



Annual Assessment of Flooding and Sea Level Rise

2023 Edition

Chapter 6

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Report's Highlights

Given Florida's flat topography and phenomenal rainfall events, flooding has been an issue throughout its history as a state. During the 2021 Session, the Florida Legislature passed CS/CS/SB 1954, an act relating to Statewide Flooding and Sea Level Rise Resilience. Among other things, the Legislature's Office of Economic and Demographic Research (EDR) was directed to develop an analysis of future expenditures by federal, state, regional, and local governments required to achieve the Legislature's intent of minimizing the adverse economic effects of inland and coastal flooding, thereby decreasing the likelihood of severe dislocations or disruptions in the economy and preserving the value of real and natural assets to the extent economically feasible. Further, to the extent possible, the analysis must evaluate the cost of the resilience efforts necessary to address inland and coastal flooding associated with sea level rise, high tide events, storm surge, flash flooding, stormwater runoff, and increased annual precipitation over a 50-year planning horizon. This year's report focuses on the 35 Florida coastal counties identified as the current High Impact Zone by EDR.

As a first step, the assessment addresses what is at risk in this zone by providing a resource inventory for these counties. This includes the property values of Residential, Commercial, Industrial, Agricultural, Institutional, Governmental, Miscellaneous and Vacant parcels. In total, Miami-Dade County contains the highest property value (close to \$526 billion) among the 35 coastal counties, followed by Palm Beach County (close to \$380 billion) and Broward County (close to \$356 billion). Considering its economic and property value in conjunction with the potential impact of various flooding hazards, the southeast portion of Florida, including Palm Beach, Broward and Miami-Dade Counties, is the most at risk area in the state. After including Monroe County, the four counties combined represent over one-third of the state's Real Gross Domestic Product (GDP). While this is the area is the most likely to experience severe dislocations or disruptions in the economy, it is not the only area. As currently identified, the entire High Impact Zone has nearly \$3.1 trillion in property value and 77.35% of the state's GDP.

Detailed analyses of three major facilities including hospitals, schools and fire stations have been conducted to estimate the number of critical at-risk facilities in the event of 2 ft. sea level rise, hurricane category 5 storm surge and annual flooding. The analysis of 2 ft. sea level rise and flooding indicates that the actual number of these buildings that may be completely or partially inundated are few. However, in low-lying areas, and especially on barrier islands, the submergence of the connecting routes may be a major issue. Taking this fact into account, to the extent possible, the state might need to consider relocating some of the existing at-risk facilities; building the future facilities further from the hazard areas; and developing alternative means of providing critical services.

In this year's assessment, the High Impact Zone is identified on a county-wide basis. For next year's report, the zone boundary will be flexed based on geospatial analysis of the various flooding factors in order to more precisely reflect at-risk geographies that are less than county-wide. At the same time, initial steps to identify the Intermediate Impact Zone will be undertaken. After gaining an understanding of the flooding domain through scenario building, the next stage is to identify likely choices for adaptation and hazard mitigation, as well as the probable near-term and longer-term costs and consequences. The forward looking aspect of this part of the analysis is extremely nuanced and will need to incorporate more than physical geography and topography. For example, some studies have already found a strong relationship between the likely deployment of adaptive measures and wealth, both for individuals and cities.

The box below reminds readers of the current working definitions used for the zones and referenced in this report. Each zone will have different strategies and costs to provide the necessary resilience efforts.

At Risk Assessment Area	Description	Status
High Impact Zone	Based on a variety of federal data sources (preferably on the USGS data) and modeling of the coastal areas which currently extends to the head of the tide. These areas are affected by a multiplicity of factors occurring persistently, rather than periodically or as a consequence of one-off events.	Currently defined as the 35 Coastal Counties.
Intermediate Impact Zone	The area beyond the High Impact Zone that may still be affected by storm surge, as well as the area along rivers or larger lakes where significant flooding either is recurrent or will likely be recurrent in the future.	TBD
Dispersed Impact Zone	The area outside the High and Intermediate Impact Zones that still experiences localized flooding challenges, but where those are primarily caused by factors such as higher levels of precipitation in urban or urbanized areas, the weaker impacts of storms and hurricanes, or nuisance flooding.	TBD

6.1. Introduction

EDR is undertaking a multistage process to estimate the needed expenditures by all levels of government which are required to achieve the Legislature’s intent of minimizing the adverse economic effects of flooding in Florida. The Legislature’s end goal is very specific: to decrease the likelihood of severe dislocations or disruptions in the economy and preserve the value of real and natural assets to the extent economically feasible.

In the first stage, EDR must quantify the flood risk and the risk areas. Risk is defined as the combination of the probability of an occurring hazard and the exposure of resources to the hazard. For the purpose of this report, hazard is defined as flooding resulting from any flooding factor. EDR's 2021-2022 study identified three flooding factors, including storm surge, annual flooding, and sea level rise (SLR) as the most probable flooding hazard factors for Florida. For each of the three flooding factors, there are multiple probability scenarios that can be projected to define the hazard areas and to estimate resource exposure to these flood hazard factors. Exposure is defined as the number of assets, people, and sensitive environmental and cultural resources within a hazard area.

EDR has defined three impact zones in Florida. These impact zones, which are primarily defined by their proximity to the coastal area and susceptibility to flooding risks, are delineated as: High Impact Zone, Intermediate Impact Zone and Dispersed Impact Zone. As the first assessment, EDR focuses on the High Impact Zone, which primarily encompasses coastal counties.

The primary step in identifying at-risk areas in each impact zone is to recognize the most probable scenarios of flooding factors, including sea level rise, annual flooding and storm surge. To quantify the risk to resources in the at-risk areas, EDR is taking multiple actions. First action is to collect information from other recent scientific studies that are applicable to Florida. The second action is using available data and applying geospatial technology to identify the probable boundaries of at-risk areas considering different hazard scenarios.

Among several national and regional models, four of the most comprehensive models and assessment projects are used in this year's EDR's study. The selected studies include South Atlantic Coastal Studies (SACS)¹, First Street Foundation², PLACE: Sea Level Rise³, and Southeast Florida Regional Climate Change Compact (Climate Compact)⁴. These studies are chosen based on their methodologies and similarities in their ultimate goals to EDR flood assessment goals. Some of the results from these studies have been included in EDR's preliminary report, and have been used throughout the report for comparison with EDR's in-house assessments.

SACS and First Street Foundation encompass assessment for the entire state of Florida. From SACS, EDR highlights their finding on the economic impact of flooding on Florida, and applies the study's conclusion to delineate the at-risk areas.⁵ The First Street Study classifies five levels of flooding risk from minor to extreme and identifies the number of at-risk facilities in each class. The First Street Foundation concludes that counties including Bay, Broward, Citrus, Collier, Flagler, Gulf, Hillsborough, Lee, Levy, Manatee, Miami-Dade, Okaloosa, Pinellas, Sarasota, St. Johns and Taylor, are in major risk, Dixie and Wakulla in severe risk and Charlotte, Franklin and Monroe in extreme risk of flooding.⁶ However, EDR's assessment shows that not all of those counties have the same level of economic risks. More detailed results from the First Street Foundation Flood Model are included in Appendix 4.

According to the SACS analysis, the existing medium-high to high risk locations in Florida, which are also considered the High Impact Zone in the EDR study, are summarized in Table 1. The at-risk locations are presented as counties and census places. Census places are defined as concentrations of population, such as cities, that have legally prescribed boundaries, powers, and functions.

The PLACE: Sea Level Rise study focuses on the Gulf of Mexico region. This study displays the impact of storm surge, storm surge maximum, and stillwater storm surge on critical infrastructures (schools, fire/EMS stations, law enforcement, and medical facilities). Selected findings from the Place: Sea Level Rise studies are included in Appendix 5. Climate Compact is a regional study that focuses on southeast Florida. This study provides the potential number of buildings and infrastructures inundation, especially

¹https://www.sad.usace.army.mil/Portals/60/siteimages/SACS/SACS_FL_Appendix_508_20220812.pdf?ver=XGRM8v-69_bdLAFPXEmlOg%3d%3d

² https://assets.firststreet.org/uploads/2021/02/The_Cost_of_Climate_FSF20210219-1.pdf

³ <https://placeslr.org>

⁴ https://southeastfloridaclimatecompact.org/wp-content/uploads/2020/04/Sea-Level-Rise-Projection-Guidance-Report_FINAL_02212020.pdf

⁵ The flood hazard factors that SACS used for its assessment include: 1) Category 5 Maximum of Maximums; 2) 1% Annual Chance Flood Event (100 year storm) (+3 ft. of Sea Level Rise); and 3) 10% Annual Chance Flood Event (10 year storm) (+3 ft. of Sea Level Rise). These flooding factors are not exactly the same as the ones that EDR is using in its assessments, but have some overlaps.

⁶ <https://firststreet.org/research-lab/published-research/highlights-from-the-cost-of-climate-americas-growing-flood-risk/>

at the 2 ft. and 3 ft. SLR scenarios. EDR utilized select findings from the Place: Sea Level Rise and Climate Compact studies in its analyses of at-risk infrastructures.

In order to quantify exposure, EDR utilizes Florida property tax data overlaid with flooding hazard factors. Eight major resources categories, including residential, commercial, industrial, agricultural, institutional, governmental, miscellaneous, and vacant are taken from the Florida Department of Revenue’s property tax value database. This data is used to rank the counties based on asset values. Overlaying this data with the flooding factors highlights the value-amount exposure and the potential economic impact or losses in each county.

Table 1: Summary of the existing medium-high to high risk locations in Florida, which are considered the High Impact Zone based on EDR and SACS studies.

Area	Counties	At-risk Locations and Census Places	Places with High Population and Infrastructure Exposure
The northeast portion of the Florida peninsula. (FL_6 in SACS study)	Portions of Nassau, Duval, St. Johns, Flagler, Clay, Putnam, Volusia, and Seminole Counties	Palm Valley, Fleming Island, St. Augustine, and Jacksonville, Jacksonville Beach, Flagler Beach, Ormond Beach, Daytona Beach, Port Orange, New Smyrna Beach, St. Augustine Back Bay and Hammock (Flagler County).	Downtown Jacksonville along with Jacksonville beaches, Sections of Fernandina Beach in Nassau County, Downtown St. Augustine in St. Johns County, and Daytona Beach in Volusia County
The east central section of Florida peninsula. (FL_7 in SACS study)	Portions of Brevard, Indian River, St. Lucie, Martin, Orange, Osceola, and Okeechobee Counties	Stuart, Indian Harbour Beach, North River Shores, River Park, Hobe Sound, Melbourne, Satellite Beach, White City, and South Patrick Shores, Coastal areas such as Naples, Fort Myers, Venice, and Sarasota, areas with high acreage include Vero Beach, Port St. Lucie, Hutchinson Island South, Cocoa Beach, Palm City, Florida Ridge, Mims, and Patrick Air Force Base (AFB)	Titusville, Cape Canaveral, Cocoa Beach, and the Melbourne area in Brevard County, Vero Beach in Indian River County along with Port St. Lucie and Fort Pierce in St. Lucie County
The southeast portion of Florida. The most at risk areas in the state. (FL_8 in SACS study)	Palm Beach, Broward and Miami-Dade Counties	Hialeah, Fountainebleau, Wilton Manors, Sunny Isles Beach, Miami, Fort Lauderdale, Homestead, West Little River, Golden Glades, Aventura, Oakland Park, Golden Beach, Miami Garden, Hallandale Beach, Boynton Beach, Princeton, Tamiami, and Westview.	Jupiter down to Homestead, all 100 miles of coast along this area. Port of Palm Beach in Palm Beach County, Port Everglades in Broward County, and Port Miami located in Miami-Dade County
The most southern parts of Florida peninsula. Relatively low exposure to population and infrastructure from storm surge inundation. (Everglades) (FL_9 in SACS study)	Monroe County and the Florida Keys	Florida Keys, portions of Key West, Marathon, Long Key, Plantation Key, Layton, Key Largo, and Islamorada. Big Pine Key, Key Largo, Marathon, and North Key Largo have the most acres of medium-high to high risk	The southern tip of the Florida Keys in Key West and Port of Key West

<p>The southwestern portion of the Florida peninsula. Monroe County has the second highest expected economic risk in the state. (FL_10 in SACS study)</p>	<p>Portions of Manatee, Sarasota, DeSoto, Hardee, Highlands, Charlotte, Lee, Glades, Hendry, and Collier Counties</p>	<p>Back bay and riverine areas: Naples Bay, the Caloosahatchee River, Gasparilla Sound Charlotte Harbor, and the Manatee River. Fort Myers Shores, South Venice, Fort Myers, Venice, and Charlotte Harbor, Cape Coral and Sanibel have the most acres of medium-high-risk to high-risk. High acreage areas: Port Charlotte, Bonita Springs, North Fort Myers, Punta Gorda, Marco Island, and Rotonda.</p>	<p>Naples, Fort Myers, Venice, Sarasota, back bay area Port Charlotte, which includes Charlotte Harbor. Marco Island, Naples, Bonita Springs, Fort Myers Beach, Cypress Lake, McGregor, Iona, Sanibel, North Fort Myers, and Port Charlotte. Cape Coral has the highest risk to infrastructure.</p>
<p>The west central portion of the Florida peninsula. The third highest expected economic risk in Florida. (FL_11 in SACS study)</p>	<p>Portions of Levy, Marion, Citrus, Hernando, Sumter, Polk, Pasco, Pinellas, and Hillsborough Counties</p>	<p>Bay areas along Hillsborough Bay and Old Tampa Bay. Coastal areas in Pasco and Hernando Counties on the Gulf Coast. South Pasadena, Largo, Holiday, West Lealman, Town 'n' County, Oldsmar, Elfers, Safety Harbor, Palm River-Clair Mel, Pinellas Park, Redington Shores, and New Port Richey</p>	<p>Tampa Bay area and the coastline of Pinellas County extending north through Pasco County including the barrier island back bays. Areas surrounding both Hillsborough Bay and Old Tampa Bay. St. Petersburg has the highest risk to infrastructure in the existing condition, followed closely by Tampa and Clearwater</p>
<p>The Big Bend region in the northwestern portion of Florida. (FL_12 in SACS study)</p>	<p>Portions of Wakulla, Leon, Jefferson, Madison Taylor, Lafayette, Gilchrist, and Dixie Counties</p>	<p>Along the Suwannee River and the St. Marks NWR. Steinhatchee, Panacea, and Wakulla Beach</p>	<p>The majority of the population & infrastructure exposure are centrally located near Tallahassee in Leon County.</p>
<p>The northwestern portion of Florida along the Florida Panhandle. The 10-percent AEP flood hazard has a significant impact in coastal areas along much of the Gulf Coast. The Category 5 MOM has a large inland extent to the south of Tallahassee and Apalachicola Bay. (FL_13 in SACS study)</p>	<p>Portions of Escambia, Santa Rosa, Okaloosa, Walton, Washington, Bay, Calhoun, Gulf, Liberty, and Franklin Counties</p>	<p>Apalachicola Bay, back bay Panama City Beach, portions of the Choctawhatchee Bay and its tidal tributaries, and back bay areas near Pensacola including the barrier islands from Pensacola to Fort Walton Beach. Gulf-facing shorelines along barrier islands</p>	<p>The coastal communities of Panama City, Fort Walton Beach, and Pensacola</p>

6.2. Resources Inventory

The starting point of Florida’s ad valorem assessment process (just value) is used to assign property values to the geographic study area. Eight categories of land use from the Florida Department of Revenue resources inventory (Residential, Commercial, Industrial, Agricultural, Institutional, Governmental,

Miscellaneous and Vacant) have been separately identified for all 67 counties in Florida.⁷ For the purpose of this year’s EDR report, the 35 Florida coastal counties, also referred to as the High Impact Zone, have been studied in greater details. In total, Miami-Dade County contains the highest total property value among the 35 coastal counties, followed by Palm Beach County and Broward County. The lowest total property value county in this zone is Dixie.

The property values of vacant lands have been summed together under one category: Vacant Properties. The total vacant property value of all coastal counties is approximately \$102 billion, with Miami-Dade first, followed by Palm Beach and Lee counties. The county with the lowest vacant property value is Jefferson. Figures 1-9 show each property value category and the total for reference (See also: Appendix 1).

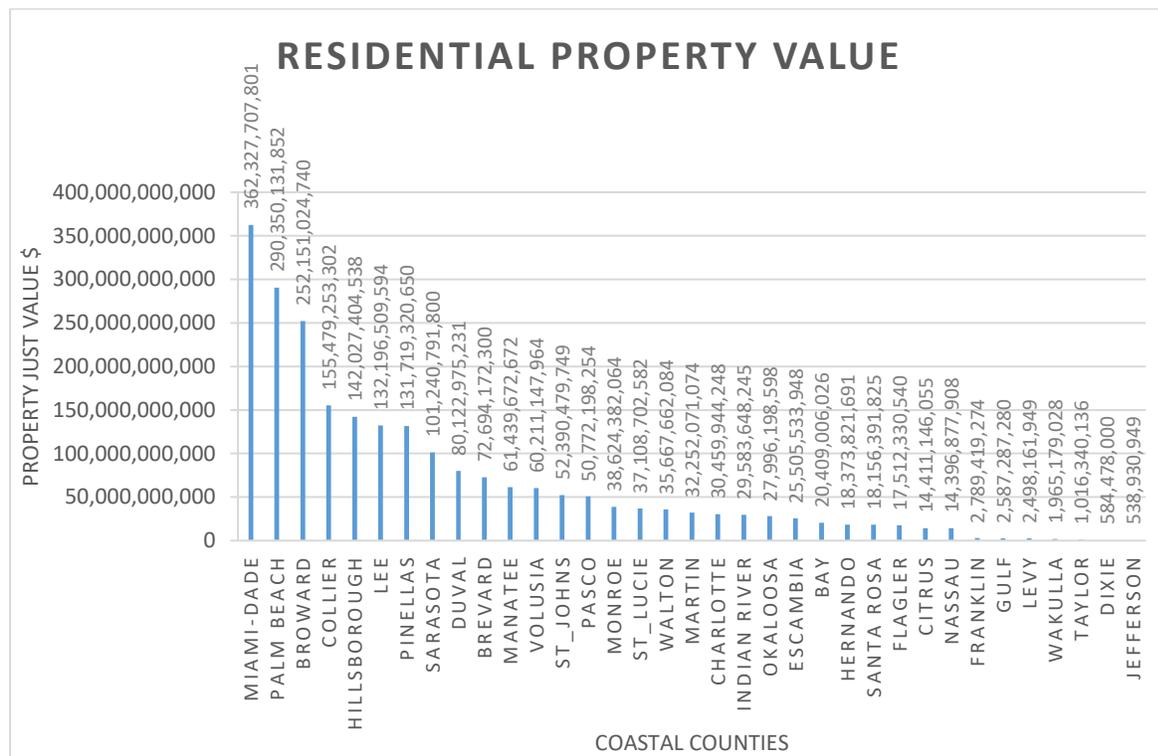


Figure 1: Residential Property Values in Florida’s 35 coastal counties (High Impact Zone).

⁷ The 2022 User’s Guide Department Property Tax Data File: <https://floridarevenue.com/property/dataportal/Pages/default.aspx?path=/property/dataportal/Documents/PTO+Data+Portal/User+Guides>

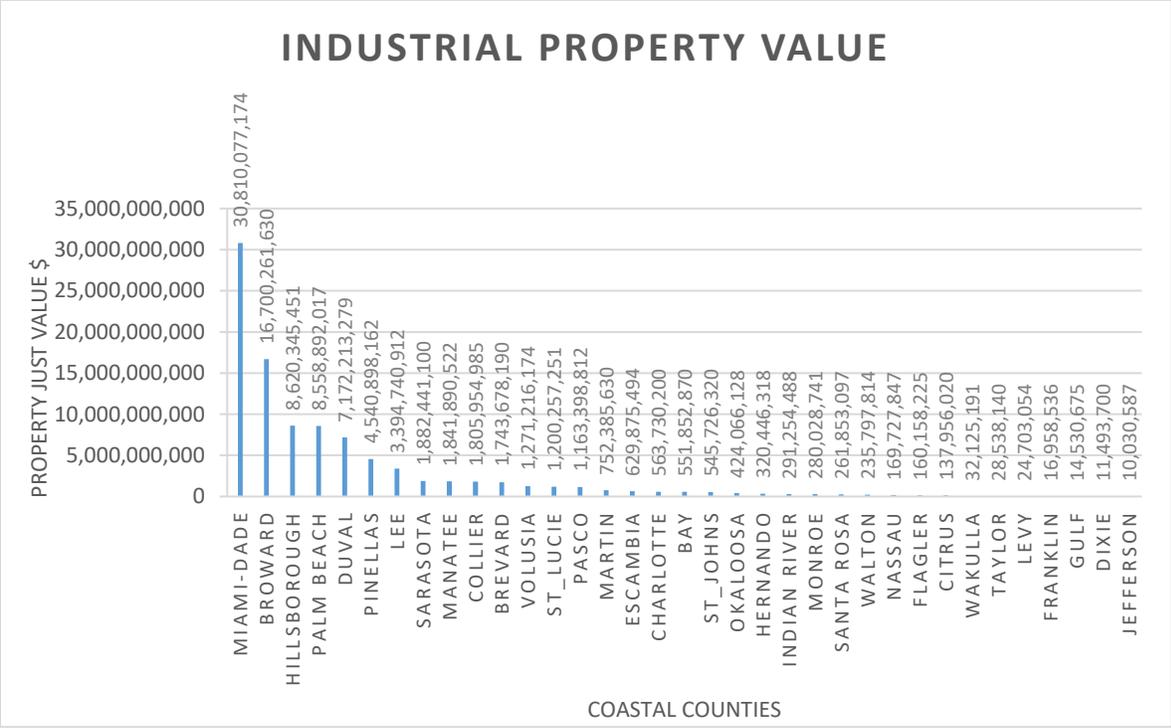


Figure 2: Industrial Property Values in Florida's 35 coastal counties (High Impact Zone).

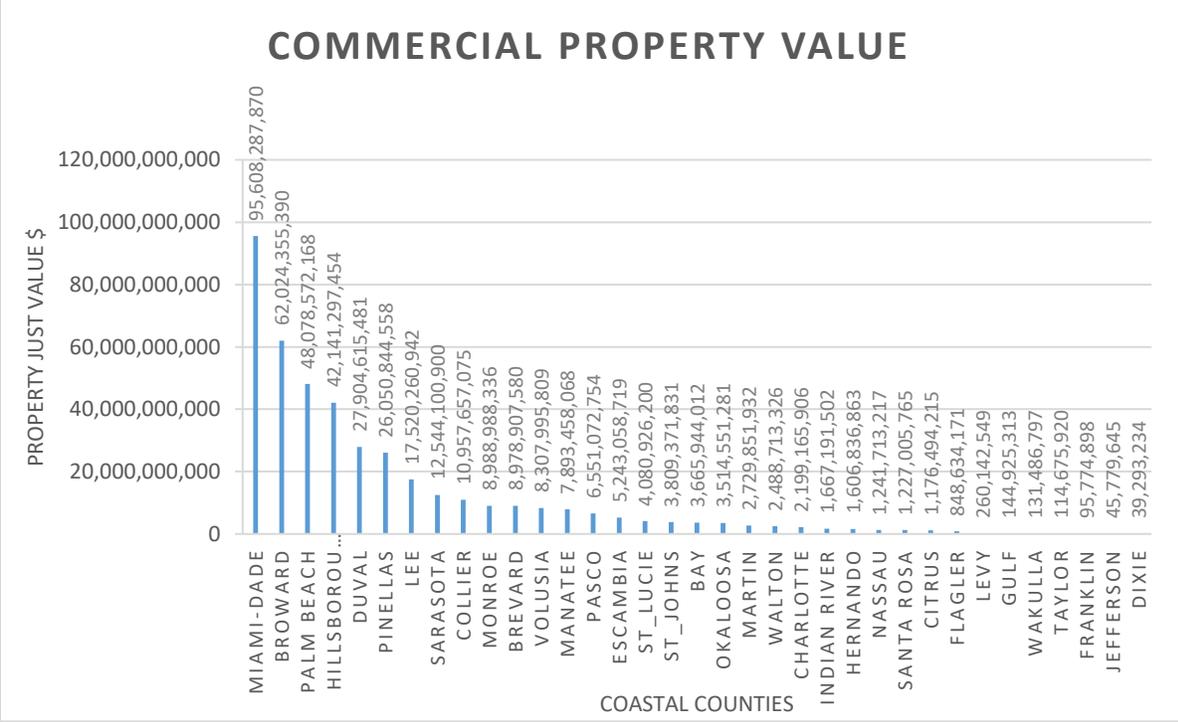


Figure 3: Commercial Property Values in Florida's 35 coastal counties (High Impact Zone).

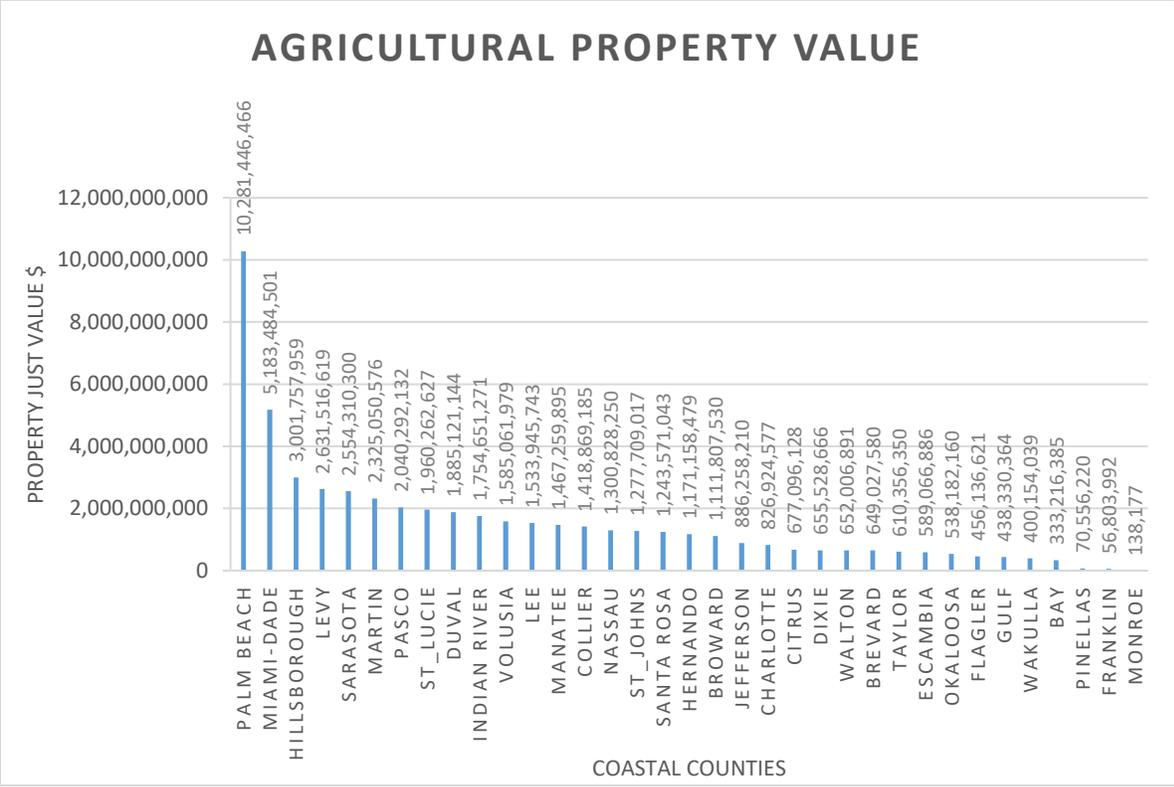


Figure 4: Agricultural Property Values in Florida's 35 coastal counties (High Impact Zone).

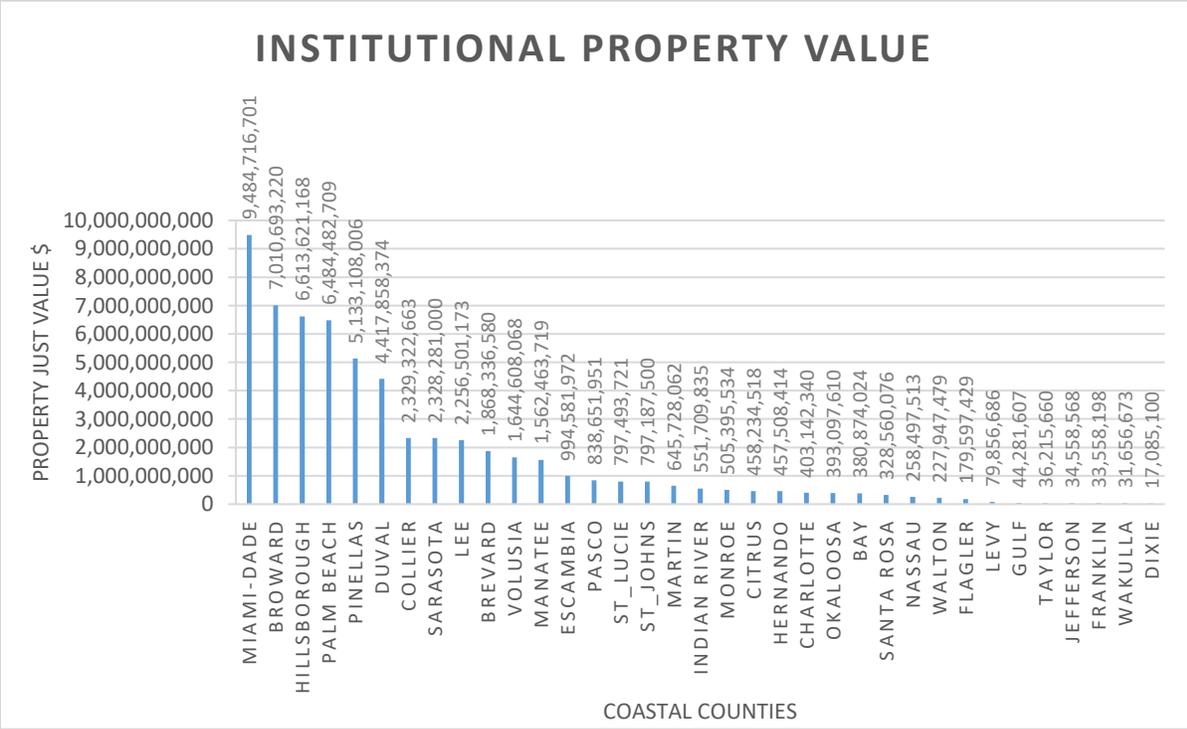


Figure 5: Residential Property Values in Florida's 35 coastal counties (High Impact Zone).

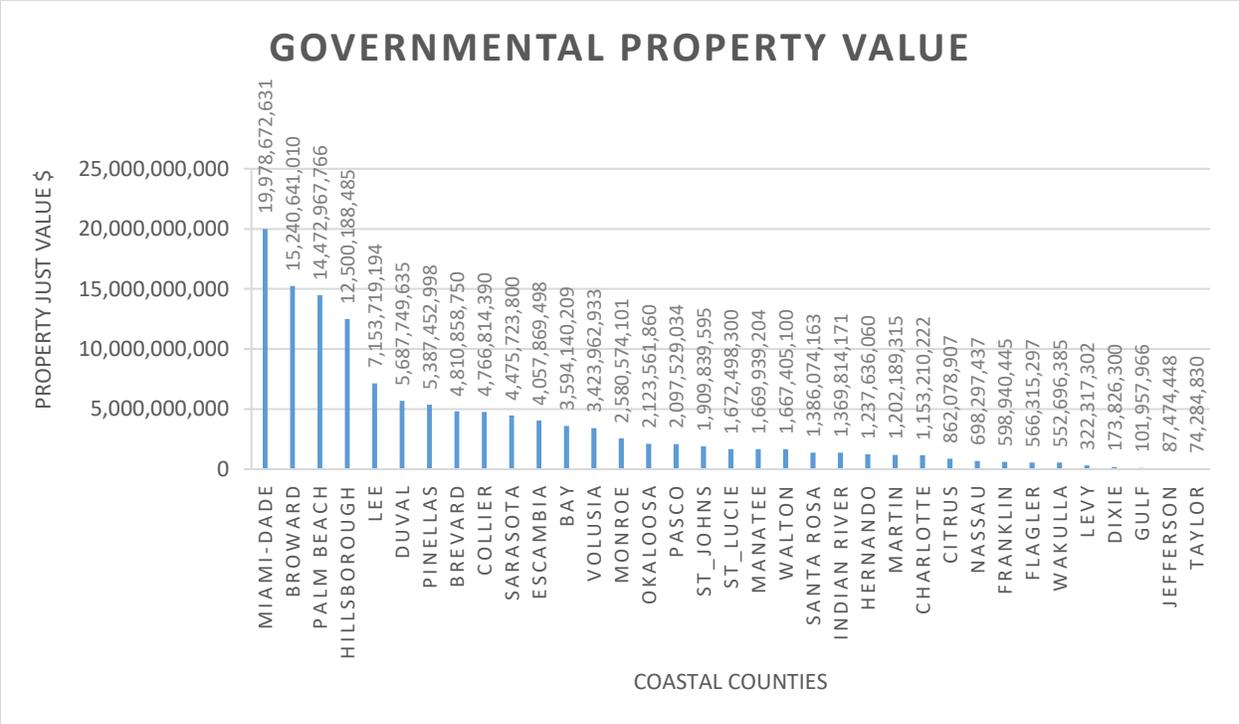


Figure 6: Governmental Property Values in Florida's 35 coastal counties (High Impact Zone).

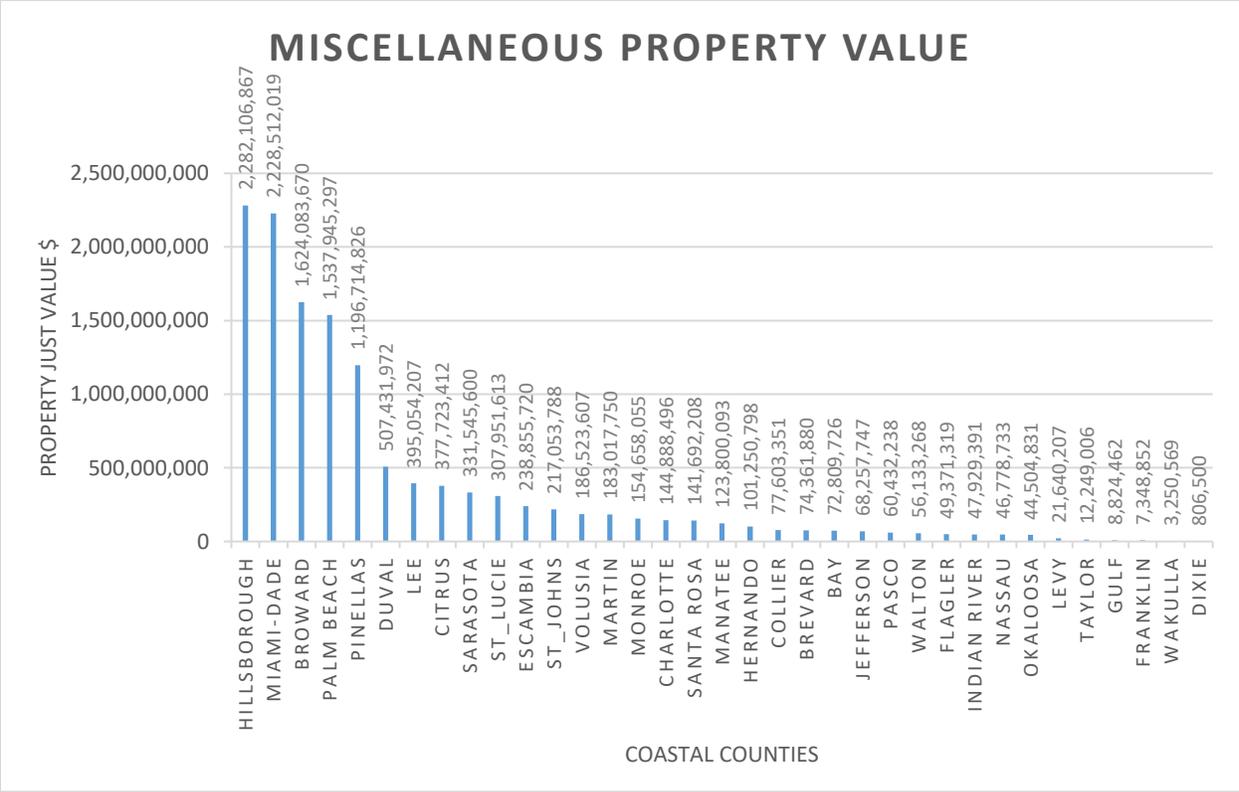


Figure 7: Residential Property Values in Florida's 35 coastal counties (High Impact Zone).

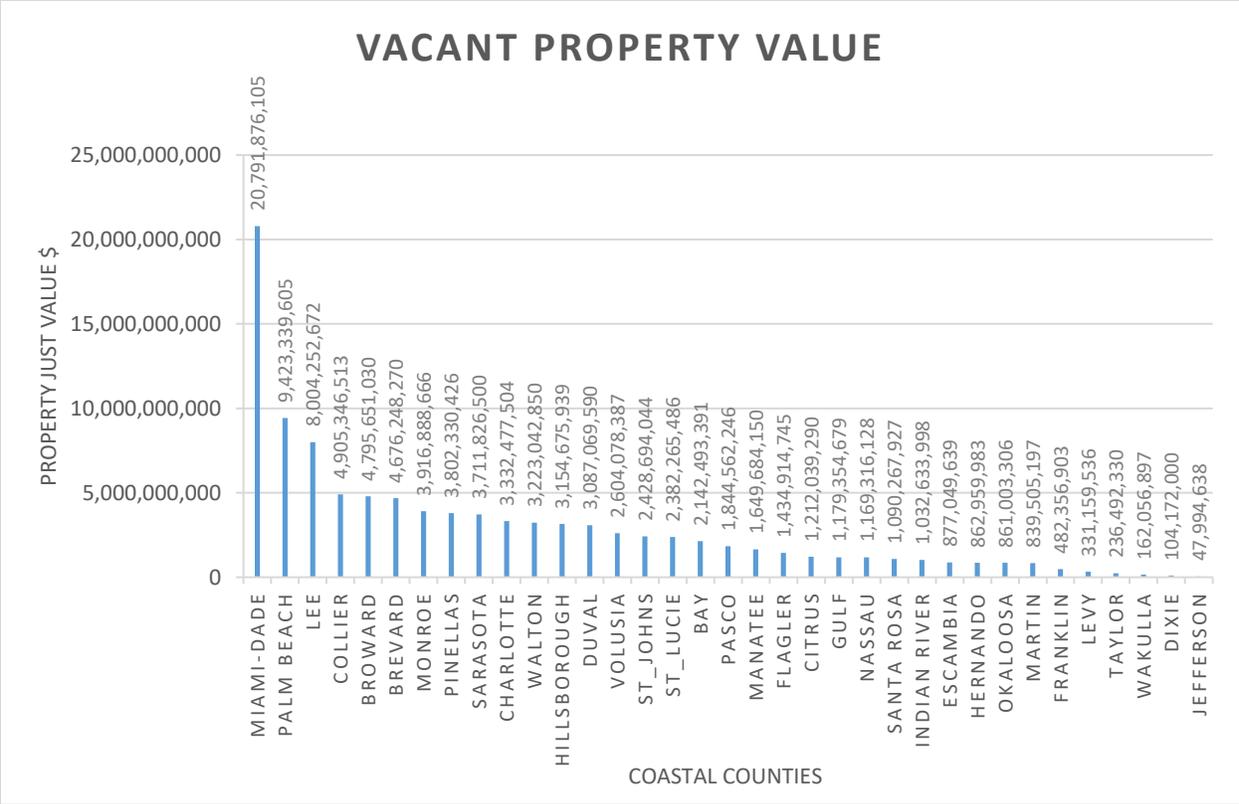


Figure 8: Vacant Property Values in Florida's 35 coastal counties (High Impact Zone).

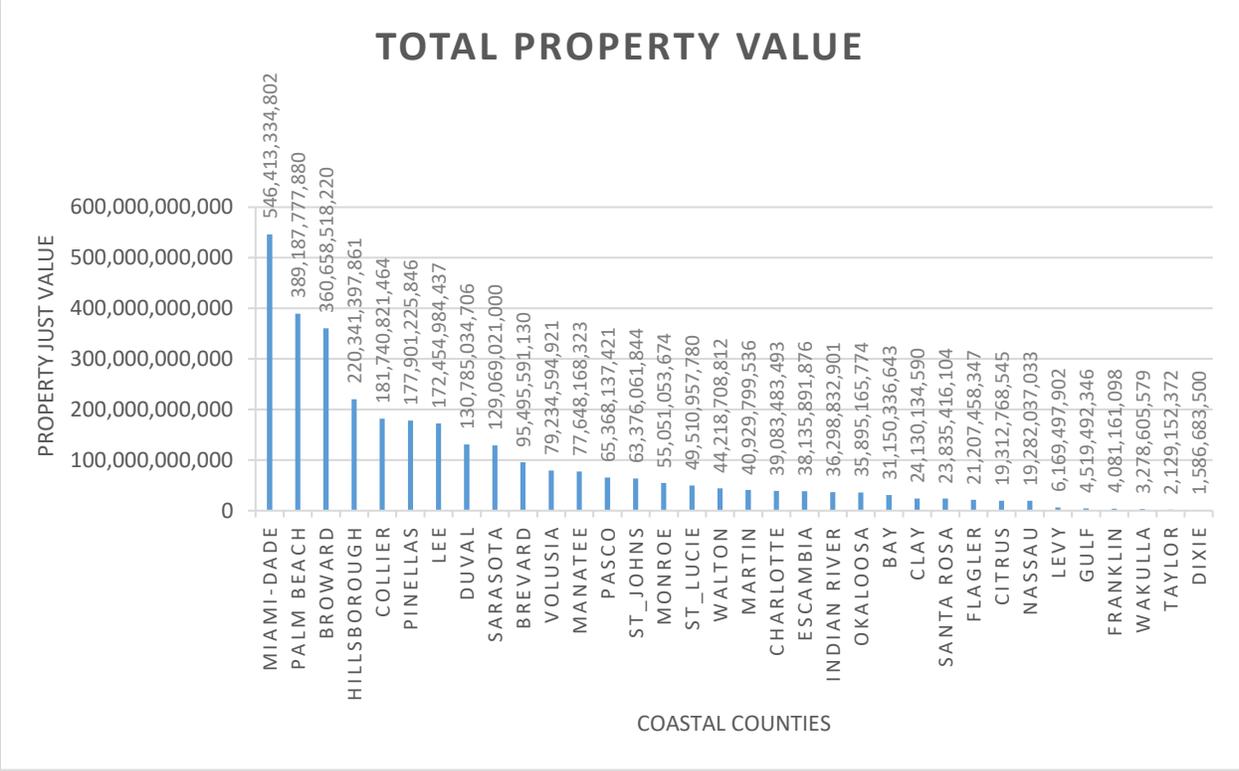


Figure 9: Total Property Values, including vacant properties, in Florida's 35 coastal counties (High Impact Zone).

The total economic risk for the coastal counties (High Impact Zone) is calculated by summing the total property value (just values) after excluding vacant properties. The final at-risk value will be lower than the total property value and the numbers shown below. Some properties will not be impacted in any projected scenarios. This is due to the fact that some properties are already reinforced against flooding, or are at higher elevations. While the precise at-risk value at a less than county-wide basis has yet to be calculated, the county-wide values provide a good working proxy. This at-risk value is presented in the following table (Table 2). Counties are ranked from highest economic risk to lowest economic risk.

Table 2: The total economic risk, excluding vacant properties, in Florida's 35 coastal counties (High Impact Zone)

County	Property Values \$
Miami-Dade	525,621,458,697
Palm Beach	379,764,438,275
Broward	355,862,867,190
Hillsborough	217,186,721,922
Collier	176,835,474,951
Pinellas	174,098,895,420
Lee	164,450,731,765
Duval	127,697,965,116
Sarasota	125,357,194,500
Brevard	90,819,342,860
Volusia	76,630,516,534
Manatee	75,998,484,173
Pasco	63,523,575,175
St Johns	60,947,367,800
Monroe	51,134,165,008
St Lucie	47,128,092,294
Walton	40,995,665,962
Martin	40,090,294,339
Escambia	37,258,842,237
Charlotte	35,751,005,989
Indian River	35,266,198,903
Okaloosa	35,034,162,468
Bay	29,007,843,252
Hernando	23,268,658,623
Santa Rosa	22,745,148,177
Flagler	19,772,543,602
Nassau	18,112,720,905
Citrus	18,100,729,255
Levy	5,838,338,366
Franklin	3,598,804,195
Gulf	3,340,137,667
Wakulla	3,116,548,682
Taylor	1,892,660,042
Jefferson	1,671,290,154
Dixie	1,482,511,500
Total	3,089,401,395,998

6.3. Identification of Flood Hazard Areas in the High Impact Zone

The impact of main flooding factors, including storm surge, annual chance of flooding, and sea level rise, have been studied to identify the hazard areas in the Florida High Impact Zone. The two major reoccurring and destructive elements in Florida are hurricanes and storm events. Storm surge, precipitation, and wind resulting from hurricanes cause extensive damage to Florida resources, especially in the High Impact Zone. For the purpose of this year's study, EDR offers the results of three analyses. First, EDR evaluates storm surge scenarios and runs a preliminary analysis of the impact of storm surge on coastal counties. Second, FEMA flood data is used to assess the areas that are in the annual chance flood zones. Third, EDR analyzes the 2 ft. Sea Level Rise scenario and considers its impacts to rank economic risk and identify at-risk infrastructures.

6.3.1. Storm Surge

Hurricane-induced storm surge is one of the greatest potential hazards in the High Impact Zone. EDR utilizes NOAA hurricane storm surge data⁸ and its assessment of the impacts of storm surge related flooding. As stated in EDR's 2021-2022 report, the majority of hurricanes that impact Florida were identified as category 3. Also, Florida has historically experienced a high number of hurricanes identified as categories 4 and 5. Hurricane impacts are unpredictable and devastating, as Florida experienced with Hurricane Michael (Cat 5, 2019) and Hurricane Ian (Cat 4, 2022). In order to consider the impact of hurricanes, EDR has created more detailed maps of Florida regions under hurricane category 5 storm surge in Appendix 3. The scenarios for this year's assessment are categories 1, 3, 4 and 5. Figures 10-13 illustrate the areas that may be affected by the storm surge associated with these hurricane categories.

⁸ NOAA hurricane storm surge data: <https://www.nhc.noaa.gov/nationalsurge/#data>. The data and maps in this tool illustrate the height of possible storm surge flooding under certain scenarios, and do not account for erosion, subsidence, sea-level change or future construction.

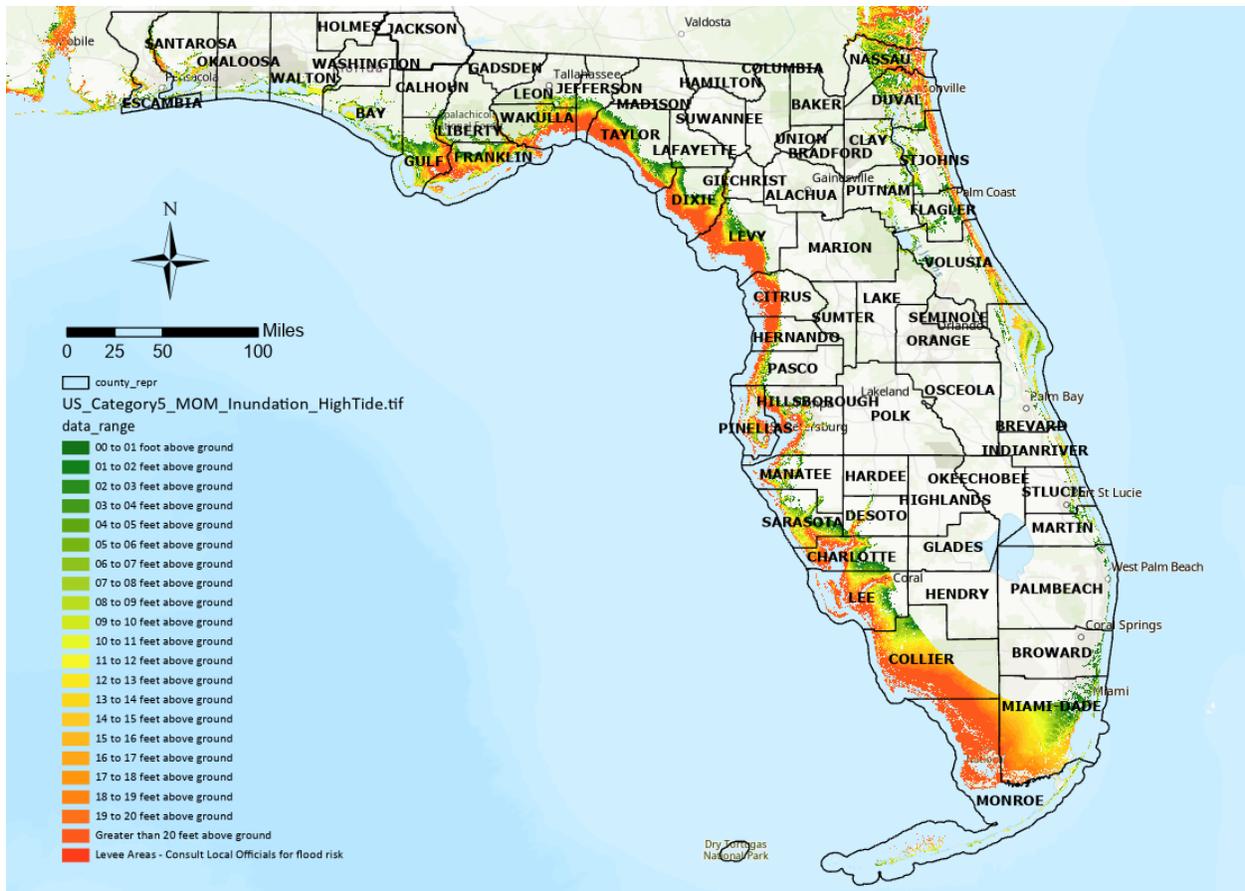


Figure 10: Areas that may be affected by hurricane category 5 storm surge.

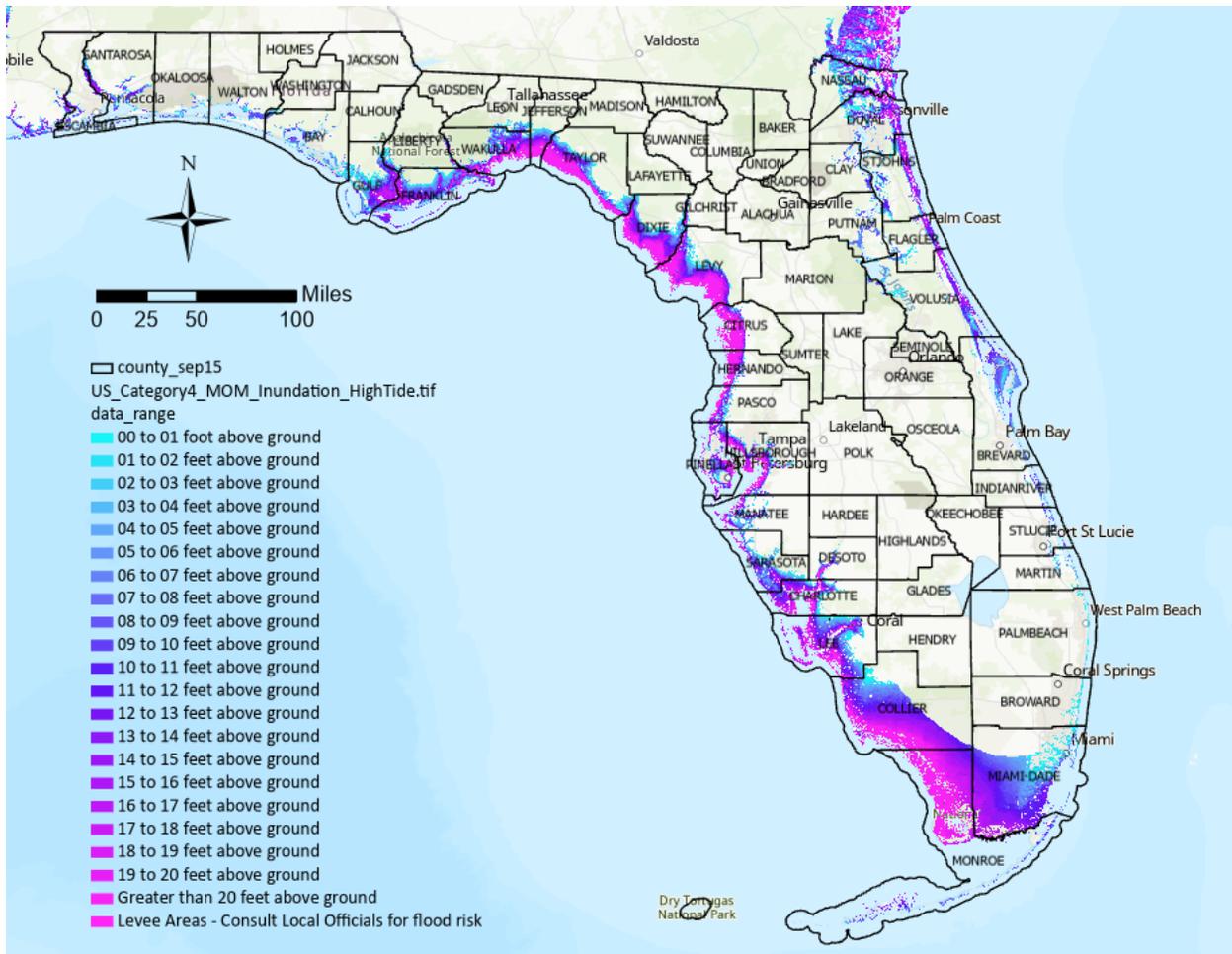


Figure 11: Areas that may be affected by hurricane category 4 storm surge.



Figure 12: Areas that may be affected by hurricane category 3 storm surge.

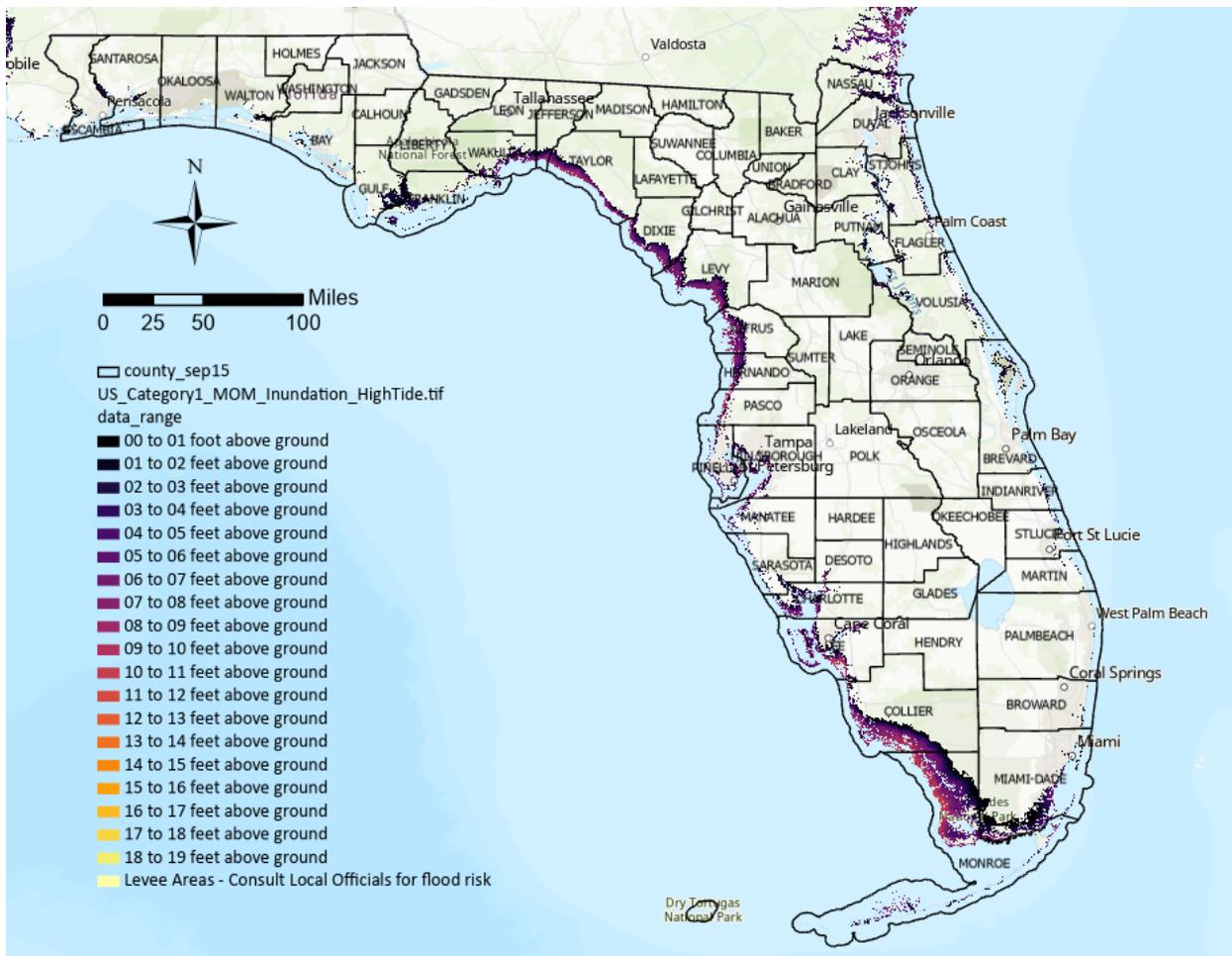


Figure 13: Areas that may be affected by hurricane category 1 storm surge.

6.3.2. Flooding: Annual Exceedance Probability

The percent chance of occurrence of flood is referred to as an Annual Exceedance Probability (AEP). For the existing condition, most studies have assessed infrastructure damage based on the 10-, 1-, 2-, and 0.2-percent AEP, also known as Annual Chance Occurrence Probability, using data from FEMA’s Flood Insurance Studies (FIS). For the future condition, FEMA adds 3 ft. of sea level rise to these events.

Figure 14 overlays FEMA flood data⁹ to highlight the areas at risk of different flood categories in Florida. In Appendix 2, more detailed maps of coastal areas under the flood projection scenarios are presented.

⁹ FEMA flood data: <https://www.fema.gov/about/reports-and-data>

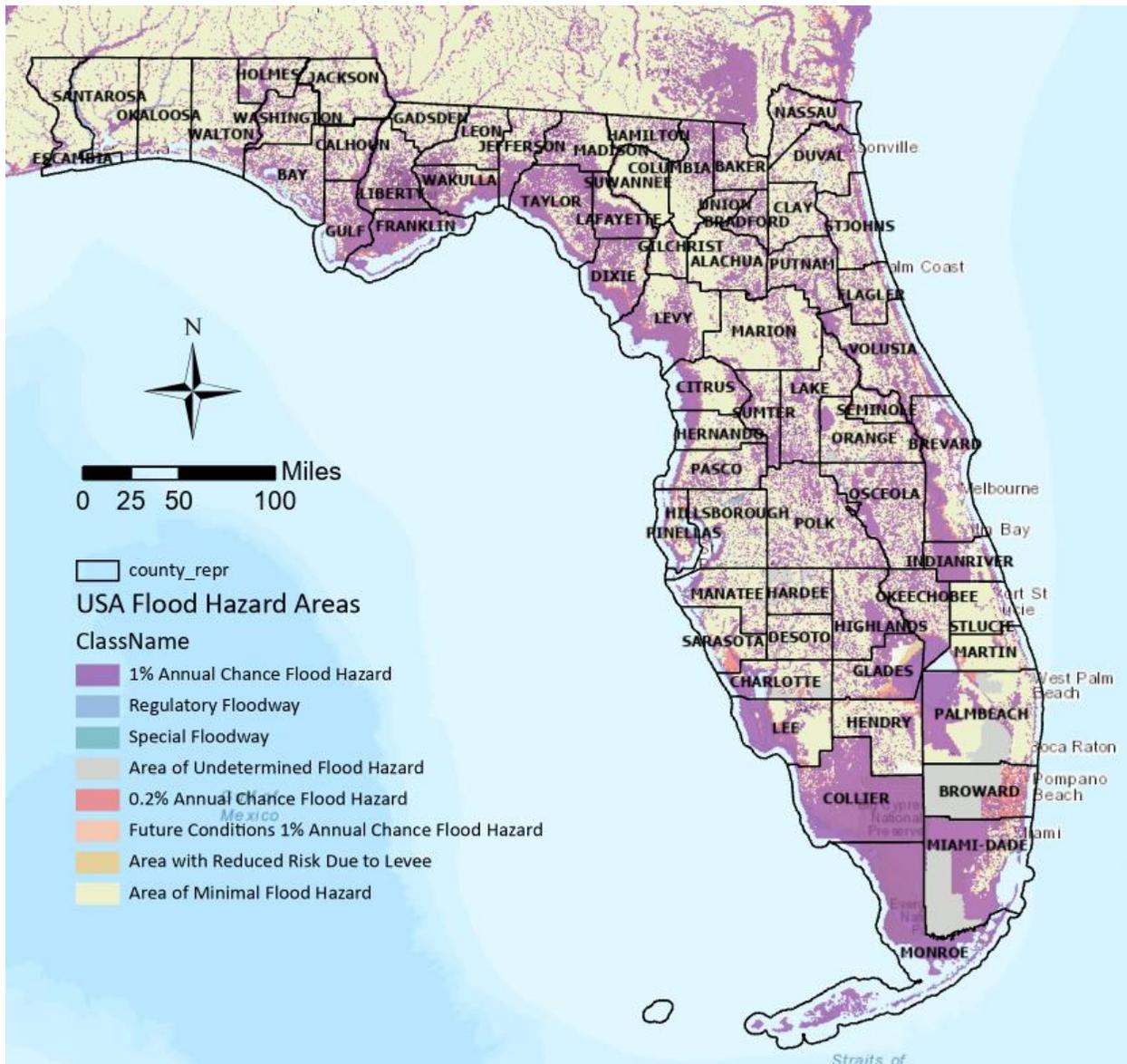


Figure 14: Areas of Florida at risk of flooding based on FEMA flood categories.

Based on a review of the maps, the potential impact of storm surge and annual chance of flooding on Florida’s counties is summarized below:

- In Nassau County, most of the areas under the 1% AEP are wetland and conservation land. However, there are some developed areas on the ocean waterfront and Fernandina Beach that are in 1% and 0.2% AEP. Hurricane category 5 maximum of maximum may cause storm surge that is projected to cover more than half of the county. Most of the oceanfront, bay front, and riverine areas may be inundated. However, many areas that are at risk of inundation are wetlands and conservation lands.

- In Duval County, most of the areas under the 1% AEP are wetland and conservation land. However, some areas that are bordering these wetlands and around Lake Wonderwood, especially Neptune Beach and Jacksonville Beach, are in 1% and 0.2% AEP zones. All waterfront properties and low lying areas may be inundated by storm surge. The majority of the county is the Jacksonville area that may be affected by storm surge flooding.
- In Broward County, approximately, all of the developed areas are under the risk of 1% and 0.2% AEP. However, the impact of storm surge cause by hurricanes seems to be minimal relative to some other areas of the state.
- In Miami-Dade County approximately one-half of the county and all of its waterfront properties are under the risk of 1% and 0.2% AEP. Most coastal developed areas may be impacted by storm surge. The storm surge may also affect all the riverine areas along the Miami River, causing inundation of many residential and commercial properties, and the Miami International Airport. The City of Miami and Miami Beach may be inundated, according to the projections.
- All of Monroe County and the Florida Keys are under 1% AEP risk. The projections of hurricane categories 4 and 5 show storm surge inundating the entire county. The portions that may remain above the water level may be disconnected from roads and the mainland.
- Most of Collier County is under 1% AEP risk and some areas are under 0.2% AEP. A large portion of the county is projected to be inundated. Although the majority of this area is preservation land, the developed areas of Naples and Marco Island are projected to be inundated with storm surge flooding caused by hurricane categories 4 and 5.
- All of Lee County's waterfront properties, in addition to the barrier islands and areas along Caloosahatchee River, are under 1% AEP risk. The entire Iona area is under 1% AEP risk. Most of the county's developed areas, including Cape Coral and Fort Myers, in addition to all waterfront areas and barrier islands, may be inundated by storm surge flooding caused by hurricane categories 4 and 5.
- Most of the developed areas in Charlotte County, especially those in close proximity to water, and in some areas as far inland as ~10 miles, are in the 1% AEP zone. Most of the developed areas of Charlotte County are in the coastal area and/or in close proximity to the water (rivers, bay, and canals). These areas are projected to be inundated by storm surge caused by hurricane categories 4 and 5. The more inland areas of this county are mainly open land, wetlands, or agricultural properties, which are not projected to be affected by storm surge.
- Sarasota County has large developed areas under 0.2% AEP and most of the developed areas, especially the ocean, river, and creek waterfronts and the barrier islands are under 1% AEP risk. Most of the developed areas of Sarasota County are in the coastal area and/or in close proximity to the water. These areas, which also include the barrier islands, are projected to be inundated by storm surge caused by hurricane categories 4 and 5. Most of the developed areas west of Highway 75, are projected to be inundated.
- In Pinellas County, all of the ocean, bay, Lake Seminole and Cross Bayou Canal waterfront properties and barrier islands are under 1% AEP risk. Some of these areas extend more than a mile inland. The borders between these areas and the rest of the county is under 0.2% AEP. A large portion of this county is projected to be affected by storm surge caused by hurricane categories 4 and 5. The central section of the county that is projected to stay dry may be disconnected from other mainland areas. Some areas east of Clearwater stay dry as well, but the roads and connections may be disrupted.

- In Hillsborough County, most of the area around Hillsborough Bay and Tampa’s waterfront is at risk of 1% AEP. Although the county seems to be sitting behind the protection of Pinellas County, its waterfront areas may be affected by storm surge caused by hurricane categories 4 and 5. The metropolitan area of Tampa is projected to be impacted to a high degree. MacDill Air Force Base is projected to be inundated.
- In Levy, Dixie, Taylor, Jefferson, Wakulla, Franklin and Gulf Counties, although large areas of these counties are under 1% AEP risk, these areas are primarily wetland, conservation or agricultural lands. In Gulf County, the Eglin Air Force Base Annex is under 1% AEP risk. Although storm surge flooding caused by hurricanes is projected to cover a large portion of these counties, the majority of the affected areas are conservation lands and wetlands. However, any developed areas along the water or in close proximity to the water, such as Cedar Key Beach and Horseshoe Beach, are projected to be inundated. In some areas, storm surge may reach more than 20 miles inland, especially in Gulf County

In Appendix 2, FEMA flood hazards data has been overlaid with counties to highlight the areas that may be affected by flood risks.

6.3.3. Sea Level Rise

EDR has selected a 2 ft. sea level rise as the most probable scenario for the next 50 years. NOAA releases the results of their periodical studies on different aspects of climate change, SLR, and flooding every 4-5 years. The latest report, which was released in February 2022¹⁰, has updates on its previous findings. The 2005–2060 SLR projections show that an average of 2 ft. SLR can be expected in the next 50 years in Florida (Table 3).

Table 3: Projected relative sea level rise for three Florida locations based on NOAA data. The locations are based on NOAA’s reported observation gauges.

Location	Relative Sea level Rise from 2005-2060 (ft.)
Virginia Key	1.80
St. Petersburg	2.29
Pensacola	2.16

In last year’s EDR report, several SLR scenarios were mapped. For this year’s study, EDR looked closer at the counties that are projected to be the most economically affected by the 2 ft. SLR scenario. Figure 15 shows a projection of 2 ft. SLR in the State of Florida and its counties.

¹⁰ NOAA 2022 report accessible at: <https://oceanservice.noaa.gov/hazards/sealevelrise/sealevelrise-tech-report.html> (Last accessed 12/16/2022)

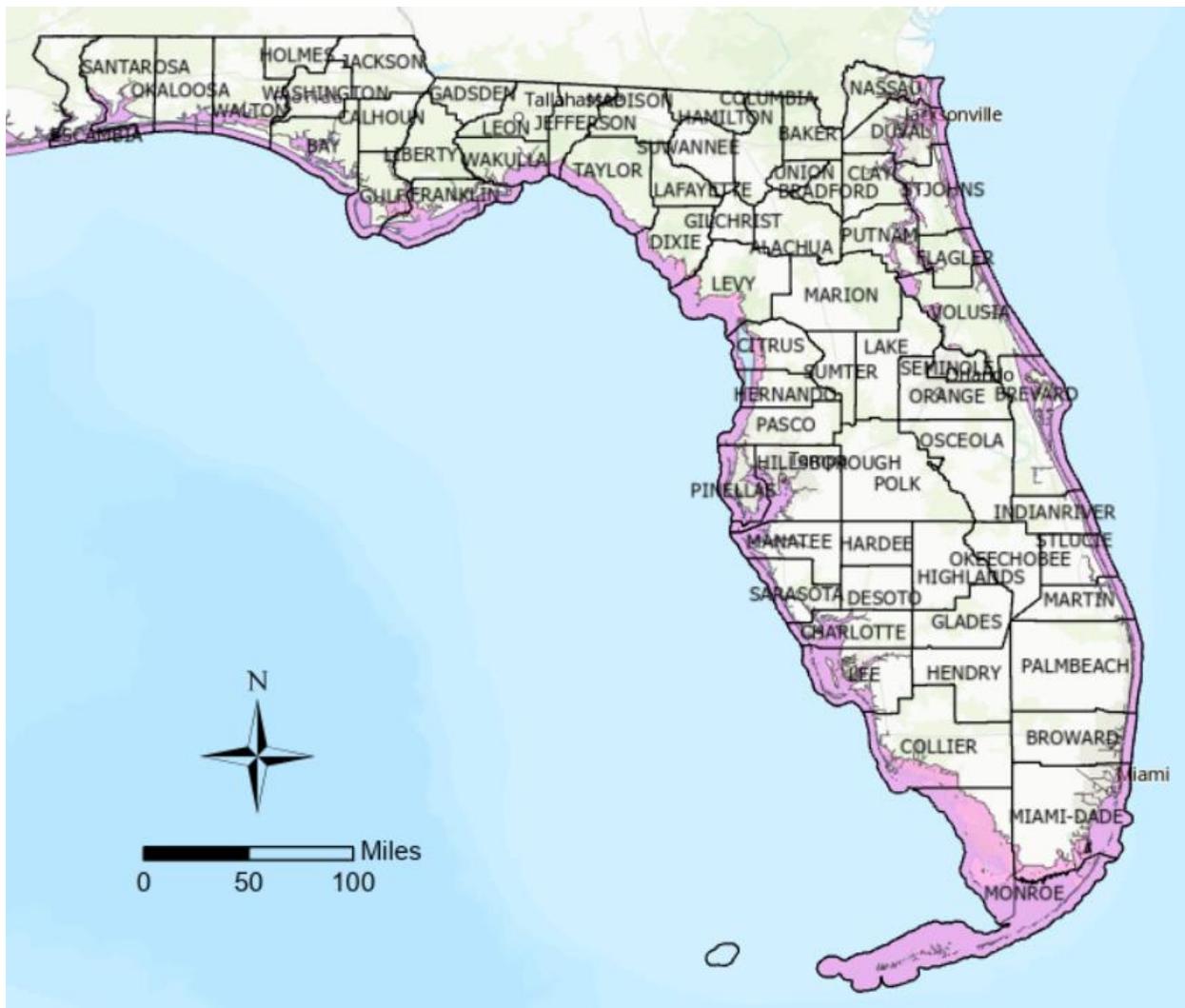


Figure 15: Projection of 2 ft. SLR in the State of Florida and its counties.

The 2 ft. SLR scenario is projected to affect all coastal areas of Florida. These areas are highly populated and developed. In addition, there are ports and power plant facilities along the coast that may be affected by 2 ft. SLR. In addition, indirect impacts of SLR on businesses, industries, residential areas, and facilities may result from road inundation and loss of accessibility.

The counties projected to be most impacted by 2 ft. SLR are Miami-Dade and Monroe, including the Florida Keys. Figure 16 illustrates these impacts. Some preliminary assessment of the impact of 2 ft. SLR on infrastructure have been presented in section 6.6.1.

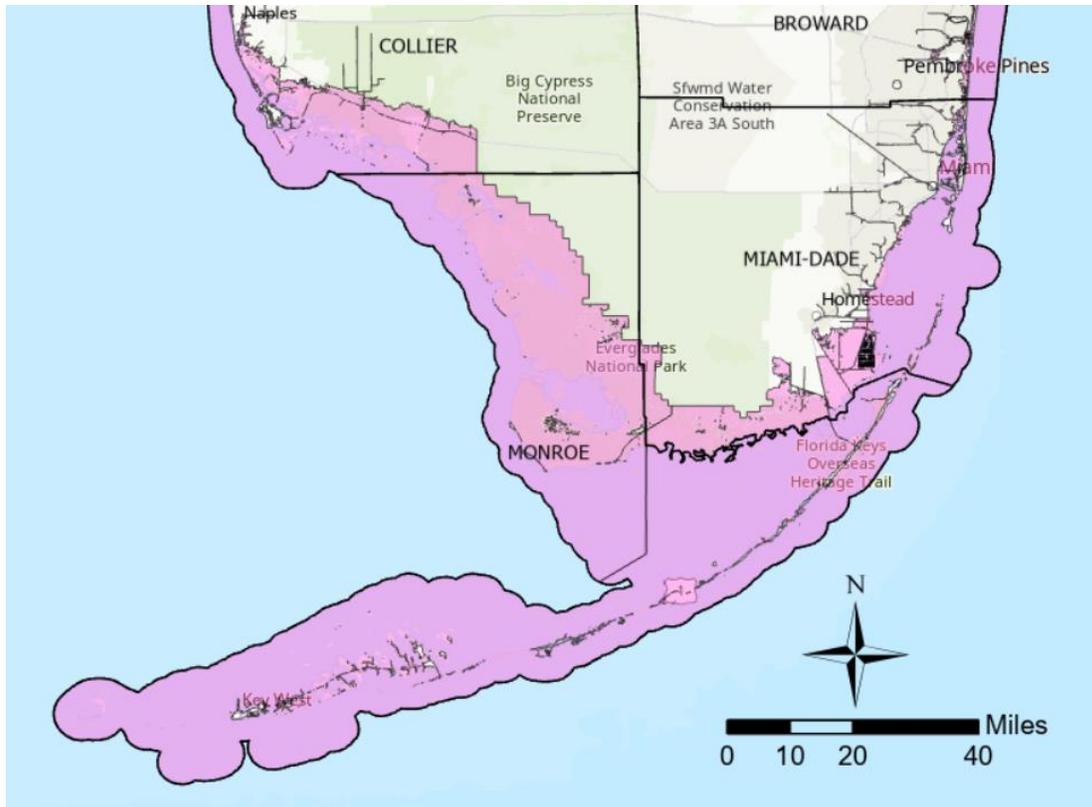


Figure 16: Projection of 2 ft. SLR on Miami-Dade and Monroe, including Florida Keys.

6.4. Preliminary Economic Assessment

EDR has analyzed existing data to conduct a preliminary economic assessment of the impacts of flooding. The SACS study offers an analysis of the economic impacts of flood factors in the South Atlantic region. A summary of these findings and a preliminary ranking of the potential economic impacts on the coastal counties in relation to the three flood factors is presented in this section. The SACS study calculates the economic impact of Florida Regions designated as FL-06 to FL-13¹¹. These regions encompass 56 out of 67 Florida counties and are depicted in Figure 17. The total estimate exposure value and number of structures is presented in Table 4.

¹¹ In order to assess the economic impact of flooding, the SACS study utilizes a Composite Exposure Index, which is comprised of 60% population and infrastructure, 30% environmental and cultural resources, and 10% social vulnerability. Exposure is defined as the number of assets, people and sensitive environmental or cultural resources within a hazard footprint. SACS Economic Risk Assessment incorporates vulnerability through its use of FEMA's Hazus model, which considers infrastructure vulnerability using depth-damage functions to represent the performance of different types of infrastructure to flood hazards and to estimate the financial impact of flooding.



Figure 17: South Atlantic Coastal Studies’ (SACS) study areas: FL_6: Nassau, Duval, St. Johns, Flagler, Clay, Putnam, Volusia, and Seminole Counties; FL_7: Brevard, Indian River, St. Lucie, Martin, Orange, Osceola, and Okeechobee Counties; FL_8: Palm Beach, Broward and Miami-Dade Counties; FL_9: Monroe County and the Florida Keys; FL_10: Manatee, Sarasota, DeSoto, Hardee, Highlands, Charlotte, Lee, Glades, Hendry, and Collier Counties; FL_11: Levy, Marion, Citrus, Hernando, Sumter, Polk, Pasco, Pinellas, and Hillsborough Counties; FL_12: Wakulla, Leon, Jefferson, Madison Taylor, Lafayette, Gilchrist, and Dixie Counties; FL_13: Escambia, Santa Rosa, Okaloosa, Walton, Washington, Bay, Calhoun, Gulf, Liberty, and Franklin Counties.

Table 4: The total estimate exposure value and number of structures that may be affected by flooding according to the SACS study.

FL SACS Study Regions	Estimated Exposure Value \$	Estimated # of Structures
FL_06	477,864,453,800	814,400
FL_07	288,544,628,000	463,700
FL_08	1,110,200,336,000	1,645,000
FL_09	59,806,847,000	93,400
FL_10	619,966,374,000	936,000
FL_11	593,183,484,000	900,000
FL_12	11,261,168,000	34,000
FL_13	225,007,803,000	379,000
All Areas	3,385,835,093,800	5,265,500

The results of SACS analysis identified more than 400 high-risk locations in Florida, which account for over one-third of the census places being assessed. The most at risk region in Florida is Southeast Florida, which includes Miami-Dade, Broward and Palm Beach Counties. The SACS region that includes Pinellas County, Hillsborough County, and the Tampa Bay is expected to have the second highest economic risk. The SACS region that includes Charlotte, Lee, Collier, Sarasota and Manatee Counties is considered to have the third highest economic risk in the state.

EDR performed a preliminary economic assessment of the 35 coastal counties in the High Impact Zone, applying property values and flooding factors. Table 5 shows the total property values, excluding vacant properties, for counties in the High Impact Zone, and highlights the counties that may be impacted by any of the three flooding factors of storm surge, annual chance of flooding, and 2ft. SLR scenario. The ranking is based on the total property value in each county. At the county level, the total property value for the High Impact Zone is estimated at \$3,089,401,395,998. The total at-risk value from storm surge categories 4 and 5 is estimated at \$1,991,378,201,915. The total at-risk value from 1% & 0.2% Chance of Flooding is estimated at \$2,361,686,842,530. The total at-risk value from 2 ft. sea level rise is estimated at \$576,755,623,705.

[See table on following page]

Table 5: The ranking of Florida's coastal counties based on the total property value (excluding vacant properties) and identification of the counties at risk from flooding factors.

County	Property Values \$	Highly in danger of Storm Surge Cat. 4 & 5	1% & 0.2% Chance of Flooding threatening developed areas	2 ft. SLR threatening developed areas
Miami-Dade	525,621,458,697	X	X	X
Palm Beach	379,764,438,275	X	Waterfront areas	
Broward	355,862,867,190	X	X	
Hillsborough	217,186,721,922	X	X	
Collier	176,835,474,951	X	X	
Pinellas	174,098,895,420	X	Waterfront areas	
Lee	164,450,731,765	X	Waterfront areas + Iona	
Duval	127,697,965,116	X	Waterfront areas	
Sarasota	125,357,194,500	X	Waterfront areas	
Brevard	90,819,342,860			
Volusia	76,630,516,534			
Manatee	75,998,484,173			
Pasco	63,523,575,175			
St Johns	60,947,367,800	X	X	
Monroe	51,134,165,008	X		X
St Lucie	47,128,092,294			
Walton	40,995,665,962			
Martin	40,090,294,339			
Escambia	37,258,842,237			
Charlotte	35,751,005,989	X	X	
Indian River	35,266,198,903			
Okaloosa	35,034,162,468			
Bay	29,007,843,252			
Hernando	23,268,658,623			
Santa Rosa	22,745,148,177			
Flagler	19,772,543,602			
Nassau	18,112,720,905	X	Some waterfront	
Citrus	18,100,729,255			
Levy	5,838,338,366	X		
Franklin	3,598,804,195	X		
Gulf	3,340,137,667	X		
Wakulla	3,116,548,682	X		
Taylor	1,892,660,042	X		
Jefferson	1,671,290,154			
Dixie	1,482,511,500	X		
Total	3,089,401,395,998	1,991,378,201,915	2,361,686,842,530	576,755,623,705

Further analysis is needed to more precisely estimate the value of at-risk properties in the projected hazard areas. In order to define more precise at-risk values, in next year's study, EDR will overlay the property tax data with flooding factor maps in order to extract the actual resources that lie within the most vulnerable areas of the counties identified in this year's High Impact Zone. As this is done, the High Impact Zone boundary will compress in some cases to be less than county-wide. In addition, any future

projections should consider whether the resource, which is being assessed, would still exist in different SLR scenarios or after coastal erosion.

Real Gross Domestic Product (GDP) is another metric frequently used to compare different geographic areas. Relative to property values, its importance speaks more to economic value or capacity. Table 6 provides the same list of counties, but ranked by each county’s share of the state’s GDP. The results are similar to property value. Altogether, the counties comprising the state’s High Impact Zone comprise 77.35% of the state’s GDP.

Table 6: GDP Analysis of High Impact Zone

High Impact Zone Counties	Percentage of 2021 State Real GDP
Miami-Dade, FL	14.75%
Broward, FL	10.19%
Hillsborough, FL	8.88%
Palm Beach, FL	8.20%
Duval, FL	6.24%
Pinellas, FL	4.72%
Lee, FL	3.13%
Brevard, FL	2.53%
Sarasota, FL	2.08%
Collier, FL	1.87%
Volusia, FL	1.72%
Escambia, FL	1.46%
Manatee, FL	1.46%
Pasco, FL	1.34%
Okaloosa, FL	1.17%
St. Johns, FL	0.98%
St. Lucie, FL	0.90%
Bay, FL	0.81%
Martin, FL	0.73%
Indian River, FL	0.64%
Charlotte, FL	0.54%
Monroe, FL	0.48%
Santa Rosa, FL	0.46%
Hernando, FL	0.42%
Citrus, FL	0.40%
Walton, FL	0.34%
Flagler, FL	0.28%
Nassau, FL	0.27%
Levy, FL	0.10%
Wakulla, FL	0.06%
Taylor, FL	0.06%
Gulf, FL	0.04%
Franklin, FL	0.04%
Dixie, FL	0.03%
Jefferson, FL	0.03%
Percent of State	77.35%

6.5. EDR's Preliminary Assessment of Infrastructures

EDR is currently assessing the impacts of flooding on critical infrastructure and resources using available data. This is done as part of the overall effort to populate the comprehensive flooding assessment model, which will be used to assess the flooding risks and vulnerability of all Florida counties.

According to the published resources, the analyses should include two categories to assess the flooding risks and vulnerability. One category is the physical features, and the other is property values. Physical features that are included in the vulnerability analysis include ports, airports, medical facilities, railroads, schools, miles of road by FDOT category, emergency shelters, water & wastewater treatment plants, evacuation routes, power plants, marine facilities, and landfills. Additional analysis will be conducted to determine the value of impacted property, acres of future land use, and acres by habitat type and land cover use.

In order to start this process, EDR has superimposed the available data with the NOAA 2 ft. SLR scenario, hurricane category 5 storm surge, and FEMA flood zones data to identify the facilities that will more likely be at risk of inundation or located in the hazard areas. For this year's analysis, three infrastructure types have been assessed: medical facilities, schools, and fire stations.

In many areas, the wetlands and conservation lands are playing an effective role in alleviating the impact of sea level rise, storm surge and flooding. However, low lying natural systems comprised of buttonwood, mangrove, scrub mangrove, and herbaceous coastal saline and freshwater wetlands are significantly impacted in all SLR scenarios. In addition, saltwater intrusion has weakened some of the vegetation in these areas. Regional studies, which includes studies on the impacts of SLR on Broward, Miami-Dade, Palm Beach and Monroe counties, states that approximately 80% of the lands affected regionally in the 1 ft. SLR scenario are conservation lands, especially coastal wetlands (Compact, 2019¹²).

6.5.1. Infrastructure Assessment at 2 ft. SLR Scenario

Using the 2 ft. SLR scenario, the assessment analyzes medical facilities, schools, and fire stations located in the 2 ft. SLR impact area. These analyses indicate that the actual number of structures that may be completely or partially inundated are few. However, in low lying areas, and especially on barrier islands, the submergence of the connecting routes to residential areas may greatly impact the continued use and occupation of these structures. In these cases, some neighborhoods may be disconnected from the services that this type of infrastructure provides. Moreover, infrastructure on the barrier islands may be cut off from the mainland. Figures 18-20 show a sample of these analyses.

¹² https://southeastfloridaclimatecompact.org/wp-content/uploads/2020/04/Sea-Level-Rise-Projection-Guidance-Report_FINAL_02212020.pdf

Medical Facilities

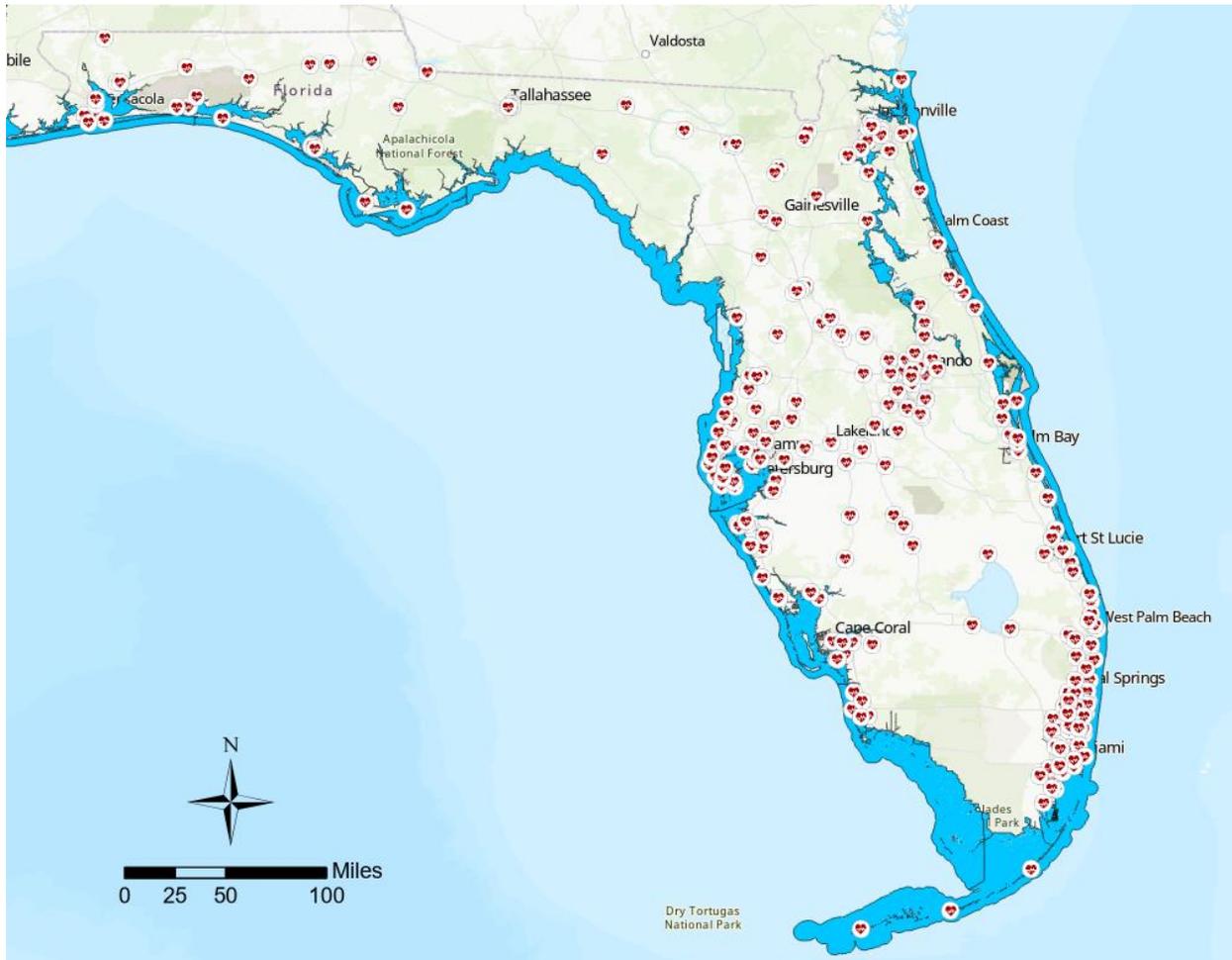


Figure 18: An overlay of medical facilities with projection of 2 ft. sea level rise in Florida.

Schools

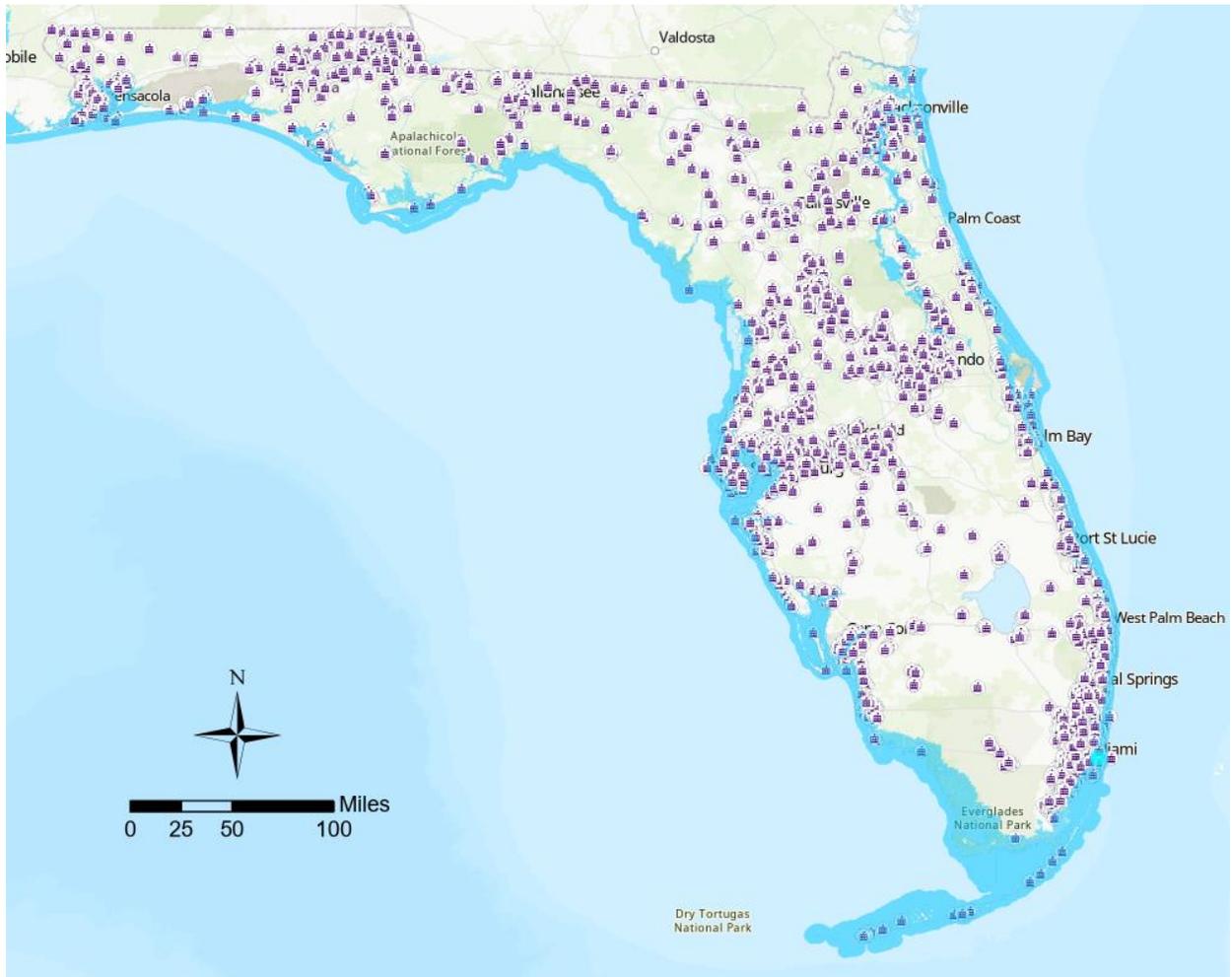


Figure 19: An overlay of schools with projection of 2 ft. sea level rise in Florida.

Fire Stations

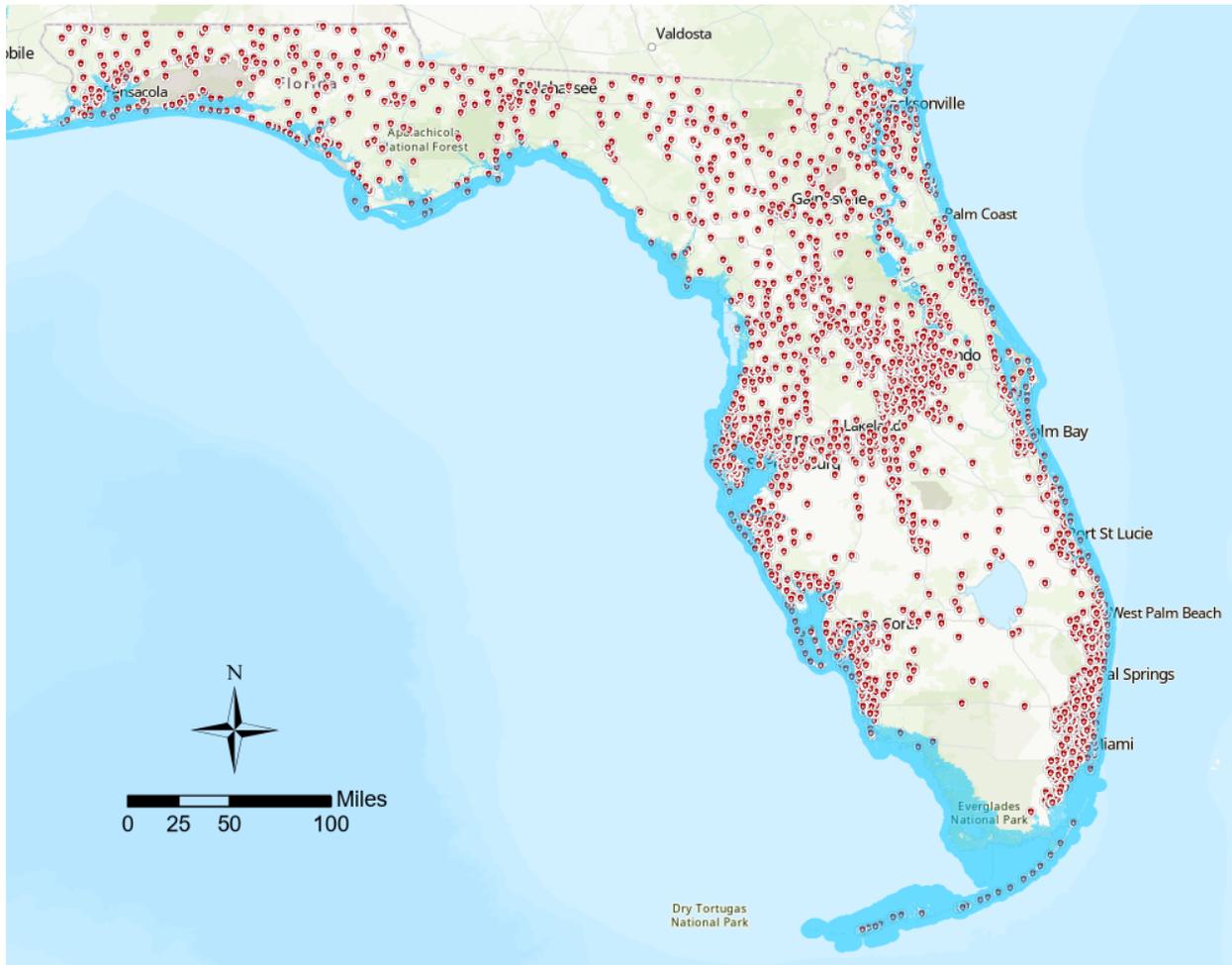


Figure 20: An overlay of fire stations with projection of 2 ft. sea level rise in Florida.

As an example, Figure 21 depicts Advent Health New Smyrna Beach, where the connection between Bouchelle Island and the mainland may be compromised and people from the island may have difficulty receiving services from the hospital.



Figure 21: The status of Advent Health New Smyrna Beach located at 401 Palmetto St, New Smyrna Beach, FL 32168 with projection of 2 ft. sea level rise.

These analyses highlight that accessibility to 53 medical facilities in the coastal areas of Florida may be disrupted. The surrounding areas and landscapes of six of these buildings may be affected by flooding. Further, two hospital buildings may be partially flooded in the 2 ft. SLR scenario. From Destin to Pensacola there are several medical facilities along the coast, but none of them would be affected by 2 ft. SLR. However, the PLACE SLR study highlighted that a combination of 0.2% annual chance flood with 1.6 ft. SLR may affect four medical facilities in the Florida Gulf Coast. The maps also show that although some roads might be affected, the medical facilities could still provide services to the surrounding communities. For detailed information, see Appendix 5.

The analysis of the impact of 2 ft. SLR on 28 schools in the coastal areas from Jacksonville to Crystal River, indicates that eight school buildings may be partially or completely inundated. Most of the areas surrounding these schools or their landscape may suffer from partial to total inundation. Access to all these building may be interrupted. From Crystal River to the eastern boundaries of Florida (Escambia County), no school was observed to be affected by 2 ft. SLR. However, PLACE SLR study stated that there are 19 schools that may be affected by a combination of 0.2% annual chance flood with 1.6 ft. SLR. For more details and EDR created maps, see Appendix 7.

The results of overlaying the 2 ft. SLR scenario on fire station data show that at least seven fire stations in the coastal areas from Jacksonville to Apalachicola may be partially or totally inundated. In addition, PLACE SLR studies identifies 28 fire stations that may be affected by a combination of 0.2% annual chance flood with 1.6 ft. SLR. Connecting routes and bridges may also be affected by 2 ft. SLR and many residential areas may be flooded, which may limit available services from these fire stations. Assessment maps are presented in Appendix 8.

EDR in-house analyses were compared with the PLACE: SLR models and Climate Compact studies to determine the degree of consistency among the studies.¹³ In some cases there were discrepancies between EDR's in-house analysis and the other studies. For example, Climate Compact found no schools impacted at the 1 ft. or 2 ft. sea level rise scenarios in Palm Beach. At the 3 ft. sea level rise scenario, only one building, Palm Beach Elementary School, is threatened. However, EDR's analysis of the 2 ft. SLR scenario indicates that Palm Beach Elementary may be affected. As shown in Figure 22, water would reach the building, resulting in partial inundation.

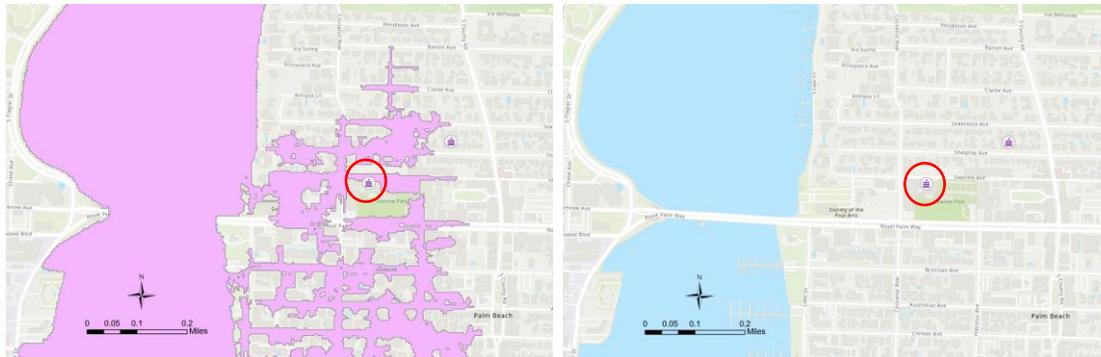


Figure 22: Palm Beach Elementary with a 2 ft. SLR scenario.

In these assessments, the height of the buildings, their construction materials, and their resistance against water intrusion have not been analyzed. In addition, the data resolution is in a scale that cannot provide precise flood boundaries. This analysis only highlights the probabilities of inundation.

Also, EDR has identified errors in the data sets. For example, in the school data set, some schools have closed or no longer exist.

6.5.2. Infrastructure Assessment in Hurricane Cat. 5 Storm Surge

The impacts of hurricanes include a combination of strong winds, precipitation, and storm surge. Therefore, it is difficult to predict the exact impact of hurricanes due to several factors, including the strength of the wind, the amount of precipitation, and the duration of the storm. Presently, NOAA storm surge data projects the extent of flooding caused by hurricane storm surge. The analysis, as such, cannot predict the amount of damage and destruction caused by wind or other factors, but the model offers an indication of the number of potentially impacted properties. Figures 23-25 show an overlay of each of the three facility types with projections of hurricane category 5 storm surge in Florida.

¹³ EDR is using 2 ft. (60 cm), which is acquired from NOAA SLR dataset. PLACE: SLR study has used 1.6 ft. (0.5 m), 3.9 ft. (1.2 m) and 6.6 (2 m) scenarios. PLACE is a regional project focusing on the Gulf of Mexico's adjacent states.

Medical Facilities

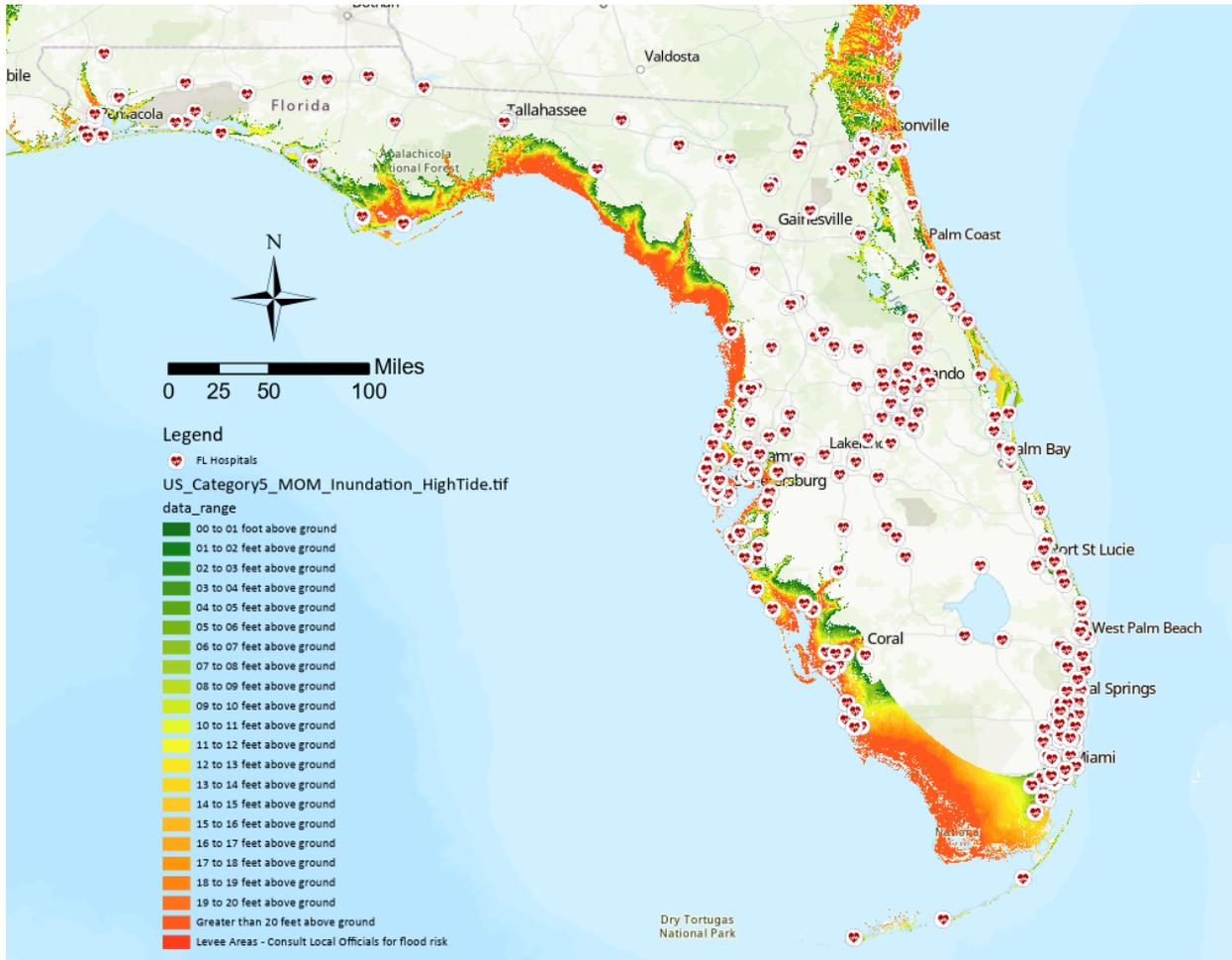


Figure 23: An overlay of medical facilities with projection of hurricane category 5 storm surge in Florida.

Schools

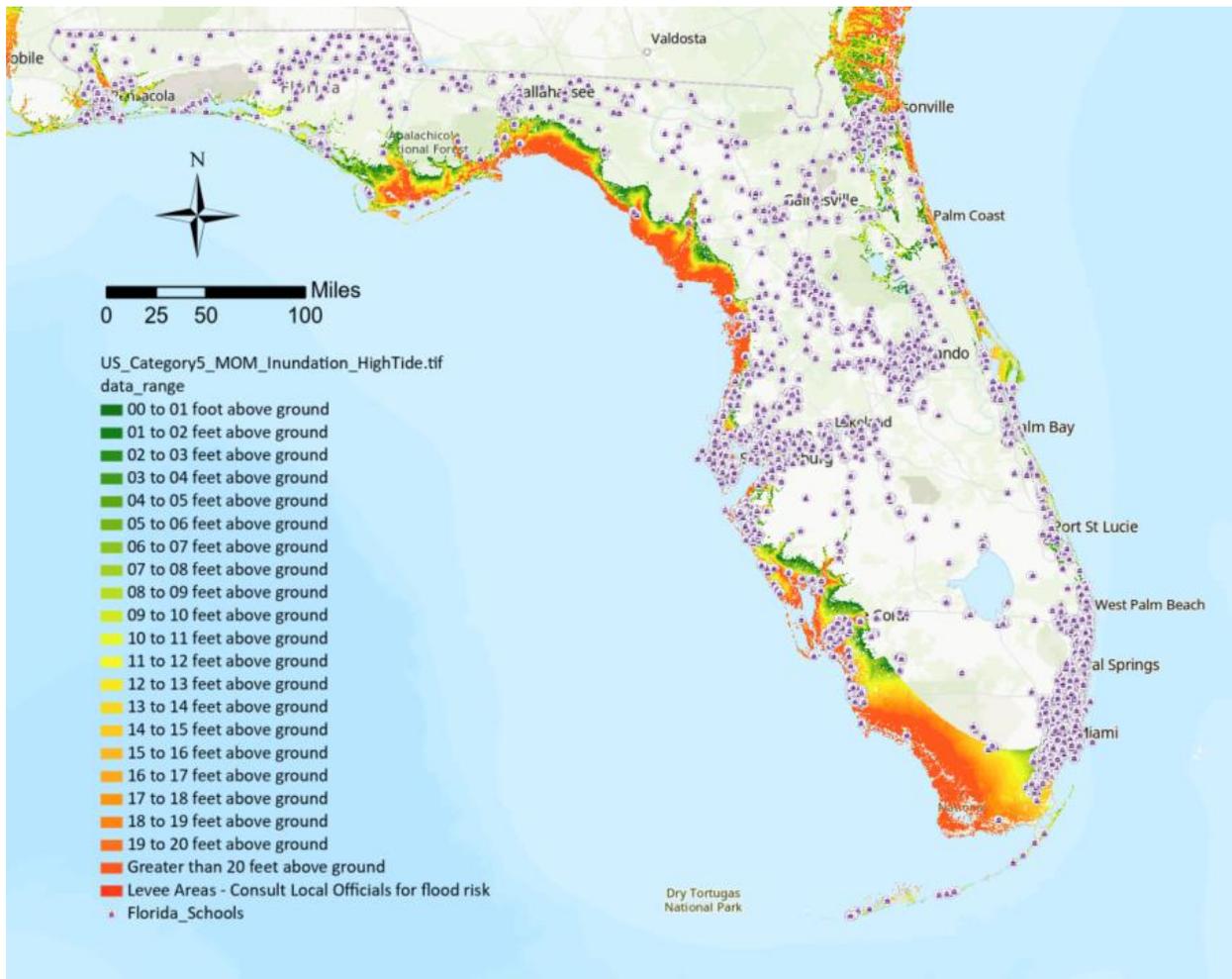


Figure 24: An overlay of schools with projection of hurricane category 5 storm surge in Florida.

Fire Stations

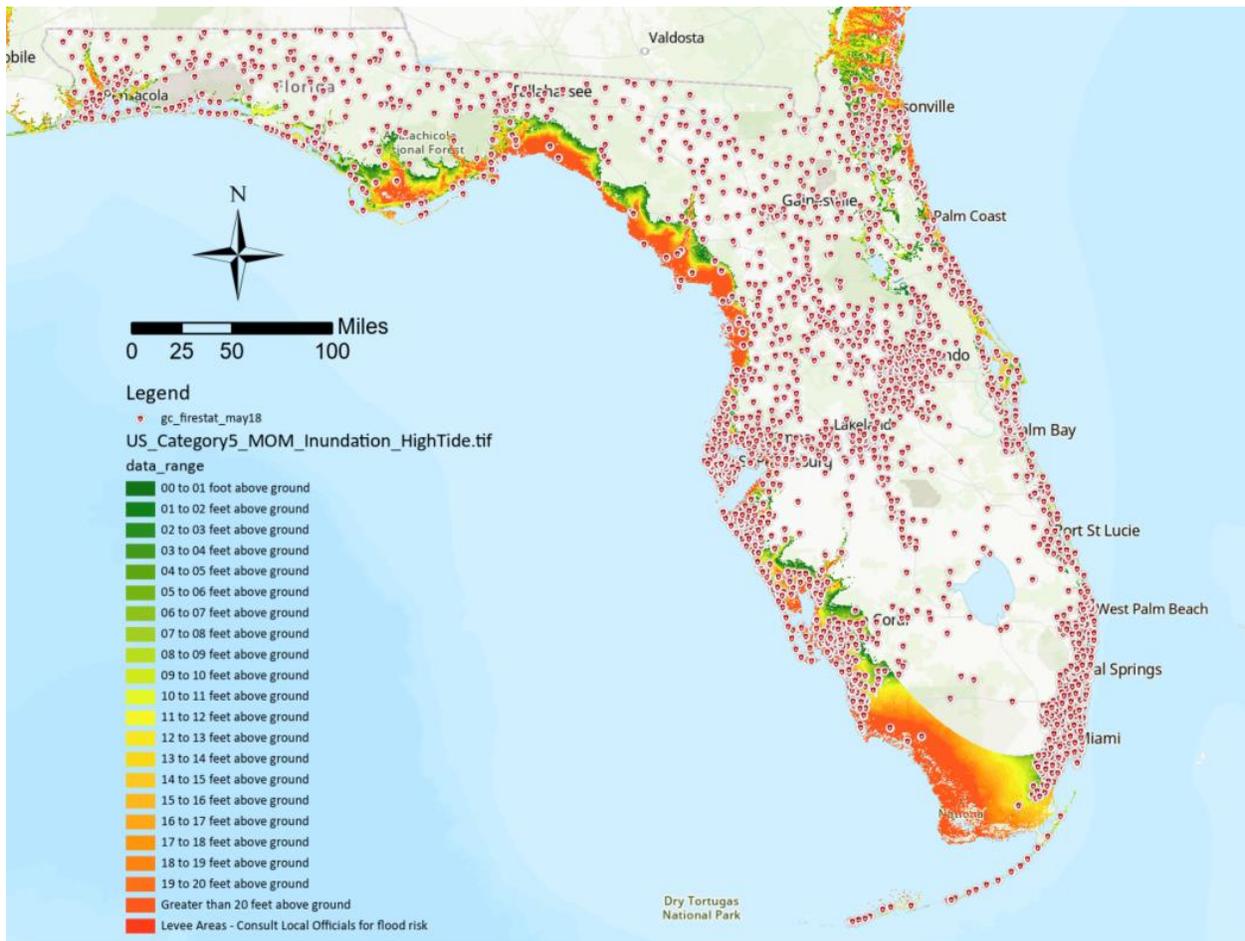


Figure 25: An overlay of fire stations with projection of hurricane category 5 storm surge in Florida.

6.5.3. Infrastructure Assessment in Flood Zones

FEMA flood hazard zones are mainly created to provide flood hazard data in support of the National Flood Insurance Program¹⁴. This data does not provide a comprehensive accounting of the coastal hazards facing any community or any individual parcel of land. However, this data is important in understanding the impact of compound flooding, especially in combination with sea level rise data. In studies conducted by several organizations, such as PLACE SLR and SACS, the FEMA flood hazard data has been used in combination with other flood factors to assess the compound impacts of flooding. Figures 26-28 illustrate medical facilities, schools and fire stations located within FEMA flood zones.

¹⁴ FEMA's National Flood hazard Layer Viewer is accessible at <https://hazards-fema.maps.arcgis.com/apps/webappviewer/index.html?id=8b0adb51996444d4879338b5529aa9cd>

Medical Facilities

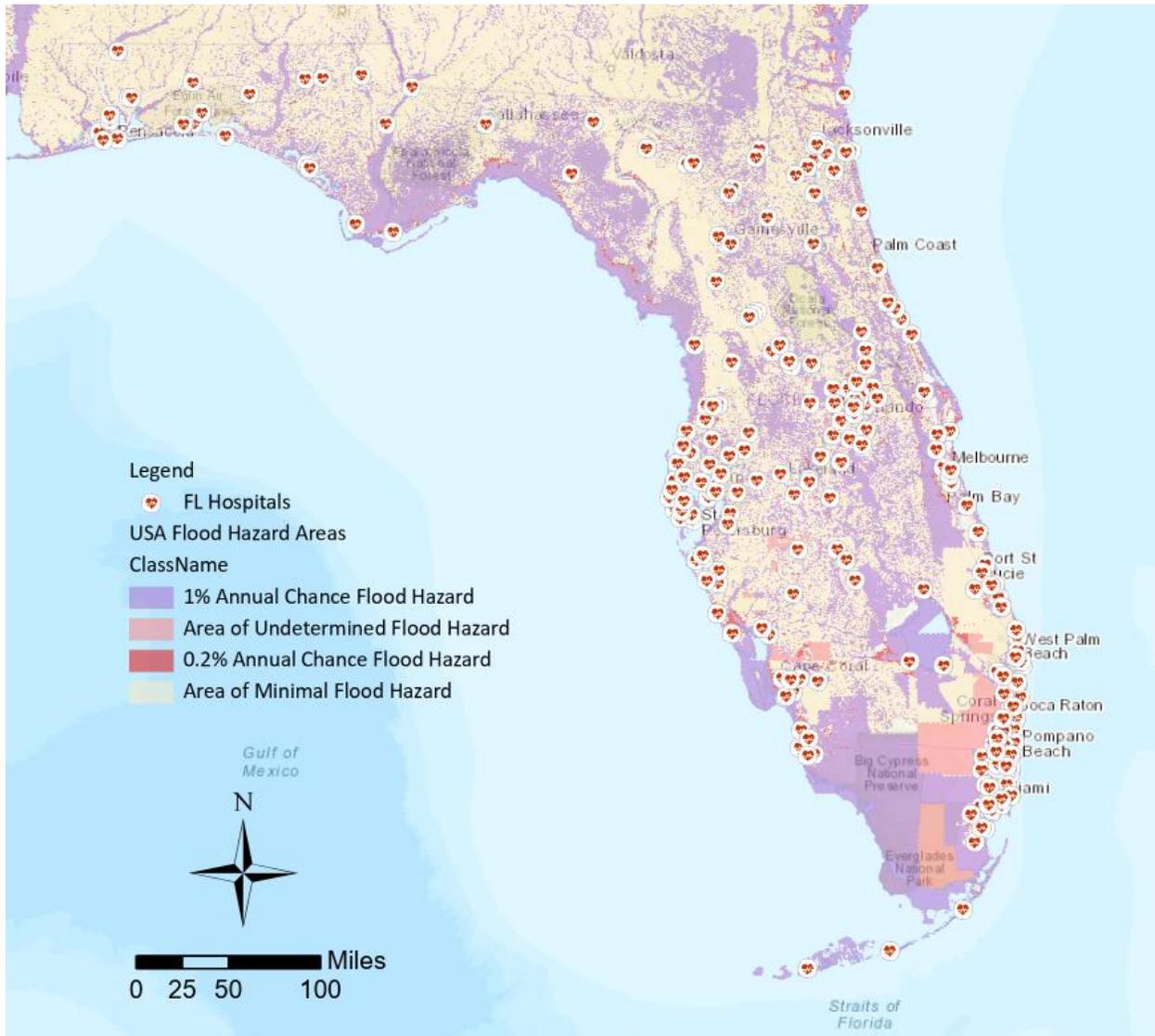


Figure 26: An overlay of medical facilities and FEMA Flood Zones.

Schools

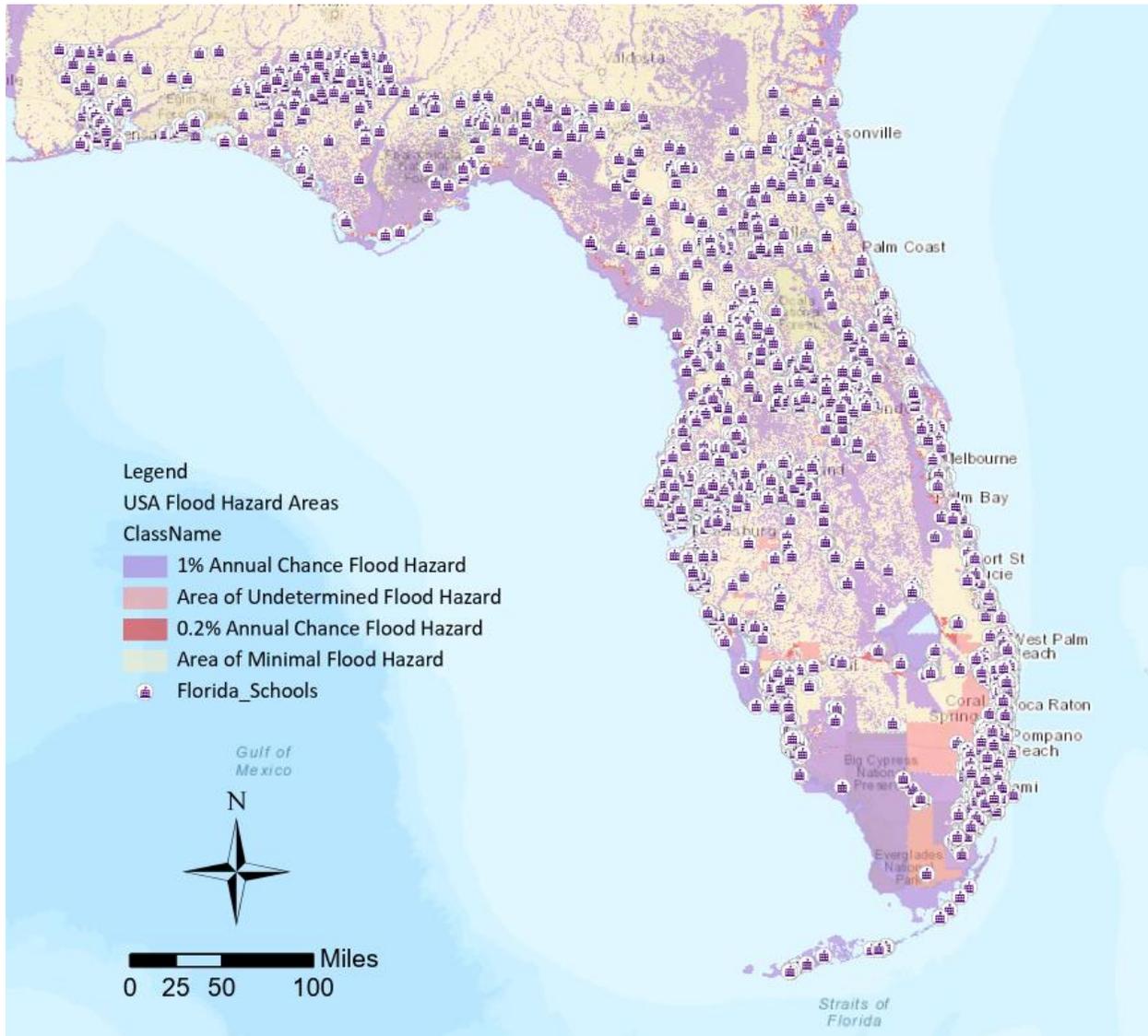


Figure 27: An overlay of schools and FEMA Flood Zones.

Fire Stations

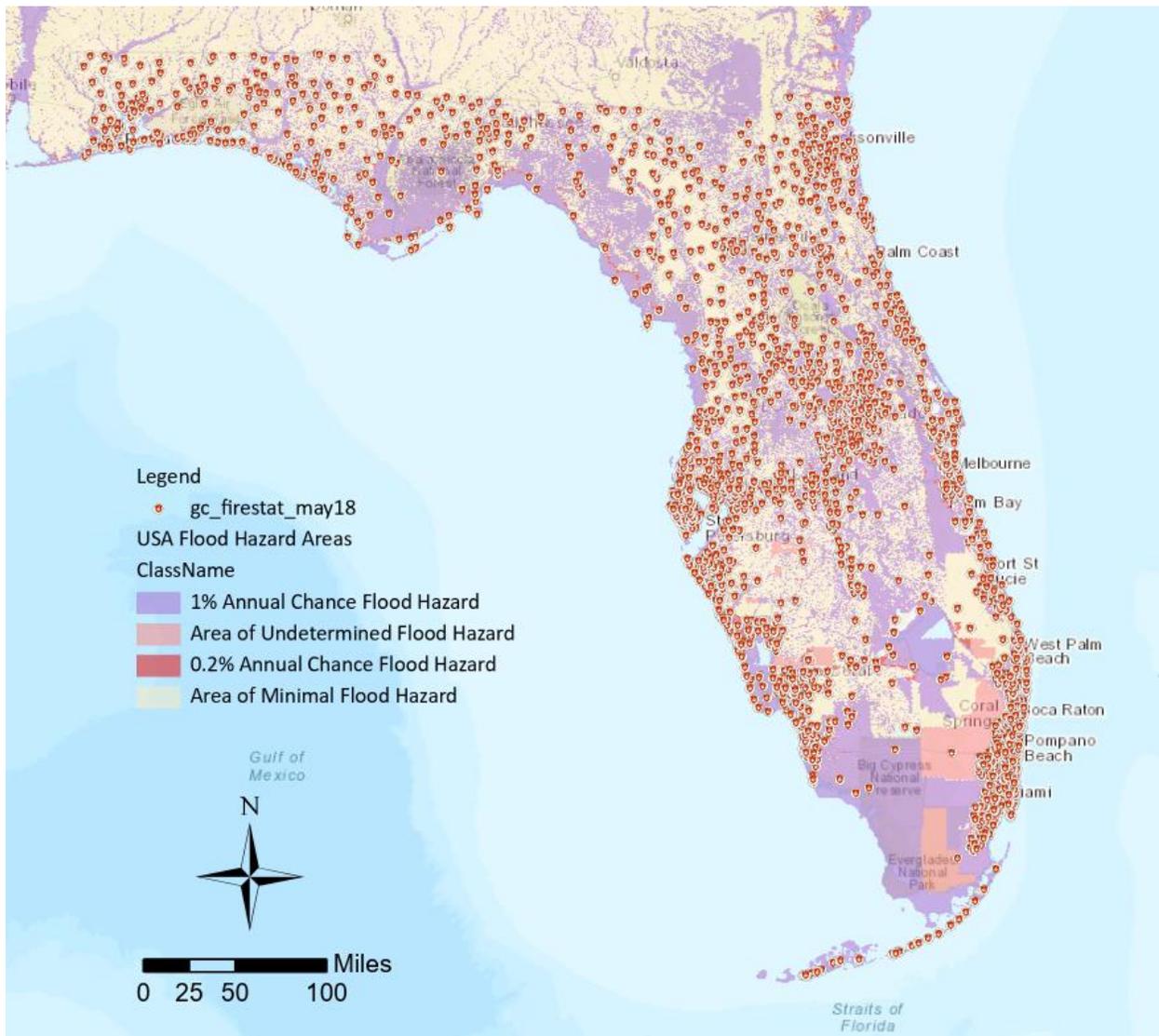


Figure 28: An overlay of schools and FEMA Flood Zones

In concurrence with EDR's analysis of the 2 ft. SLR scenario, Climate Compact also concluded that submergence of critical infrastructure is often limited to marginal areas of the properties or adverse effects on existing drainage infrastructure. However, Monroe County is the exception with potential building and infrastructure inundation, especially at the 2 ft. and 3 ft. SLR scenarios. According to this analysis, 3 of Monroe County's 4 medical facilities¹⁵, 65% of Monroe's schools, and 71% of emergency shelters are at elevations below sea level at the 1 ft. SLR scenario. Similar facilities in the other counties are mainly impacted at the 3 ft. SLR scenario. Power plant properties in Miami-Dade and Broward Counties, as well as energy transmission facilities in Monroe County, are vulnerable at the 1 ft. SLR

¹⁵ ArcGIS analysis shows that the water gets very close to these buildings but may not cause flooding in the buildings.

scenario. More than 81 miles of roadway from Miami-Dade through Palm Beach County are at elevations below sea level at the 1 ft. SLR scenario, increasing to more than 893 miles at the 3 ft. SLR scenario. As transportation is vital for the life of these communities, an assessment of the economic impact of flooding on transportation routes and accessibility should be one priority of EDR's future assessments.

6.6. Conclusion, Challenges and Future Actions

All previous and ongoing studies demonstrate that Florida is at high risk of flooding due to multiple flood factors acting in combination. However, the risk of flood hazard varies throughout Florida. Also, Florida counties exhibit different levels of vulnerability. These risks and vulnerabilities vary between inland versus coastal areas, but also within the coastal counties in the High Impact Zone.

The total property value of all Florida counties in the High Impact Zone exceeds 3 trillion dollars. The studies and analyses highlight that Miami-Dade, Palm Beach, Broward and Hillsborough Counties are the most at risk and economically important counties in the State of Florida. Although St. Johns, Monroe and Charlotte counties all exhibit multiple flooding factors placing them at high risk, with individual county GDPs of less than one percent of the state's GDP, their economic contributions are smaller. However, the census places, such as some towns and cities, need to be analyzed more closely.

As EDR continues to learn from ongoing and future studies, we also move towards creating a Florida Flooding Assessment Model, which will consider the compound effects of multiple flooding factors. EDR's previous and current studies may be characterized as isolated one-flood-factor analyses. When comparing EDR studies with studies that include the compound impacts of multiple flooding factors, EDR recognizes that the compound impact of multiple flooding factors may result in greater impacts on vulnerable properties and resources.

EDR continues to explore collaboration with agencies such as USGS to develop a comprehensive flooding model. Collaborative efforts will allow partner agencies to share resources and expertise while reducing duplication. The primary goal is to create a comprehensive flooding model that functions under one harmonized system with common terminology and assessments. This model would be used to study the flooding vulnerability of the entire state. These studies would then form the basis of a coordinated resiliency plan, thus minimizing the economic risks to the state from flooding.

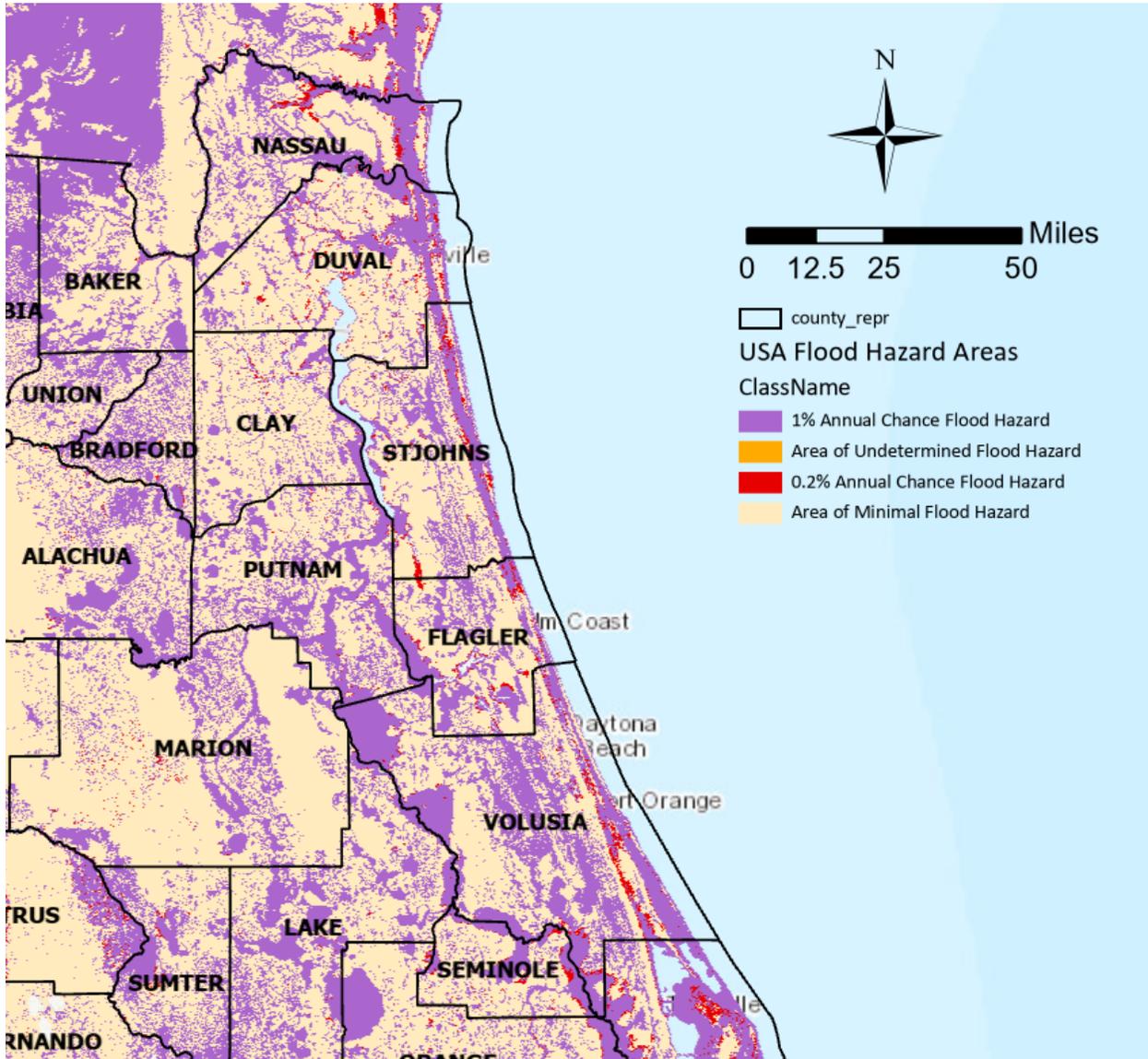
Appendices

Appendix 1. Property Tax Categories

CNTY Name	Residential	Commercial	Industrial	Agricultural	Institutional	Governmental	Miscellaneous	Total
Bay	20,409,006,026	3,665,944,012	551,852,870	333,216,385	380,874,024	3,594,140,209	72,809,726	29,007,843,252
Brevard	72,694,172,300	8,978,907,580	1,743,678,190	649,027,580	1,868,336,580	4,810,858,750	74,361,880	90,819,342,860
Broward	252,151,024,740	62,024,355,390	16,700,261,630	1,111,807,530	7,010,693,220	15,240,641,010	1,624,083,670	355,862,867,190
Charlotte	30,459,944,248	2,199,165,906	563,730,200	826,924,577	403,142,340	1,153,210,222	144,888,496	35,751,005,989
Citrus	14,411,146,055	1,176,494,215	137,956,020	677,096,128	458,234,518	862,078,907	377,723,412	18,100,729,255
Collier	155,479,253,302	10,957,657,075	1,805,954,985	1,418,869,185	2,329,322,663	4,766,814,390	77,603,351	176,835,474,951
Miami-Dade	362,327,707,801	95,608,287,870	30,810,077,174	5,183,484,501	9,484,716,701	19,978,672,631	2,228,512,019	525,621,458,697
Dixie	584,478,000	39,293,234	11,493,700	655,528,666	17,085,100	173,826,300	806,500	1,482,511,500
Duval	80,122,975,231	27,904,615,481	7,172,213,279	1,885,121,144	4,417,858,374	5,687,749,635	507,431,972	127,697,965,116
Escambia	25,505,533,948	5,243,058,719	629,875,494	589,066,886	994,581,972	4,057,869,498	238,855,720	37,258,842,237
Flagler	17,512,330,540	848,634,171	160,158,225	456,136,621	179,597,429	566,315,297	49,371,319	19,772,543,602
Franklin	2,789,419,274	95,774,898	16,958,536	56,803,992	33,558,198	598,940,445	7,348,852	3,598,804,195
Gulf	2,587,287,280	144,925,313	14,530,675	438,330,364	44,281,607	101,957,966	8,824,462	3,340,137,667
Hernando	18,373,821,691	1,606,836,863	320,446,318	1,171,158,479	457,508,414	1,237,636,060	101,250,798	23,268,658,623
Hillsborough	142,027,404,538	42,141,297,454	8,620,345,451	3,001,757,959	6,613,621,168	12,500,188,485	2,282,106,867	217,186,721,922
Indian River	29,583,648,245	1,667,191,502	291,254,488	1,754,651,271	551,709,835	1,369,814,171	47,929,391	35,266,198,903
Jefferson	538,930,949	45,779,645	10,030,587	886,258,210	34,558,568	87,474,448	68,257,747	1,671,290,154
Lee	132,196,509,594	17,520,260,942	3,394,740,912	1,533,945,743	2,256,501,173	7,153,719,194	395,054,207	164,450,731,765
Levy	2,498,161,949	260,142,549	24,703,054	2,631,516,619	79,856,686	322,317,302	21,640,207	5,838,338,366
Manatee	61,439,672,672	7,893,458,068	1,841,890,522	1,467,259,895	1,562,463,719	1,669,939,204	123,800,093	75,998,484,173
Martin	32,252,071,074	2,729,851,932	752,385,630	2,325,050,576	645,728,062	1,202,189,315	183,017,750	40,090,294,339
Monroe	38,624,382,064	8,988,988,336	280,028,741	138,177	505,395,534	2,580,574,101	154,658,055	51,134,165,008
Nassau	14,396,877,908	1,241,713,217	169,727,847	1,300,828,250	258,497,513	698,297,437	46,778,733	18,112,720,905
Okaloosa	27,996,198,598	3,514,551,281	424,066,128	538,182,160	393,097,610	2,123,561,860	44,504,831	35,034,162,468
Palm Beach	290,350,131,852	48,078,572,168	8,558,892,017	10,281,446,466	6,484,482,709	14,472,967,766	1,537,945,297	379,764,438,275
Pasco	50,772,198,254	6,551,072,754	1,163,398,812	2,040,292,132	838,651,951	2,097,529,034	60,432,238	63,523,575,175
Pinellas	131,719,320,650	26,050,844,558	4,540,898,162	70,556,220	5,133,108,006	5,387,452,998	1,196,714,826	174,098,895,420
St_Johns	52,390,479,749	3,809,371,831	545,726,320	1,277,709,017	797,187,500	1,909,839,595	217,053,788	60,947,367,800
St_Lucie	37,108,702,582	4,080,926,200	1,200,257,251	1,960,262,627	797,493,721	1,672,498,300	307,951,613	47,128,092,294
Santa Rosa	18,156,391,825	1,227,005,765	261,853,097	1,243,571,043	328,560,076	1,386,074,163	141,692,208	22,745,148,177
Sarasota	101,240,791,800	12,544,100,900	1,882,441,100	2,554,310,300	2,328,281,000	4,475,723,800	331,545,600	125,357,194,500
Taylor	1,016,340,136	114,675,920	28,538,140	610,356,350	36,215,660	74,284,830	12,249,006	1,892,660,042
Volusia	60,211,147,964	8,307,995,809	1,271,216,174	1,585,061,979	1,644,608,068	3,423,962,933	186,523,607	76,630,516,534
Wakulla	1,965,179,028	131,486,797	32,125,191	400,154,039	31,656,673	552,696,385	3,250,569	3,116,548,682
Walton	35,667,662,084	2,488,713,326	235,797,814	652,006,891	227,947,479	1,667,405,100	56,133,268	40,995,665,962
State	2,317,560,303,951	419,881,951,681	96,169,504,734	53,567,887,962	59,629,413,851	129,659,221,741	12,933,112,078	3,089,401,395,998

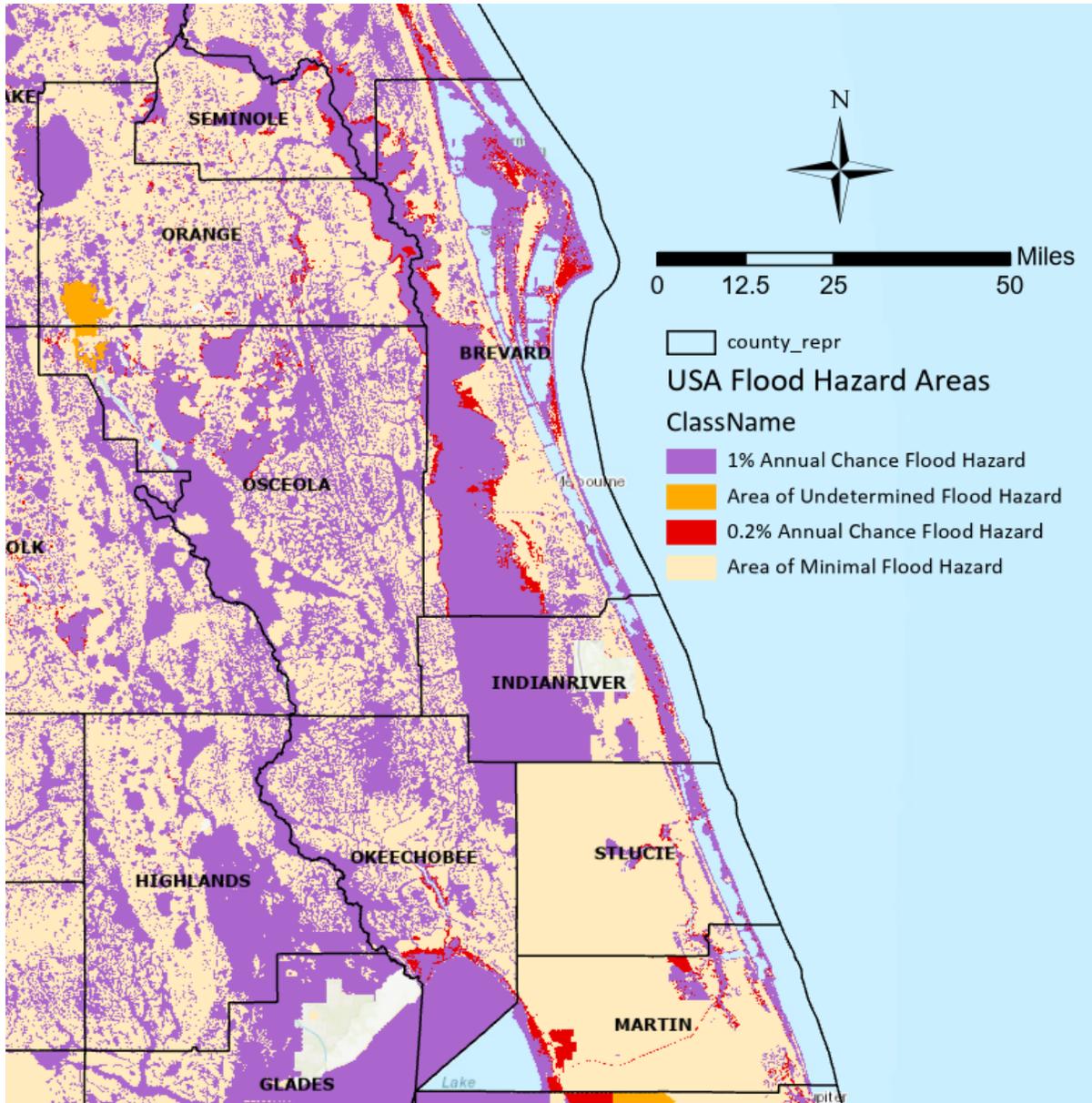
Appendix 2. Flooding

Area	Counties
The northeast portion of the Florida peninsula	Portions of Nassau, Duval, St. Johns, Flagler, Clay, Putnam, Volusia, and Seminole Counties



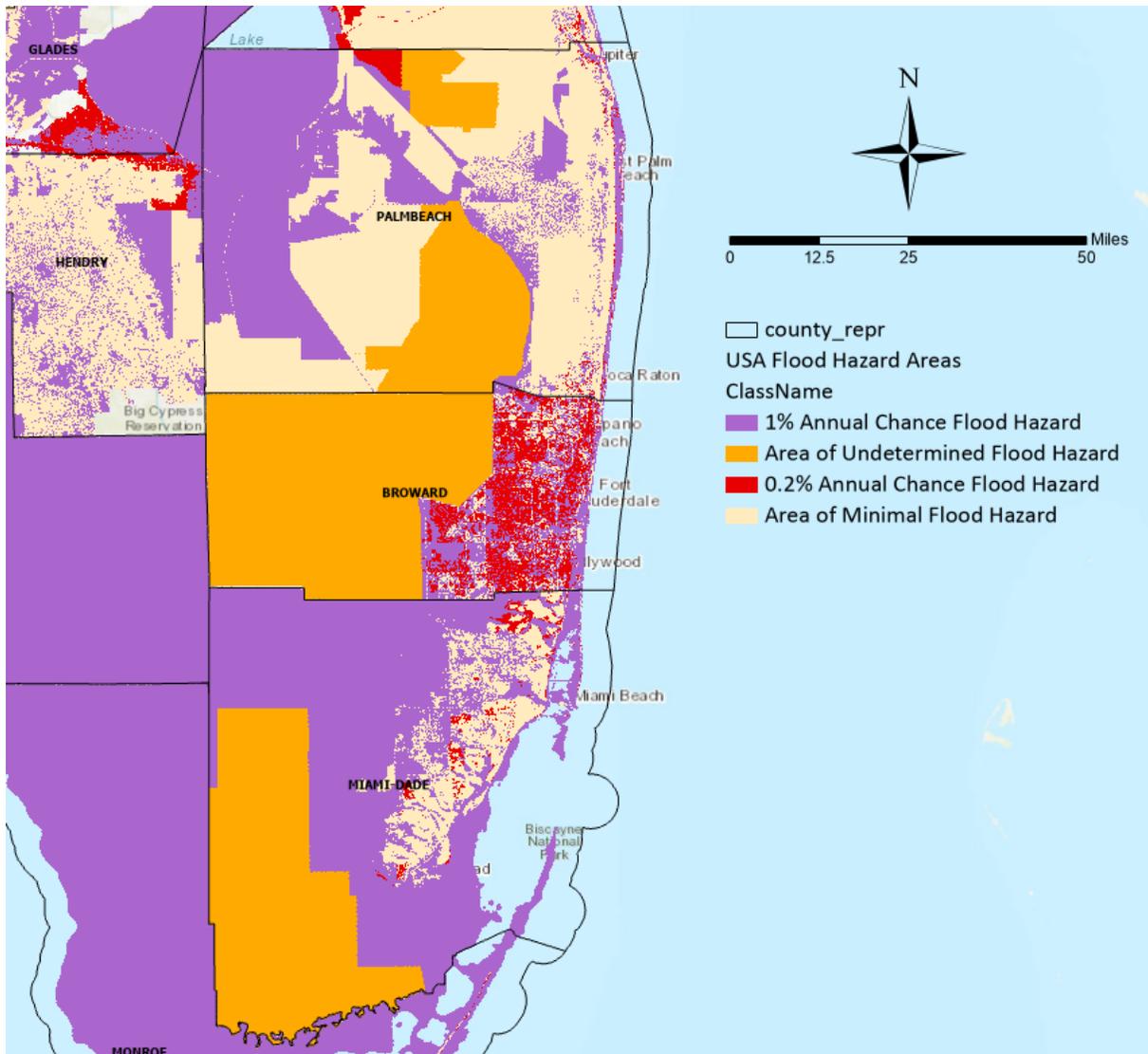
The east central section of Florida peninsula

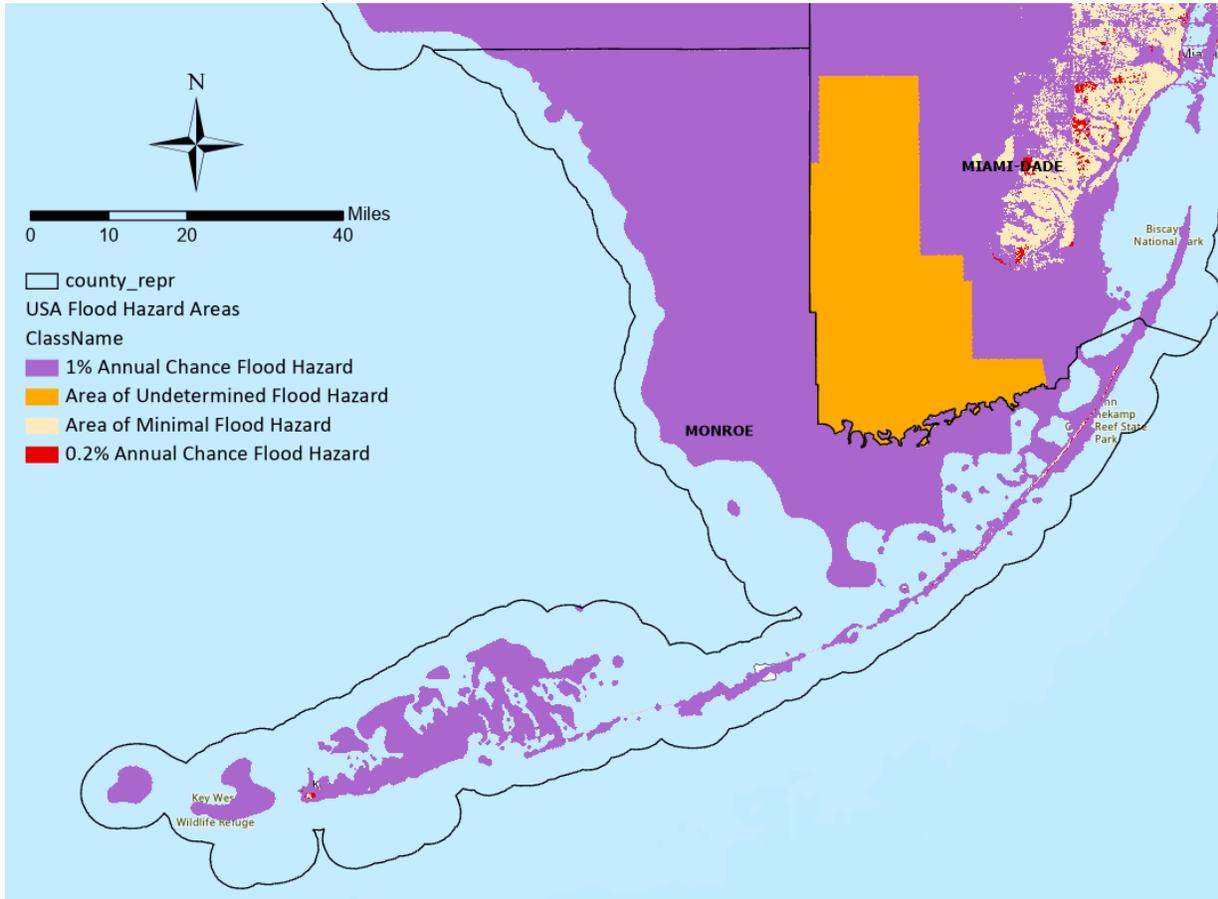
Portions of Brevard, Indian River, St. Lucie, Martin, Orange, Osceola, and Okeechobee Counties



The southeast portion of Florida
(One of the most at risk areas in the state)

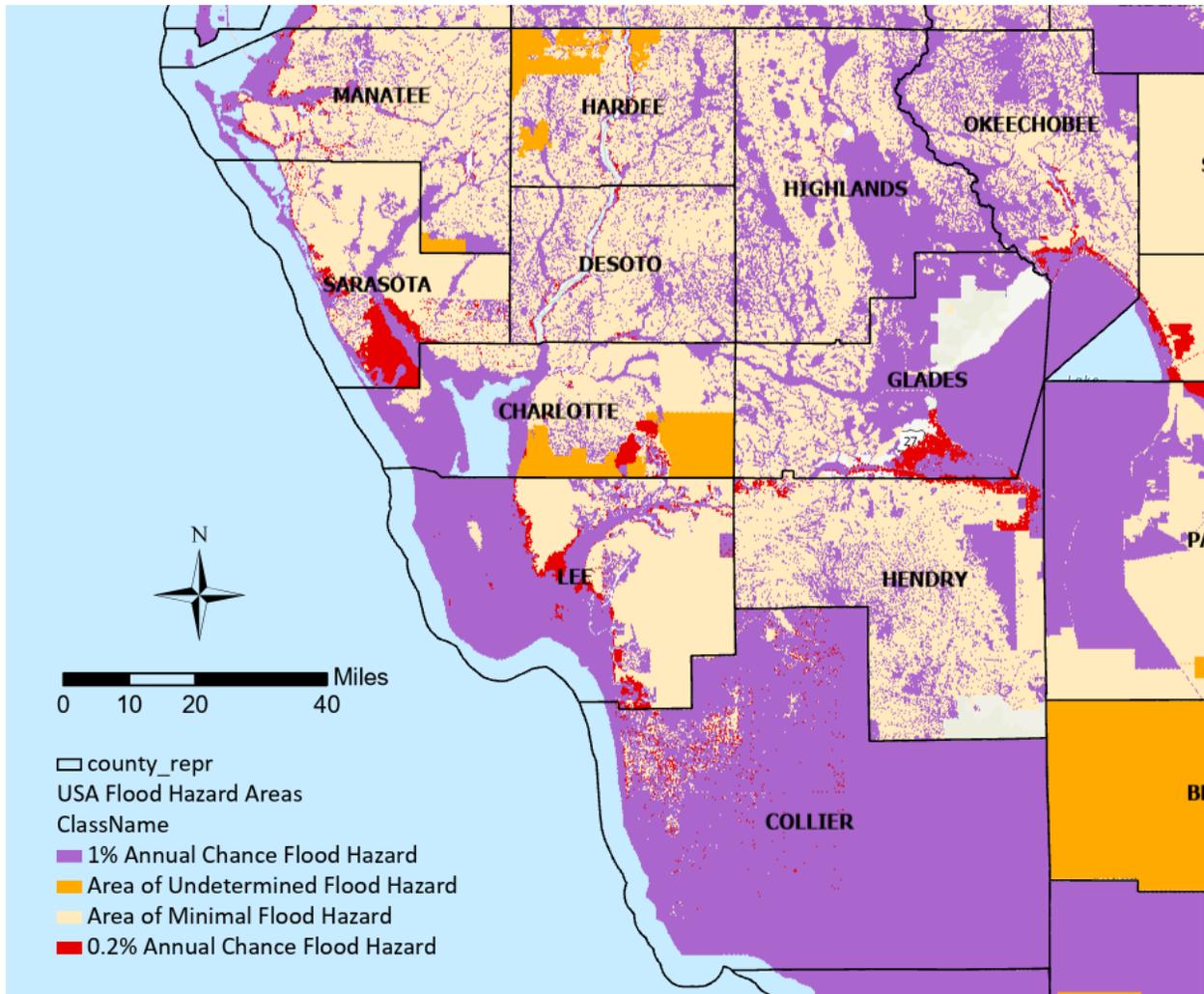
Palm Beach, Broward and Miami-Dade Counties





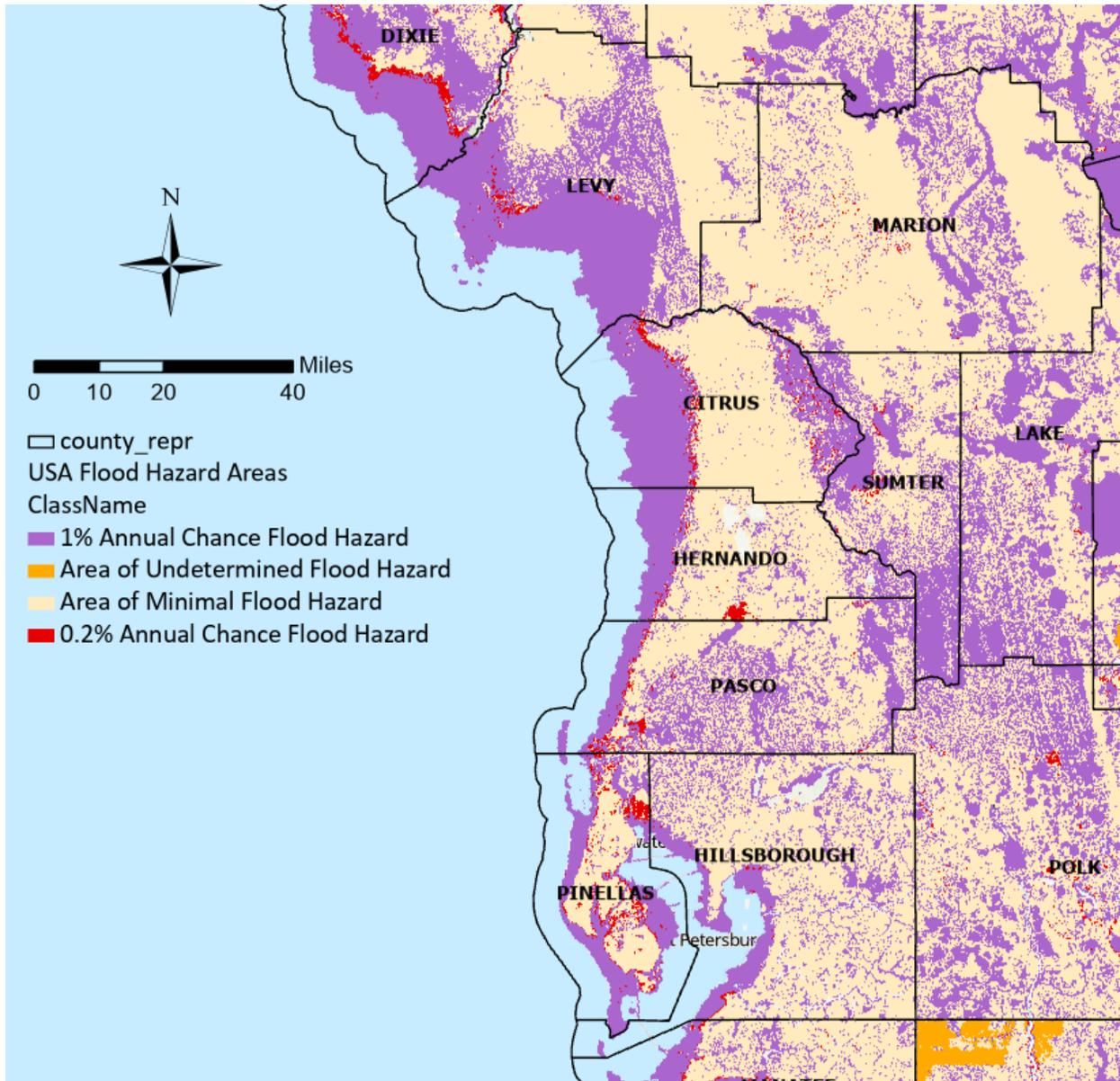
The southwestern portion of the Florida peninsula

Portions of Manatee, Sarasota, DeSoto, Hardee, Highlands, Charlotte, Lee, Glades, Hendry, and Collier Counties



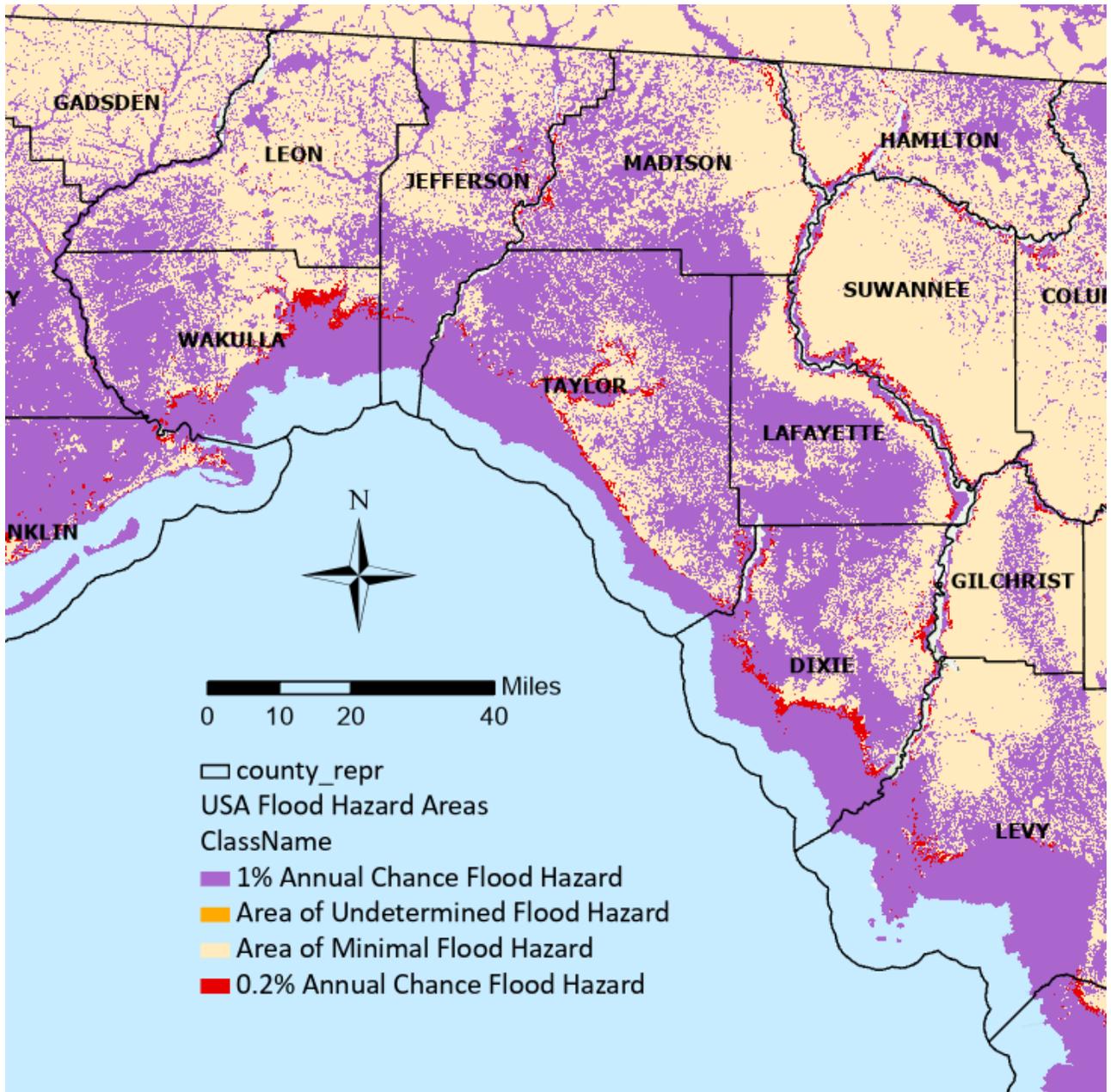
The west central portion of the Florida peninsula

Portions of Levy, Marion, Citrus, Hernando, Sumter, Polk, Pasco, Pinellas, and Hillsborough Counties



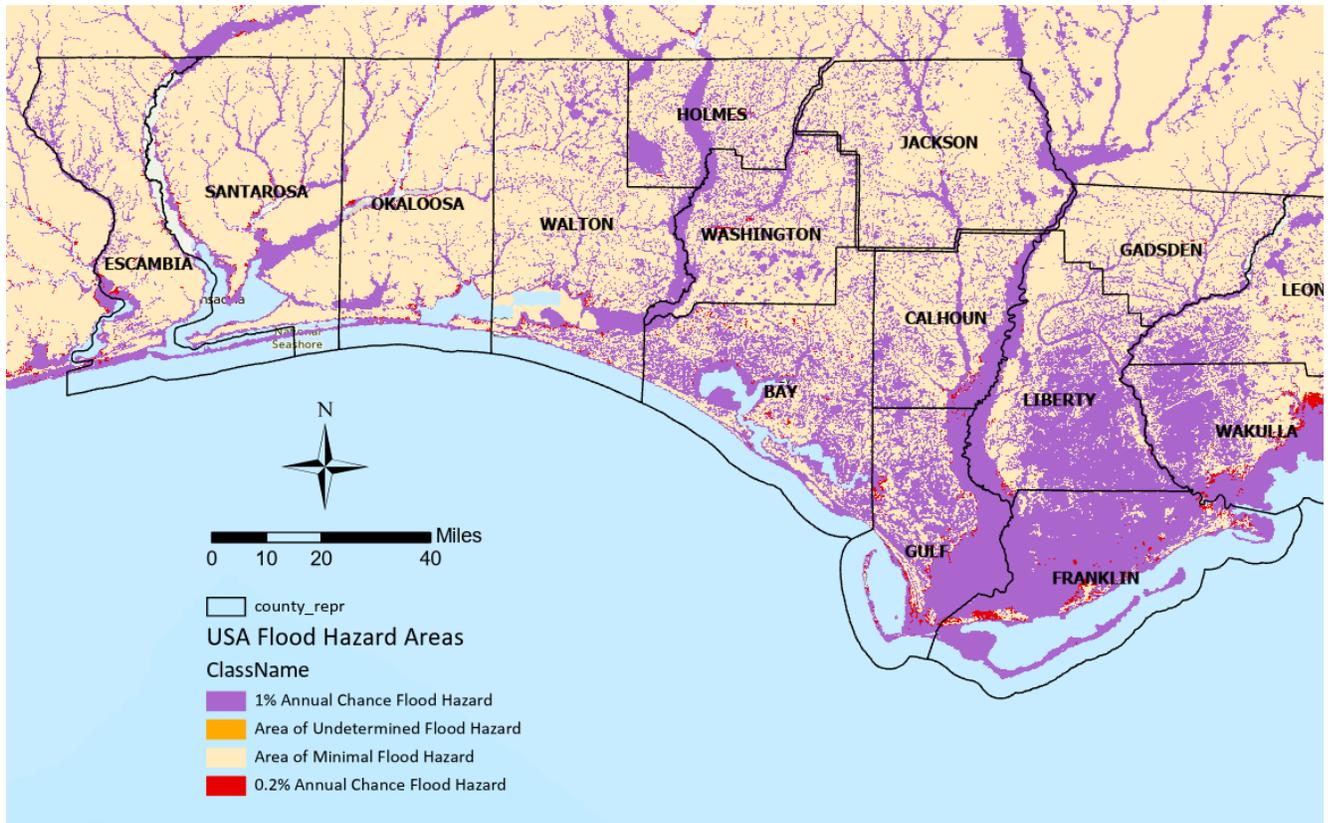
The Big Bend region in the northwestern portion of Florida

Portions of Wakulla, Leon, Jefferson, Madison
Taylor, Lafayette, Gilchrist, and Dixie Counties



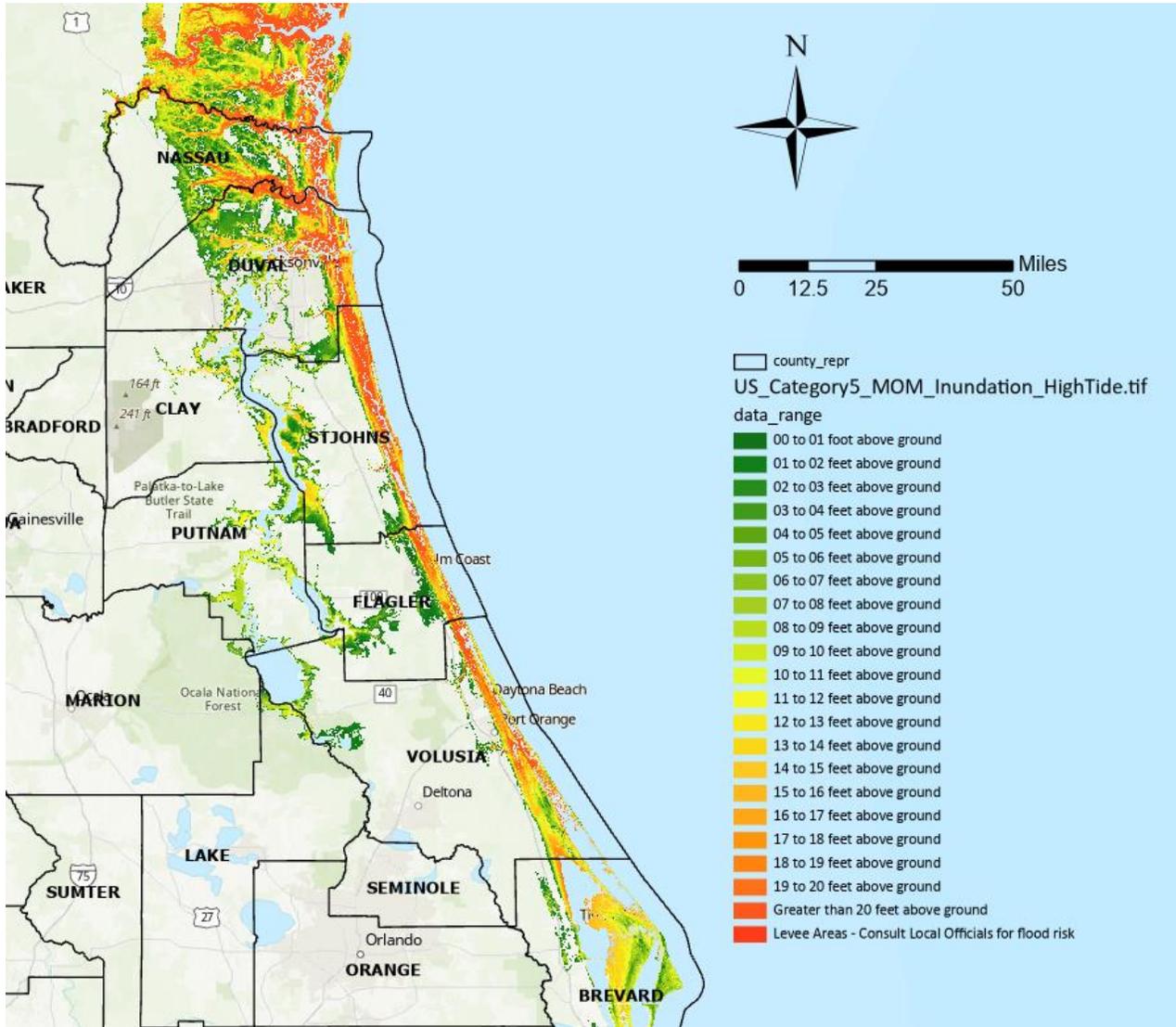
The northwestern portion of Florida along the Florida Panhandle

Portions of Escambia, Santa Rosa, Okaloosa, Walton, Washington, Bay, Calhoun, Gulf, Liberty, and Franklin Counties

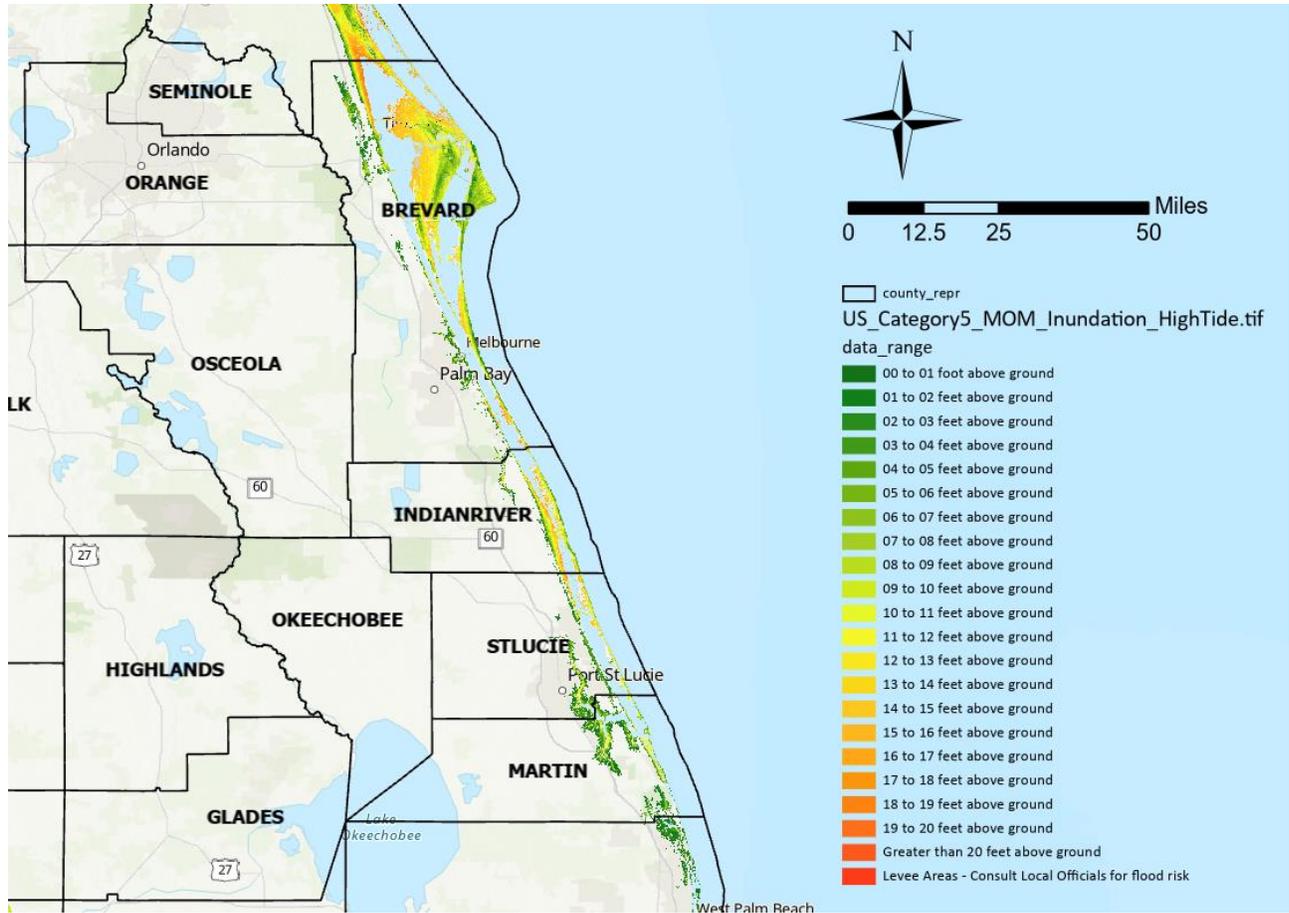


Appendix 3. Hurricane Category 5 Storm Surge

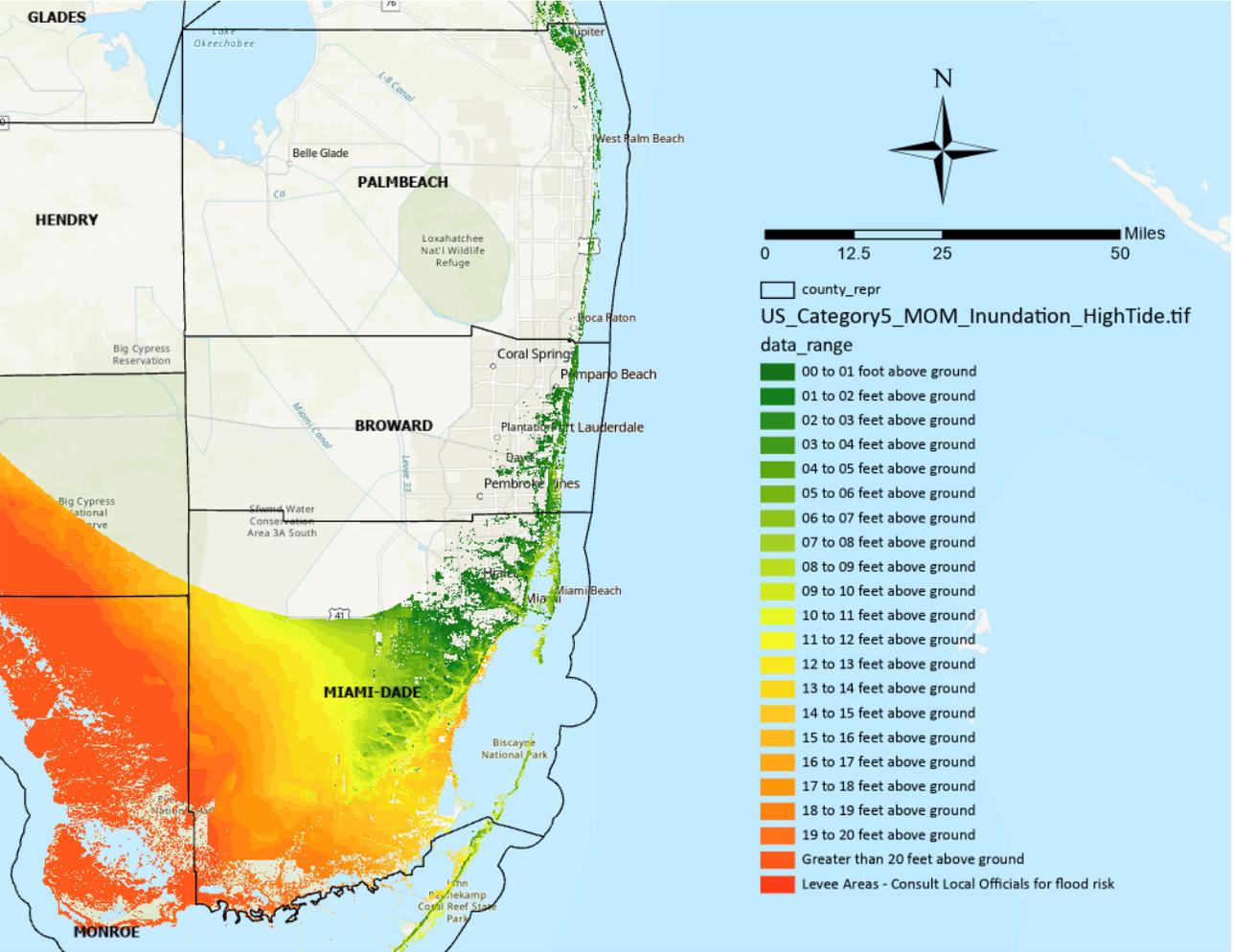
Area	Counties
The northeast portion of the Florida peninsula	Portions of Nassau, Duval, St. Johns, Flagler, Clay, Putnam, Volusia, and Seminole Counties



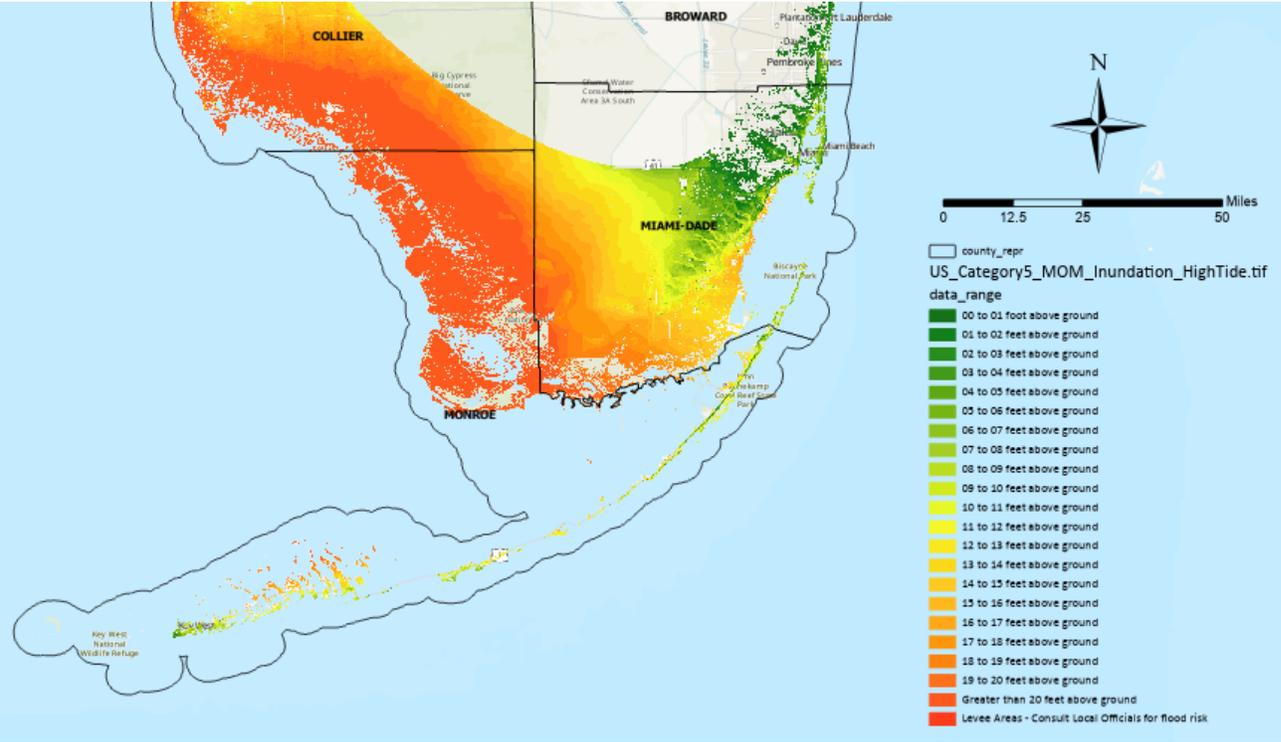
Area	Counties
The east central section of Florida peninsula	Portions of Brevard, Indian River, St. Lucie, Martin, Orange, Osceola, and Okeechobee Counties



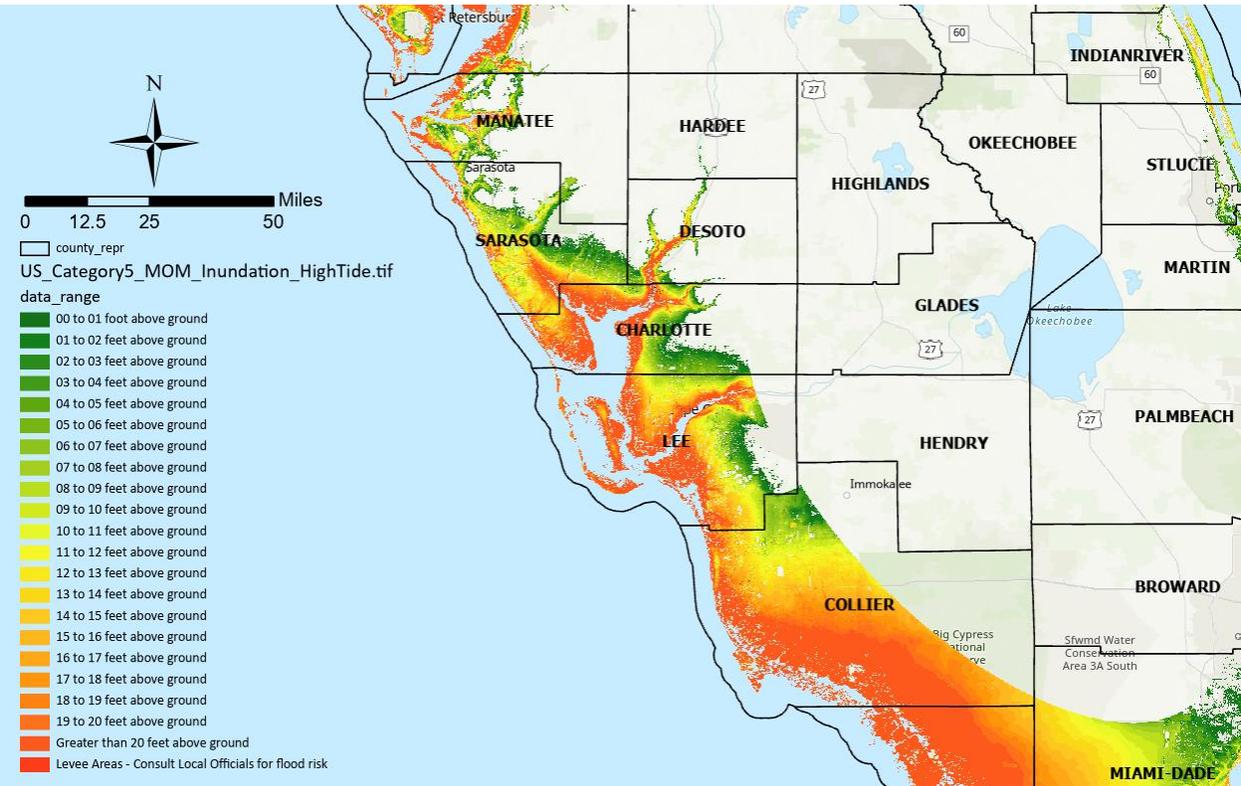
Area	Counties
The southeast portion of Florida (One of the most at risk areas in the state)	Palm Beach, Broward and Miami-Dade Counties



Area	Counties
<p>The most southern parts of Florida peninsula</p> <p>Relatively low exposure to population and infrastructure from storm surge inundation (Everglades)</p>	<p>Monroe County and the Florida Keys</p>



Area	Counties
The southwestern portion of the Florida peninsula Monroe County, inclusive of the Florida Keys, has the second highest risk in the state.	Portions of Manatee, Sarasota, DeSoto, Hardee, Highlands, Charlotte, Lee, Glades, Hendry, and Collier Counties

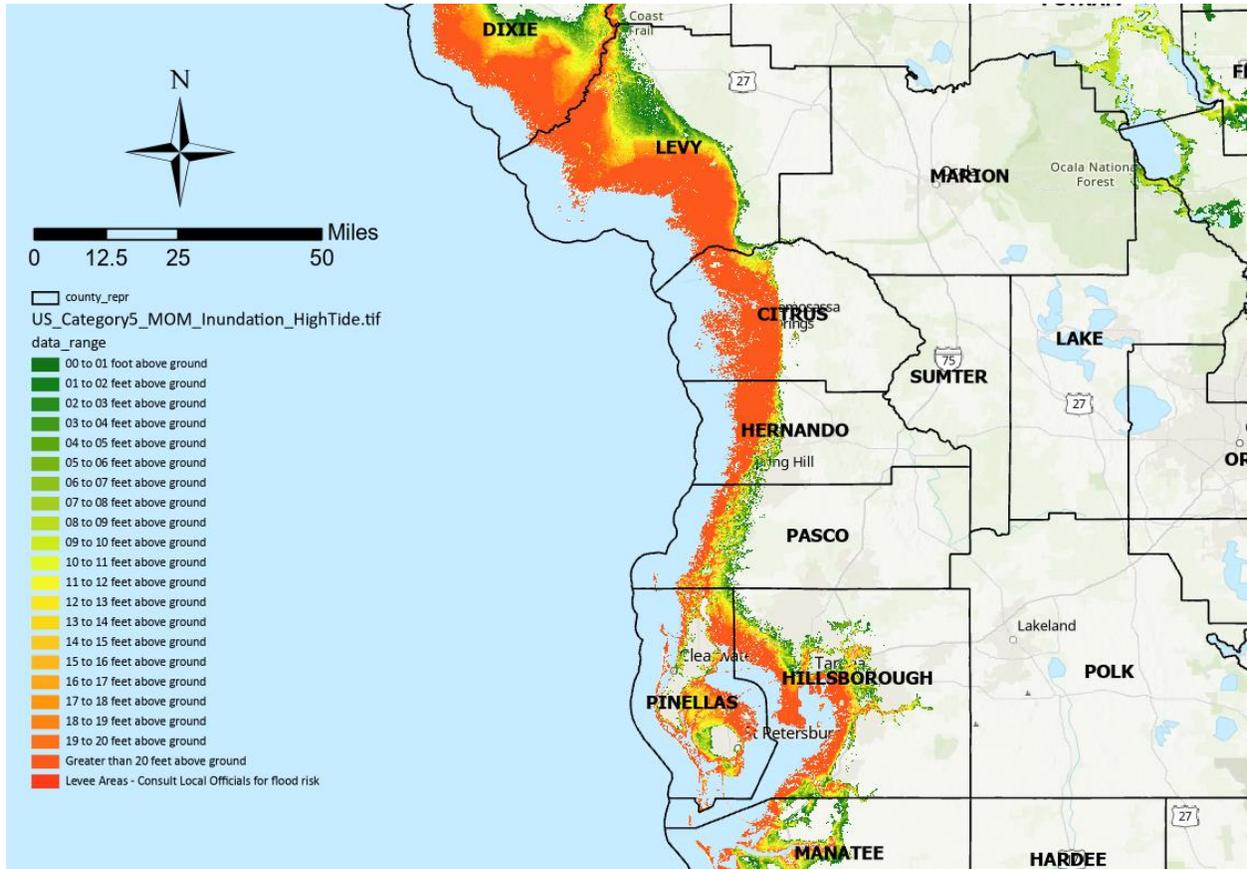


Area

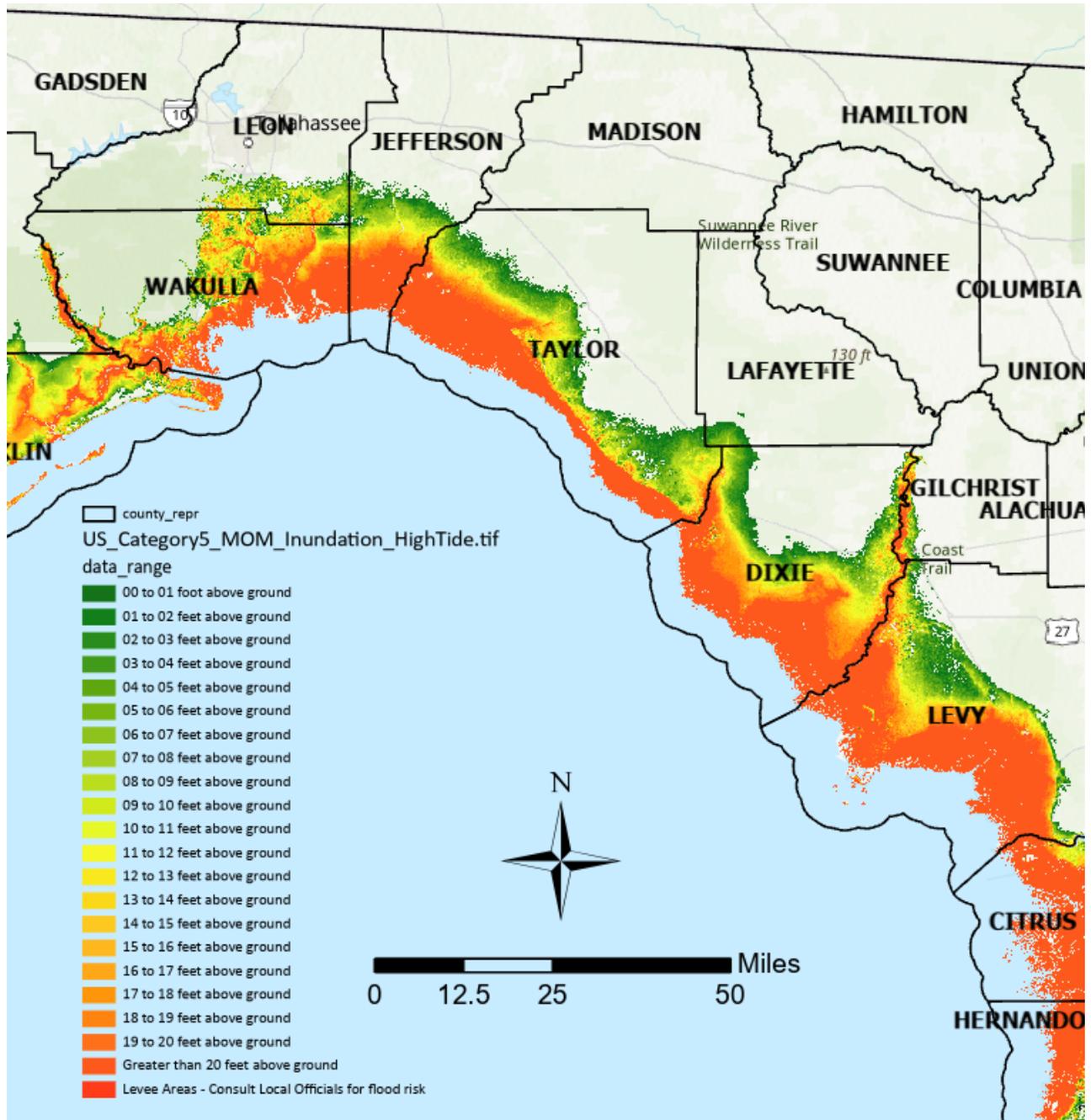
Counties

The west central portion of the Florida peninsula

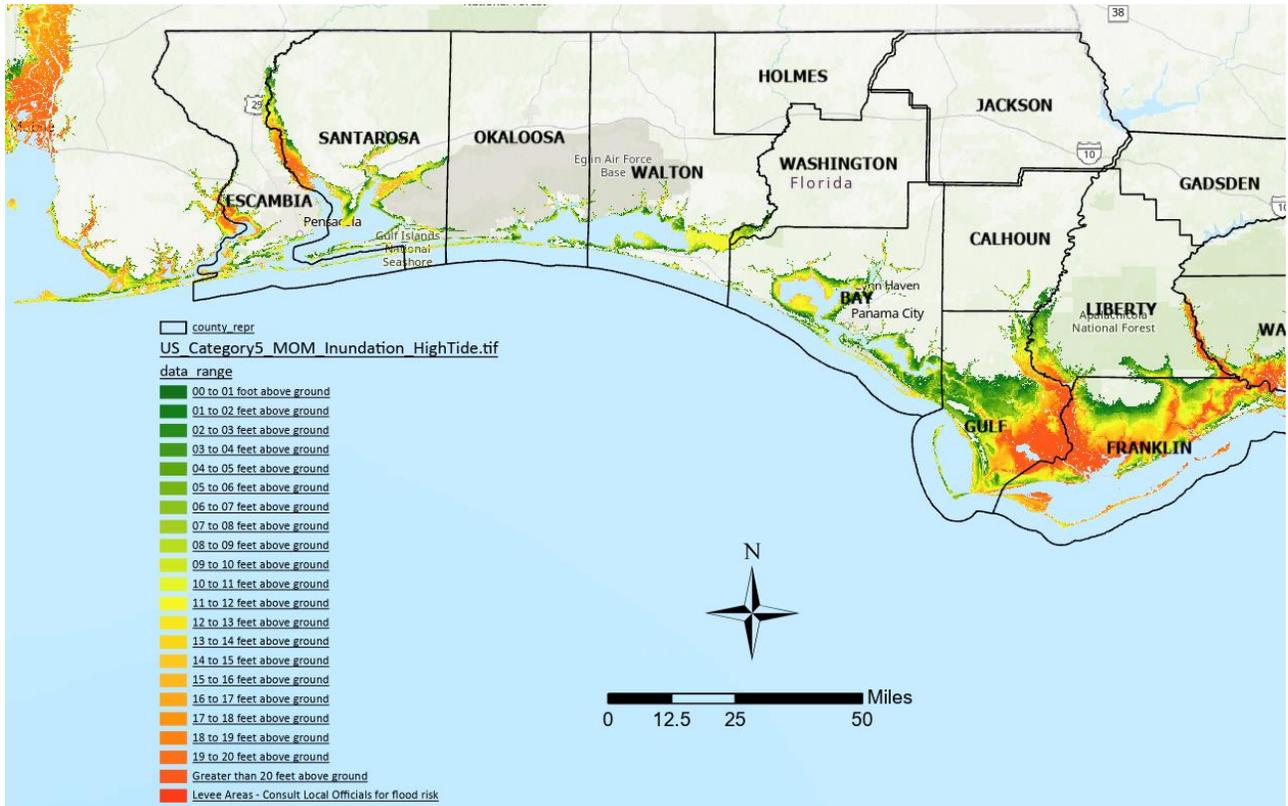
Portions of Levy, Marion, Citrus, Hernando, Sumter, Polk, Pasco, Pinellas, and Hillsborough Counties



Area	Counties
The Big Bend region in the northwestern portion of Florida	Portions of Wakulla, Leon, Jefferson, Madison Taylor, Lafayette, Gilchrist, and Dixie Counties

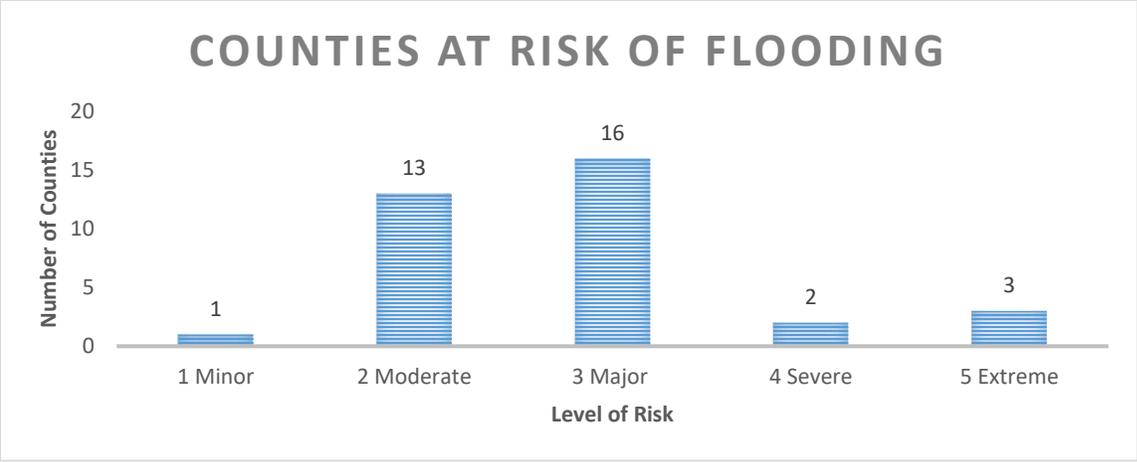


Area	Counties
<p>The northwestern portion of Florida along the Florida Panhandle. The 10-percent AEP flood hazard has a significant impact in coastal areas along much of the Gulf Coast. The Category 5 MOM has a large inland extent to the south of Tallahassee and Apalachicola Bay.</p>	<p>Portions of Escambia, Santa Rosa, Okaloosa, Walton, Washington, Bay, Calhoun, Gulf, Liberty, and Franklin Counties</p>



Appendix 4. First Street Foundation

County	Residential @ Risk #	Total Res.	Risk level	Roads Miles	Total Roads	Risk level	Commercial @ Risk #	Total Commercial	Moderate	Critical Infrastructure	Total Infrast.	Risk level	Social Facilities	Total Social	Risk Level	Overall Risk Level
Bay	28,285	86,452	Moderate	1,331	3,699	Minor	1,084	4,200	Moderate	30	82	Minor	52	175	Moderate	Major
Brevard	70,719	211,742	Major	3,489	5,487	Minor	3,194	8,406	Major	85	159	Major	192	525	Major	Moderate
Broward	229,848	449,829	Major	6,319	8,668	Minor	14,666	23,781	Moderate	188	279	Moderate	1,162	2,137	Major	Major
Charlotte	84,058	95,279	Extreme	2,830	3,328	Major	3,083	3,500	Extreme	34	49	Severe	126	135	Extreme	Extreme
Citrus	25,022	74,112	Major	1,735	3,979	Moderate	1,265	2,442	Extreme	27	48	Severe	43	124	Major	Major
Collier	68,259	115,047	Major	2,921	4,703	Minor	2,939	4,308	Severe	54	76	Major	224	338	Major	Major
Dixie	5,118	8,809	Extreme	1,824	2,620	Moderate	123	255	Severe	8	13	Moderate	8	20	Major	Severe
Duval	60,402	323,163	Moderate	2,272	6,515	Minor	4,064	15,875	Moderate	110	208	Moderate	248	1,120	Moderate	Moderate
Escambia	14,952	109,873	Moderate	1,302	5,468	Minor	2,196	8,035	Moderate	28	91	Moderate	61	308	Moderate	Moderate
Flagler	28,152	49,079	Major	925	1,663	Minor	913	1,572	Severe	11	32	Moderate	41	72	Major	Major
Franklin	7,084	7,990	Extreme	1,452	1,729	Major	416	427	Extreme	27	30	Severe	10	32	Severe	Extreme
Gulf	4,250	8,023	Major	1,111	1,720	Moderate	207	332	Major	13	22	Major	10	20	Major	Major
Hernando	20,474	79,020	Major	1,097	3,154	Moderate	492	1,965	Major	17	45	Moderate	27	170	Minor	Moderate
Hillsborough	120,990	401,557	Major	3,414	8,592	Moderate	7,106	16,479	Major	136	299	Major	470	1,319	Major	Major
Indian River	22,781	60,098	Moderate	1,543	2,373	Minor	1,030	2,392	Major	24	41	Moderate	66	158	Moderate	Moderate
Jefferson	330	5,432	Minor	311	1,467	Minor	13	275	Minor	1	14	Minor	1	39	Minor	Minor
Lee	182,132	282,956	Severe	5,451	7,434	Moderate	6,766	9,605	Severe	81	150	Major	390	597	Major	Major
L Levy	7,126	17,370	Major	2,149	4,255	Moderate	385	867	Severe	19	35	Major	16	45	Major	Major
Manatee	55,486	137,430	Major	1,675	3,725	Moderate	1,941	4,573	Severe	43	78	Major	151	336	Major	Major
Martin	17,387	55,236	Moderate	1,124	2,350	Minor	733	1,927	Major	30	60	Moderate	59	189	Moderate	Moderate
Miami-Dade	299,074	475,996	Major	7,970	10,092	Minor	16,679	25,088	Major	263	351	Major	1,856	2,697	Major	Major
Monroe	33,872	34,247	Extreme	1,300	1,401	Major	2,865	2,941	Extreme	55	58	Severe	178	181	Extreme	Extreme
Nassau	13,665	34,264	Moderate	799	2,392	Minor	591	1,112	Major	25	47	Major	43	90	Major	Moderate
Okaloosa	16,474	72,235	Moderate	793	3,778	Minor	801	3,472	Moderate	16	72	Major	49	199	Major	Major
Palm Beach	191,529	394,369	Moderate	5,638	8,687	Moderate	6,199	13,077	Moderate	109	220	Moderate	635	1,457	Moderate	Moderate
Pasco	64,288	207,270	Moderate	1,604	4,577	Minor	2,265	5,543	Major	21	79	Major	133	419	Moderate	Moderate
Pinellas	139,994	276,785	Major	3,460	5,254	Moderate	8,353	14,887	Severe	100	148	Major	389	811	Major	Major
Santa Rosa	16,813	67,163	Moderate	1,288	4,707	Minor	538	2,061	Moderate	22	69	Moderate	37	122	Major	Moderate
Sarasota	80,429	168,526	Major	2,926	4,246	Moderate	3,279	6,875	Severe	26	69	Moderate	207	421	Major	Major
St Johns	35,298	99,612	Moderate	1,225	2,950	Minor	1,573	2,729	Major	39	67	Major	180	308	Severe	Major
St Lucie	36,177	114,233	Moderate	2,361	3,846	Minor	946	2,962	Moderate	32	55	Moderate	82	298	Moderate	Moderate
Taylor	4,358	8,496	Severe	2,261	3,753	Moderate	176	459	Major	12	21	Moderate	15	33	Moderate	Major
Volusia	63,738	195,549	Moderate	2,326	5,829	Minor	4,512	10,261	Major	59	142	Moderate	214	541	Major	Moderate
Wakulla	8,253	12,792	Severe	1,133	1,736	Major	318	484	Extreme	15	20	Extreme	23	38	Major	Severe
Walton	14,529	50,670	Moderate	790	3,442	Minor	381	1,827	Moderate	12	61	Moderate	23	122	Moderate	Moderate



The number of Florida counties in each of the five risk level zones

Appendix 5. PLACE: SEA Level Rise

The number of facilities in each of the studied counties in PLACE: SLR study that may be affected by 1.6 ft. of SLR.

0.2% annual chance flood with 1.6 ft. (0.5 m) sea-level rise								
County	# of Facilities	# of Affected Facilities	Type of Essential Facility					
			Emergency Operation Center	Fire Station	Hospital	Police Station	School	Wastewater Treatment
Escambia & Santa Rosa	22	18	0	6	0	1	8	9
Okaloosa	10	3	0	2	0	2	6	0
Walton	1	1	0	1	0	0	0	0
Bay	11	6	0	5	0	2	3	1
Gulf	4	3	0	2	0	2	0	0
Franklin	11	7	0	6	2	2	1	0
Wakulla	10	5	0	6	2	1	1	0
Total	69	43	0	28	4	10	19	10

Appendix 6. Infrastructure: Medical Facilities Assessment

Infrastructure (Medical Facilities)	Address	Completely Flooded buildings	Partially Flooded Buildings	Building with Flooded Surrounding	Buildings Cut Off from Full Service
Baptist Medical Center Nassau	1250 S 18th St, Fernandina Beach, FL 32034				The bridge (Creekside Dr. and CSX Transportations) will be affected and can cut the connection to the main land.
Baptist Medical Center Jacksonville	800 Prudential Dr., Jacksonville, FL 32207			Half of the area may be flooded.	I-95 Expy N entry to Fuller Warren Brg. N might cut. Nemours Children’s Hospital on the south of the road gets close to the water (~100 ft.). The areas surrounding this hospital may be flooded.
Ascension St Vincent's Riverside	1 Shircliff Way, Jacksonville, FL 32204			Water edge may move by about 50 ft. towards the site. With higher SLR the building may be at risk.	
Baptist Medical Center - Beaches	1350 13th Ave S, Jacksonville Beach, FL 32250				The closest two roads (bridges) to reach main land may be affected.
Advent Health New Smyrna Beach	401 Palmetto St, New Smyrna Beach, FL 32168				The connection between Bouchelle Island and the main land may be compromised and people from the island might have difficulty reaching to and receiving service from the hospital. There is only one hospital in the far south of the island that SLR and flooding may disturb the access to that one too.
Halifax Health Medical Center- Port Orange	1041 Dunlawton Ave, Port Orange, FL 32127				The connection between Daytona Beach Shore and the main land may be compromised and people from the island might have difficulty reaching to and receiving service from the

					hospital. There is only one hospital in the far south of the island that SLR and flooding may disturb the access to that one too.
Cape Canaveral Hospital	701 W Cocoa Beach Cswy, Cocoa Beach, FL 32931			The water gets very close to the pathways and a few buildings.	The Cocoa Beach Cswy may be severely affected and the connection between this hospital and the islands and the mainland both may be cut. This hospital is the closest one to Cape Canaveral. With 2 ft. SLR the connection between Cape Canaveral and all other medical facilities may be cut.
Holmes Regional Medical Center Circles of Care Inc.	1350 S HICKORY ST, MELBOURNE, FL 32901 400 E Sheridan Rd, Melbourne, FL 32901				The connection between Melbourne Beach to the mainland may be cut and the communities on the island may have difficulty reaching to the medical facilities.
Steward Sebastian River Medical Center	13695 US Hwy 1, Sebastian, FL 32958-3230				Highway 1 that connects Roseland (hospital side) with the northern areas may be disturbed or cut.
Cleveland Clinic Indian River Hospital Encompass Health Rehabilitation Hospital of Treasure Coast	1000 36th St, Vero Beach, FL 32960 Encompass Health Rehabilitation Hospital of Treasure Coast				The connection between Indian River shores and the mainland, where the medical facilities are located may be cut. East Causeway Blvd. and another road on the north of this causeway may be cut or disturbed by 2 ft. SLR. The Indian Shores River communities are far from any other hospital and care facilities.
St Mary's Medical Center	901 45th St, West Palm Beach, FL 33407				This hospital is more located inland. But is the closest one to Palm Beach Shores community. With 2 ft. SLR the connection between the island and main land may be cut.

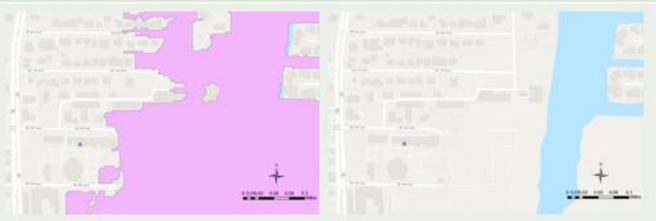
Good Samaritan Medical Center	1309 N Flagler Dr, West Palm Beach, FL 33401				The two connections, A1A and 704 (Royal palm Way), may be disturbed or cut and Palm Beach communities may have difficulty reaching to the mainland and medical facilities.
Mount Sinai Medical Center	4300 Alton Rd, Miami Beach, FL 33140				It is the only hospital in Miami Beach. With 2 ft. SLR the connections between the mainland and Miami Beach may be cut off.
Mercy Hospital A Campus of Plantation General Hospital	3663 S Miami Ave, Miami, FL 33133-4253				This hospital is the closest to Key Biscayne. With 2 ft. SLR the connections between the island and mainland may be disturbed.
Select Specialty Hospital	955 NW 3rd St, Miami, FL 33128		The building may be affected by low 2 ft. SLR. This building is in a low laying area. The impact on the site and building should be assessed. The site may be more affected by 3 ft. SLR	The building may be affected by low 2 ft. SLR. This building is in a low laying area. The impact on the site and building should be assessed. The site may be more affected by 3 ft. SLR	The impact on the community should be assessed.
Mercy Hospital A Campus of Plantation General Hospital	20601 Old Cutler Rd, Miami, FL 33189				No immediate risk. However, this area is low laying covered with wetland, stormwater basins and drainage ponds. Also the connection between Key Largo and the main land may be affected.
South Florida Evaluation And Treatment Center	18680 SW 376th St, Florida City, FL 33034-6304				No immediate risk. However, this area is low laying covered with wetland, stormwater basins and drainage ponds. Also the connection between Key Largo

					and the main land may be affected.
Mariners Hospital	91500 Overseas Hwy, Tavernier, FL 33070				The hospital is located on a narrow barrier island. With 2 ft. SLR the connection between different sections of the island may be disturbed.
Fisherman's Community Hospital	3301 Overseas Hwy, Marathon, FL 33050				The hospital is located on a narrow barrier island, Marathon Shore. With 2 ft. SLR the connection between different sections of the island may be disturbed.
Lower Keys Medical Center	5900 College Rd, Key West, FL 33040			There is no immediate risk to the building. But too close to the water.	The hospital is located in Key West, Marathon Shore. With 2 ft. SLR the connection between different sections of the island may be disturbed. The hospital site is very close to the water.
Depoo Hospital	1200 Kennedy Dr, Key West, FL 33040			There is no immediate risk to the building. But too close to the water.	The hospital is located in Key West, Marathon Shore. With 2 ft. SLR the connection between different sections of the island may be disturbed.
Willough at Naples	9001 Tamiami Trl E, Naples, FL 34113				The access roads might get closed/disturbed. The site is very close to wetland and water.
1.NCH Healthcare System North Naples Hospital Campus 2. Physical Regional Medical Cntr-N	11190 ealthpark Blvd, Naples, Fl 34110 1285 REEKSIDE BLVD E, NAPLES, FL 34109				These medical facilities are some of the closest ones to the coastal communities. With 2 ft. SLR some of the connection between the medical facilities and these communities may be disturbed.

1. Healthpark Medical Center 2. Park Royal Hospital	9981 Healthpark Cir, Fort Myers, FL. 9241 Park Royal Dr, Fort Myers, FL. 33908				These medical facilities are some of the closest ones to the coastal communities at Fort Myers Beach. With 2 ft. SLR some of the connections between the medical facilities and these communities may be disturbed.
1. Bayfront Health Punta Gorda 2. Fawcett Memorial Hospital 3. Bayfront Health Port Charlotte	1. 809 E Marion Ave, Punta Gorda, FL 33950 2. 21298 Olean Blvd, Port Charlotte, FL 33952 3. 2500 Harbor Blvd, Port Charlotte, FL 33952				Some roads and connections between different sides of the bay may be disturbed.
Englewood Community Hospital	700 Medical Blvd, Englewood, FL 34223				Some roads and connections between different sides of the bay might be disturbed, especially between the barrier island and the mainland where the hospital is located.
Venice Regional Bayfront Health	540 The Rialto, Venice, FL 34285				Two bridges connect Venice to the mainland that might get affected by flooding and SLR
Sarasota Memorial Hospital	1700 S Tamiami Trl, Sarasota, FL 34239				The connection roads between the hospital on the mainland, with several keys (Longboat, Lido, and Siesta) might be disturbed. Sarasota memorial is the closest hospital to these communities.
1. Suncoast Behavioral Health Center 2. Centerstone of Florida 3. Manatee Memorial					The connecting roads between the barrier islands and some sections of the mainland might be affected.

4.Blake Medical Center					
Kindred Hospital - Bay Area - St Petersburg	3030 6th St S, Saint Petersburg, FL 33705			Parts of the landscape around the building can get too close to the water edge.	The connecting routs between the island (area to the east) and the mainland where the hospital is located might be compromised.
1.Palms of Pasadena Hospital 2.Bay Pines VA Healthcare System	1.300 Pinellas St, Clearwater, FL 33756 2. 2025 Indian Rocks Rd, Largo, FL 33774				These two medical facilities are the closest ones to the barrier islands, e.g. Clearwater Beach, Honeymoon Island, and Indian Rocks Beach. The 2 ft. SLR can compromise the access routes between these communities and the medical facilities.
George E Weems Memorial Hospital	135 Ave G, Apalachicola, FL 32320		The building and site are far from the water. *But according to PLACE SLR this hospital may be damaged.		The connecting routs may potentially be affected.
Ascension Sacred Heart Bay	615 N Bonita Ave, Panama City, FL 32401				Potential disturbance of the connecting routs between the barrier island's communities and the mainland where this hospital is located, including Panama City Beach to the west of this map.

Appendix 7. Infrastructure: Schools Assessment

Name	Object ID in Dataset	Direct Risk of SLR	Indirect Risk of SLR	
San Mateo Elementary School	18071	No direct impact to the building.	The surrounding area will experience some inundation. The access road (Baisden Rd) might be disturbed.	
Jacksonville Marine Institute	19809	No direct impact to the building.	Some parts of the landscape will be inundated. There will be possible road access (ICW Beach Bridge) disturbance.	
Heritage Christian Academy	19893	No direct impact to the building or the landscape.	Possible access road (US Highway 17) disturbance. Inundation of Moccasin Slough Park next to the academy.	
New Smyrna Beach Senior High School	19676	The building stays intact.	The inundation of the areas around the school causes inaccessibility to this site.	
Saint Mark School	21142	The building will not be affected.	The water gets close to the building.	
Palm Beach Public Elementary School	19369	Water reaches the building and part of the building will be inundated.	Water covers some areas around the building, causing inundation of some surrounding buildings. The access road (Royal Palm Way) will be disturbed. *	

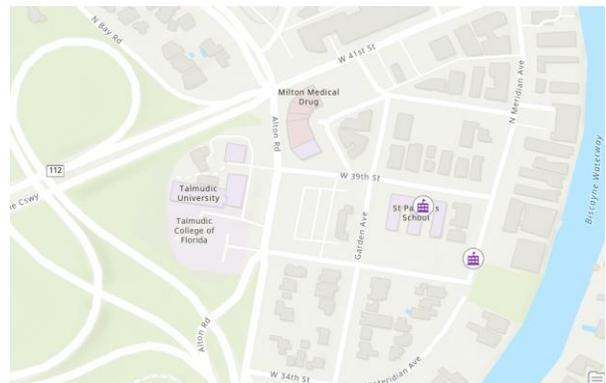
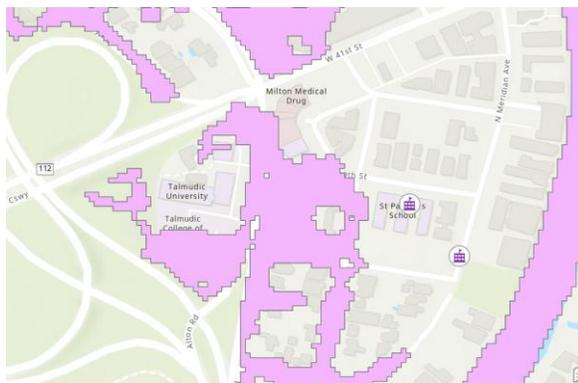
*According to Climate Compact: A total of 187 schools were reviewed. No schools are impacted at the 1 or 2 ft. sea level rise scenarios (Palm Beach). At a 3 ft. sea level rise, only one building, Palm Beach Elementary School, appears to be in jeopardy. But EDR's observation showed that Palm Beach Elementary may be affected by 2 ft. SLR.

Name	Object ID in Dataset	Direct Risk of SLR	Indirect Risk of SLR	
Nowlin Ocean View Private School *	19917	Water gets close and apparently touches the building. Some service buildings in the site will be inundated. *	Large areas around the building will be inundated. Connecting roads will be disturbed.	
Lehrman Community Day School **	20397 Labeled as Biscayne Community Elem School. Add: 727 77th St, Miami Beach, FL 33141			
Nautilus Middle School	17823	Water will get close or be reaching to the building. Some areas and roads around the site will be inundated.	Access to the building might be compromised.	
North Dade Christian School	20538	Water will get very close to the building and parts of the site might be inundated.	Several access roads to the building will be disturbed and cut off. This school has not been mentioned in Climate Compact 2012 Vulnerability Study.	
Talmudic University Chabad Hebrew School Miami Beach	170039 Wrong data. Google Map shows that Talmudic Uni. is not at this location.		Data seems to be wrong. The Talmudic University (red circle) is not located here and will not be affected by SLR. However, Chabad Hebrew School Miami Beach is located on where the star is marked and will be inundated by 2ft SLR and will be disconnected from the mainland and other islands.	

*According to Climate Compact: At a 3 ft. sea level rise, only one of the 239 school facilities appears to be affected (in Broward). Even at this site, the majority of inundation is limited to the open space areas around the school. But EDR’s observation showed that there is at least one school site and building that may be affected by 2 ft. SLR.

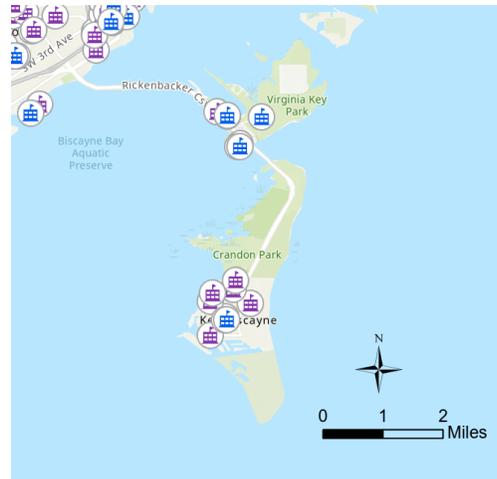
** According to Climate Compact: No schools in Unincorporated Miami-Dade County were impacted. Only three of the 867 schools were affected in municipalities in the 3 ft. sea level rise scenario. However, there is a need for more specific survey information on all affected schools, such as elevation certificates and topographic survey to determine if and how those would be actually impacted. EDR’s observation showed that there is a chance for the water to touch or get very close to the Student Services & Attendance on 489 East Drive, Miami Springs 33166, School Board Administrative – Annex, on 1500 Biscayne Boulevard, Miami 33132, and Biscayne Elementary on 800 77th Street, Miami Beach 33141.

Name	Object ID in Dataset	Direct Risk of SLR	Indirect Risk of SLR	
Nautilus Middle School	17823	Water will get close or be reaching to the building. Some areas and roads around the site will be inundated.	Access to the building might be compromised.	
North Dade Christian School	20538	Water will get very close to the building and parts of the site might be inundated.	Several access roads to the building will be disturbed and cut off. This school has not been mentioned in Climate Compact 2012 Vulnerability Study.	
Talmudic University Chabad Hebrew School Miami Beach	170039 Wrong data. Google Map shows that Talmudic Uni. Is not at this location.		Data seems to be wrong. The Talmudic University (red circle) is not located here and will not be affected by SLR. However, Chabad Hebrew School Miami Beach is located on where the star is marked and will be inundated by 2ft SLR and will be disconnected from the mainland and other islands.	



Talmudic Uni. and St. Patrick School are in an area that their landscape, some of the buildings lose to them and access roads may be affected by 2 ft. SLR.

Virginia Key and Key Biscayne may be cut off from the mainland. In Virginia Key some of the schools' buildings and landscapes may be affected (See in the following pages), but in Biscayne Key the schools may not be affected by 2 ft. SLR.



Name	Object ID in Dataset	Direct Risk of SLR	Indirect Risk of SLR	
<p>Landow Preschool</p> <p>*Climate Compact doesn't indicate any impact due to SLR on this building though.</p>	170351	The building and its will be affected and/or inundated.	<p>The connecting routes will be compromised.</p> <p>On the dataset, there are two other schools in the vicinity of this preschool. However, These schools cannot be found on the same location in Google Map</p>	
South Pointe Elementary School	170060	The building and its surrounding get very close to the water.	<p>The connecting routes will be compromised or cut off.</p> <p>*Although the dataset shows a few other schools close to this school, those schools were not found in the Google Map.</p>	
<p>MAST ACADEMY</p> <p>AMIKIDS MIAMI-DADE SOUTH</p> <p>UNIVERSITY OF MIAMI COOPERATIVE INSTITUTE FOR MARINE AND ATMOSPHERIC STUDIES (CIMAS)</p>	<p>FID:</p> <p>3660</p> <p>4005</p> <p>3088</p>	<p>AMIKIDS will be inundated. The other two schools will have flooding in their surrounding, especially UM Cooperative Institute..</p>	<p>The connecting routes will be cut off and most of the area will be flooded.</p>	

Name	Object ID or FID in Dataset	Direct Risk of SLR	Indirect Risk of SLR	
MIAMI BRIDGE NORTH	997	Water gets too close to the building and covers parts of the landscape.	Some access routes might be affected.	
1.THE COLLEGE OF THE FLORIDA KEYS 2.GERALD ADAMS ELEMENTARY SCHOOL 3.POINCIANA ELEMENTARY SCHOOL 4SIGSBEE CHARTER SCHOOL		No direct building damage. But most of the surrounding areas and access routes will be inundated.		
SOMERSET ISLAND PREP	1999	Most school buildings seem to be unaffected by 2ft SLR. The only one with a very close proximity to the water or partial submergence will be Somerset.	The routes and connecting roads will be affected.	
EVERGLADES CITY SCHOOL	406	Most of the island will be submerged. Although some of the school buildings might stay above water level, all surrounding areas and some of the school buildings will be inundated.	Except for a few houses and buildings that stay above water level, the whole island will be inundated.	

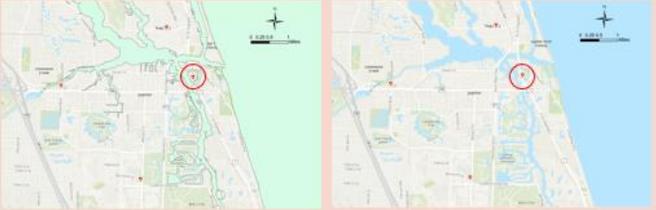
The school buildings and sites on Key Largo down to Islamorada, Marathon, Vaca Key may not be affected directly by the 2 ft. SLR. However, most areas around these buildings may be flooded and access routes may be cut off or compromised. The Pigeon Key and Marine Science Center located there may be inundated.

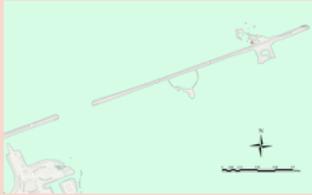
Kudjoe Key and Pirate Cove areas may be mainly flooded although it seems the schools are located in higher ground. But the access routes may be cut off and most residential areas may be inundated.

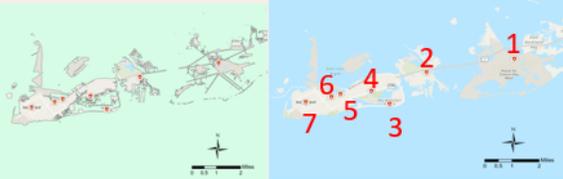
Name	Object ID or FID in Dataset	Direct Risk of SLR	Indirect Risk of SLR	
Marco Island Academy	FID 4170	Marco island's schools stay intact, except for the Marco Island Academy. Parts of this site and buildings might be inundated. Other schools will be remain unaffected.	Some of the connection routes and bridges will be compromised.	
Sand Castle Kindergarten Temporary closed (Last checked May 2022)	FID 2805	Around 30% of the building seems to be inundated	The waterfront part of the building and landscape will be submerged. The connecting routes of Fort Mayer with the mainland will be compromised.	
FORT MYERS BEACH ELEMENTARY SCHOOL	FID 4569	The building will not be affected, but a large part of the yard (landscape) will be submerged.	Connection routes with the mainland will be compromise.	
THE SANIBEL SCHOOL	FID 3312	The school buildings will not get affected, but a portion of the landscape will be submerged.	The connecting routes between the Sanibel Island and the mainland will be compromised.	
PINE ISLAND ELEMENTARY SCHOOL	FID 3269	The water reaches the site, but the building will not get affected.	The connecting routes between the Pine Island and the mainland will be compromised.	
Pine Island Middle School	FID 1781	The building will not be affected. The surrounding area will be inundates.	The connecting routes between the Pine Island and the mainland will be compromised. This section of the island will be isolated from other sections and surrounded by water.	

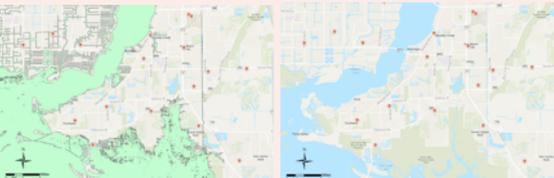
Name	Object ID or FID in Dataset	Direct Risk of SLR	Indirect Risk of SLR		
ANNA MARIA ELEMENTARY SCHOOL	FID 1139	A few of the detached buildings in this site will be inundated. Half of the landscape will be submerged.	A large part of Holmes Beach and the island will be submerged and the connecting routes with the other sections (mainland) will be compromised.		
Clearwater Christian School	FID 2501	The water gets close to the building, but it will not affect it. However, some parts of the landscape will be submerged.	The connecting routes will be compromised to some extent.		
Homosassa Elementary School	FID 3180	The building will not get affected. However, a large portion of this area will be inundated.	The connecting routes will be cut off. Surrounding areas will be inundated.		
ACADEMY OF ENVIRONMENTAL SCIENCE MARINE SCIENCE STATION	FID 180 FID 2707	A large part of the Academy will be undated and all the Marine Science Station will be flooded.	The areas around these two buildings will be completely inundated with 2 ft. SLR. The connecting route, W Fort Island Trl will be cut off.		

Appendix 8. Infrastructure: Fire Stations Assessment

Name	Object ID or FID in Dataset	Direct Risk of SLR	Indirect Risk of SLR	
PALM BEACH COUNTY FIRE DEPARTMENT AND RESCUE STATION 18	FID 1797	No direct effect on the building.	The connecting routes between this station which is located at Burt Reynolds Park on an island, will be compromised/cut off. If this station is supposed to provide service to the area beyond the park, it might not be possible.	
PALM BEACH COUNTY FIRE DEPARTMENT STATION 38	FID 1784 600 S OCEAN BLVD, Manalapan, 33462	No direct effect on the building.	The main connecting route might be disturbed/flooded.	
1. MIAMI FIRE RESCUE STATION 13 2. NORTH BAY VILLAGE FIRE DEPARTMENT STATION 27	1. FID 2116 990 NE 79TH ST, MIAMI 2. FID 2115 1275 NE 79TH ST, N Bay Village	#1 will be inundated and probably out of operation. #2 will be cut off and get isolated on Pelican Harbor.	These two stations will be out of operation either due to submergence or losing connecting routes.	
MIAMI BEACH FIRE DEPARTMENT AND RESCUE STATION 1	FID 418 1051 JEFFERSON AVE, Miami Beach	The building stays intact.	The area around this site will be inundated and connecting routes will be compromised.	
ISLAMORADA VILLAGE OF ISLANDS FIRE DEPARTMENT AND RESCUE STATION 19 (LOWER MATECUMBE)	74070 OVERSEAS HWY, Islamorada	The building will partially be flooded.	Some connecting routes to parts of the island and connection to mainland will be compromised.	
MONROE COUNTY FIRE DEPARTMENT STATION 18 (LAYTON)	68260 OVERSEAS HWY, Layton	Building might be affected by 2 ft. SLR.	Connecting routes to provide service to some areas will be compromised. This is the only fire department on this section of Long Key that provides service to the area after 2 ft SLR.	

Name	Object ID or FID in Dataset	Direct Risk of SLR	Indirect Risk of SLR		
MONROE COUNTY FIRE DEPARTMENT STATION 17 (CONCH KEY)	10 S CONCH AVE, Marathon	The building probably will not be affected.	Some of the roads will be affected and some areas on Conch Key and Duck Key will lose their connecting roads.		
MARATHON FIRE DEPARTMENT AND RESCUE STATION 15	59265 OVERSEAS HWY, Marathon	The building will not be affected.	Some of the roads will be affected and some areas on Crowl Key will lose their connecting roads.		
1. MONROE COUNTY RESCUE STATION TRAUMA STAR AIR AMBULANCE 2. MARATHON FIRE DEPARTMENT AND RESCUE STATION 14 (AIRPORT FIRE STATION) EMS AIRPORT 3. MONROE COUNTY FIRE DEPARTMENT ADMINISTRATION 4. MARATHON FIRE RESCUE STATION 1	1. 10100 OVERSEAS HWY 2. 8900 OVERSEAS HWY 3. 490 63RD ST 4. 3299 OVERSEAS HWY Marathon	None of these buildings will be affected by 2 ft. SLR.	Some of the roads and access to different areas will be compromised.		

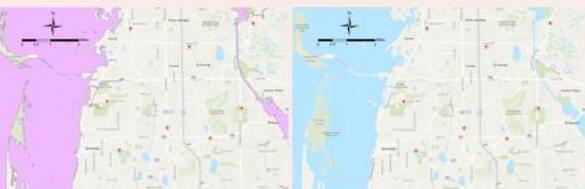
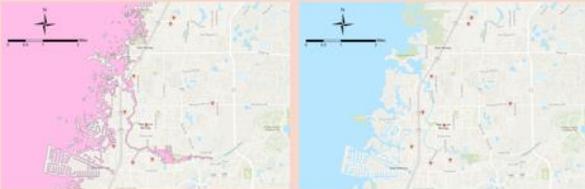
Name	Object ID or FID in Dataset	Direct Risk of SLR	Indirect Risk of SLR	
<p>1. MONROE COUNTY FIRE DEPARTMENT STATION 13 (BIG PINE KEY)</p> <p>2. MONROE COUNTY FIRE DEPARTMENT STATION 11 (CUDJOE KEY)</p> <p>3. MONROE COUNTY FIRE DEPARTMENT STATION 10 (SUGARLOAF)</p> <p>4. BIG COPPITT VOLUNTEER FIRE DEPARTMENT AND RESCUE STATION 9</p>	<p>1. FID 237</p> <p>2. FID 236</p> <p>3. FID 235</p> <p>4. FID 234</p>	<p>1, 2 & 4 the buildings probably will not be affected. Building 3 will be partially submerged.</p>	<p>The roads between the communities and islands will be disturbed and inundated and connections will be cut. There will be no access to Pirate Cove, Summerland, Baypoint, Ramrod Keys and the community on Boca Chica Road.</p>	
<p>1. NAVAL AIR STATION KEY WEST FIRE AND EMERGENCY SERVICES</p> <p>2. MONROE COUNTY FIRE DEPARTMENT STATION 8 (STOCK ISLAND)</p> <p>3. KEY WEST INTERNATIONAL AIRPORT FIRE DEPARTMENT STATION 4</p> <p>4. KEY WEST FIRE DEPARTMENT STATION 3</p> <p>5. AMERICAN MEDICAL RESPONSE KEY WEST RESCUE STATION</p> <p>6. KEY WEST FIRE DEPARTMENT STATION 1</p> <p>7. KEY WEST FIRE DEPARTMENT STATION 2</p>	<p>1. FID 1872</p> <p>2. FID 233</p> <p>3. FID 230</p> <p>4. FID 232</p> <p>5. FID 958</p> <p>6. FID 231</p> <p>7. FID 229</p>	<p>1, 2, 3, 4, 5, 6, 7, 6: No direct impact on the building</p>	<p>1, 2, 3, 4, 5, 6 & 7: Some access roads will be disturbed. Key West will be disconnected from the mainland, but the Fire Deps can still service the community.</p>	

Name	Object ID or FID in Dataset	Direct Risk of SLR	Indirect Risk of SLR	
1. OCHOPEE FIRE DEPARTMENT STATION 66 2. OCHOPEE FIRE DEPARTMENT AND RESCUE STATION 60 3. OCHOPEE FIRE CONTROL DISTRICT STATION 61	1. FID 846 2. FID 1115 3. FID 2079	1: The building seems not to be inundated. 2: The building will be partially inundated or get very close to the water lever. 3: The building will not get affected by the water level.	1: all the areas around this FD will be inundated. Parts of the connecting roads will be disturbed too. 2: The connection between this FD and the communities will be cut and most of the area around this FD will be inundated. The connection between Chokoloskee and the main land will be cut. 3: This FD only will be able to provide service to a small portion of the island. Most of the connecting routs to the other sections of the island and the mainland will be cut.	
1. MARCO ISLAND FIRE DEPARTMENT AND RESCUE STATION 50 2. MARCO ISLAND FIRE DEPARTMENT STATION 51 3. ISLES OF CAPRI FIRE DEPARTMENT AND RESCUE STATION 90 4. EAST NAPLES FIRE DEPARTMENT AND RESCUE STATION 23	1. FID 850 2. FID 851 3. FID 825 4. FID 834	These buildings will not be affected by 2 ft. SLR.	1, 2 & 3 will suffer from road disturbance and road submergence and they will be cut from the mainland.	 <p data-bbox="865 1003 1365 1024">From Marco Island to Bonita Shores the FDs will not be affected.</p>
1. BONITA SPRINGS FIRE DEPARTMENT AND RESCUE STATION 7 (PROPOSED) 2. FORT MYERS BEACH FIRE DEPARTMENT AND RESCUE STATION 33 3. FORT MYERS BEACH FIRE CONTROL DISTRICT 4. FORT MYERS BEACH FIRE DEPARTMENT AND RESCUE STATION 31	1. FID 1899 2. FID 1626 3. FID 1299 4. FID 1624	These building will not be affected by 2 ft. SLR.	All these FDs, to some extent, will suffer from road submergence and disturbance and their connections to the mainland will be cut.	 <p data-bbox="865 1398 1390 1444">In this area, there are some FDs on the mainland along the coast that will not be affected by SLR directly or indirectly.</p>
The cape Coral Area and north of Fort Myers Beach and Fort Myers Area FDs.		The buildings will not get affected.	The main connection routs will not get affected. There are some bridges that might be closed due to inundation. But the number of active FDs are enough to provide service to this areas. Un general it seems the areas on the mainland stay safe.	

Name	Object ID or FID in Dataset	Direct Risk of SLR	Indirect Risk of SLR	
1.SANIBEL FIRE DEPARTMENT AND RESCUE STATION 1 2.SANIBEL FIRE DEPARTMENT AND RESCUE STATION 2 3.CAPTIVA FIRE DEPARTMENT AND RESCUE STATION 4.MATLACHA - PINE ISLAND FIRE DEPARTMENT AND RESCUE STATION	1. FID 1630 2. FID 1631 3. 1618 4. FID 1629	No direct impact on the buildings.	The connection between some areas and the mainland will be disturbed or cut off.	
1.MATLACHA - PINE ISLAND FIRE DEPARTMENT AND RESCUE STATION 1 2. MATLACHA-PINE ISLAND FIRE STATION 153 3.MATLACHA - PINE ISLAND FIRE DEPARTMENT STATION 3 4. UPPER CAPTIVA FIRE DEPARTMENT 5.USEPPA ISLAND VOLUNTEER FIRE DEPARTMENT 6.CAYA COSTA FIRE DEPARTMENT PARK PATROL 7.BOCA GRANDE FIRE DEPARTMENT AND RESCUE STATION	1. FID 1616 2. FID 2099 3. FID 1617 4. FID 1619 5. FID 1092 6. FID 1614 7. 1615	No direct impact on the buildings.	The connection between some areas and the mainland will be disturbed or cut off. But the FDs on the islands will be able to provide service to most communities.	 <p>The FDs on the mainland will not be directly or indirectly affected by 2 ft. SLR.</p>
1. LITTLE GASPARILLA ISLAND FIRE AND RESCUE 2. CHARLOTTE COUNTY FIRE DEPARTMENT AND RESCUE STATION 14 3. CHARLOTTE COUNTY FIRE DEPARTMENT STATION 10	1. FID 1318 2. FID 791 3. FID 792	2 & 3 the buildings stay intact. Building 1 and its surrounding area will be inundated.	FD 3 will only be able to serve a small portion of Palm Island as its connection to the other areas will be cut off. The connection of FD 2 will be cut off with some areas.	 <p>Venice area FDs will not be affected as they are mainly on mainland.</p>
1. SARASOTA COUNTY FIRE DEPARTMENT AND RESCUE STATION 3	1. FID 598	This building and its surrounding will be inundated.	The connection between different sections of Longboat Key, Bird Key and the areas around will be disturbed/cut off.	 <p>In the Sarasota area the inland FDs will stay intact. But the ones on barrier islands can be affected as explained. Many residential areas in this section will be inundated.</p>

Name	Object ID or FID in Dataset	Direct Risk of SLR	Indirect Risk of SLR	
Some of the coastal FDs FID are in the FID column.	1. FID 590 2. FID 573 3. FID 578 4. FID 579	The FDs in the area of Bradenton and Bradenton Beach will not get affected directly by 2 ft. SLR.	The connecting routes between a few FDs and the mainland and some areas on the barrier island and coastal areas will be severed. However, it seems the FDs stay functional. The community in Cortez will be inundated. FD 2 & 3 will not be able to provide service to some of these neighborhoods.	
1. WEST MANATEE FIRE DEPARTMENT AND RESCUE STATION 3	1. FID 580	According to the maps, this building is on a higher ground and all its connecting routes water will not touch it.	The area around this FD, on Holmes Beach, will be inundated. This FD will be separated from other parts and all its connecting routes will be inundated.	

Name	Object ID or FID in Dataset	Direct Risk of SLR	Indirect Risk of SLR	
Bella Vista, St Pete Beach and Tierra Verde area.		There is no direct risk.	The FDs on the barrier islands will be cut off from the mainland. Some residential areas, especially the waterfront, including Don-Ce-Sar Place, Treasure Island and Bella Vista Beach will suffer from inundation. Some roads will be flooded with water as well and the connection with other parts of the island and mainland will be cut off.	
Madeira Beach, Redington and Seminole areas.	FID 1547 & 733 are the ones on the barrier island.	No direct risk to the FD buildings.	The FDs on the mainland will remain intact and active. The areas on the barrier islands will suffer from road submergence and lack of access to other areas. The connection between the barrier island and the mainland will be cut off. Many residential areas and their routes will suffer from inundation; in particular, areas around Mitchell, Madeira and Redington Beach. The canal area along Indian Shore will also suffer from some waterfront submergence.	

Name	Object ID or FID in Dataset	Direct Risk of SLR	Indirect Risk of SLR	
1.CLEARWATER FIRE DEPARTMENT STATION 44 2. 1.CLEARWATER FIRE DEPARTMENT and RESCUE STATION 46	1. FID 1559 2. FID 726	No direct impact on the FD buildings in the Clearwater area.	On the Clearwater Beach some areas and roads will be inundated and create problem with accessibility. The barrier islands in this area will be disconnected from the mainland. The three FDs on the Tampa Bay side will not get affected directly or indirectly.	
		No direct impact on the FD buildings in the Dunedin and Palm Harbor areas.	In Dunedin and Palm Harbor areas, some of the connecting routes to the barrier island will be cut. Honeymoon island will be disconnected from the mainland and the FD service.	
			The FDs in the Tarpon Spring area will not be affected by 2ft SLR directly or indirectly.	
		No direct risk to the FDs.	Some areas along the costs will be inundated and some roads will become inaccessible.	 North of this area up to Spring Hill and Weeki Washee up to Homossa Spring FDs stay operational. However the coastal areas will suffer from inundation and road cutoff.
1. CITRUS COUNTY VOLUNTEER FIRE DEPARTMENT STATION 11 (OZELLO)	1. FID 632	This FD will be surrounded with water and become dysfunctional.	Homossa Springs, Ozello and Crystal River coastal areas will be inundated. Many residential areas and roads will be submerged or/and cutoff from accessible roads.	 North of Crystal River the coastal areas are not developed and mainly marshes, which is creating a barrier from the SLR.

Name	Object ID or FID in Dataset	Direct Risk of SLR	Indirect Risk of SLR	
1. CEDAR KEY VOLUNTEER FIRE DEPARTMENT AND RESCUE STATION 75 2. DIXIE COUNTY FIRE DEPARTMENT STATION 71 3. DIXIE COUNTY FIRE DEPARTMENT STATION 61	1. FID 1464 2. FID 1479 3. FID 272	FD1, FD2 and FD3 the buildings will stay intact.	FD1 its access to many coastal areas and the mainland will be cutoff. FD2 its access to <u>Swannee</u> will be cutoff. Most of <u>Swannee</u> will be inundated. FD3 access to some parts of the areas in Horseshoe Beach will be cutoff.	 <p data-bbox="808 537 1422 604">From here up to Big Bend around Saint Marks, FDs will remain functional. Most coastal areas in this along this area are less developed therefore there is no immediate risk to the built areas.</p>
1. APALACHEE BAY VOLUNTEER FIRE DEPARTMENT 2. OCHLOCKONEE BAY VOLUNTEER FIRE DEPARTMENT	1. FID 221 2. DID 14	FD1 and FD2 buildings will stay intact.	Most of Live oak island will be inundated and several roads will be disturbed. FD2 will lose connection with several areas in the south of Panacea.	
				