 8	.67 9.	70 10.48	12.12					
# Counties Impacted								Future Risk b	Census	Block
2						C	B Risk Rating	# Census Blocks	Acres	Future Ris
# Census Places Impacted	Future Ma	iximum Flood	Elevation p	per Return Period	Event by	1	-High	1	7,764	\$302,90
			County (f	t)		2	-Med-High	1	266	\$106,68
	Coastal	FC_10Yr F	C_20Yr FC	_50Y FC_100 I	C_500Yr	3	-Med	3	4,590	\$166,58
	Counties		r	۲r		5	-Low	1	1,241	\$3,17
	St John	10.36	10.97	11.97 12.78	14.37	Т	otal	6	13,861	\$579,35



● Existing Risk ● Future Risk ● Risk Change







Census Block Risk Rating • 1-High • 2-Med-High • 3-Med

Figure 4-69: Planning Reach VI_3 Risk Details

Consequences & Risk per AEP Event by Census Place														
Place	EC_DL_10Yr	FC_DL_10Yr	EC_DL_20Yr	FC_DL_20Yr	EC_DL_50Yr	FC_DL_50Yr	EC_DL_100Yr	FC_DL_100Yr	EC_DL_500Yr	FC_DL_500Yr	Existing EAD	Future EAD	% of Existing	% of Future
													Risk	Risk T
Estate Number 1 of Trunk Bay	\$2,560,000	\$2,830,000	\$2,610,000	\$2,960,000	\$2,710,000	\$3,190,000	\$2,810,000	\$3,390,000	\$3,060,000	\$4,890,000	\$260,000	\$302,906	75.80%	52.28%
Estate San Soucci	\$490,000	\$970,000	\$550,000	\$1,080,000	\$670,000	\$1,340,000	\$740,000	\$1,580,000	\$1 ,060,000	\$2,450,000	\$58,000	\$118,408	16.91%	20.44%
Estate Chocolate Hole and Great Cruz Bay	\$90,000	\$580,000	\$130,000	\$770,000	\$200,000	\$1,250,000	\$260,000	\$1,970,000	\$600,000	\$4,680,000	\$15,000	\$106,686	4.37%	18.41%
Estate Concordia A	\$60,000	\$250,000	\$80,000	\$350,000	\$130,000	\$660,000	\$180,000	\$900,000	\$320,000	\$1,690,000	\$10,000	\$48,177	2.92%	8.32%
Estate Hope	\$0	\$0	\$0	\$0	\$0	\$10,000	\$0	\$20,000	\$0	\$660,000	\$0	\$3,179	0.00%	0.55%
Total	\$3,200,000	\$4,630,000	\$3,370,000	\$5,160,000	\$3,710,000	\$6,450,000	\$3,990,000	\$7,860,000	\$5,040,000	\$14,370,000	\$343,000	\$579,356	100.00%	100.00%

Figure 4-70: Planning Reach VI_3 Consequences and Risk Details