Annual Assessment of Flooding and Sea Level rise

2024 Edition

Chapter 6

Part 1
Zones, Flooding Factors, Calculations and Investments

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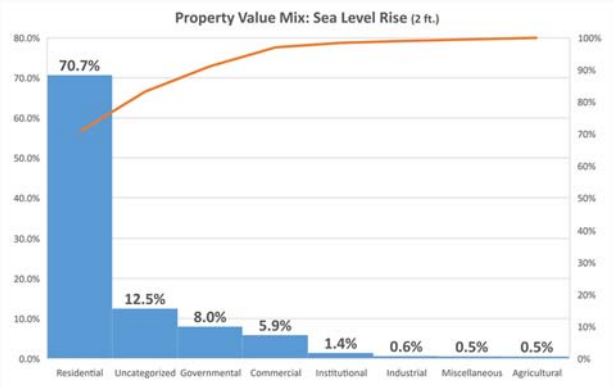
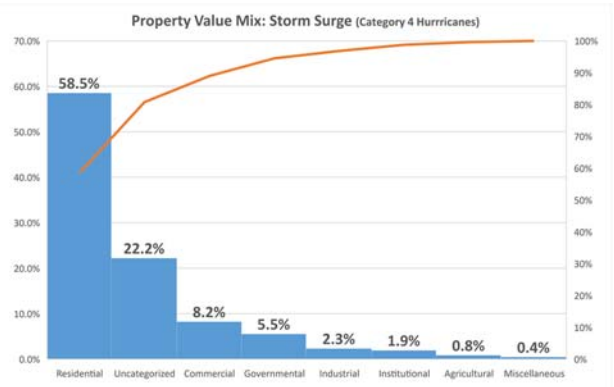
1. Executive Summary

The stated intent of the Florida Legislature is to minimize the adverse economic effects of inland and coastal flooding, while preserving the value of real and natural assets to the extent economically feasible. As in prior years, the Office of Economic and Demographic Research (EDR) continues to identify and quantify hazard exposure, recognize vulnerabilities, and develop information on resilience programs and plans. In Part 1 of this year's report, EDR expands its assessment and analysis of the impact of flooding on Florida's physical and natural resources. EDR also provides the history of resilience and adaptation planning in the state, as well as the outcomes of some of these initiatives.

In prior editions of this report, EDR identified three potential impact zones: High Impact Zone, Intermediate Impact Zone, and Dispersed Impact Zone. In this year's report, EDR has refined its analysis and delineated new boundaries for the High Impact Zone that are less than countywide. In addition, it has begun mapping and defining the two additional zones: the Intermediate Impact Zone and the Dispersed Impact Zone. According to the Federal Emergency Management Agency (FEMA), 50 Florida counties are exposed to coastal flooding. EDR considers those counties or portions of counties that lie either (1) within the FEMA coastal flooding zone but outside the High Impact Zone, or (2) in an area affected by certain other flooding factors, as part of the Intermediate Impact Zone. Based on FEMA studies, only 17 counties in Florida are not exposed to coastal flooding; however, two of these counties are significantly affected by other factors. This prompted EDR to move Orange and Seminole to the Intermediate Impact Zone, leaving 15 of the 17 counties identified by FEMA as neither exposed to coastal flooding, nor 1ft. and 2ft. sea level rise, to comprise the Dispersed Impact Zone.

For coastal counties, the total just value at risk from the selected flooding factors can be used to create a functional risk range. Within the next 50 years, it is feasible that coastal property valued between $354.8 billion and $1.74 trillion could be at risk from flooding. In percentage terms, this equates to 11.6% to 56.9% of all value in the coastal area. Narrowing the range slightly to bracket it by a 2ft. sea level rise on the low end ($448.6 billion) and a category 4 hurricane storm surge on the high end ($1.54 trillion) allows an analysis of the types of properties that would be affected. Under either scenario, residential properties face the majority of the risk.





Gaining this understanding of the flooding domain is critical to the calculation of economic impacts, as well as the cost-benefit analysis of potential investments. 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. See the accompanying Part 2 of Chapter 6 for implications regarding property insurance.

Since FY 2018-19, Florida has provided funding to address resilience planning and initiatives. During this five-year period, appropriations have exceeded $1.0 billion, with 19% coming from the General Revenue Fund and 81% coming from the Resilient Florida Trust Fund. The latter source is funded through annual distributions from the Documentary Stamp Tax, as well as $700 million in one-time transfers from American Rescue Plan (ARP) funds. Overall, the disbursement levels have been extremely low, with only 2.6% of the funds actually disbursed. The dollars currently invested in flood mitigation are all federal.

In this year's report, EDR continues its assessment of at-risk structures and facilities with a renewed emphasis on the critical assets defined in s. 380.093, F.S. The assessment includes the number of the facilities that may be affected by hurricane categories 1, 4 and 5 storm surge; 1ft. and 2ft. sea level rise scenarios; and the annual chance of flooding from FEMA. For several categories, these assets are sorted by zone location using the respecified boundaries. The actual number of structures that may be completely or partially inundated are limited; 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—and to the extent feasible—the state may need to consider:

- Relocating some of the existing at-risk facilities.
- Building future facilities further from the hazard areas.
- Incentivizing alternative means of providing critical services.

2. Impact Zones

In the 2022 and 2023 editions of the Annual Assessment of Flooding and Sea Level Rise, EDR identified three impact zones: High Impact Zone, Intermediate Impact Zone, and Dispersed Impact Zone. In this year's report, EDR has refined its analysis and delineated new boundaries for the High Impact Zone that are less than countywide. In addition, it has begun mapping and defining the two additional zones: the Intermediate Impact Zone and the Dispersed Impact Zone. According to the Federal Emergency Management Agency (FEMA), 50 Florida counties are exposed to coastal flooding. EDR considers those counties or portions of counties that lie either (1) within the FEMA coastal flooding zone but outside the High Impact Zone, or (2) in an area affected by certain other flooding factors, as part of the Intermediate Impact Zone. Based on FEMA studies, only 17 counties in Florida are not exposed to coastal flooding; however, two of these counties are significantly affected by other factors. This prompted EDR to move Orange and Seminole to the Intermediate Impact Zone, leaving 15 of the 17 counties identified by FEMA as neither exposed to coastal flooding, nor 1ft. and 2ft. sea level rise, to comprise the Dispersed Impact Zone. As its base, EDR uses the Sea, Lake and Overland Surges from Hurricanes (SLOSH) Model developed by the National Weather Service, a part of the National Oceanic and Atmospheric Administration (NOAA).[1]

2.1 High Impact zone

In last year's report, EDR generally defined the High Impact Zone to include all of Florida's coastal counties. As part of its ongoing effort to further refine and delineate the High Impact Zone boundaries, EDR now brings in the latest national studies developed by FEMA and NOAA. Rather than focus on entire counties, the updated analysis more narrowly targets those portions of a county that are most likely to be affected. At the same time, the analysis is relaxed to include those portions of non-coastal counties containing major rivers, creeks, and lakes that should also be included within this maximum risk area.

Hurricanes are a major flooding and destructive factor in Florida. In recent years, the state has been impacted by hurricanes with extreme storm surges. Therefore, EDR begins its analysis with the inclusion of all areas, coastal and non-coastal, that are at risk from storm surge associated with hurricane categories 4 and 5. Additionally, sea level rise may gradually and permanently cause inundation of some areas. Therefore, the 1ft. and 2ft. sea level rise scenarios are added to the analysis.[2]

In total, 47 counties may be affected by hurricane categories 4 and 5 storm surge, while 48 counties are projected to be impacted by both 1ft. and 2ft. sea level rise scenarios. Table 2.1.1

[1] https://www.nhc.noaa.gov/surge/slosh.php (Last retrieval date 10.9.2023)

[2] Dangendorf, S., Hendricks, N., Sun, Q. *et al* (2023). Acceleration of U.S. Southeast and Gulf coast sea-level rise amplified by internal climate variability. *Nat Commun* 14, 1935. https://doi.org/10.1038/s41467-023-37649-9

summarizes the number and square mileage of counties that may be affected by the selected flooding factors.

Table 2.1.1 Number and square mileage of counties at risk from four selected flooding factors

Counties	In 1 t. SLR	In 2 ft. SLR	In Cat. 4 Storm Surge	In Cat. 5 Storm Surge
# of Counties	48	48	47	47
Sq. Miles	2,888.80	3,084.29	10,994.06	11,593.51

The High Impact Zone now includes only those areas affected by a hurricane category 4 storm surge or a sea level rise of 2ft., covering a total of 11,885.6 square miles. Functionally, this is 28.3% of the affected county area. Figure 2.1.1 visually shows the more targeted zone that results from this analysis, and Table 2.1.2 displays the coverage area of the new boundaries by county. As more accurate data becomes available, EDR will continue to refine these boundaries.

Figure 2.1.1 High Impact Zone: the projections of hurricane category 4 storm surge merged with 2 ft. sea level rise scenario

Table 2.1.2 High Impact Zone: respecified coverage area

County	Total Area (Square Miles)	Area in High Impact Zone (Square Miles)	Area in High Impact Zone (%)
Bay	882.742	246.248	27.9%
Brevard	1295.16	471.159	36.4%
Broward	1221.51	37.123	3.0%
Calhoun	574.43	1.637	0.3%
Charlotte	745.71	316.245	42.4%
Citrus	604.096	178.847	29.6%
Clay	643.72	67.412	10.5%
Collier	2055.36	1161.386	56.5%
DeSoto	639.586	43.368	6.8%
Dixie	720.2671	411.632	57.1%
Duval	849.637	340.068	40.0%
Escambia	748.954	153.787	20.5%
Flagler	507.446	97.15	19.1%
Franklin	574.7923	451.288	78.5%
Gilchrist	355.447	17.903	5.0%
Gulf	571.587	336.711	58.9%
Hardee	638.305	0.1	0.0%
Hernando	494.723	108.431	21.9%
Hillsborough	1088.5	230.263	21.2%
Indian River	539.855	59.417	11.0%
Jefferson	612.319	114.695	18.7%
Lafayette	548.002	2.552	0.5%
Lake	1156.39	16.816	1.5%
Lee	894.1018	633.84	70.9%
Leon	701.923	49.656	7.1%
Levy	1151.33	484.439	42.1%
Liberty	843.238	65.569	7.8%
Manatee	796.243	165.79	20.8%
Marion	1662.66	6.069	0.4%
Martin	677.224	52.063	7.7%
Miami-Dade	2022.734	1406.737	69.5%
Monroe	1197.915	1197.915	100.0%
Nassau	669.24	278.913	41.7%
Okaloosa	996.18	85.601	8.6%
Palm Beach	2230.4	34.616	1.6%
Pasco	767.395	93.519	12.2%
Pinellas	334.4699	235.105	70.3%
Putnam	827.346	145.065	17.5%
Santa Rosa	1147.79	235.825	20.5%
Sarasota	605.768	290.048	47.9%
Seminole	344.863	2.695	0.8%
St John	673.628	239.559	35.6%
St Lucie	615.062	69.168	11.2%
Taylor	1051.76	411.129	39.1%
Volusia	1265.83	358.04	28.3%
Wakulla	629.033	321.924	51.2%
Walton	1148.58	147.617	12.9%
Washington	615.554	10.455	1.7%
TOTAL	**41,938.8**	**11885.6**	**28.3%**

2.2 Intermediate Impact Zone

In the previous year's report, the Intermediate Impact Zone was briefly presented and defined as 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.

Recent flooding and storm events demonstrate that the impact of hurricanes and storm surge can extend well beyond the coastal counties. According to FEMA, 50 Florida counties are exposed to coastal flooding.[3] Therefore, EDR considers those counties or portions of counties that lie either (1) within the FEMA coastal flooding zone but outside the High Impact Zone, or (2) in an area affected by certain other flooding factors, as part of the Intermediate Zone.

2.3 Dispersed Impact Zone

Based on FEMA studies, only 17 counties are not exposed to coastal flooding; however, the projection of 1ft. and 2ft. sea level rise scenarios and hurricane categories 4 and 5 storm surge showed that some areas of Orange and Seminole counties may be at significant risk from other types of flooding. Therefore, EDR considers only 15 of the 17 counties identified by FEMA as

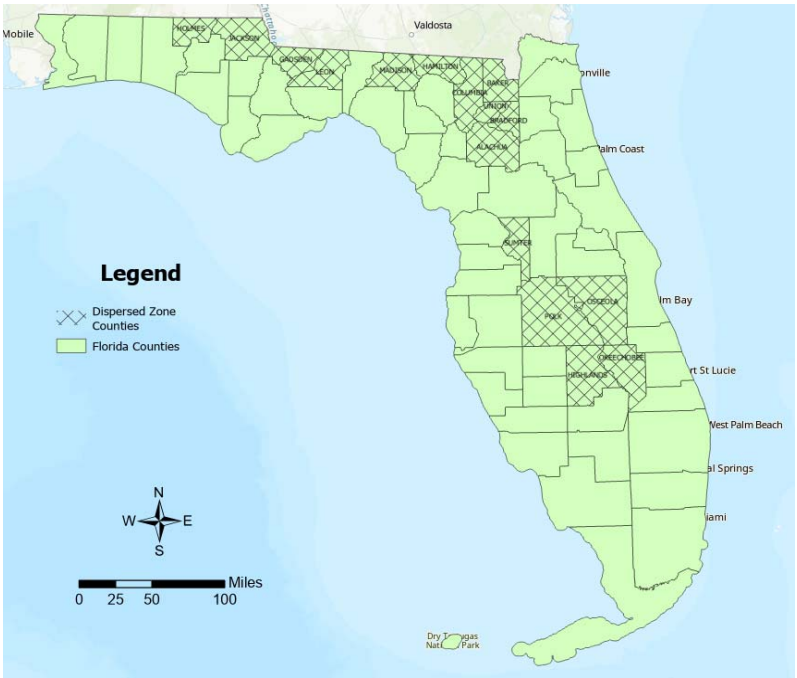


Figure 2.3.1 Dispersed Zone Counties: Alachua, Baker, Bradford, Columbia, Holmes, Okeechobee, Union, Gadsden, Hamilton, Highlands, Jackson, Madison, Osceola, Polk, and Sumter

[3] https://msc.fema.gov/portal/resources/download#HazusDownloadAnchor (Last retrieval date 10.9.2023)

comprising the Dispersed Impact Zone. Orange and Seminole counties have been reassigned to the Intermediate Impact Zone. With the exception of Leon County, only whole counties are currently used for the Dispersed Impact Zone.

2.4 Mapped High, Intermediate, and Dispersed Impact Zones

Figure 2.4.1 depicts the newly revised High Impact, Intermediate, and Dispersed impact zones.

Figure 2.4.1 Depiction of three impact zones: High Impact Zone, Intermediate Impact Zone and Dispersed Impact Zone

3. Critical Asset Exposure & Assessment

Exposure is defined as the number of assets, people, and sensitive environmental and cultural resources within a hazard area. In the following section, EDR presents the exposure risk of critical assets.

In 2021, the Florida Legislature defined "critical assets" for the purpose of statewide flooding and sea level rise planning. According to s. 380.093, F.S., critical assets include:

1. Transportation assets and evacuation routes, including airports, bridges, bus terminals, ports, major roadways, marinas, rail facilities, and railroad bridges. In this category, EDR presents an assessment of airports and ports in this year's report.

2. Critical infrastructure, including wastewater treatment facilities and lift stations, storm water treatment facilities and pump stations, drinking water facilities, water utility conveyance systems, electric production and supply facilities, solid and hazardous waste facilities, military installations, communications facilities, and disaster debris management sites. In this category, EDR presents an assessment of wastewater treatment facilities, solid waste landfills, power plants and military bases in this year's report.

3. Critical community and emergency facilities, including schools, colleges, universities, community centers, correctional facilities, disaster recovery centers, emergency medical service facilities, emergency operation centers, fire stations, health care facilities, hospitals, law enforcement facilities, local government facilities, logistical staging areas, affordable public housing, risk shelter inventory, and state government facilities. In this category, EDR presents an assessment of colleges, universities, correctional facilities, health care facilities (including emergency medical service facilities, emergency operation centers, health care facilities, and hospitals), fire stations, and law enforcement facilities in this year's report.

4. Natural, cultural, and historical resources, including conservation lands, parks, shorelines, surface waters, wetlands, and historical and cultural assets. In this category, EDR presents a preliminary assessment of historical and cultural assets, and parks (natural preserves and recreational parks) in this year's report.

3.1 Critical Infrastructure and Transportation Inventory

Wastewater treatment facilities, solid waste landfills, power plants, seaports, airports and military bases are assessed in this section. For the first time, the assets are categorized based on the zones in which they are located (see Table 3.1.1 below). Detailed maps are provided in Appendix A.

Table 3.1.1 Number of Critical Infrastructure and Transportation Assets at risk from flooding

Facility	*Total*	*High Impact Zone*	*Intermediate Impact Zone*	*Dispersed Impact Zone*
Solid Waste Landfill	12345	3042	7597	1706
Wastewater	2833	233	2337	263
Power Plants	45	8	27	10
Military Bases	39	27	10	2
Port Facilities	1100	1002	83	15
Airport Runways	618	117	375	126
Airport Points	1491	268	927	296

3.2 Critical Community and Emergency Facilities Inventory

This year, EDR updates its assessment for Critical Community and Emergency Facilities to align better with the statutory category. For the first time, the assets are categorized based on the zones in which they are located (see Table 3.2.1 below).[4,5] Detailed maps are provided in Appendix B.

Table 3.2.1 Critical Community and Emergency Assets at risk from flooding

Facility	*Total*	*High Impact Zone*	*Intermediate Impact Zone*	*Dispersed Impact Zone*
Fire Stations	2125	534	1269	322
Schools	5449	1286	5259	578
Medical Centers	517	140	322	55
Law Enforcement	915	252	550	113
Correctional Facilities	331	61	180	90
Places of Worship	18537	3776	12438	2323
Emergency Operation Centers | Medical Services	588	223	314	51

[4] 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.

[5] Hospitals (ESRI USHospitals data-base) Esri, United States Geological Survey, U.S. Geographic Names Information System

3.3 Cultural, and Historical, and Natural Resources Inventory

For Cultural, Historical, and Natural Resources, EDR performs a preliminary analysis of certain cultural resources (Table 3.3.1) as proof of concept prior to moving on to zone assessment. For the first part of this analysis, the data is drawn from the Florida Master Site File, which is the State of Florida's official inventory of historical cultural resources. Resource categories recorded on the Site File include archaeological sites, historical structures, historical cemeteries, historical bridges, and historic districts.[6] It is important to note that the various flooding factors could affect these sites in unusual ways as their physical features differ (open space versus enclosed, buried versus uncovered, buildings versus ruins, etc.).

Table 3.3.1 Cultural and Historical Resource Assets at risk from flooding

Cultural Resource	Total #	Cat 1 Storm Surge # (%)	Cat 4 Storm Surge # (%)	Cat 5 Storm Surge # (%)	1 ft. SLR # (%)	2 ft. SLR # (%)	FEMA Flood Zone # (%)
Historical Structures	209368	18136 (8.66%)	67713 (32.24%)	81128 (38.75)	310 (0.14%)	1409 (0.67%)	50268 (24%)
Historical Cemeteries	1958	76 (3.88%)	391 (19.97%)	491 (25.07%)	30 (1.53%)	38 (1.94%)	448 (22.9%)
National Register	1879	423 (22.51%)	853 (45.40)	947 (50.40%)	286 (15.22)	329 (17.51%)	850 (45.23%)
Resource Groups	3445	860 (24.96%)	1438 (41.74%)	1584 (45.98%)	693 (20.11%)	756 (21.95%)	Data Issues

A second analysis focuses on parks and recreational areas, using a dataset obtained from the Florida Department of Agriculture and Consumer Services (FDACS) website.[7] Table 3.3.2 shows the results for selected flooding risks and scenarios. The underlying dataset includes neighborhood parks, boat ramps, nature parks, athletic centers, playgrounds, dock and piers, mixed use recreation areas, water and beach accesses, and public open spaces.

Table 3.3.2 Parks and Recreational Area Assets at risk from flooding (FDACS data)

Natural Resource	Total # (Acres)	Cat 1 Storm Surge # (Acres)	Cat 4 Storm Surge # (Acres)	Cat 5 Storm Surge # (Acres)	1 ft. SLR # (Acres)	2 ft. SLR # (Acres)	FEMA Flood Zone # (Acres)
Parks & Rec. Areas	12800 (301,303.3)	2165 (32,791.5)	5326 (69,620.5)	5997 (77,793.4)	266 (10,373.2)	515 (15,475.6)	6616 (147,688.3)

[6] https://dos.myflorida.com/historical/about/division-faqs/master-site-file/#:~:text=Q%3A%20What%20is%20the%20Florida,historical%20bridges%20and%20historic%20districts.
[7] Data from Florida Department of Agriculture and Consumer Services: https://geodata.floridagio.gov/datasets/FDACS::park-and-recreation-areas-2019/explore?location=28.153373%2C-83.379273%2C7.75

An alternative set of data on parks and recreation areas is available from the Department of Transportation (FDOT).[8] This dataset categorizes parks and recreational areas into 12 types, including Wildlife Management Areas; State Forests; State Parks with Campsite; State Parks; Recreational Areas with Campsites; Recreational Areas; National Wildlife Refuges; National Parks; National Monuments; National Forests; Marine Sanctuaries; and Great Florida Birding Trail Gateway Sites. There may be overlap between the FDOT and FDACS datasets; however, a number of significant sites, including wildlife refuges, wildlife management areas, and state reserves are missing from the FDACS dataset (Table 3.3.3).

Table 3.3.3 Parks and Recreational Area Assets at risk from flooding (FDOT data)

Natural Resource	Total #	Cat 1 Storm Surge #	Cat 4 Storm Surge #	Cat 5 Storm Surge #	1 ft. SLR #	2 ft. SLR #	FEMA Flood Zone #
FDOT Parks & Rec. Areas	501	78	174	190	41	54	276

4. Risk Assessment

According to s. 380.093, F.S., at least two local sea level rise scenarios, which must include the 2017 NOAA intermediate-low and intermediate-high sea level rise projections for the years 2040 and 2070, should be considered for the Resilient Florida Grant Program. While not a requirement for this assessment, EDR has adopted this as guidance. Table 4.0.1 shows these scenarios.[9]

Table 4.0.1 NOAA 2017: intermediate-low and intermediate-high sea level rise projections

GMSL Scenario NOAA 2017 Technical Report	2040	2070
Intermediate-Low	0.59 ft.	1.14 ft.
Intermediate-High	~1 ft.	2.59 ft.

The data acquired from NOAA offers sea level rise projections of 1ft., 2ft., and 3ft., which are the closest values to the NOAA Intermediate Low and High scenarios. In this year's study, EDR continues its economic and infrastructure assessments, considering sea level rise scenarios of 1ft. and 2ft. In addition, the assessments include the projected impacts of storm surge induced by

[8] FDOT Parks and Rec Areas data (last update 2017): https://gis-fdot.opendata.arcgis.com/datasets/fdot::parks-and-recreation/about

[9] The 2022 technical report is now available. For Florida, NOAA presents three estimates for 2060: Virginia Key at 1.80 ft.; St. Petersburg at 2.29 ft.; and Pensacola at 2.16 ft. The sea level rise scenarios for 2050 for the contiguous United State are projected as intermediate-Low: 1.18 ft.; Intermediate: 1.31ft., and Intermediate-High: 1.51ft. https://tidesandcurrents.noaa.gov/publications/techrpt83_Global_and_Regional_SLR_Scenarios_for_the_US_final.pdf (Last retrieval date 10.9.2023)

hurricane categories 1, 4 and 5. For next year's report, the respective results will be updated, overlaid and merged into the three zones: high impact, intermediate impact and dispersed impact.

4.1 Partial Economic Impact Assessment

This section includes an assessment of property that would be at risk from storm surges associated with hurricane categories 1, 4, and 5, in addition to 1ft. and 2ft. sea level rise scenarios. This section should be read with the accompanying Part 2 of Chapter 6 for implications regarding property insurance.

Just value data from local ad valorem tax rolls is used to assess the dollar value of the properties within the geographical areas defined by the selected flooding factors.[10] Table 4.1.1 shows these values for the five scenarios that EDR has determined fall within the probability range for the next 50 years. Monroe County generally has the greatest shares of its property exposed to the risks from storm surge and sea level rise, but Miami-Dade faces a greater potential dollar loss from storm surge and Palm Beach faces a greater potential dollar loss from sea level rise.

Table 4.1.1 Property value at risk from hurricane categories 1, 4 and 5 storm surge, and 1ft. and 2ft. sea level rise in coastal areas

County	Total Property JV ($)	Property JV for Cat. 1 Storm Surge	Property JV for Cat. 4 Storm Surge	Property JV for Cat. 5 Storm Surge	Property JV at 1 ft. SLR	Property JV at 2 ft. SLR
Bay	31,267,916,950	4,361,560,502	15,467,574,912	19,842,413,089	5,327,259,929	5,648,480,965
Brevard	95,102,672,000	9,757,061,870	33,083,736,110	41,451,483,720	10,948,220,240	12,607,344,870
Broward	360,525,244,470	27,180,016,780	82,396,919,710	99,960,550,670	12,707,622,030	42,812,463,570
Charlotte	38,691,649,085	21,627,487,958	36,909,578,465	38,691,649,085	8,284,673,978	9,807,520,237
Citrus	19,383,887,008	3,619,204,207	5,888,167,007	6,286,054,371	1,694,892,410	1,978,707,076
Collier	182,007,875,827	108,885,659,538	177,316,896,536	178,229,684,593	35,076,235,196	41,302,004,200
Dixie	1,583,827,722	511,659,593	971,354,980	1,099,282,605	354,893,526	395,146,440
Duval	130,652,370,568	12,034,401,176	51,258,681,107	63,015,101,191	10,518,407,492	11,309,467,568
Escambia	38,128,985,429	5,071,628,910	11,812,977,455	12,668,415,653	5,882,371,444	6,338,769,976
Flagler	21,271,061,736	3,068,104,710	9,490,416,369	13,898,288,497	2,535,343,303	2,753,537,018
Franklin	3,972,574,838	2,099,789,238	3,835,973,270	3,901,022,595	1,497,887,323	1,664,399,709
Gulf	4,577,562,993	1,443,794,144	3,694,026,941	3,981,906,966	1,240,595,458	1,444,156,946
Hernando	24,380,299,489	1,451,531,630	4,984,454,737	7,251,884,244	541,444,224	750,288,128
Hillsborough	220,487,095,329	40,877,589,784	100,165,613,584	116,613,882,517	13,066,624,568	14,229,997,681
Indian River	36,462,721,995	8,015,698,256	18,963,670,754	20,434,951,167	5,123,713,549	5,916,152,538

[10] This data is from the 2022 property tax rolls compiled by the Department of Revenue. Since the property tax data is released in July of each year and the datasets need additional preparation for EDR's analysis, EDR is still working with the 2022 data. Next year's report will use the 2023 data.

Jefferson	1,725,632,185	20,124,246	85,857,253	130,593,868	8,349,411	8,692,241
Lee	172,453,667,854	78,415,904,194	156,796,146,105	164,204,863,205	21,323,478,708	26,959,044,983
Levy	6,198,371,152	878,050,525	1,805,848,165	2,092,595,703	395,876,082	461,875,509
Manatee	77,593,285,512	20,967,344,186	43,161,225,312	51,287,282,889	8,644,979,815	12,271,777,797
Martin	41,208,935,496	4,869,368,010	14,652,058,815	20,272,446,944	8,249,736,037	9,368,346,706
Miami Dade	416,119,947,820	65,687,335,866	258,335,726,056	315,689,213,982	37,652,967,614	48,050,716,781
Monroe	55,021,000,146	45,491,819,784	53,552,696,429	54,184,316,759	30,624,291,747	36,258,415,802
Nassau	16,909,611,767	2,554,943,356	12,266,253,615	13,802,156,782	64,000,000	1,696,728,071
Okaloosa	35,944,188,224	2,849,852,326	14,576,648,789	17,595,747,125	5,163,250,349	5,992,887,854
Palm Beach	388,377,448,498	19,298,116,191	80,742,144,939	97,070,771,889	51,565,542,385	60,362,769,491
Pasco	65,540,467,557	6,250,279,188	19,019,542,162	22,105,938,123	2,346,954,721	2,666,794,066
Pinellas	178,002,599,140	34,437,262,799	125,488,520,895	126,494,229,197	29,980,624,723	34,437,262,799
Santa Rosa	24,801,693,153	1,881,497,265	7,000,615,176	8,464,059,769	3,102,386,192	3,491,466,787
Sarasota	129,542,382,100	44,623,478,300	100,021,800,300	109,413,667,900	21,284,002,800	24,611,997,400
St. Johns	59,123,103,576	9,629,252,413	30,757,057,179	34,243,660,898	4,869,424,318	6,043,255,122
St. Lucie	49,675,436,835	4,359,041,270	8,201,490,676	11,460,741,044	3,646,607,329	4,226,726,574
Taylor	2,155,674,272	523,896,212	919,945,642	1,031,130,502	271,145,000	310,476,570
Volusia	79,463,959,001	6,435,687,654	35,846,937,765	39,075,217,857	5,934,774,653	6,852,207,884
Wakulla	3,310,774,474	699,163,096	2,635,195,944	2,867,466,857	460,357,424	520,100,377
Walton	44,392,612,698	4,478,688,068	16,996,919,766	20,793,500,482	4,377,390,030	5,072,498,300

Within the coastal counties, the total just value at risk from the selected flooding factors is summarized in Table 4.1.2. These numbers can be used to create a functional range: within the next 50 years, it is feasible that coastal property valued between $354.8 billion and $1.74 trillion could be at risk from flooding. In percentage terms, this equates to 11.6% to 56.9% of all value in the coastal area.

Table 4.1.2 Total property value within coastal counties at risk from the five flooding factors

All Counties	Total JV $	Cat. 1 Storm Surge	Cat. 4 Storm Surge	Cat. 5 Storm Surge	1 ft. SLR	2 ft. SLR
Total $	3,056,056,536,899	604,356,293,245	1,539,102,672,920	1,739,606,172,738	354,766,324,008	448,622,478,036

The at-risk value that is presented in this section is pulled from the parcels that are touched by one or more of the flooding factors (storm surge or sea level rise); however, in a substantial number of instances, only a portion of the parcel is affected. Because of this, the calculated values for the individual scenarios will tend to be higher than the actual value that is affected by flooding. It should be noted that in some areas, properties at the edges of water bodies, lakes, and rivers will also be affected by sea level rise and other flooding factors. Over the long term, these

areas may experience erosion, change of habitat, and wetland expansion. These issues will be addressed in greater detail in the next report.

The non-coastal counties (shown below) have been chosen because one or more of the selected flooding factors affect at least one of the parcels in those counties; however, not all parcels in these counties would be affected by the flooding factors in the same ways. For example, in Calhoun and Lafayette counties, the extent of sea level rise or storm surge may reach to the low-lying areas around certain bodies of water, but the analyzed maps suggest that the property values and assets would not be adversely affected. Table 4.1.3 summarizes the value assessment of non-coastal counties in the event that one or more of the flooding factors occurs (hurricane categories 1, 4, and 5 storm surge, or 1ft. and 2ft. sea level rise). Overall, Putnam has the greatest share of its property exposed to the risks from storm surge and sea level rise, but Clay has the greatest potential dollar loss from both.

Table 4.1.3 Property value at risk from hurricane categories 1, 4 and 5 storm surge, and 1ft. and 2ft. sea level rise in non-coastal areas

	Total Property Just Value	Value at Cat. 1 Storm Surge	Value at Cat. 4 Storm Surge	Value at Cat. 5 Storm Surge	Value at 1 ft. SLR	Value at 2 ft. SLR
Calhoun*	914,890,271	0	10,803,971	24,775,398	0	0
Clay	24,204,363,912	962,668,634	4,433,930,155	6,174,427,913	1,476,412,806	1,633,261,713
DeSoto	4,935,182,245	103,199,214	751,543,735	1,263,422,793	2,068,910	2,068,910
Gilchrist**	1,777,855,450	15,110,062	127,888,306	180,587,351	25,229,181	26,169,020
Hardee*	3,712,218,980	0	22,448,729	41,137,786	0	0
Hendry*	7,500,371,548	3,448,572	3,448,572	3,448,572	0	3,448,572
Lafayette*	810,797,679	0	6,473,192	13,045,257	0	0
Lake**	46,588,581,244	146,469,452	162,918,611	166,307,979	49,767,785	53,271,693
Leon	33,969,245,230	0	326,418,943	562,359,385	0	0
Liberty	866,100,724	10,467,559	67,353,093	96,694,007	9,803,829	11,311,233
Marion*	45,130,539,647	47,853,969	62,261,694	77,059,673	32,658,261	44,143,729
Orange**	253,624,441,689	0	0	0	111,268,114	111,268,114
Putnam	7,757,936,332	877,820,357	1,577,684,381	1,782,788,294	1,218,593,648	1,283,642,298
Seminole*	65,334,302,538	0	0	0	60,047,999	61,967,454
Washington**	1,905,997,968	2,650,275	12,371,516	14,035,372	17,992,311	20,440,447

* Small portions of parcels around certain rivers may be affected, but entire parcels would not be affected.
**As the sea level rise projection goes further upstream, it touches more parts of the county; however, the values associated with sea level rise should be less than what is shown here, as it only touches the edges of individual parcels.

Although, Hendry County shows a negligible amount of assets at risk from the selected flooding factors, its location and the impact of recent events (Hurricane Ian 2022) makes it prone to damage and economic loss. Therefore, Hendry is included in the Intermediate Impact Zone in EDR studies.

Because the impact of flooding factors will vary across different types of property, the following tables present an overview of individual categories at risk from the selected flooding factors within the coastal area. These categories are based on the ad valorem use codes which include the following types of property: residential, commercial, industrial, agricultural, institutional, governmental and miscellaneous. For an explanation of each category, please see the Department of Revenue (DOR) 2022 Users' Guide.[11]

In instances where the analysis shows that only a portion of a parcel may be in the inundation zone, the included dollar value reflects the total value of the parcel, as limiting the calculation to only the value of the affected portions is not feasible at this stage. This is due both to the map resolution and the accuracy of data.

Residential Category

According to the DOR 2022 User's Guide, the Residential Category includes all vacant, single, multi-family, mobile and retirement homes, as well as condominiums and cooperatives. For the purposes of this assessment, multi-family homes of 10-units or more are also considered in the residential category (Table 4.1.4). Just over one-half (50.6%) of the total value in coastal counties is classified as residential when defined in this manner. Statewide, 58.5% of the potential impact of storm surge associated with a category 4 hurricane is residential. The results are even more disproportionate for a 2ft. sea level rise where 70.7% of the impact is residential.

Table 4.1.4 Coastal Counties Residential Category Value

	Total	1 ft. SLR	2 ft. SLR	Cat. 4	Cat.5
Bay	673,951,853	188,853,688	201,450,496	423,083,174	471,289,786
Brevard	364,897,100	130,632,470	142,291,610	235,076,150	283,140,690
Broward	96,432,231,520	20,609,967,580	27,448,929,380	43,805,587,960	49,359,360,640
Charlotte	26,054,004,529	7,294,569,058	8,586,595,970	25,183,625,648	26,013,385,686
Citrus	13,200,784,257	1,027,717,212	1,269,774,102	3,723,743,271	3,983,908,753
Collier	124,392,293,083	34,301,436,547	40,767,812,582	122,355,885,430	122,906,434,112
Dixie	266,141,600	176,340,200	185,475,800	238,759,700	245,371,700
Duval	70,888,262,407	6,384,713,273	7,011,021,452	30,640,114,679	37,481,911,138
Escambia	21,555,623,375	1,369,936,287	1,652,641,424	4,467,710,529	5,137,978,923
Flagler	15,643,467,134	2,226,038,853	2,414,856,398	7,254,816,950	10,501,883,736
Franklin	2,796,343,962	1,031,035,896	1,149,069,063	2,725,190,672	2,764,146,818
Gulf	2,778,006,147	641,122,325	789,403,740	2,240,854,571	2,440,008,050
Hernando	17,046,996,405	464,382,328	648,249,976	3,797,994,258	5,712,240,578
Hillsborough	118,768,178,354	7,719,174,747	8,746,966,064	58,574,360,159	66,890,721,122

[11] https://floridarevenue.com/property/dataportal/Documents/PTO%20Data%20Portal/User%20Guides/User%27s%20Guide.pdf (Last retrieval date 10.9.2023)

Indian River	25,519,819,505	4,066,293,973	4,629,582,324	13,870,849,404	14,574,641,272
Jefferson	567,717,532	330,764	352,833	1,983,832	8,468,664
Lee	106,196,235,415	19,049,349,635	23,582,031,570	99,221,118,573	102,851,585,893
Levy	2,519,992,290	187,925,453	214,814,237	720,825,928	880,565,041
Manatee	51,383,809,623	6,332,683,666	8,792,416,255	27,633,726,892	33,217,848,248
Martin	24,910,741,488	6,811,833,977	7,747,588,367	10,747,195,906	14,269,846,905
Miami Dade	200,568,090,121	26,714,254,979	33,074,453,973	137,267,451,841	165,021,667,874
Monroe	39,092,966,077	22,323,410,669	26,253,783,564	38,422,941,456	38,670,629,758
Nassau	12,244,444,908	1,077,806,851	1,215,684,071	9,176,061,869	10,346,798,964
Okaloosa	23,244,186,990	3,104,711,342	3,658,612,983	8,599,885,634	14,925,990,522
Palm Beach	221,559,223,622	36,307,108,237	42,624,602,699	55,143,949,243	66,755,981,761
Pasco	43,288,376,195	2,225,418,010	2,465,119,684	13,985,873,077	16,139,083,849
Pinellas	104,033,632,738	22,528,265,524	26,166,144,531	79,605,589,770	83,067,312,254
Santa Rosa	19,279,020,180	2,125,039,309	2,477,321,995	5,429,936,898	6,658,833,154
Sarasota	30,456,780,700	15,674,184,900	17,412,487,500	28,491,911,500	29,092,268,400
St Johns	44,895,930,060	3,769,580,476	4,756,544,129	25,138,668,964	27,719,320,122
St Lucie	4,538,602,722	1,588,153,200	1,879,398,600	2,871,147,540	3,313,908,940
Taylor	958,046,846	189,912,720	220,179,020	498,869,050	537,254,900
Volusia	48,073,422,915	4,367,639,457	4,965,766,592	24,382,792,466	26,152,878,658
Wakulla	1,967,793,877	290,577,097	331,168,582	1,699,562,128	1,852,234,292
Walton	31,683,531,201	3,088,290,620	3,571,151,728	12,271,653,890	14,888,023,302

Commercial Category

According to the DOR 2022 User's Guide, the Commercial category includes airports, bus terminals, ports, and marinas. Table 4.1.5 shows the at-risk value of commercial property. The number of at-risk airports and ports is also analyzed and presented in the section entitled Critical Infrastructure and Transportation Inventory (Section 3.1). Well less than ten percent (8.3%) of the total value in coastal counties is classified as commercial when defined in this manner. A similar percentage (8.2%) of the potential impact from a storm surge (category 4 hurricane) is commercial, but only 5.9% of the coastal impact associated with a 2ft. sea level rise is commercial. Monroe has the greatest shares of its commercial property at risk from sea level rise, but Charlotte, Collier, Franklin and Lee face greater relative risk to their commercial property from a storm surge. Miami-Dade has the largest dollar values at risk.

Table 4.1.5 Coastal Counties Commercial Category Value

	Total	1 ft. SLR	2 ft. SLR	Cat. 4	Cat.5
Bay	3,229,279,401	263,458,107	439,841,962	1,186,885,642	1,697,888,200
Brevard	6,230,648,130	329,137,860	370,286,170	1,810,138,350	2,743,228,860

Broward	41,844,654,750	2,740,058,660	3,367,371,090	10,945,002,950	14,317,162,480
Charlotte	2,252,155,628	259,538,523	303,232,338	2,193,040,326	2,249,589,720
Citrus	1,258,568,103	81,103,320	96,046,370	619,352,859	628,449,101
Collier	8,926,207,437	791,341,758	853,114,967	8,769,806,430	8,771,726,793
Dixie	43,017,534	9,409,234	9,447,734	25,050,634	25,482,234
Duval	15,439,522,467	563,238,500	647,366,378	5,408,161,300	6,611,861,994
Escambia	4,117,738,561	97,232,555	103,490,244	856,410,792	923,948,074
Flagler	892,099,301	68,778,388	70,766,363	316,356,355	588,162,841
Franklin	100,891,848	14,519,929	16,902,888	98,604,749	99,880,908
Gulf	132,347,126	7,523,696	11,143,091	116,999,731	118,626,064
Hernando	1,604,761,180	17,263,935	19,086,432	468,888,353	557,943,318
Hillsborough	24,760,692,876	1,270,672,497	1,306,254,733	14,353,596,977	16,773,716,424
Indian River	1,611,004,824	67,501,829	80,135,993	797,086,014	1,017,038,740
Jefferson	42,866,243	0	0	0	7,433
Lee	13,390,637,556	895,772,229	1,132,155,016	12,903,544,044	13,143,618,617
Levy	255,905,391	16,449,778	18,226,637	52,855,860	67,432,465
Manatee	4,830,897,018	267,575,488	431,664,781	3,137,974,442	3,646,336,762
Martin	2,565,334,347	350,646,395	386,714,588	783,550,932	1,321,423,309
Miami Dade	32,635,804,200	4,906,615,827	5,577,361,640	24,652,890,265	28,046,044,064
Monroe	7,528,777,101	3,613,633,369	3,613,633,369	7,040,413,026	7,320,336,375
Nassau	1,123,945,442	29,423,006	40,198,137	832,805,499	960,127,149
Okaloosa	2,642,655,397	233,710,389	287,185,408	825,208,137	1,240,489,060
Palm Beach	34,896,710,534	2,221,963,190	2,963,137,696	5,105,894,489	6,224,352,986
Pasco	5,038,496,315	40,300,347	94,265,865	1,494,824,109	1,705,624,891
Pinellas	10,668,122,316	1,531,562,110	1,691,349,012	8,036,370,610	8,405,394,821
Santa Rosa	1,281,462,235	82,434,333	83,256,938	283,472,388	394,172,015
Sarasota	9,851,961,500	1,011,991,300	1,303,734,100	6,975,912,800	8,032,106,000
St. Johns	3,520,372,046	260,946,875	309,217,440	1,941,939,134	2,178,436,416
St. Lucie	3,488,897,916	217,996,800	226,265,800	450,274,640	717,267,240
Taylor	109,300,990	6,312,370	6,507,440	15,980,200	16,455,340
Volusia	6,564,432,611	269,573,112	319,910,439	3,202,922,564	3,519,616,420
Wakulla	142,595,096	10,156,868	11,384,262	120,660,742	134,806,910
Walton	2,059,099,952	75,336,350	94,715,474	725,168,166	974,272,764

Industrial Category

None of the Industrial Category items listed in the DOR 2022 User's Guide are considered critical assets. Table 4.1.6 shows the general values of industrial property at risk from flooding. Only 3.0% of the total value in coastal counties is classified as industrial. A moderately lower

percentage (2.3%) of the potential impact from a storm surge (category 4 hurricane) is industrial, but only 0.6% of the coastal impact associated with a 2ft. sea level rise is industrial. Monroe has the greatest shares of its industrial property at risk from sea level rise and storm surge, but Miami-Dade has the largest dollar values at risk.

Table 4.1.6 Coastal Counties Industrial Category Value

	Total	1 ft. SLR	2 ft. SLR	Cat. 4	Cat.5
Bay	560,258,703	47,598,126	52,083,101	97,747,762	186,287,032
Brevard	1,851,307,300	43,725,280	45,737,050	278,759,570	547,759,090
Broward	16,594,036,690	364,556,920	500,836,400	2,081,694,860	3,900,488,910
Charlotte	546,080,856	9,064,952	13,204,724	536,003,047	546,080,856
Citrus	145,360,180	3,102,590	5,153,080	51,388,250	53,239,710
Collier	1,869,630,253	12,314,538	20,672,291	1,808,970,014	1,808,970,014
Dixie	12,191,800	0	180,500	2,669,100	3,573,500
Duval	7,409,076,670	401,616,491	410,483,647	2,852,220,820	3,849,400,907
Escambia	636,282,451	57,705,074	58,560,393	103,687,876	114,335,231
Flagler	169,541,649	6,551,526	6,942,201	18,691,497	40,986,626
Franklin	17,010,722	4,717,847	5,842,216	16,394,098	16,974,922
Gulf	14,530,675	4,753,967	4,753,967	9,096,856	11,025,366
Hernando	326,386,097	872,060	872,060	28,298,900	32,611,058
Hillsborough	8,614,780,852	301,723,440	315,843,558	5,507,993,060	5,507,993,060
Indian River	307,783,268	4,744,383	4,744,383	66,043,334	173,557,207
Jefferson	10,280,928	0	0	0	0
Lee	3,373,750,067	40,983,244	53,776,933	3,206,557,070	3,358,417,544
Levy	24,921,662	105,056	105,056	4,566,463	4,607,855
Manatee	1,783,646,037	4,514,040	8,576,849	1,227,933,376	1,421,752,534
Martin	730,343,072	0	2,879,370	73,441,888	259,847,347
Miami Dade	27,251,894,141	617,633,401	755,799,248	12,353,450,406	15,227,146,533
Monroe	284,929,783	118,282,678	149,713,156	283,952,787	284,929,783
Nassau	194,253,887	69,756,028	69,756,028	155,101,510	160,580,696
Okaloosa	418,609,830	21,242,729	21,286,490	68,391,391	116,217,367
Palm Beach	8,488,175,840	19,761,593	22,613,190	355,852,410	407,134,807
Pasco	1,221,885,315	2,874,149	3,466,740	368,094,588	397,252,074
Pinellas	2,839,820,486	50,432,814	57,934,296	2,386,042,097	2,421,205,520
Santa Rosa	283,932,654	9,081,886	9,081,886	17,022,607	29,643,165
Sarasota	1,790,307,200	11,917,900	12,497,400	905,023,000	1,240,300,900
St Johns	534,975,886	10,736,887	18,559,513	186,709,828	203,802,345
St Lucie	1,291,696,751	19,948,151	21,597,651	78,746,451	122,082,651

Taylor	28,538,140	0	0	5,975,250	6,165,820
Volusia	1,312,155,076	26,930,664	38,991,277	458,482,959	458,482,959
Wakulla	32,747,859	8,874,917	8,874,917	30,402,633	31,597,141
Walton	237,697,873	5,991,880	6,127,348	43,432,365	67,275,662

Agricultural Category

None of the Agricultural Category items listed in the DOR 2022 User's Guide are considered critical assets. It should be noted that the impact of flooding on agricultural properties goes beyond land inundation, to include—but not limited to—saltwater intrusion and soil contamination.[12,13] Table 4.1.7 shows the general values of agricultural properties at risk from flooding. Only 1.6% of the total value in coastal counties is classified as agricultural. A moderately lower percentage (0.8%) of the potential impact from a storm surge (category 4 hurricane) is agricultural, and only 0.5% of the coastal impact associated with a 2ft. sea level rise is agricultural. Monroe has the greatest shares of its agricultural property at risk from sea level rise and storm surge, but Duval has the largest dollar values at risk from sea level rise and Miami-Dade has the largest dollars at risk from storm surge.

Table 4.1.7 Coastal Counties Agricultural Category Value

	Total	1 ft. SLR	2 ft. SLR	Cat. 4	Cat.5
Bay	257,167,445	47,336,459	54,541,806	86,319,411	112,246,314
Brevard	612,446,090	77,333,310	78,818,030	151,096,920	185,428,780
Broward	1,050,707,250	0	0	0	0
Charlotte	762,144,986	40,517,552	49,312,225	400,932,646	485,025,652
Citrus	656,963,128	40,124,815	43,903,055	165,193,858	176,243,763
Collier	1,355,124,195	21,871,278	44,863,209	547,453,815	648,654,683
Dixie	400,763,403	17,332,692	30,333,006	218,993,480	250,523,755
Duval	1,877,842,866	234,915,097	237,982,786	1,119,552,128	1,252,346,866
Escambia	542,295,897	6,125,519	10,823,837	26,812,404	38,788,442
Flagler	421,281,434	21,698,338	25,997,939	90,543,338	142,877,884
Franklin	52,782,896	18,946,559	21,418,059	49,985,096	51,447,896
Gulf	438,155,954	65,707,578	75,144,958	267,079,554	307,590,183
Hernando	1,127,035,325	2,876,242	3,397,452	40,344,038	50,674,898
Hillsborough	2,932,420,599	70,661,624	75,379,929	371,589,485	506,330,968
Indian River	1,643,846,688	6,367,239	10,065,349	52,216,367	79,109,031

[12] Craig, Heather, et al. (2021) Quantifying National-Scale Changes in Agricultural Land Exposure to Fluvial Flooding. *Sustainability*. 13(22): 1–16. doi: 10.3390/su132212495

[13] https://www.climatehubs.usda.gov/hubs/northeast/topic/minimizing-impacts-saltwater-flooding-farmland-eastern-us (Last retrieval date 10.9.2023)

Jefferson	824,561,319	879,608	879,608	26,365,117	51,580,342
Lee	1,505,819,732	129,892,945	163,947,598	1,110,416,210	1,239,763,461
Levy	2,109,463,842	69,481,849	92,537,225	586,309,612	658,585,252
Manatee	1,435,496,842	84,465,705	94,689,840	391,317,299	488,175,685
Martin	1,759,740,254	224,680,865	236,358,095	556,707,838	774,795,799
Miami Dade	4,218,949,581	48,638,444	124,644,536	3,844,961,319	3,912,707,264
Monroe	138,177	124,194	124,194	138,177	138,177
Nassau	1,116,012,438	202,963,092	209,129,290	581,194,398	625,217,181
Okaloosa	484,972,198	1,859,141	2,566,191	11,509,184	11,509,184
Palm Beach	9,195,070,677	16,913,236	16,913,236	17,239,110	17,239,110
Pasco	2,025,818,276	0	0	0	0
Pinellas	69,533,170	3,174,585	6,745,776	54,596,643	56,885,239
Santa Rosa	1,412,314,638	35,020,879	40,285,340	109,922,015	109,922,015
Sarasota	2,549,509,700	24,336,900	30,885,400	866,673,300	1,119,554,600
St Johns	1,263,578,467	177,296,361	230,548,761	468,931,890	555,975,361
St Lucie	1,918,585,789	1,940,114	2,800,859	4,005,040	16,568,202
Taylor	461,638,680	22,762,720	26,300,410	159,744,610	192,622,950
Volusia	1,521,681,996	59,061,485	64,028,414	142,267,415	225,301,730
Wakulla	379,325,591	32,575,772	37,111,254	317,863,950	336,779,027
Walton	546,922,822	14,467,989	16,178,677	25,147,421	29,240,654

Institutional Category

Based on the DOR 2022 User's Guide, some of the Institutional Category properties are critical assets under the Critical Community and Emergency Facilities grouping. This category includes churches (places of worships); private schools and hospitals; cultural organizations; and community centers. Table 4.1.8 shows the value of institutional properties at risk from flooding. Only 2.0% of the total value in coastal counties is classified as institutional. A similar percentage (1.9%) of the potential impact from a storm surge (category 4 hurricane) is institutional, but only 1.4% of the coastal impact associated with a 2ft. sea level rise is institutional. Monroe has the greatest share of its institutional property at risk from sea level rise, but Charlotte has the greatest share of its institutional property at risk from storm surge. Duval and Miami-Dade have the largest dollar values at risk from sea level rise, and Miami-Dade by itself has the largest dollars at risk from storm surge.

Table 4.1.8 Coastal Counties Institutional Category Value

	Total	1 ft. SLR	2 ft. SLR	Cat. 4	Cat.5
Bay	380,998,324	9,661,113	9,931,669	68,414,068	122,557,335
Brevard	1,879,129,970	207,913,570	215,871,420	463,854,200	830,541,460

Broward	7,079,748,220	211,784,290	223,498,950	1,414,665,900	2,006,869,910
Charlotte	403,198,950	15,947,198	18,329,430	396,781,502	402,882,367
Citrus	462,674,948	2,405,682	4,115,134	122,727,640	125,181,770
Collier	2,385,114,675	195,074,265	213,348,929	2,143,036,971	2,144,163,126
Dixie	16,926,000	0	254,900	4,278,500	5,795,000
Duval	4,456,683,193	955,293,762	963,182,617	2,149,711,162	2,419,293,229
Escambia	997,099,349	15,726,084	16,607,162	59,385,153	66,533,543
Flagler	179,881,927	0	10,300,440	60,594,732	119,841,380
Franklin	33,453,198	5,827,121	5,827,121	25,608,746	26,654,416
Gulf	44,281,607	0	0	29,665,077	31,776,342
Hernando	464,254,029	2,386,896	2,386,896	184,572,925	200,062,376
Hillsborough	6,474,413,067	589,588,074	617,344,162	2,926,601,378	3,591,244,116
Indian River	552,955,957	67,984,886	92,794,132	247,477,735	327,081,212
Jefferson	34,457,580	0	320,761	6,298,607	7,013,294
Lee	2,350,876,270	524,569,591	525,704,904	2,173,711,065	2,273,611,255
Levy	79,662,763	648,662	1,638,571	13,455,291	18,501,558
Manatee	1,575,234,809	116,522,301	139,373,109	1,053,611,914	1,179,819,680
Martin	648,640,822	60,097,540	72,015,520	189,291,478	267,790,782
Miami Dade	9,713,452,407	865,091,752	1,119,217,406	6,805,097,034	7,844,911,837
Monroe	498,798,608	138,578,016	173,556,366	472,741,224	491,977,404
Nassau	265,907,340	13,542,227	13,725,683	171,116,012	208,415,213
Okaloosa	399,090,573	13,624,550	22,238,419	66,969,606	105,028,907
Palm Beach	6,484,892,499	317,107,864	478,759,552	982,673,360	1,143,753,235
Pasco	3,218,550,678	62,906,248	68,895,792	964,624,239	1,195,189,300
Pinellas	5,110,428,912	502,483,375	537,146,295	3,246,154,930	3,683,011,142
Santa Rosa	338,038,073	9,867,153	11,123,879	84,108,280	118,186,966
Sarasota	2,407,330,600	346,938,500	383,959,400	1,710,414,300	1,956,153,500
St Johns	797,187,500	171,550,402	181,809,512	489,282,099	565,016,204
St Lucie	811,326,721	19,363,400	22,255,200	52,184,800	85,136,400
Taylor	36,274,690	0	190,180	3,609,010	5,260,740
Volusia	1,659,925,206	54,663,966	54,840,246	699,971,861	802,991,734
Wakulla	31,689,682	494,852	699,894	23,119,766	27,565,003
Walton	233,680,555	32,331,938	32,389,243	90,249,989	101,165,274

Governmental Category

Based on the DOR 2022 User's Guide, some of the Governmental Category properties are critical assets under the following groupings: Critical Infrastructure; Critical Community and Emergency Facilities; and Natural, Cultural and Historical Resources. This category includes

parks and recreational areas; non-private and public schools and hospitals; and military installations. Table 4.1.9 shows the value of governmental properties at risk from flooding. Only 4.6% of the total value in coastal counties is classified as governmental. A slightly higher percentage (5.5%) of the impact from a storm surge (category 4 hurricane) is governmental, and a much higher 8.0% of the coastal impact associated with a 2ft. sea level rise is governmental. Escambia has the greatest share of its governmental property at risk from sea level rise, but Monroe has the greatest share of its governmental property at risk from storm surge. Miami-Dade has the largest dollar values at risk from both sea level rise and storm surge.

Table 4.1.9 Coastal Counties Governmental Category Value

	Total	1 ft. SLR	2 ft. SLR	Cat. 4	Cat.5
Bay	3,823,828,144	2,801,723,110	2,805,007,128	3,103,460,362	3,144,613,936
Brevard	6,435,821,140	2,328,134,470	2,455,828,230	3,709,167,200	4,137,006,500
Broward	15,932,703,380	2,283,842,830	2,833,970,810	5,748,284,110	6,423,366,480
Charlotte	1,416,816,299	256,953,734	262,608,963	1,048,027,213	1,383,441,965
Citrus	1,131,329,352	239,651,845	246,929,215	548,243,393	631,284,393
Collier	1,795,752,444	269,753,505	282,669,988	1,568,322,673	1,579,899,587
Dixie	148,660,200	91,500,100	92,786,700	108,285,500	109,144,800
Duval	6,444,962,601	1,831,236,839	1,947,999,168	4,379,380,761	4,735,241,595
Escambia	4,054,459,584	3,242,409,727	3,264,519,751	3,488,100,939	3,495,534,989
Flagler	555,562,463	63,697,604	64,902,919	148,705,590	313,733,499
Franklin	395,715,271	286,426,590	295,581,790	388,612,414	392,464,383
Gulf	589,784,279	426,137,324	439,115,178	532,053,945	542,325,358
Hernando	1,250,041,928	39,566,393	55,350,336	256,394,529	336,831,896
Hillsborough	12,455,455,500	2,909,238,392	2,932,600,156	7,733,903,370	8,641,500,699
Indian River	1,350,165,069	245,166,508	253,747,050	568,870,537	776,814,079
Jefferson	91,398,372	7,096,265	7,096,265	45,836,766	54,866,381
Lee	7,895,217,484	618,939,759	708,474,354	7,395,787,037	7,616,592,498
Levy	249,771,548	60,879,751	63,142,372	85,227,529	89,349,753
Manatee	1,832,731,223	243,816,781	268,648,506	1,381,276,987	1,465,378,729
Martin	1,175,069,395	195,063,015	202,044,965	481,444,315	637,738,515
Miami Dade	26,057,571,366	4,659,487,360	5,126,046,370	19,594,515,044	22,218,164,469
Monroe	4,307,989,057	2,832,976,684	3,436,721,573	4,261,044,024	4,278,111,287
Nassau	1,363,502,207	260,152,679	268,335,765	925,781,805	1,018,221,643
Okaloosa	1,985,854,622	680,821,327	686,352,877	974,162,436	1,085,341,480
Palm Beach	15,312,347,143	1,239,253,070	1,357,785,892	2,562,654,397	3,054,267,606
Pasco	2,086,628,090	34,518,667	38,469,105	630,459,848	699,928,904
Pinellas	5,597,859,318	1,240,131,828	1,282,207,434	4,012,510,499	4,340,902,272

Santa Rosa	2,007,991,802	807,339,780	830,525,568	1,009,157,490	1,048,858,379
Sarasota	4,413,609,500	790,596,900	893,159,300	3,699,057,900	4,132,137,200
St Johns	1,888,634,853	350,681,856	379,638,986	1,209,546,082	1,274,734,449
St Lucie	1,702,447,500	359,349,100	368,079,400	550,669,900	727,049,500
Taylor	151,485,350	27,498,540	29,149,970	29,149,970	89,322,650
Volusia	4,048,656,486	497,750,479	514,465,419	1,325,045,803	1,934,232,355
Wakulla	198,367,140	49,670,010	54,107,402	168,544,644	177,392,924
Walton	1,693,743,511	981,514,857	1,121,772,130	1,373,608,591	1,394,655,564

Miscellaneous Category

Based on the DOR 2022 User's Guide, some of the Miscellaneous Category properties are critical assets under Critical Infrastructure and Transportation. The critical assets include water and sewer services, sewage disposal, solid waste, and locally assessed railroads and roads; however, this category is comprised of more than just the aforementioned infrastructure components. Table 4.1.10 shows the general value of miscellaneous properties at risk from flooding. Only 0.4% of the total value in coastal counties is classified as miscellaneous. The same percentage (0.4%) of the impact from a storm surge (category 4 hurricane) is miscellaneous, and a slightly higher 0.5% of the coastal impact associated with a 2ft. sea level rise is miscellaneous. Citrus has the greatest share of its miscellaneous property at risk from sea level rise, but Collier and Monroe have the greatest shares of their property at risk from storm surge. Pinellas and Miami-Dade have the largest dollar values at risk from sea level rise, and Hillsborough has the greatest dollars at risk from storm surge.

Table 4.1.10 Coastal Counties Miscellaneous Category Value

	Total	1 ft. SLR	2 ft. SLR	Cat. 4	Cat.5
Bay	72,583,138	10,991,833	11,487,836	27,204,673	30,821,781
Brevard	74,169,810	13,296,020	13,297,820	25,752,660	39,213,060
Broward	1,480,471,810	149,822,890	170,334,560	297,287,770	357,113,610
Charlotte	144,315,419	22,435,454	26,953,988	120,874,124	133,954,412
Citrus	377,348,922	273,664,322	274,488,702	347,125,432	349,074,664
Collier	67,495,555	853,530	1,865,236	65,583,432	66,058,350
Dixie	689,600	33,900	64,500	415,300	415,300
Duval	506,158,024	92,223,448	107,447,242	334,149,836	343,691,992
Escambia	225,846,235	51,815,544	53,306,519	92,370,101	93,406,876
Flagler	49,103,687	16,625,170	16,659,398	26,951,177	34,078,594
Franklin	6,057,361	2,834,543	2,834,543	5,740,402	5,977,861
Gulf	6,266,948	97,193	820,391	3,986,442	4,065,832
Hernando	93,506,769	2,652,050	2,924,051	23,152,417	27,893,040
Hillsborough	2,192,459,223	157,379,160	163,226,485	1,864,932,450	1,936,040,368

Indian River	47,582,427	5,600,123	5,635,683	10,856,868	20,005,164
Jefferson	66,066,846	16,390	16,390	425,037	2,432,407
Lee	389,769,651	40,050,471	56,976,629	282,382,454	379,939,567
Levy	18,372,452	523,355	600,403	7,060,972	7,207,501
Manatee	121,794,644	3,300,661	4,152,258	66,086,205	68,753,379
Martin	182,847,210	20,270,670	20,270,670	23,598,040	36,402,520
Miami Dade	2,224,348,283	382,443,897	447,587,252	1,114,456,841	1,386,388,808
Monroe	152,995,394	87,555,933	97,586,566	147,657,174	152,762,554
Nassau	46,244,486	27,491,462	27,514,207	40,765,970	42,732,020
Okaloosa	44,354,488	432,574	433,773	2,144,626	28,975,949
Palm Beach	1,494,546,980	157,090,195	182,628,635	241,812,568	257,672,400
Pasco	59,981,147	22,149,613	22,217,232	33,996,550	34,909,568
Pinellas	1,162,793,526	386,439,153	403,843,546	951,360,060	970,316,795
Santa Rosa	61,895,681	11,019,429	12,976,067	19,986,547	21,319,128
Sarasota	318,476,200	19,032,700	23,263,500	229,348,700	252,897,700
St Johns	201,779,966	36,550,443	37,713,211	108,022,840	129,630,444
St Lucie	306,603,113	96,806,664	96,902,964	101,709,213	223,952,413
Taylor	11,944,276	4,605,840	4,616,540	9,301,582	9,305,222
Volusia	175,113,128	23,723,250	23,780,038	37,944,127	40,079,603
Wakulla	3,209,177	254,567	279,192	2,333,422	2,467,793
Walton	54,385,691	487,784	571,759	7,742,515	11,696,980

4.2 Buildings Footprint Assessment

This assessment begins to address the number of buildings that may be affected by the flooding factors of sea level rise and hurricane induced storm surge. In addition, the number of buildings that are located in FEMA Flood Hazard Zones is calculated. The flooding hazard data (categories 1, 4 and 5 storm surge, 1ft. and 2ft. sea level rise and FEMA Flood Hazard zones) are overlaid with building footprints, using ArcGIS analysis (Table 4.2.1).[14]

Table 4.2.1 Number of buildings at risk from flooding

Facility	Total	Cat 1	Cat 4	Cat 5	1 ft. SLR	2 ft. SLR	FEMA Flood Hazard Zone
# Building footprints	7,263,891	690,491	2,791,370	3,267,879	15,988	43,311	1,958,888

[14] The data is acquired from https://automaticknowledge.co.uk/us-building-footprints/ and https://github.com/Microsoft/USBuildingFootprints). These two data sets for building footprints were compared with Google map. The first set appear more reliable and was used for the assessments in this report.

5. Investments and Progress

Adaptation to a changing environment and building community resilience is vital for the socioeconomic sustainability and continued prosperity of the state over the next century.[15] Adaptation is the process of adjustment to actual or expected flooding events and their effects.[16] Resilience is a socio-ecological concept that has become progressively more important as a means of assessing and mitigating losses due to environmental hazards and disasters. The resilience research and application aim to mitigate or respond to the negative impacts of exposure and vulnerability.[17]

As investing in resilience helps with long-term economic sustainability and reducing economic loss, building resilience against flooding is important for all communities. Florida has initiated vulnerability assessments, which have created a basis for building resiliency against flooding and sea level rise.[18] The following sections provide an overview of adaptation planning and resilience efforts (including funding) in Florida. Some of these efforts are statewide, and some are localized in cities, towns, counties, and regions.[19]

5.1 Timeline of Resilience and Adaptation Planning in Florida

Several events serve as milestones in Florida's resiliency efforts. They include:

- One of the state's first sustained adaptation planning efforts was seated in the Southeast Florida Climate Leadership Summit. It was first held in Fort Lauderdale in 2009 and has been held annually ever since. The focus of the summit is to facilitate climate-related collaboration and knowledge sharing.[20]
- In 2009, the City of Punta Gorda completed a publicly-led adaptation planning process to address sea level rise in its downtown area. This initiative resulted in a document entitled *The City of Punta Gorda Adaptation Plan*.[21]
- In the fall of 2009, the City of Satellite Beach embarked on a project to assess municipal vulnerability to the rising sea level, including a separate planning process to properly mitigate impacts. This document was submitted to the City of Satellite Beach in 2010.

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[15] https://floridadep.gov/sites/default/files/Adaptation_Planning_Guidebook_0.pdf (Last retrieval date 10.9.2023)
[16] https://sgp.fas.org/crs/misc/IF11827.pdf (Last retrieval date 10.9.2023)
[17] Buck, K.D., Dunn, R.J., Bennett, M.K. *et al.* (2022). Influence of cross-scale measures on neighborhood resilience. *Natural Hazards* https://doi.org/10.1007/s11069-022-05493-7
[18] https://floridadep.gov/sites/default/files/CRI_Vulnerability_Assessment_Report_1_Focus_Group.pdf (Last retrieval date 10.9.2023)
[19] https://floridadep.gov/program-content/RCP/Florida-Resilient-Coastlines-Program?type=document_publications&page=1 (Last retrieval date 10.9.2023)
[20] https://floridadep.gov/sites/default/files/AdaptationPlanningGuidebook.pdf (Last retrieval date 10.9.2023)
[21] http://www.cakex.org/sites/default/files/Punta%20Gorda.pdf (Last retrieval date 10.9.2023)

- In 2010, Broward, Miami-Dade, Monroe, and Palm Beach Counties formed the Southeast Florida Regional Climate Change Compact to coordinate mitigation and adaptation activities across county lines.[22]
- Lee County followed up on its 2010 Climate Change Vulnerability Assessment with a Climate Change Resiliency Strategy. This strategy includes approaches to mitigate and adapt to the effects of climate change, while also positioning the County to take advantage of potential economic development opportunities associated with climate change.[23]
- In 2011, the Florida legislature passed the Community Planning Act (CPA). As a result of this law, local governments are given the option of developing an Adaptation Action Area (AAA) within their jurisdictions to help address the impacts of sea level rise.[24]
- In 2013, the National Oceanic and Atmospheric Administration (NOAA) approved the Florida Coastal Management Program's (FCMP) Section 309 Strategy, including an initiative to be conducted by (then) Florida Department of Economic Opportunity (DEO) titled: "Community Resiliency: Planning for Sea Level Rise."[25] This initiative resulted in a few pilot community projects, including one in the City of Fort Lauderdale, and funding for regional studies that culminated in the *Adaptation Action Plan: A Planning Guidebook for Florida's Local Governments*.[26]
- In 2015, the Florida Legislature passed "an act relating to the peril of flood."[27] This law requires the consideration of future flood risk from storm surge and sea level rise in certain parts of local government comprehensive plans. According to this law, sea level rise should be included as one of the causes of flood risk that must be addressed by "redevelopment principles, strategies, and engineering solutions."
- In 2015, *Planning for Sea Level Rise in Matanzas Basin: Opportunities for Adaptation* was published after a three-year planning process. The document resulted from a collaborative project spearheaded by Guano Tolomato Matanzas (GTM) National Estuarine Research Reserve and the University of Florida, both of whom worked with Matanzas Basin stakeholders in Northeast Florida. The goal was to plan for sea level rise

[22] https://southeastfloridaclimatecompact.org/ (Last retrieval date 10.9.2023)
[23] https://www.adaptationclearinghouse.org/resources/lee-county-florida-climate-change-resiliency-strategy-ccrs.html (Last retrieval date 10.9.2023)
[24] https://floridadep.gov/sites/default/files/AdaptationPlanningGuidebook.pdf (Last retrieval date 10.9.2023)
[25] https://floridadep.gov/sites/default/files/AdaptationPlanningGuidebook.pdf (Page VII) (Last retrieval date 10.9.2023)
[26] https://floridadep.gov/rcp/florida-resilient-coastlines-program/documents/criadaptation-action-areas-planning-guidebook (Last retrieval date 10.9.2023)
[27] https://www.adaptationclearinghouse.org/resources/florida-sb-1094-e-an-act-relating-to-the-peril-of-flood-e.html (Last retrieval date 10.9.2023)

in a way that protects communities and the environments they depend on for quality of life and commerce.[28]

- In 2016, three pilot projects were conducted in Escambia County, the City of Clearwater, and the City of St. Augustine.
- From 2011 to 2017, DEO led the Community Resiliency Initiative in partnership with the Florida Department of Environmental Protection (DEP) with assistance from the Division of Emergency Management. The goal of the Community Resiliency Initiative was to provide technical assistance to coastal communities interested in pursuing innovative planning and development strategies that ensure their long-term vitality while addressing current and future coastal flooding risks.[29]
- Since 2018, more robust and harmonized statewide planning and actions have been initiated. The DEP continues its efforts through the Florida Resilient Coastal Program to help ensure collaboration among Florida's coastal communities and to offer technical assistance and funding to coastal communities dealing with increasingly complex flooding, erosion and habitat shifts. The Florida Resilient Coastal Program offers grant funding for both planning and implementation projects that further coastal resilience.[30]

For FY 2021-22, the state made a significant investment in resiliency and flood mitigation, in conjunction with the passage of CS/CS/SB 1954, Statewide Flooding and Sea Level Rise Resilience. The stated intent in s. 380.093, F.S., is as follows:

(1) LEGISLATIVE INTENT.—

(a) The Legislature recognizes that the state is particularly vulnerable to adverse impacts from flooding resulting from increases in frequency and duration of rainfall events, storm surge from more frequent and severe weather systems, and sea level rise. Such adverse impacts pose economic, social, environmental, and public health and safety challenges to the state. To most effectively address these challenges, funding should be allocated in a manner that prioritizes addressing the most significant risks.

(b) The Legislature further recognizes that the adverse impacts of flooding and sea level rise affect coastal and inland communities all across the state. Consequently, a coordinated approach is necessary to maximize the benefit of efforts to address such impacts and to improve the state's resilience to flooding and sea level rise.

(c) The Legislature further recognizes that to effectively and efficiently address and prepare for the adverse impacts of flooding and sea level rise in the state, it is necessary to conduct a comprehensive statewide assessment of the specific risks posed to the state by

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[28] https://planningmatanzas.files.wordpress.com/2012/06/planning-for-sea-level-rise-in-the-matanzas-basin1.pdf (Last retrieval date 10.9.2023)

[2929] Wallace, K. (2018). *Florida's Community Resiliency Initiative 2011-2017* [Case study on a project of the Florida Department of Environmental Protection, Florida Department of Economic Opportunity, NOAA, and Florida Division of Emergency Management]. Product of EcoAdapt's State of Adaptation Program. Retrieved from CAKE: https://www.cakex.org/case-studies/floridas-community-resiliency-initiative-2011-2017 (Last updated November 2018)

[30] https://floridadep.gov/rcp/florida-resilient-coastlines-program (Last retrieval date 10.9.2023)

flooding and sea level rise and develop a statewide coordinated approach to addressing such risks.

5.2 Florida Appropriations and Disbursements: Resiliency

Table 5.2.1 summarizes the appropriations and disbursements through DEP for resilience efforts from FY 2018-19 to FY 2022-23. During this five-year period, appropriations have exceeded $1.0 billion, with 19% coming from the General Revenue Fund and 81% coming from the Resilient Florida Trust Fund. The latter source is funded through annual distributions from the Documentary Stamp Tax, as well as $700 million in one-time transfers from American Rescue Plan (ARP) funds. Overall, the disbursement levels have been extremely low, with only 2.6% of the funds actually disbursed.

Table 5.2.1 Appropriations and disbursements through DEP for resilience efforts (FY 2018-19 to FY 2022-23)

RESILIENCY APPROPRIATIONS & DISBURSEMENTS					
FY Ending	Fund	Appropriation Category Title	Appropriation	Disbursements	
2019	GENERAL REVENUE	FL RESILIENT COASTLINE	3,600,000	1,925,671	
2020	GENERAL REVENUE	FL RESILIENT COASTLINE	5,450,800	4,134,376	
2021	GENERAL REVENUE	FL RESILIENT COASTLINE	9,166,944	7,274,147	
2022	RESILIENT FLORIDA TF	RGN RESILIENCE COALITIONS	2,000,000	0	
2022	GENERAL REVENUE	FL RESILIENT COASTLINE	9,569,604	7,772,446	
2022	RESILIENT FLORIDA TF	RESILIENT FL	200,000	42,820	
2022	RESILIENT FLORIDA TF	RESILIENT FL PLN GRTS	20,000,000	0	
2022	RESILIENT FLORIDA TF	ARP RES FL GRANTS	408,701,835	0	
2023	RESILIENT FLORIDA TF	RESILIENT FL DATA COLL/ANA	7,100,000	0	
2023	RESILIENT FLORIDA TF	RESILIENT FL	275,000	74,751	
2023	GENERAL REVENUE	FLOOD/SEA LEVEL RISE - STW	170,874,990	0	
2023	RESILIENT FLORIDA TF	FLOOD/SEA LEVEL RISE - STW	100,000,000	749,163	
2023	GENERAL REVENUE	FL RESILIENT COASTLINE	-1,169,184	5,511,523	
2023	RESILIENT FLORIDA TF	RESILIENT FL PLN GRTS	20,000,000	0	
2023	RESILIENT FLORIDA TF	ARP RES FL GRANTS	291,298,165	0	***Disb %***
		Grand Total	**1,047,068,154**	**27,484,897**	**2.6%**
		General Revenue	*197,493,154*	*26,618,163*	*13.5%*
		5-Year Average (GR)	*39,498,631*		
		Resilient Florida Trust Fund	*849,575,000*	*866,735*	*0.1%*
		5-Year Average (TF)	*169,915,000*		

5.3 Florida Appropriations and Disbursements: Flood Mitigation

Table 5.3.1 summarizes the appropriations and disbursements from the Federal Grants Trust Fund for flood mitigation projects. The Legislature has authorized this funding through the Executive Office of the Governor to the Division of Emergency Management to meet the state's obligations under the Flood Mitigation Assistance Program. During this eleven-year period,

appropriations have totaled nearly $90.5 million, with all of it coming from FEMA as pass-through funding for FEMA-approved and awarded project grants to eligible subapplicants. Overall, the disbursement levels have been low, with only 34.7% of the funds actually disbursed. Some of the annual disbursements have used available funds from the prior year.

Table 5.3.1 Flood Mitigation Appropriation and Disbursement (FY 2012-13 to FY 2022-23)

FLOOD MITIGATION: APPROPRIATIONS & DISBURSEMENTS					
FY Ending	**Fund Title**	**Appropriation Category Title**	**Appropriation**	**Disbursements**	
2013	FEDERAL GRANTS TF	G/A-FLOOD MITIGATION/PROG	4,952,331	2,804,596	
2014	FEDERAL GRANTS TF	G/A-FLOOD MITIGATION/PROG	6,018,536	3,600,100	
2015	FEDERAL GRANTS TF	G/A-FLOOD MITIGATION/PROG	7,635,591	3,536,631	
2016	FEDERAL GRANTS TF	G/A-FLOOD MITIGATION/PROG	7,328,374	7,579,868	
2017	FEDERAL GRANTS TF	G/A-FLOOD MITIGATION/PROG	7,078,374	1,696,283	
2018	FEDERAL GRANTS TF	G/A-FLOOD MITIGATION/PROG	9,147,256	1,066,695	
2019	FEDERAL GRANTS TF	G/A-FLOOD MITIGATION/PROG	9,147,256	2,571,440	
2020	FEDERAL GRANTS TF	G/A-FLOOD MITIGATION/PROG	9,797,256	1,988,428	
2021	FEDERAL GRANTS TF	G/A-FLOOD MITIGATION/PROG	9,797,256	3,396,684	
2022	FEDERAL GRANTS TF	G/A-FLOOD MITIGATION/PROG	9,797,256	1,506,004	
2023	FEDERAL GRANTS TF	G/A-FLOOD MITIGATION/PROG	9,797,256	1,622,291	***Disb %***
		Grand Total	**90,496,742**	**31,369,020**	**34.7%**
		11-Year Average (TF)	*8,226,977*	*2,851,729*	

5.4 Combined Federal and State Expenditures over 10-year period

Table 5.4.1 State and Federal Expenditures on Flooding and Resiliency (in $millions)

(millions)	***13-14***	***14-15***	***15-16***	***16-17***	***17-18***	***18-19***	***19-20***	***20-21***	***21-22***	***22-23***
Federal Flood Mitigation Assistance	$3.60	$3.54	$7.58	$1.70	$1.07	$2.57	$1.99	$3.40	$1.51	$1.62
Planning & Assessment	$-	$-	$-	$-	$-	$-	$-	$-	$0.04	$-
Local Project Support	$-	$-	$-	$-	$-	$-	$-	$-	$-	$0.08
Statewide Support	$-	$-	$-	$-	$-	$-	$-	$-	$-	$0.75
Resiliency / Coastal Resilience	$-	$-	$-	$-	$-	$1.93	$4.13	$7.27	$7.77	$5.51
TOTAL	**$3.60**	**$3.54**	**$7.58**	**$1.70**	**$1.07**	**$4.50**	**$6.12**	**$10.67**	**$9.32**	**$7.96**

Over the 10-year period, expenditures for resiliency and flood mitigation have totaled just over $56 million. Due to the infusion of one-time dollars into resiliency and delays in the process, at this point there is no clear pattern to the expenditures.

5.5 Regional Expenditures

The state also provides funding to the Water Management Districts for flood protection. In order to identify Water Management District (WMD) expenditures related to flooding, EDR reviewed the WMDs' preliminary budgets developed in accordance with sections 373.535 and 373.536, Florida Statutes, respectively.

Table 5.5.1 provides a forecast and details a history of expenditures across all program areas that the WMDs attribute to the flood protection area of responsibility. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it has been converted to state fiscal years. Rather than using a simple three-year moving average, the forecast also takes into account the three-year moving average growth rate, averaging the two.

Table 5.5.1 Water Management District Flood Protection Expenditures (in $millions)

Flood Control	***LFY15-16***	***LFY16-17***	***LFY17-18***	***LFY18-19***	***LFY19-20***	***LFY20-21***	***LFY21-22***
NWF	$2.70	$2.36	$2.62	$2.72	$2.82	$2.55	$2.48
SJ	$8.42	$11.47	$15.30	$18.61	$15.01	$17.34	$17.23
S	$90.42	$98.50	$109.50	$101.54	$100.19	$114.32	$115.16
SW	$17.47	$17.94	$26.12	$31.31	$34.98	$23.10	$29.56
SR	$4.47	$2.62	$3.00	$3.83	$3.92	$3.52	$3.54
Total	$123.48	$132.89	$156.55	$158.01	$156.93	$160.84	$167.98
Forecast	SFY20-21	SFY21-22	***SFY22-23***	***SFY23-24***	***SFY24-25***	***SFY25-26***	***SFY26-27***
Total	$159.86	$166.19	*$165.13*	*$167.88*	*$170.68*	*$172.26*	*$174.75*

Source: Annual Budgets of the Water Management Districts

6. Assessing Risk and Resilience

One recognized source that allows the comparison of Florida's resiliency level to the rest of the United States is FEMA's Baseline Resilience Indicators for Communities (BRIC), developed in cooperation with the University of South Carolina - Hazards & Vulnerability Research Institute (HVRI). According to FEMA, "The Baseline Resilience Indicators for Communities (BRIC) describes the differences in community resilience among counties within the state and within the nation through a comparative community resilience score."[31] Its overarching purpose is to identify and map the communities that will most likely need support before, during, and after a

[31] https://www.fema.gov/emergency-managers/practitioners/data-hub (Last retrieved on 2.3.2024)

hazardous event.[32] FEMA's research provides the maps and data for the national risk index, which fundamentally is the product of multiplying two components: the expected annual loss and the community risk factor. The community risk factor is developed from measures of social vulnerability and community resilience. The FEMA graphic (Figure 6.0.1) below depicts the basic formula.[33]

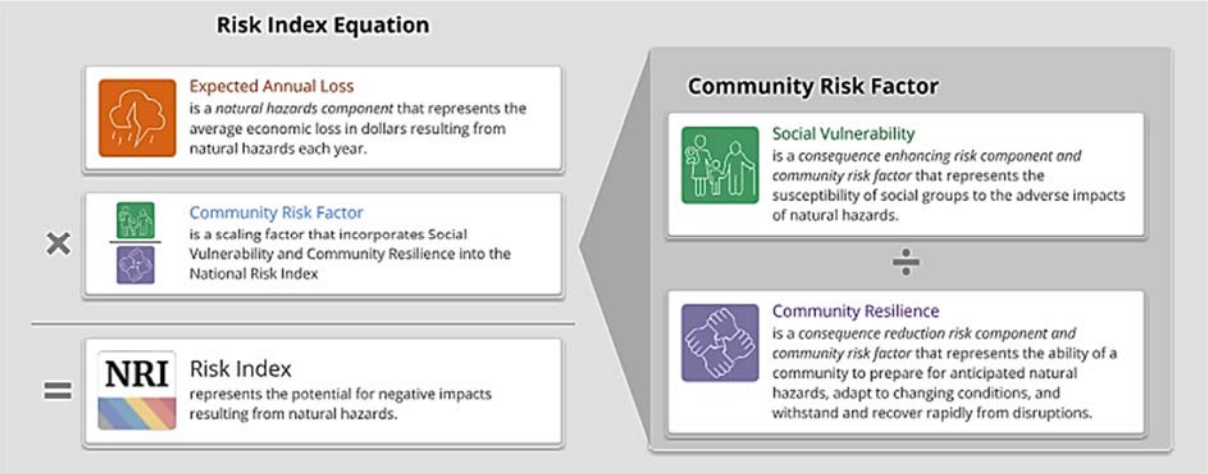


Figure 6.0.1 FEMA Formula Graphic

The various components of the National Risk Index can help determine the areas where improvement are most needed. Many of Florida's coastal counties have high index scores and rank highly among all of the counties in the nation—with Miami-Dade, Broward, Palm Beach and Hillsborough counties shown as "very high.". Figure 6.0.2 below shows the results of the county-level analysis for Florida.

[See Figure on following page.]

[32] https://experience.arcgis.com/experience/376770c1113943b6b5f6b58ff1c2fb5c/page/BRIC/ (Last retrieved on 10.9.2023)
[33] https://hazards.fema.gov/nri/determining-risk (Last retrieved on 10.9.2023)

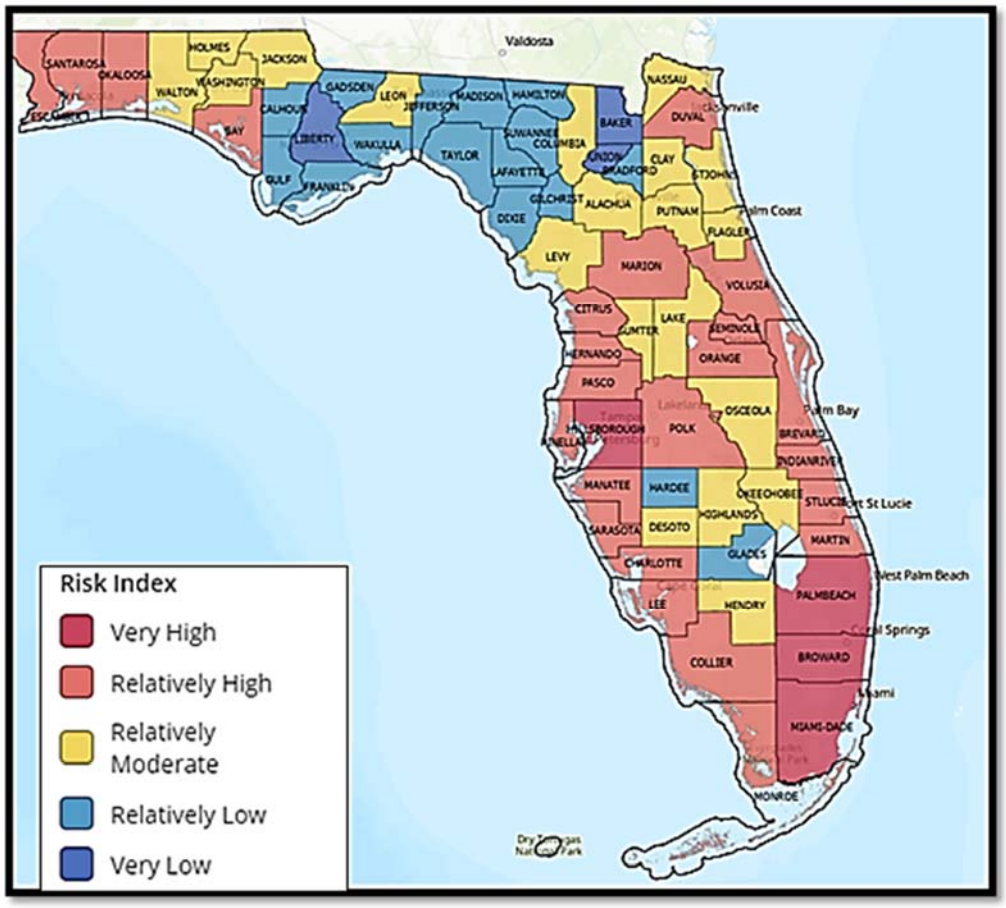


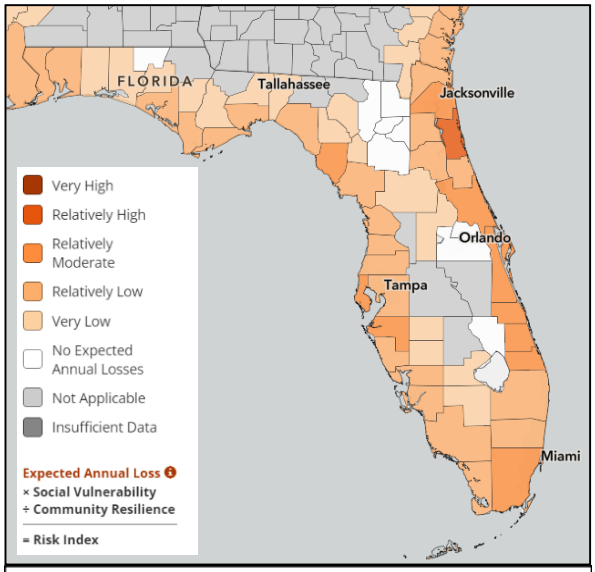
Figure 6.0.2 National Risk Index rating for all natural hazards at the county level in Florida

6.1 Expected Annual Loss

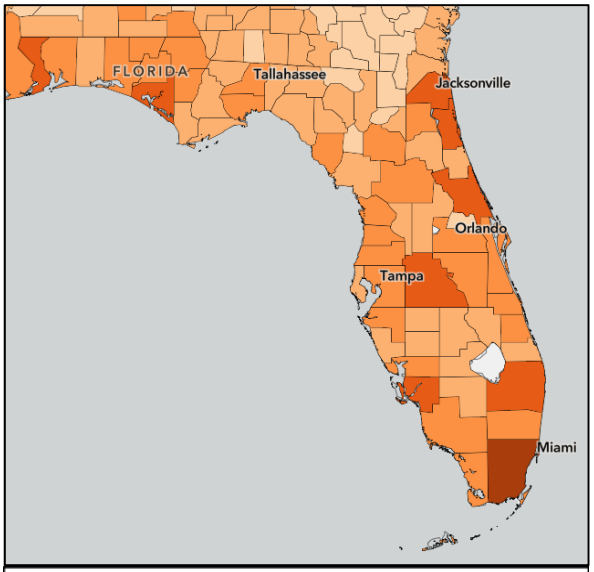
Expected Annual Loss (EAL) represents the average economic loss in dollars resulting from natural hazards each year. EAL is calculated for each hazard type and quantifies loss for buildings, people, and agriculture. An EAL score and rating represent a community's relative level of expected losses each year when compared to all other communities. Since the EAL score is positively associated to a community's risk, a higher EAL score results in a higher Risk Index score. FEMA calculates the EAL through the following formula:

Exposure x Annualized frequency x Historic Loss Ratio = Expected Annual Loss

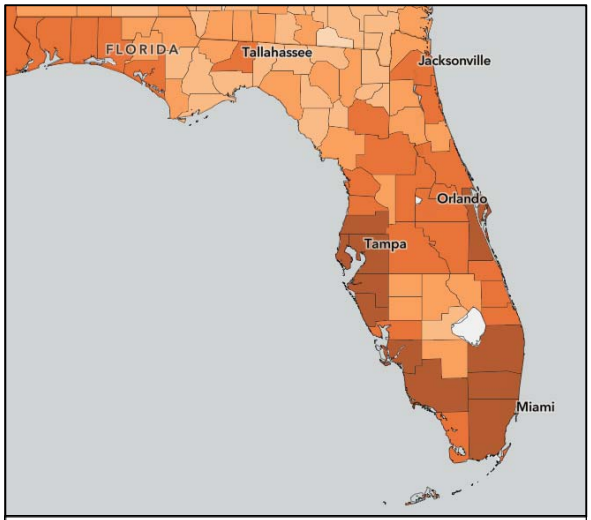
FEMA also provides data for each natural hazard individually. Figure 6.1.1 includes maps showing the EAL for coastal flooding, riverine flooding, hurricane and all hazards in Florida. For this year's preliminary analysis, EDR uses the all Hazard map and data.



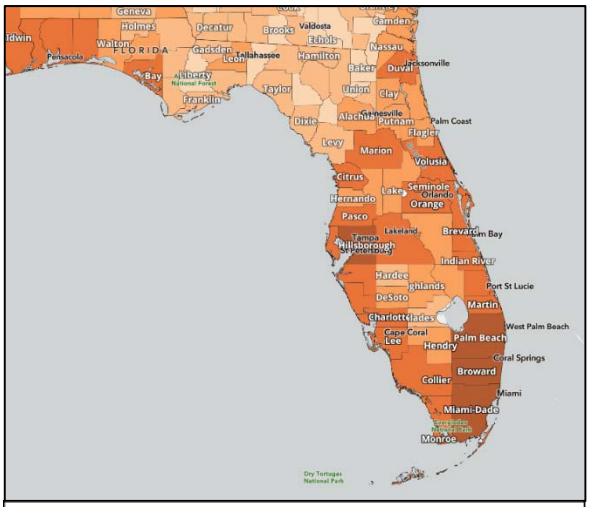
Coastal Flooding Expected Annual Loss



Riverine Flooding Expected Annual Loss



Hurricane Expected Annual Loss



All Hazards Expected Annual Loss

Figure 6.1.1 Four FEMA maps showing the relative Expected Annual Loss for coastal flooding, riverine flooding, hurricane and all hazards in Florida

6.2 Social Vulnerability

Social vulnerability is the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. A Social

Vulnerability score and rating represent the relative level of a community's social vulnerability compared to all other communities. A community's Social Vulnerability score is positively associated to a community's overall risk, a higher Social Vulnerability score results in a higher Risk Index score.[34] Figure 6.2.1 shows the Social Vulnerability rating for Florida.

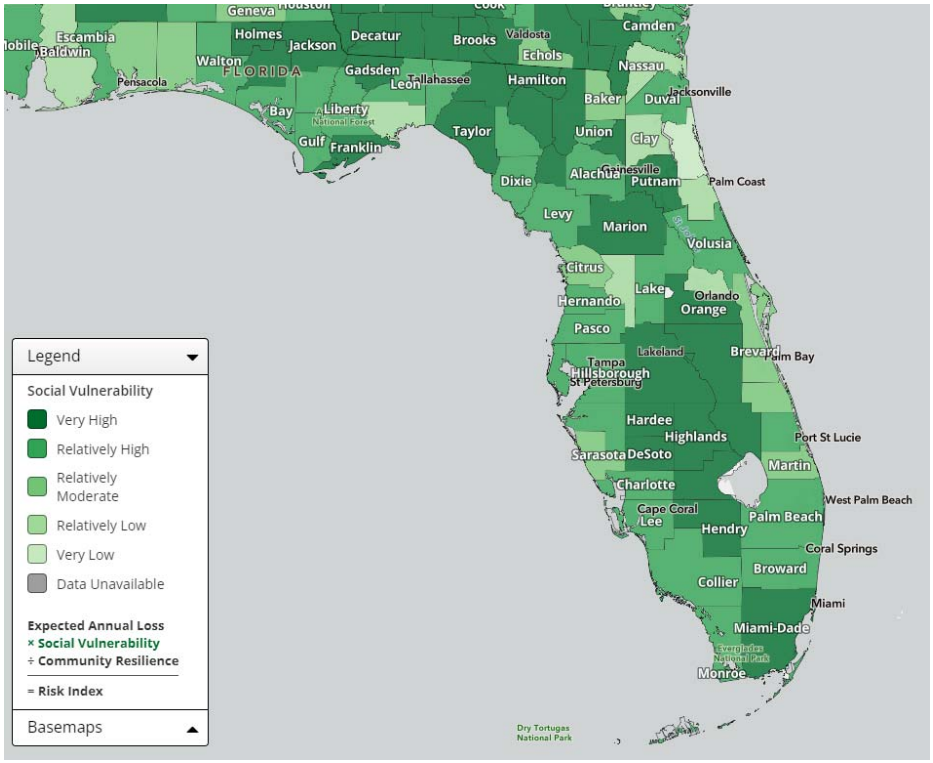


Figure 6.2.1 FEMA-produced Social Vulnerability Rating

6.3 Community Resilience

Community Resilience is the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. A Community Resilience score and rating represent the relative level of a community's resilience compared to all other communities at the same level. Since the community's Community Resilience score is inversely proportional to a community's risk, a higher Community Resilience score results in a

[34] https://hazards.fema.gov/nri/social-vulnerability (Last retrieved on 10.9.2023)

lower Risk Index score.[35] Figure 6.3.1 shows FEMA's Community Resilience rating for Florida.[36]

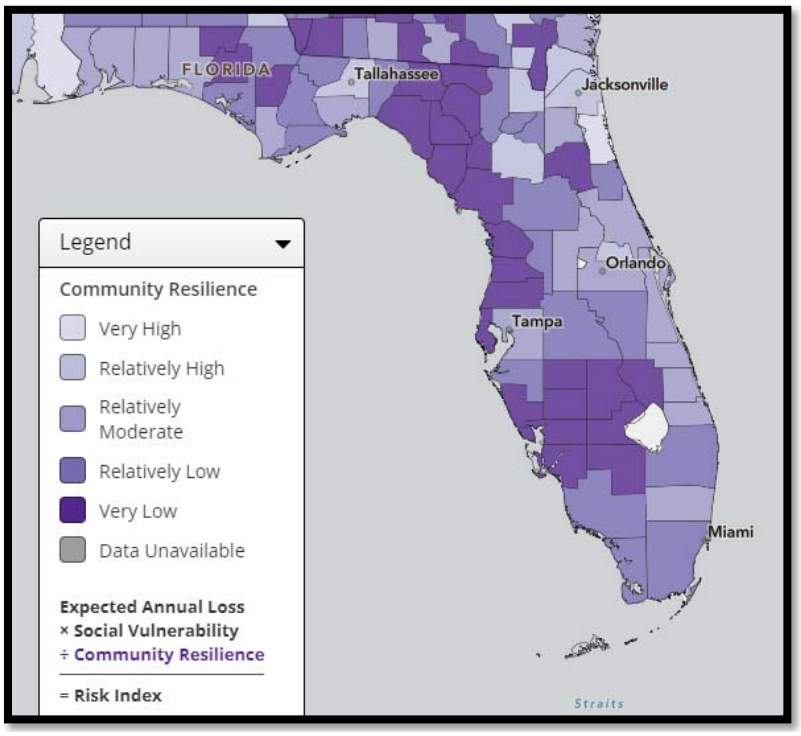


Figure 6.3.1 FEMA-produced Community Resilience Rating

7. Conclusion, Challenges and Future Actions

In this year's report, EDR refined the High Impact Zone boundaries and developed the preliminary boundaries for the Intermediate and Dispersed Zones. Relative to last year, the High Impact Zone boundary was respecified based on the two flooding factors: 2ft. sea level rise and storm surge induced by a hurricane category 4. The Intermediate Impact Zone was delineated as the portion of counties that are not in the High Impact Zone, but still may be affected by sea level rise and/or storm surge. The Dispersed Impact Zone are those counties that are not in the High Impact or Intermediate Zones. Incorporating the impact of precipitation in future studies will help better define the impact of flooding, especially in riverine areas.

Gaining this granular understanding of the flooding domain is critical to the calculation of economic impacts, as well as the cost-benefit analysis of potential investments. The next stage is to identify likely choices for adaptation and hazard mitigation, as well as the probable near-term

[35] https://hazards.fema.gov/nri/community-resilience (Last retrieved on 10.9.2023)
[36] Buck, K.D., Dunn, R.J., Bennett, M.K. *et al.* (2022). Influence of cross-scale measures on neighborhood resilience. *Natural Hazards* https://doi.org/10.1007/s11069-022-05493-7

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.

Flood Hub is working on new models that include precipitation and tide factors; however, their products may not be ready until three years from now. In the meantime, based on the data available from NOAA, USGS, FEMA and local measurements of sea level rise and flooding, EDR will continue to refine the impact zones and update the assessment of infrastructure and economic impact accordingly.

One of the Florida Legislature's objectives for this project is to promote economically beneficial flood resilience initiatives. To create resilience, adaptation and adaptation planning is required. Adaptation planning consists of the steps a community takes toward becoming more resilient to the impacts of rising sea levels over a specified period.[37]According to the Department of Commerce, "The actions a community will take to mitigate vulnerability to coastal flooding and sea level rise are very similar. The main difference is that sea level rise adaptation assumes a longer period for impact and therefore offers a longer period for need and implementation. Sea level rise also assumes an increase in the vulnerability of areas already subject to coastal flooding; therefore, adaptation projects consider the increased vulnerability." [38]

In future reports, EDR will begin to analyze the various strategies being deployed in Florida and elsewhere.

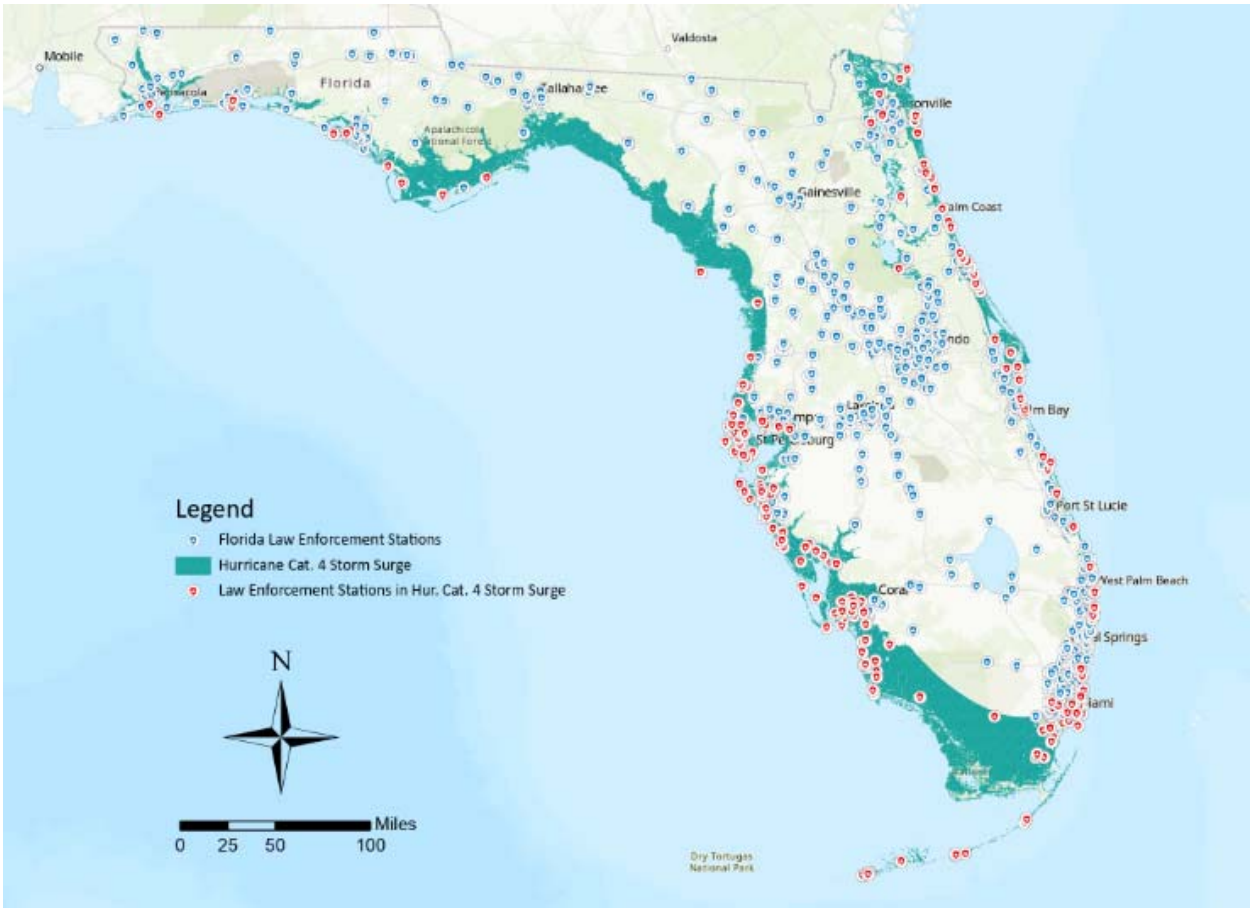
[37] https://floridadep.gov/sites/default/files/Adaptation-Historic-Properties_0.pdf (Last retrieved on 10.9.2023)
[38] https://www.floridajobs.org/community-planning-and-development/programs/community-planning-table-of-contents/adaptation-planning (Last retrieved on 10.9.2023)

Appendices

Appendix A: Critical Infrastructure and Transportation

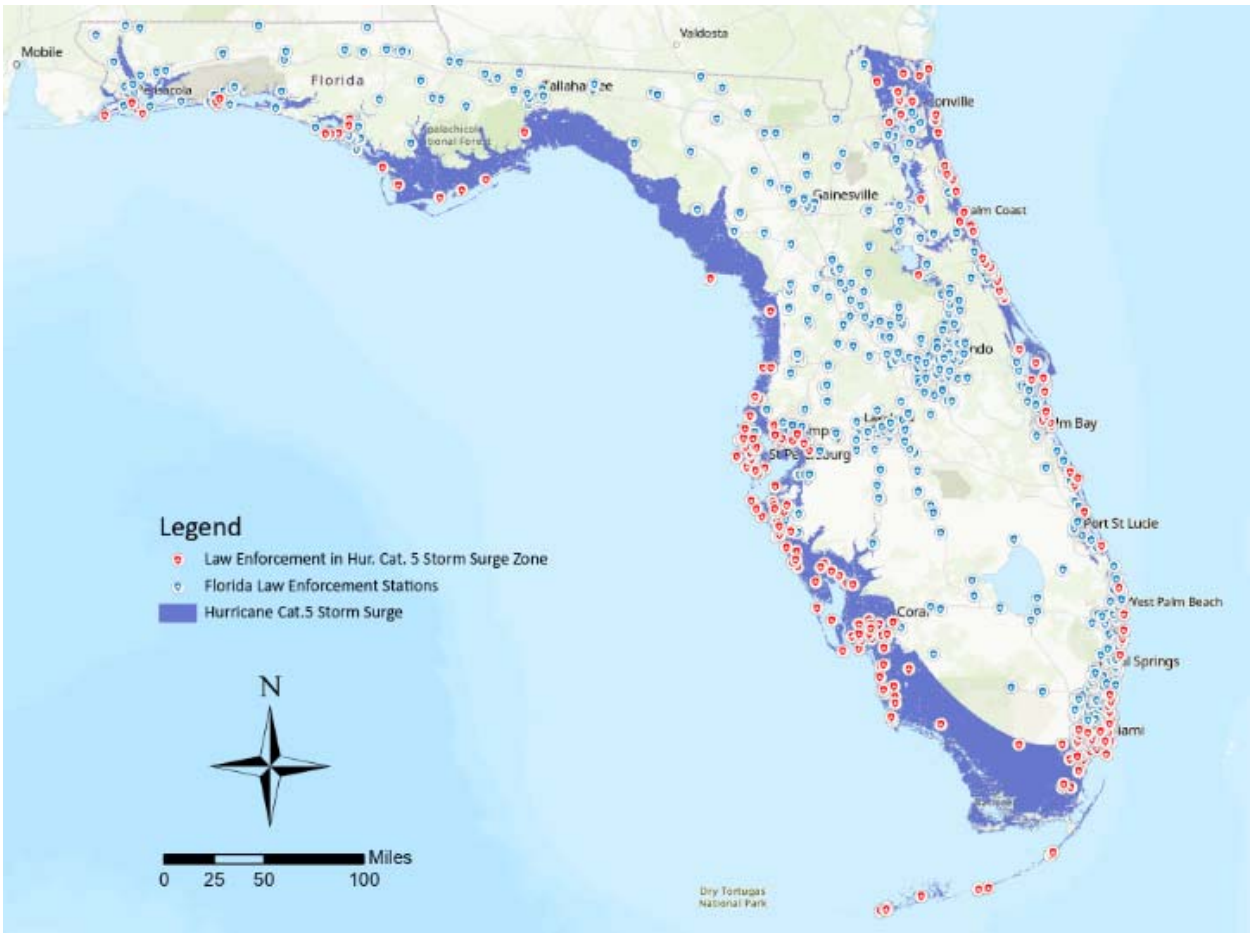
Maps of law enforcement stations, wastewater treatment facilities, wastewater facilities, solid waste landfills, and power plants located in various flooding zones. See Legends.

Facility	Total	In Cat 4	In Cat 5	2 ft. SLR	In FEMA Annual Chance of Flooding
Law Enforcement Stations	915	252	315		205
Wastewater Treatment[39]	2833	233	765	3 Mangrove Marine WWTP, Manatee Bay Club, Key Largo Shopper[40]	239



[39] Data at: https://www.arcgis.com/home/item.html?id=16c3d068cd5a436880bd393abde7d945)

[40] Although Key Largo Shopper is indicated as being affected by 2 ft. SLR, it seems the dataset that was used here had located the site in the wrong location. According to the visual investigation of the maps, it seems this wastewater facility may not be affected.


Mobile
Florida
Valdosta
Gainesville
Legend
Law Enforcement in Hur. Cat. 5 Storm Surge Zone
Florida Law Enforcement Stations
Hurricane Cat.5 Storm Surge
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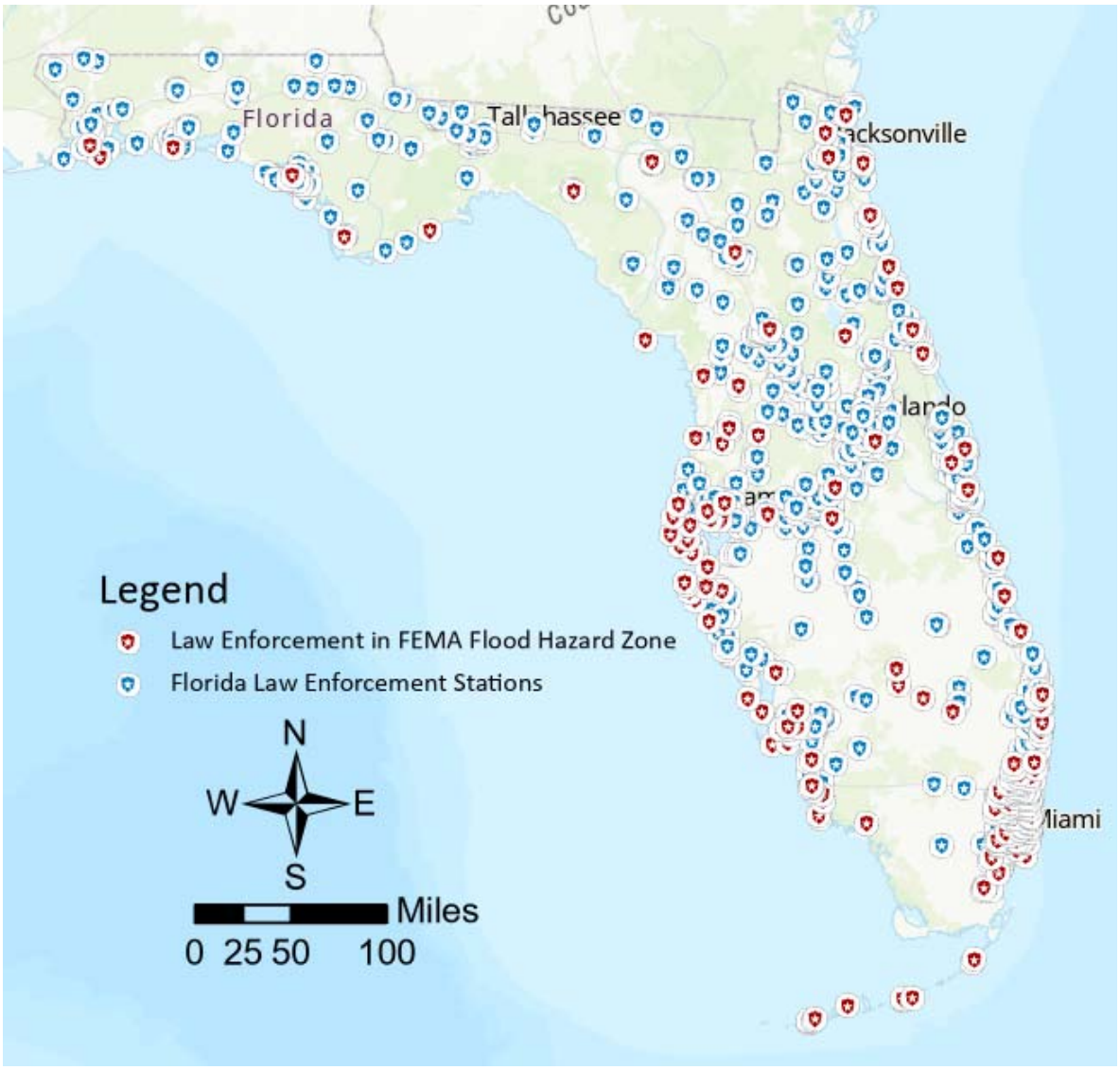
Miles
0 25 50 100
Port St Lucie
West Palm Beach
Springs
Dry Tortugas
National Park


Florida
Tallahassee
Jacksonville
Orlando
Miami
Legend
Law Enforcement in FEMA Flood Hazard Zone
Florida Law Enforcement Stations
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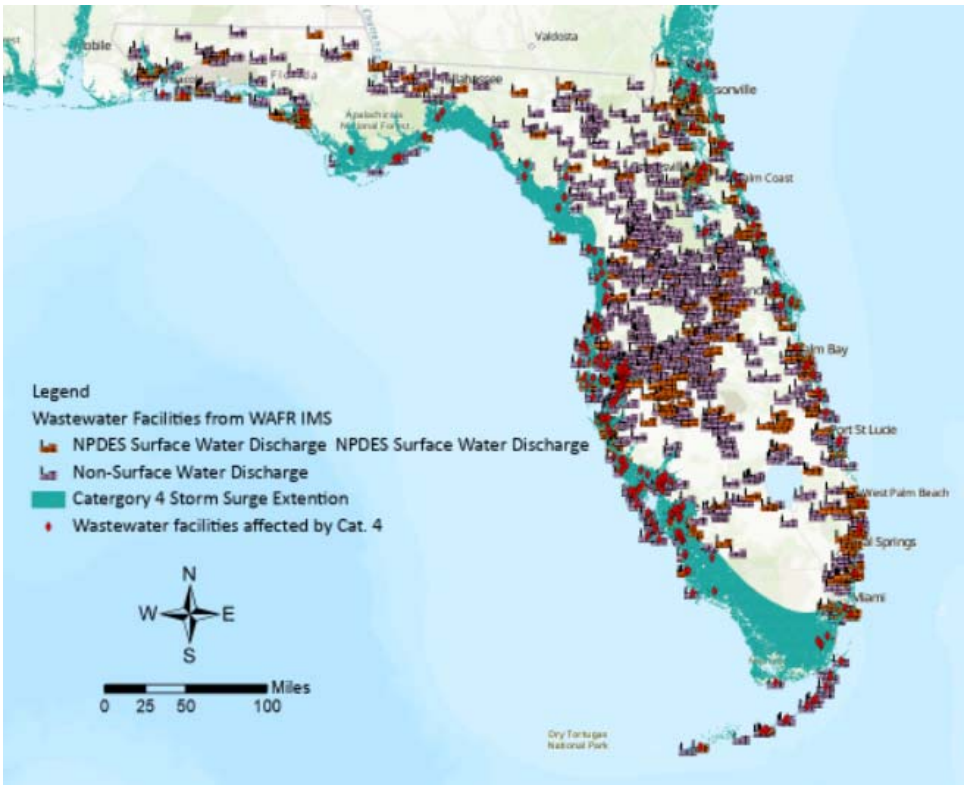
Valdosta
Legend
Wastewater Facilities from WAFR IMS
NPDES Surface Water Discharge NPDES Surface Water Discharge
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Wastewater facilities affected by Cat. 4
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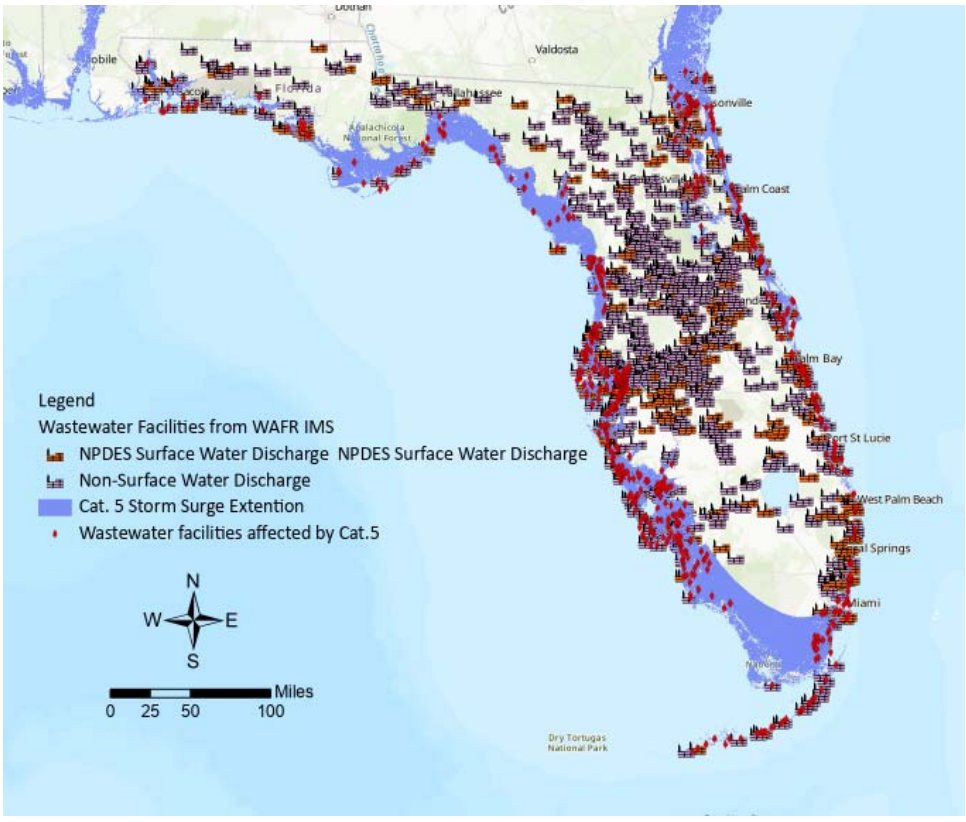
Valdosta
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Wastewater Facilities from WAFR IMS
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Non-Surface Water Discharge
Cat. 5 Storm Surge Extention
Wastewater facilities affected by Cat.5
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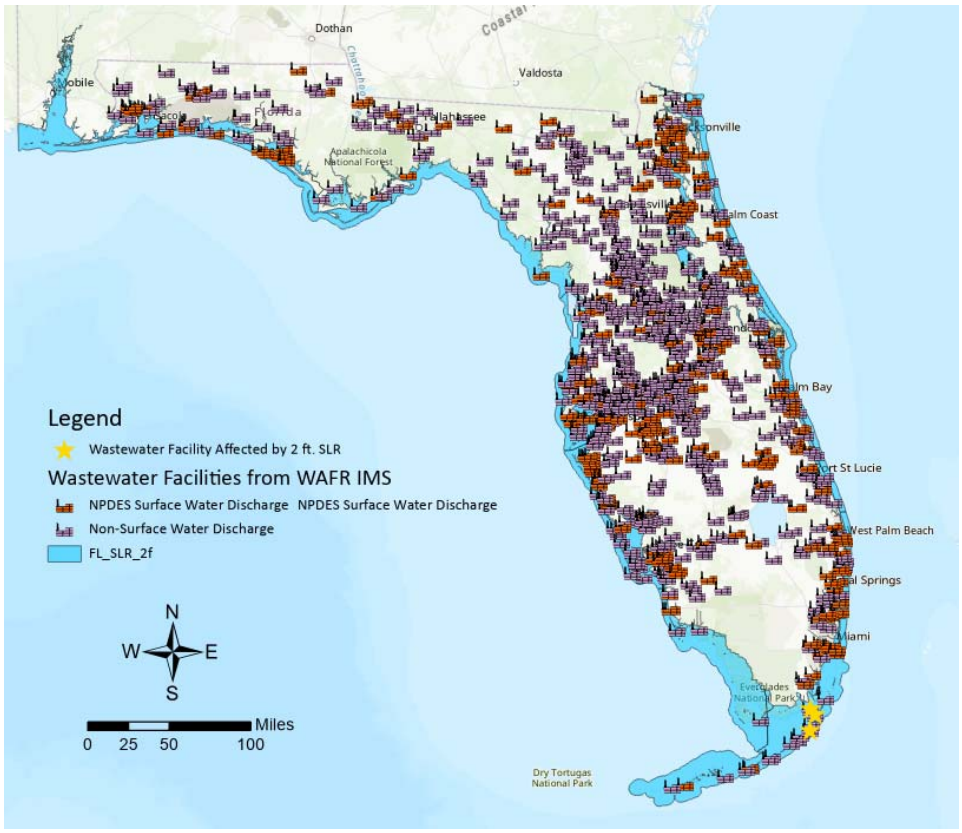
Dothan
Valdosta
Mobile
Pensacola
Florida
Tallahassee
Jacksonville
Apalachicola National Forest
Gainesville
Palm Coast
Miami
Everglades National Park
Dry Tortugas National Park
Legend
Wastewater Facility Affected by 2 ft. SLR
Wastewater Facilities from WAFR IMS
NPDES Surface Water Discharge NPDES Surface Water Discharge
Non-Surface Water Discharge
FL_SLR_2f
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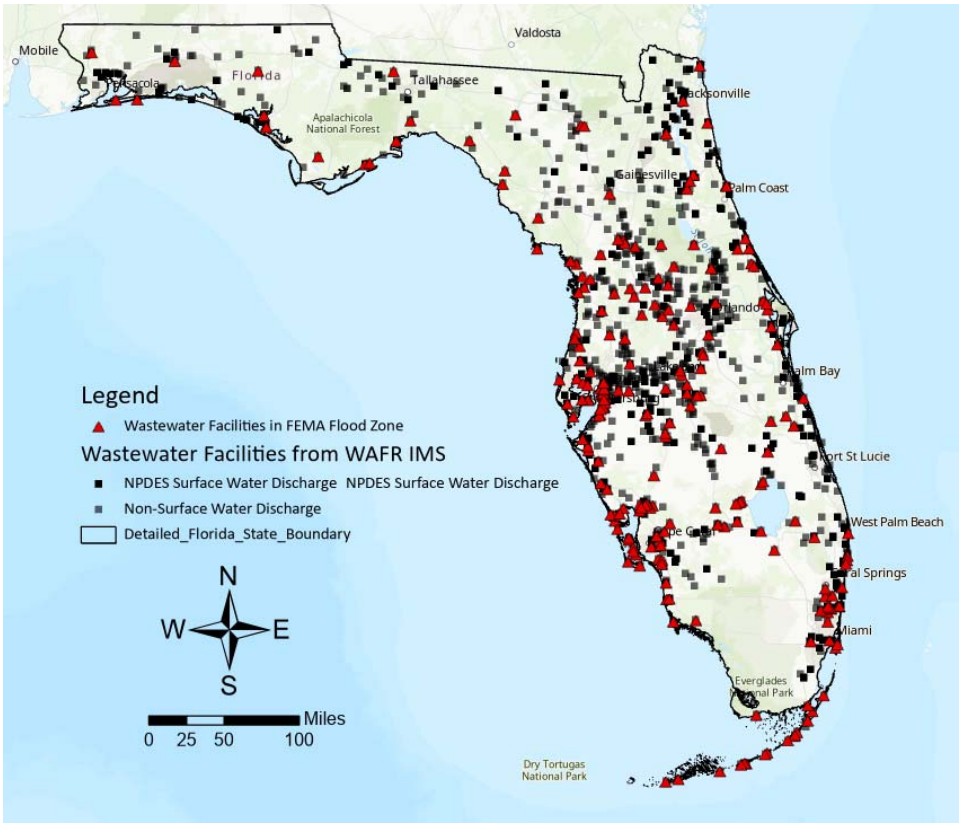
Valdosta
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Pensacola
Florida
Tallahassee
Jacksonville
Apalachicola National Forest
Gainesville
Palm Coast
Miami
Everglades National Park
Dry Tortugas National Park
Legend
Wastewater Facilities in FEMA Flood Zone
Wastewater Facilities from WAFR IMS
NPDES Surface Water Discharge NPDES Surface Water Discharge
Non-Surface Water Discharge
Detailed_Florida_State_Boundary
N
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Miles
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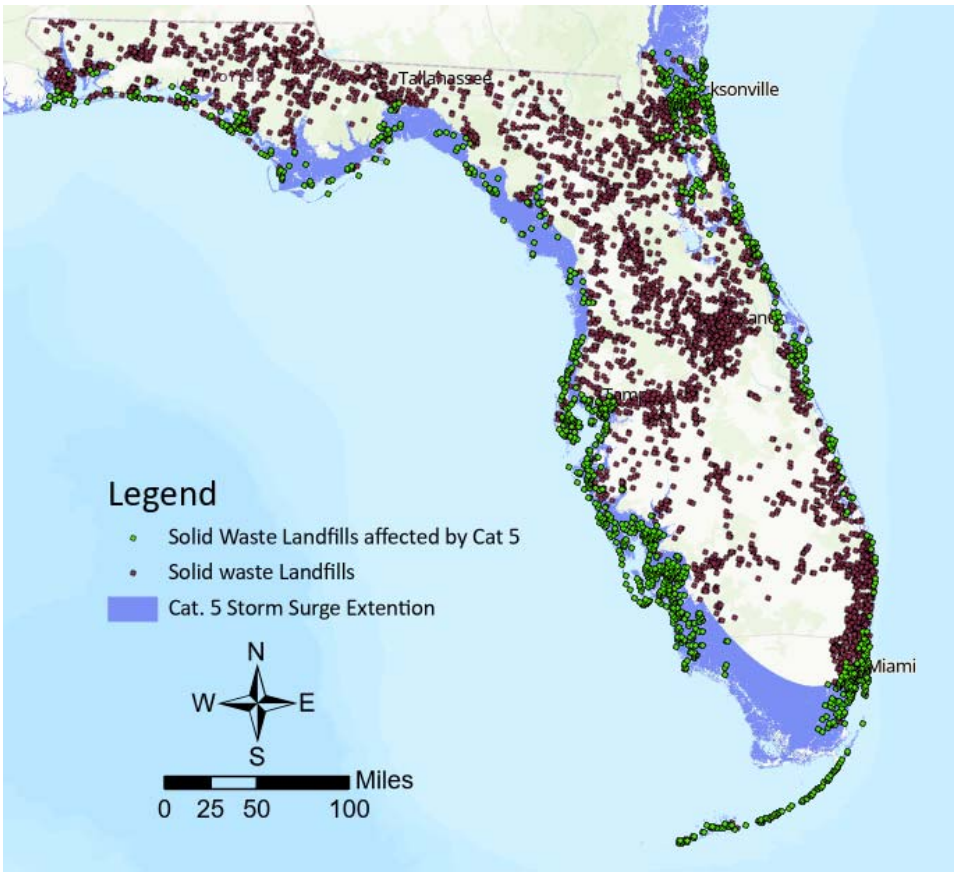
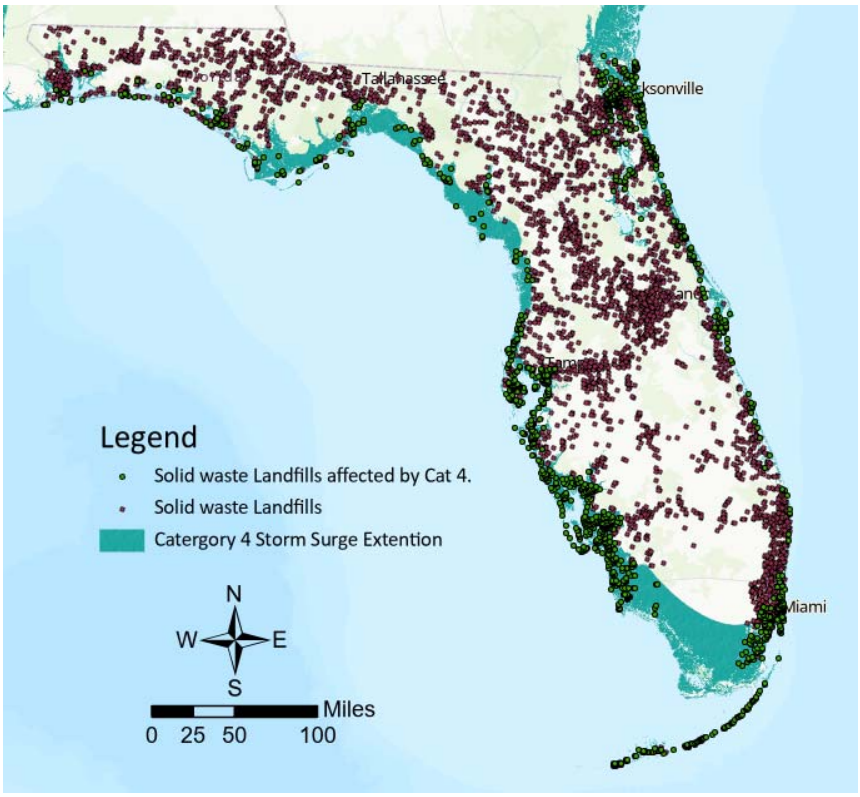
Facility	Total in FL	In Cat 4	In Cat 5	2 ft. SLR	In FEMA Annual Chance of Flooding
Solid Waste Landfills[41]	12345	2926	3457	116	



[41] Solid waste. Landfills: This dataset contains locations of and information on sites that are regulated under the Resource Conservation and Recovery Act (RCRA). Hazardous waste information is contained in the Resource Conservation and Recovery Act Information (RCRAInfo), a national program management and inventory system about hazardous waste handlers. In general, all generators, transporters, treaters, storers, and disposers of hazardous waste are required to provide information about their activities to state environmental agencies. These agencies, in turn pass on the information to regional and national EPA offices. This regulation is governed by the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984. (Excerpted from https://www.epa.gov/enviro/rcrainfo-overview). Additional Information is available at the EPA website http://www.epa.gov/geospatial/. Source: www.fgdl.org/fgdlmap/


Tallahassee
Miami
Legend
Solid waste Landfills affected by Cat 4.
Solid waste Landfills
Catergory 4 Storm Surge Extention
N
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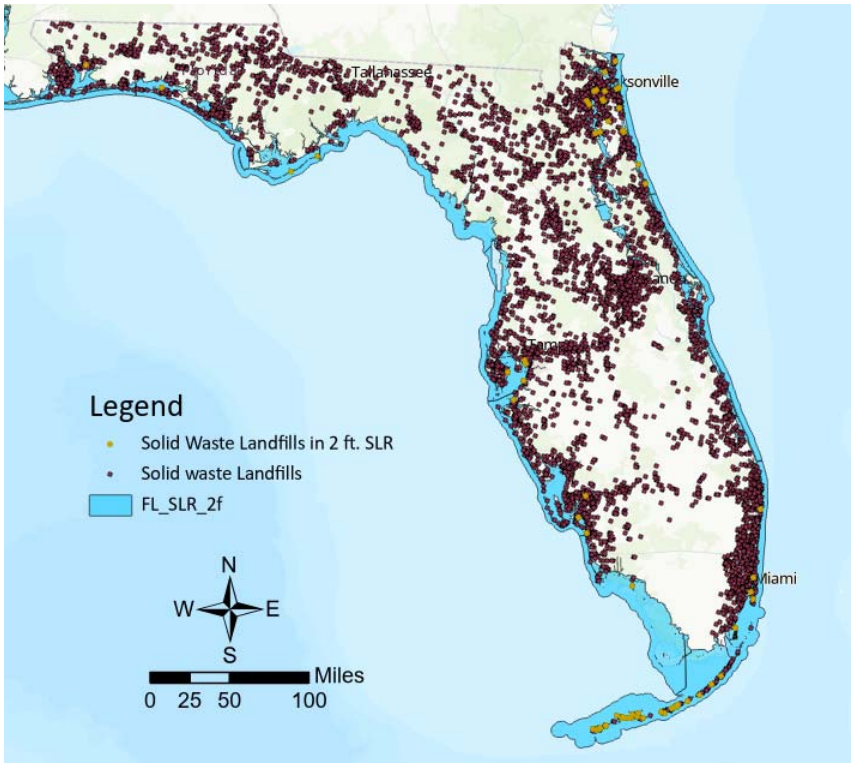
Tallahassee
Miami
Legend
Solid Waste Landfills in 2 ft. SLR
Solid waste Landfills
FL_SLR_2f
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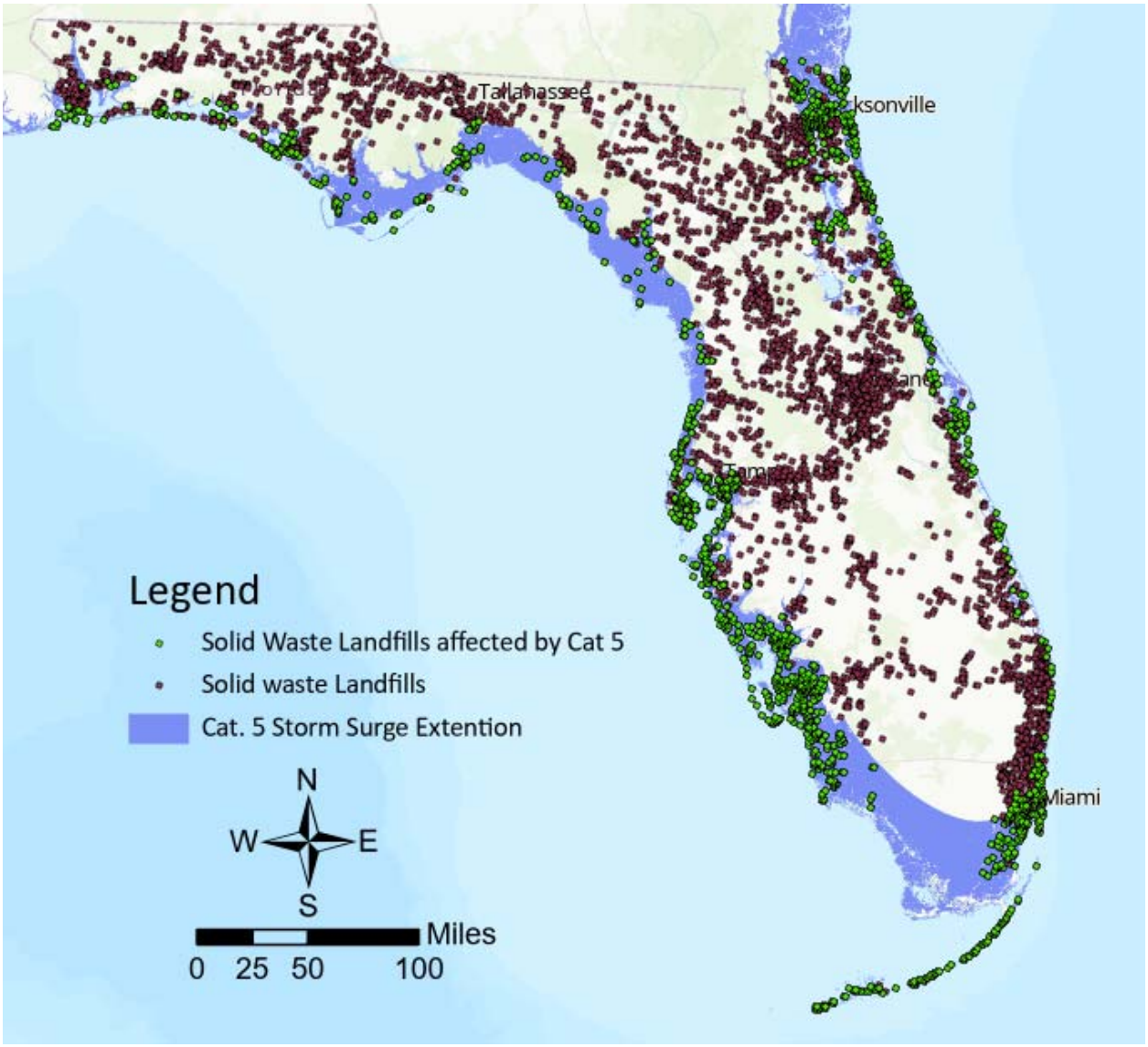
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Miami
Legend
Solid Waste Landfills affected by Cat 5
Solid waste Landfills
Cat. 5 Storm Surge Extention
N
W
E
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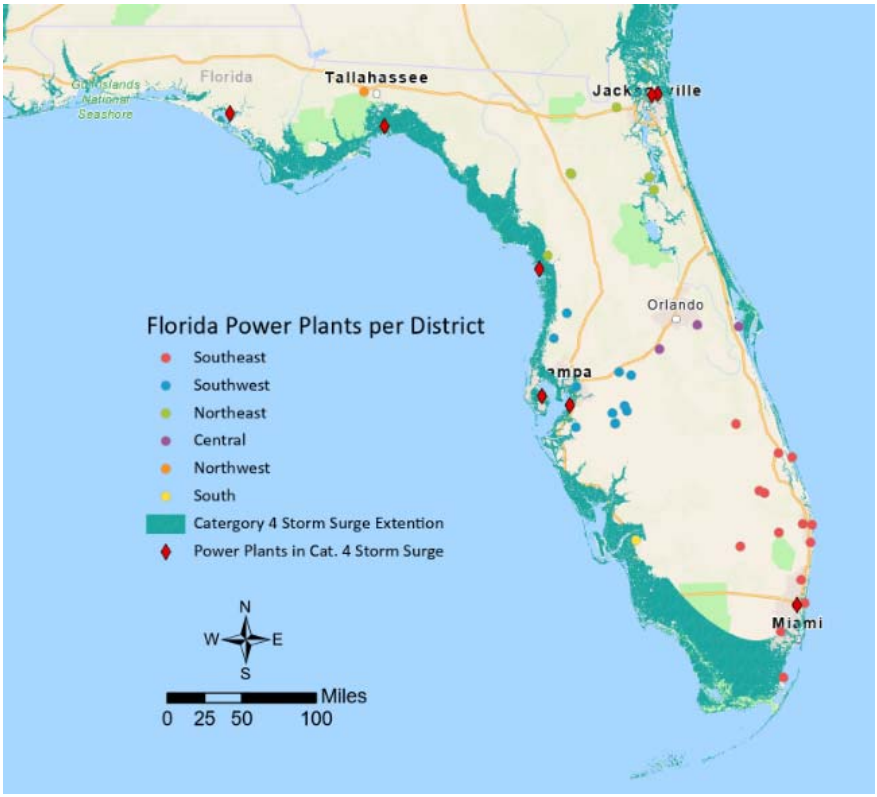
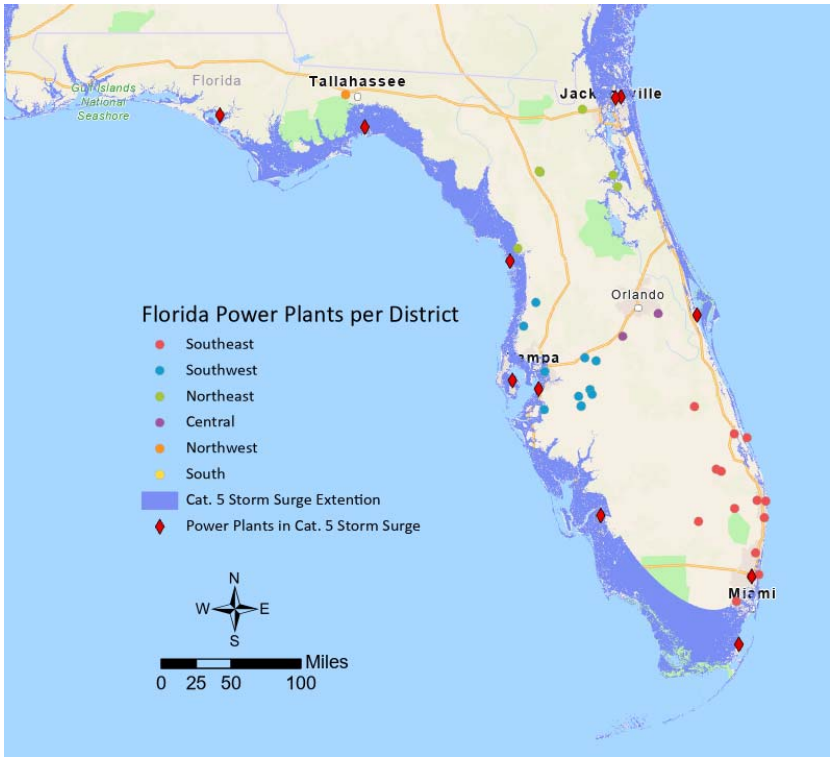
Miles
0 25 50 100

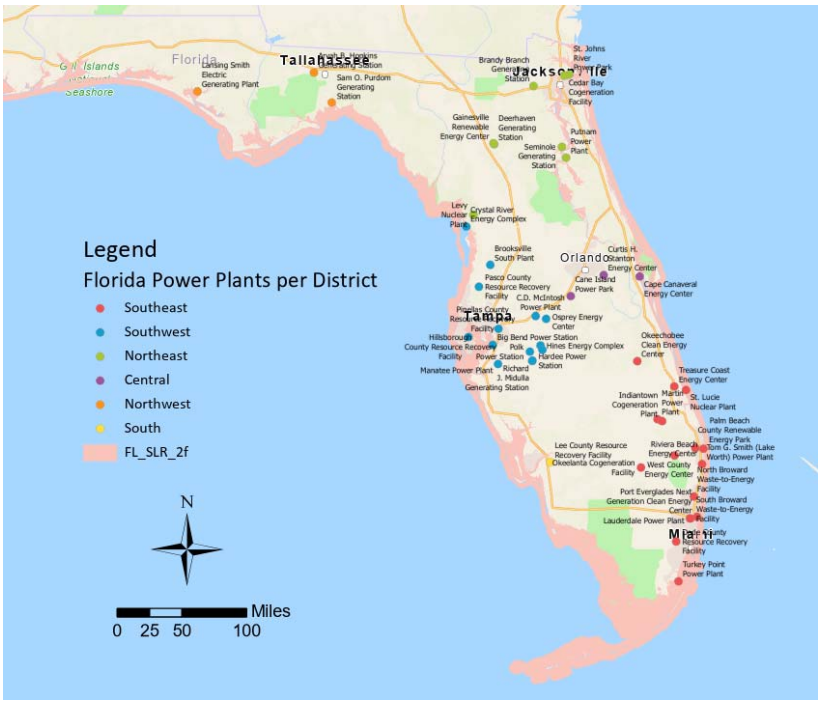
Facility	Total in FL	In Cat 4	In Cat 5	2 ft. SLR	FEMA Flood Hazard Zone
Power Plants[42]	45	8	10	0[43]	9

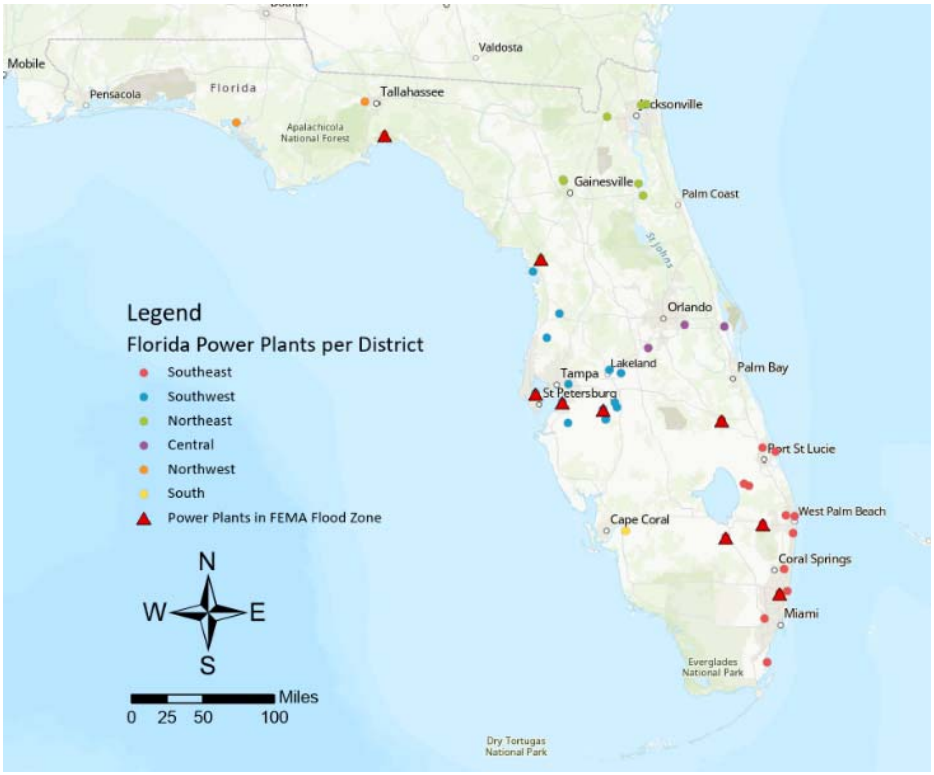


[42] Florida Power Plant data is acquired from: https://www.arcgis.com/apps/mapviewer/index.html?layers=92f7502779cf490aa1f6671659ae22fe

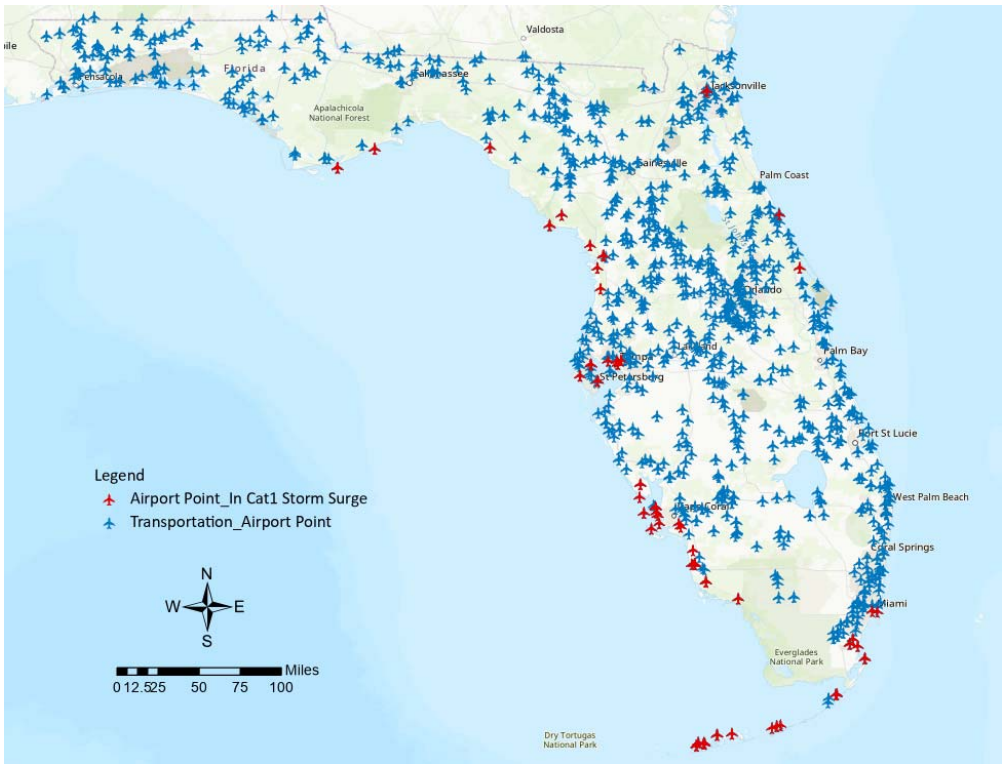
[43] The power plant facilities appear unaffected by 2 ft. SLR. However, some of the facilities surrounding may be inundated. The facilities seem to be located on higher grounds.

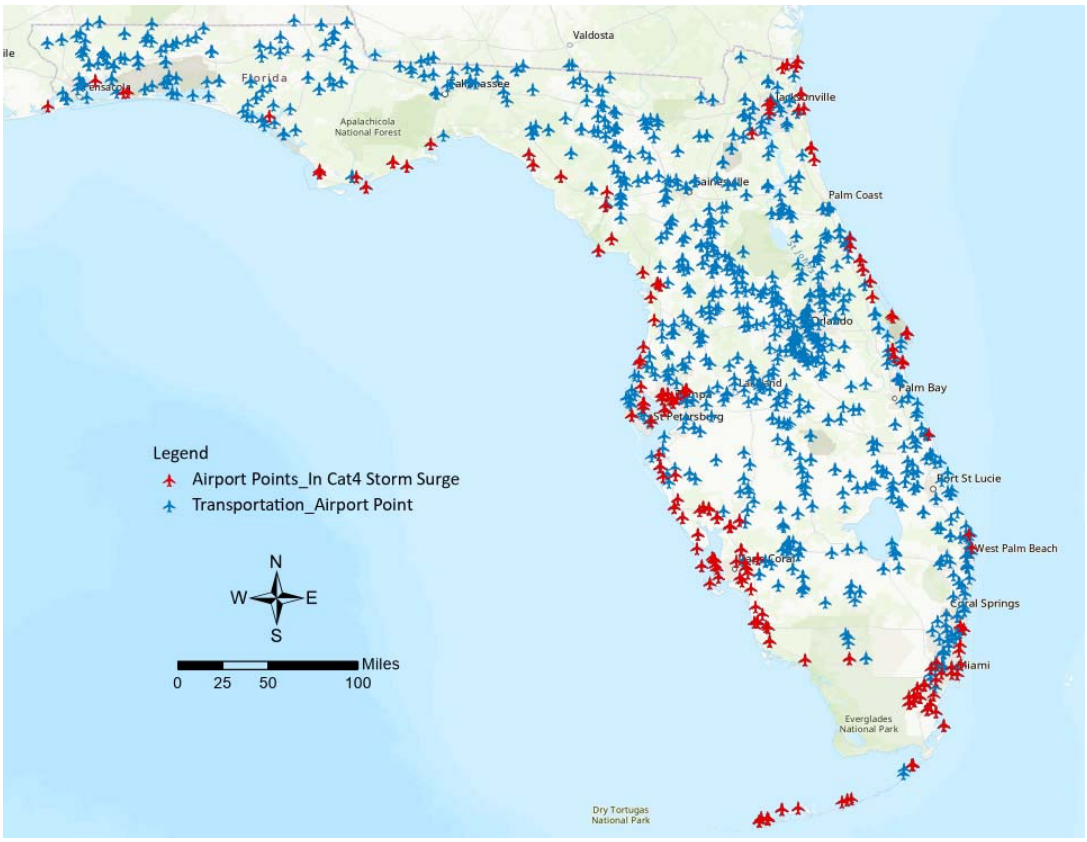

Florida
Tallahassee
Orlando
Miami
Florida Power Plants per District
Southeast
Southwest
Northeast
Central
Northwest
South
Cat. 5 Storm Surge Extention
Power Plants in Cat. 5 Storm Surge
N
W
E
S
Miles
0 25 50 100

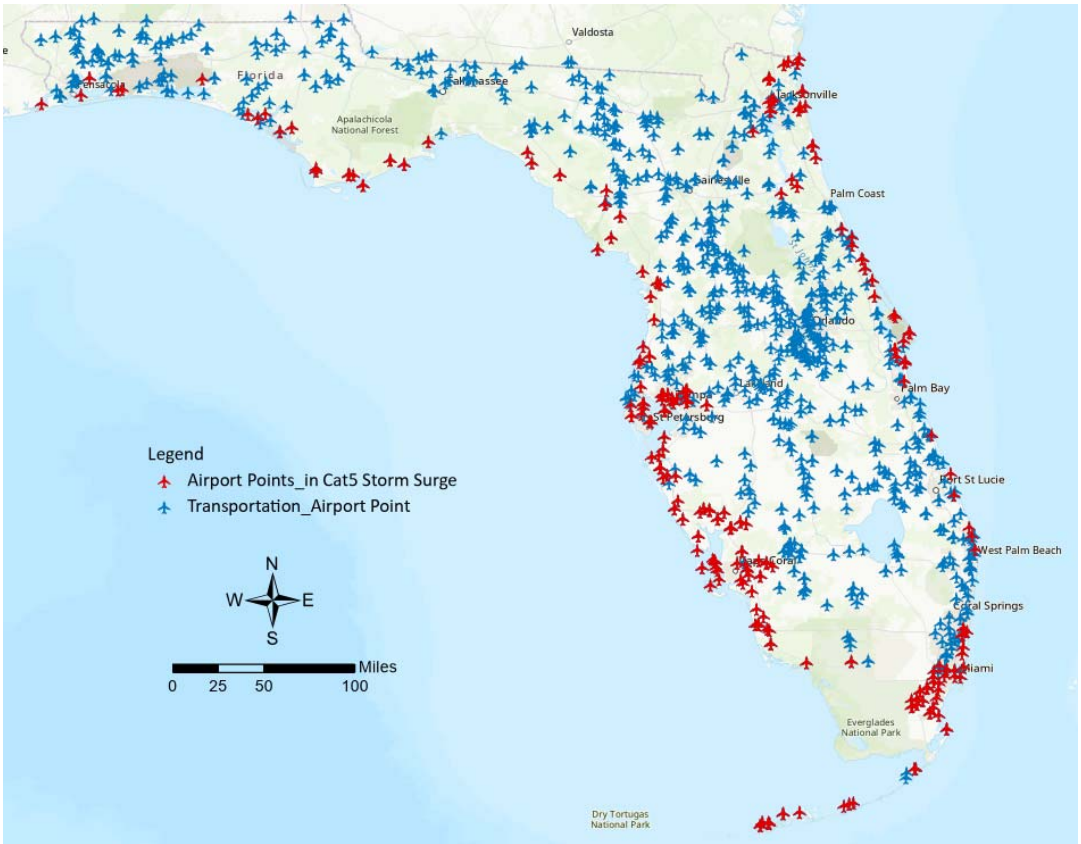

Florida
Tallahassee
Jacksonville
Orlando
Tampa
Miami
Legend
Florida Power Plants per District
Southeast
Southwest
Northeast
Central
Northwest
South
FL_SLR_2f
N
Miles
0 25 50 100

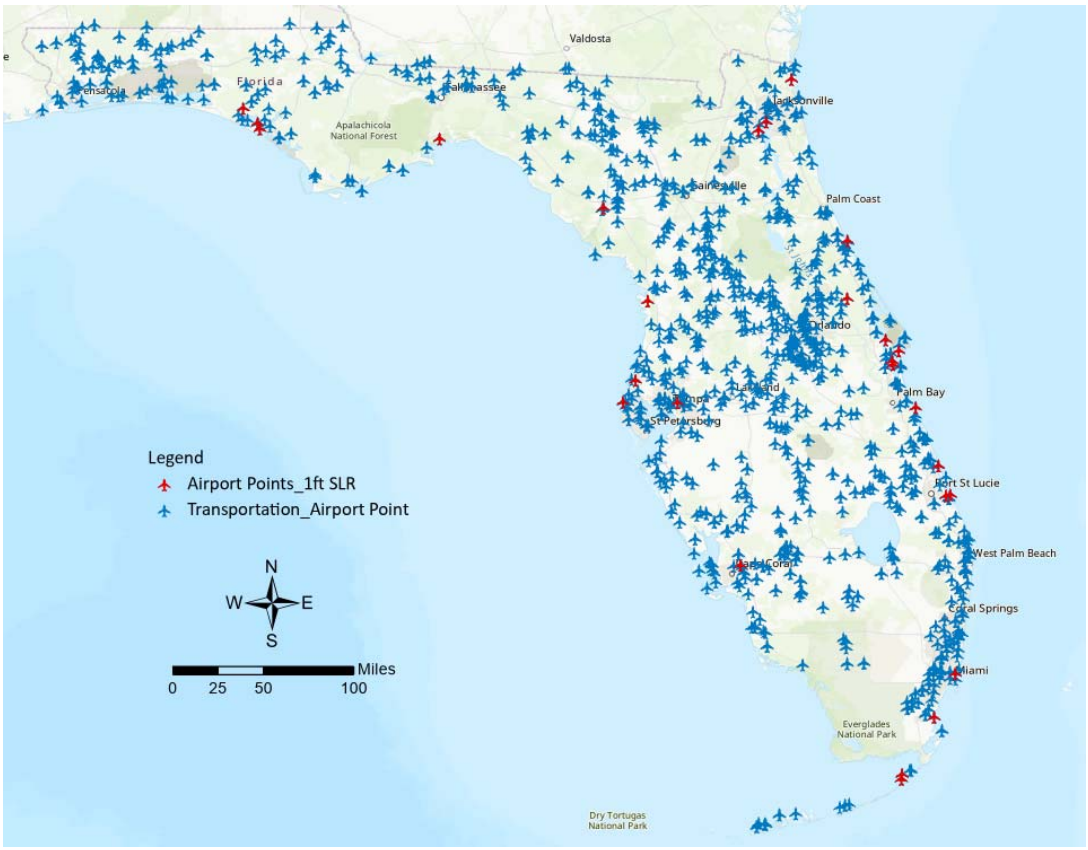

Legend
Florida Power Plants per District
Southeast
Southwest
Northeast
Central
Northwest
South
Power Plants in FEMA Flood Zone
N
W
E
S
Miles
0 25 50 100
Mobile
Pensacola
Florida
Tallahassee
Valdosta
Apalachicola National Forest
Gainesville
Palm Coast
St Johns
Orlando
Tampa
Lakeland
St Petersburg
Palm Bay
Port St Lucie
Cape Coral
West Palm Beach
Coral Springs
Miami
Everglades National Park
Dry Tortugas National Park

Facility		Total	Cat 1	Cat 4	Cat 5	1 ft. SLR	2 ft. SLR	In FEMA Annual Chance of Flooding
Airports	Points	1491	79	244	309	27	32	0
	Runways	618	45	117	138	3	12	0




Valdosta
Florida
Tallahassee
Jacksonville
Apalachicola National Forest
Gainesville
Palm Coast
Orlando
Lakeland
Tampa
St Petersburg
Palm Bay
Port St Lucie
West Palm Beach
Coral Springs
Miami
Everglades National Park
Dry Tortugas National Park
Legend
Airport Points_In Cat4 Storm Surge
Transportation_Airport Point
N
W
E
S
Miles
0 25 50 100


Valdosta
Florida
Tallahassee
Jacksonville
Apalachicola National Forest
Gainesville
Palm Coast
Orlando
Lakeland
Tampa
St Petersburg
Palm Bay
Port St Lucie
West Palm Beach
Coral Springs
Miami
Everglades National Park
Dry Tortugas National Park
Legend
Airport Points_in Cat5 Storm Surge
Transportation_Airport Point
N
W
E
S
Miles
0 25 50 100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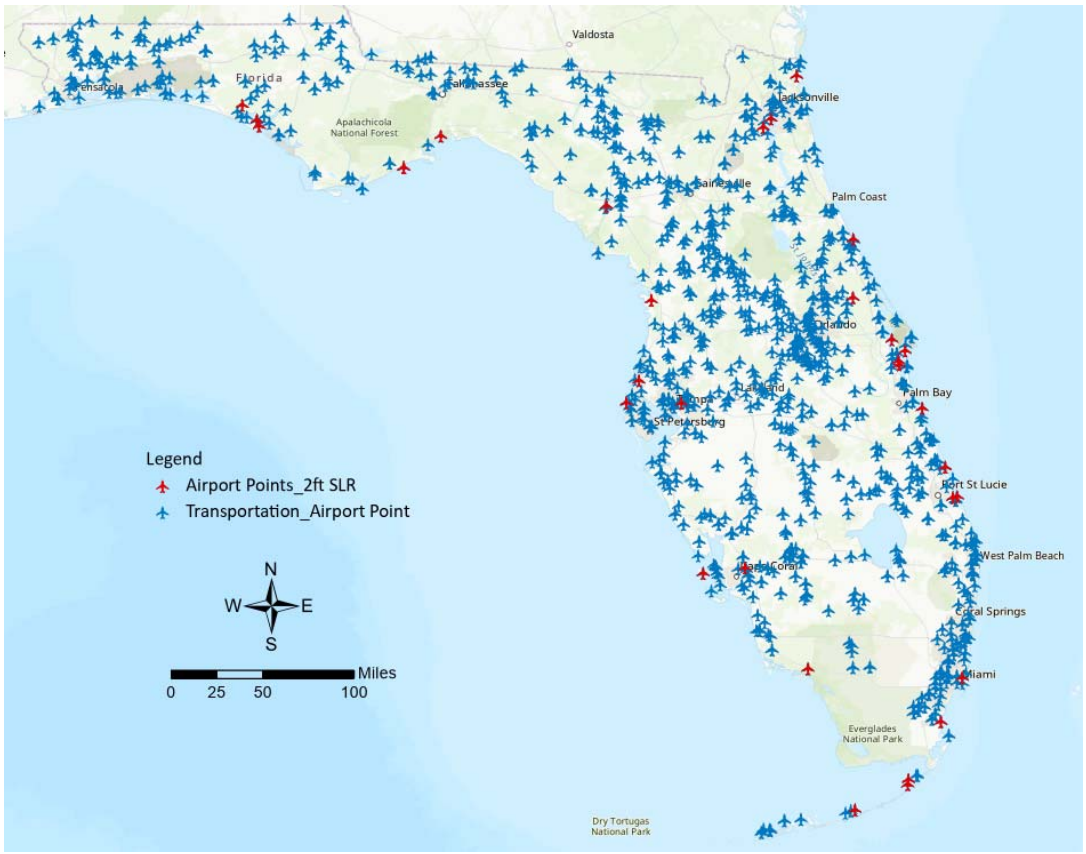
Florida
Pensacola
Tallahassee
Jacksonville
Apalachicola National Forest
Gainesville
Palm Coast
Orlando
Lakeland
Tampa
St Petersburg
Palm Bay
Port St Lucie
West Palm Beach
Coral Springs
Miami
Everglades National Park
Dry Tortugas National Park
Legend
Airport Points_1ft SLR
Transportation_Airport Point
N
W
E
S
Miles
0 25 50 100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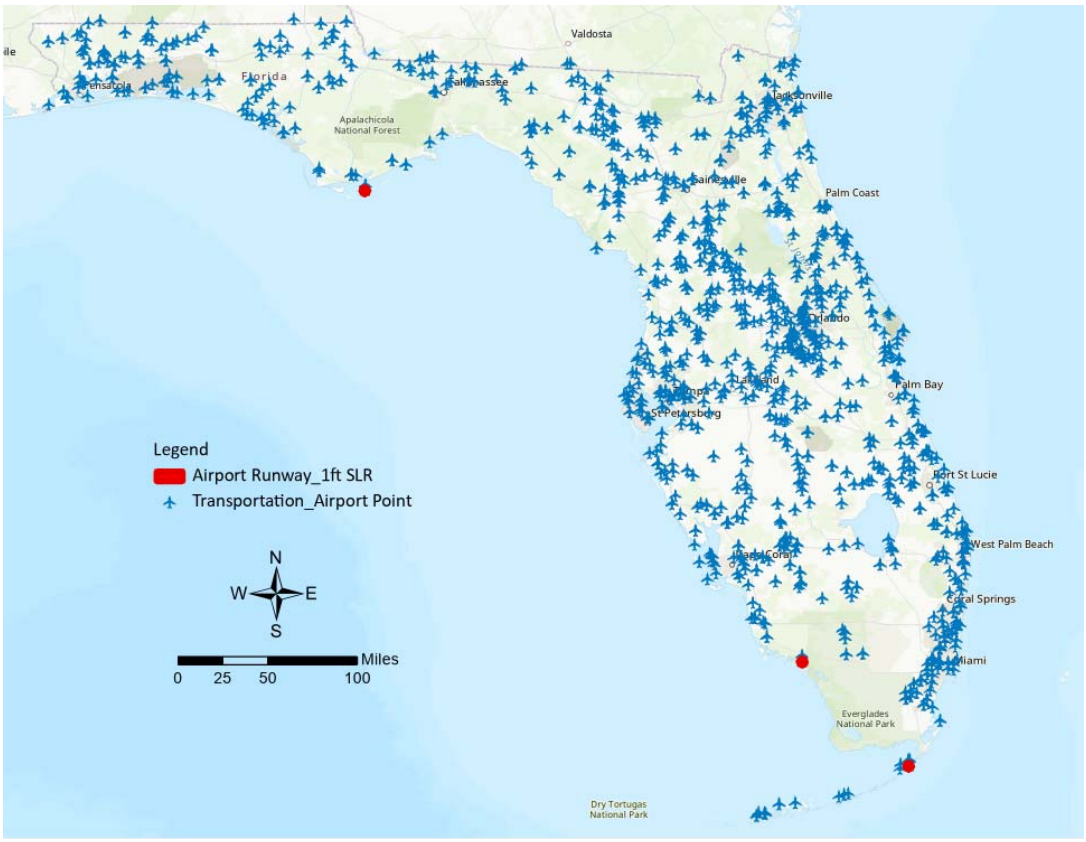
Florida
Pensacola
Tallahassee
Jacksonville
Apalachicola National Forest
Gainesville
Palm Coast
Orlando
Lakeland
Tampa
St Petersburg
Palm Bay
Port St Lucie
West Palm Beach
Coral Springs
Miami
Everglades National Park
Dry Tortugas National Park
Legend
Airport Points_2ft SLR
Transportation_Airport Point
N
W
E
S
Miles
0 25 50 100


Valdosta
Florida
Pensacola
Tallahassee
Jacksonville
Apalachicola National Forest
Gainesville
Palm Coast
Orlando
Lakeland
Tampa
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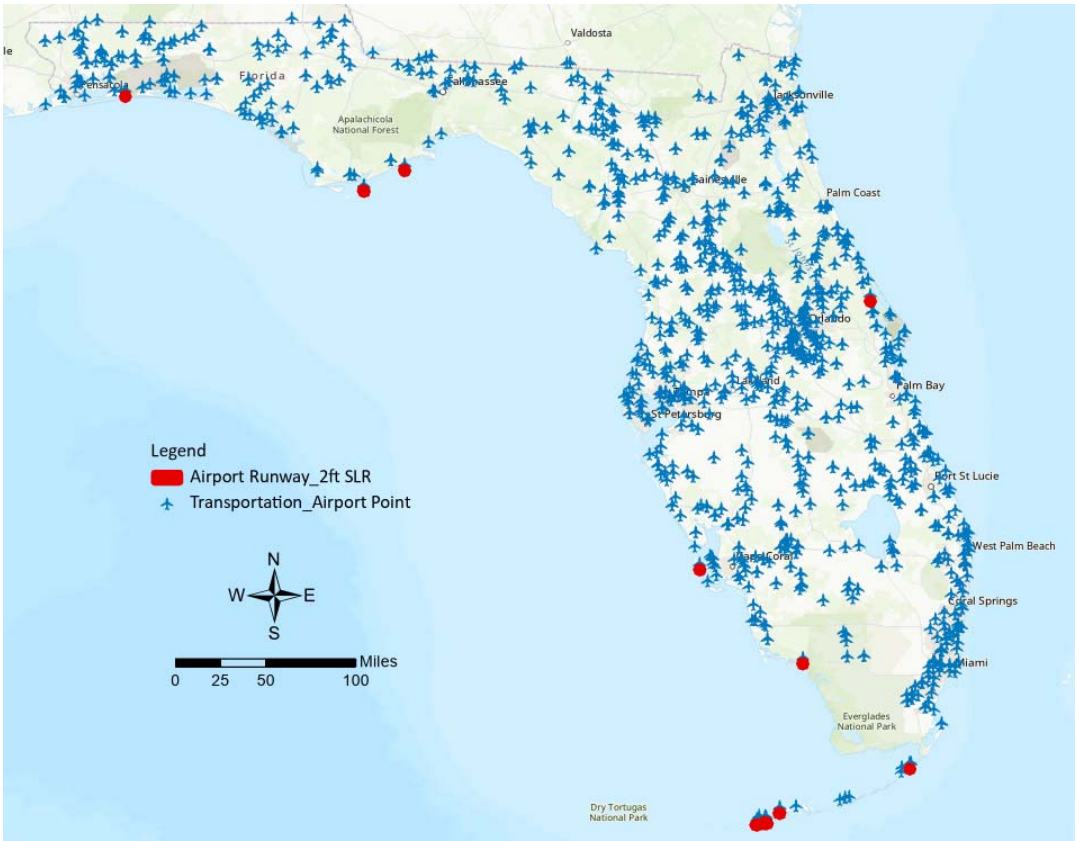
Palm Bay
Fort St Lucie
West Palm Beach
Coral Springs
Miami
Everglades National Park
Dry Tortugas National Park
Legend
Airport Runway_1ft SLR
Transportation_Airport Point
N
W
E
S
Miles
0 25 50 100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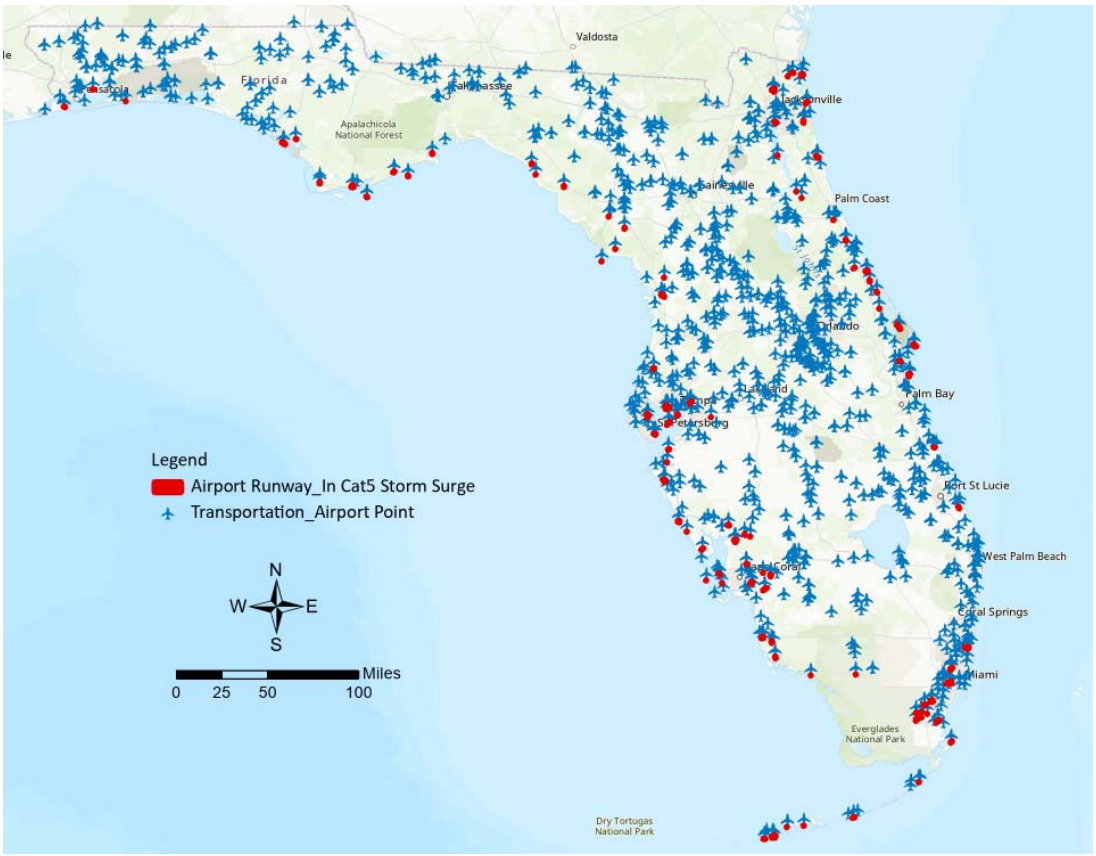
Pensacola
Tallahassee
Jacksonville
Apalachicola National Forest
Gainesville
Palm Coast
Orlando
Lakeland
Tampa
St Petersburg
Palm Bay
Fort St Lucie
West Palm Beach
Coral Springs
Miami
Everglades National Park
Dry Tortugas National Park
Legend
Airport Runway_2ft SLR
Transportation_Airport Point
N
W
E
S
Miles
0 25 50 100


Valdosta
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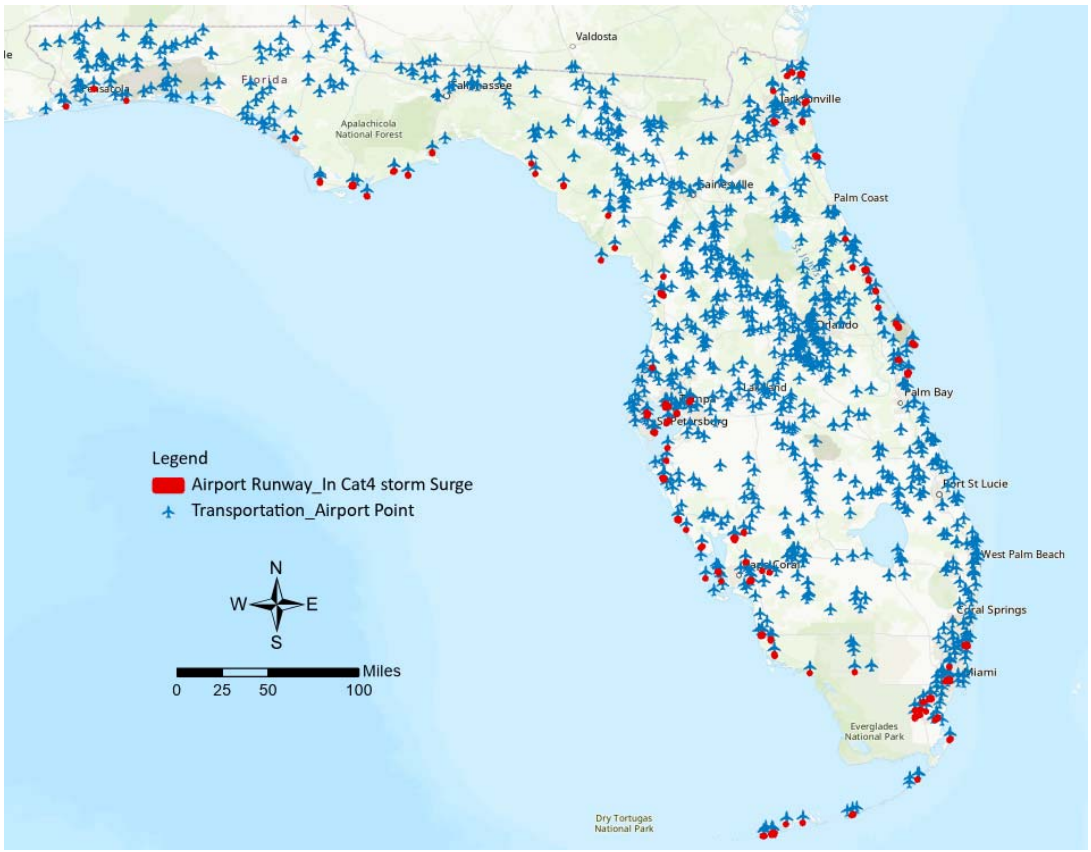
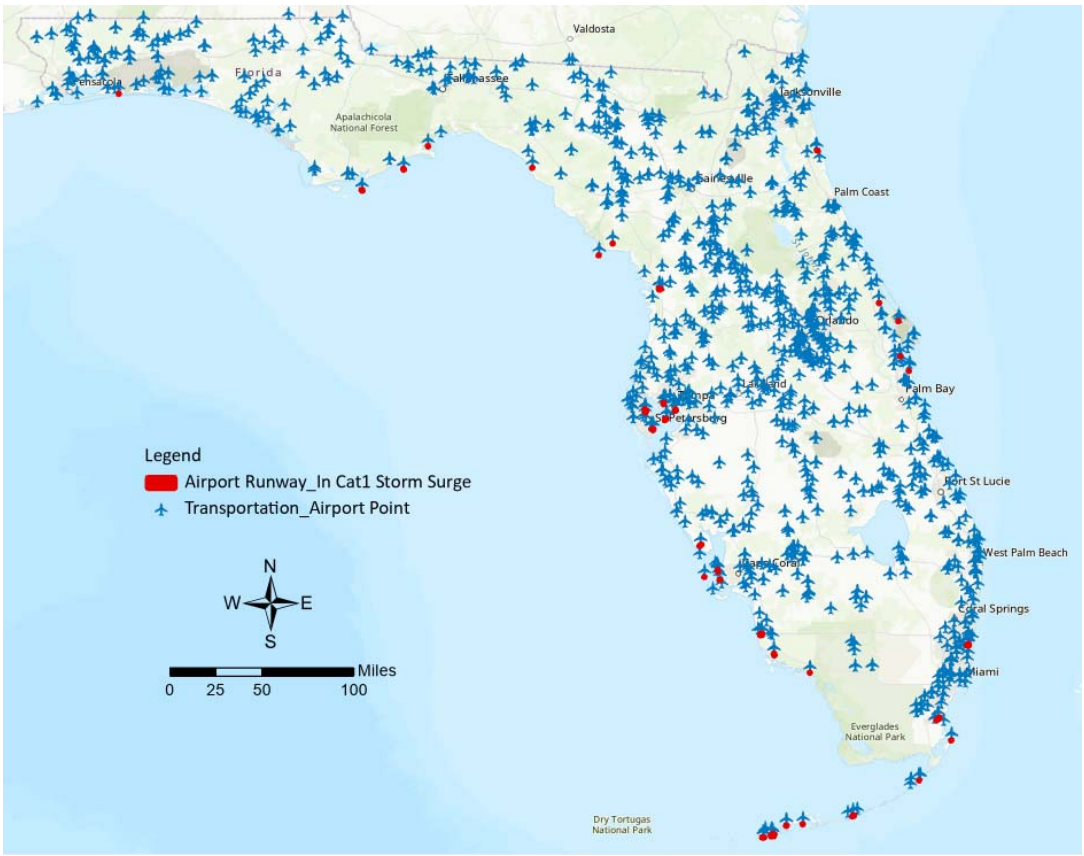
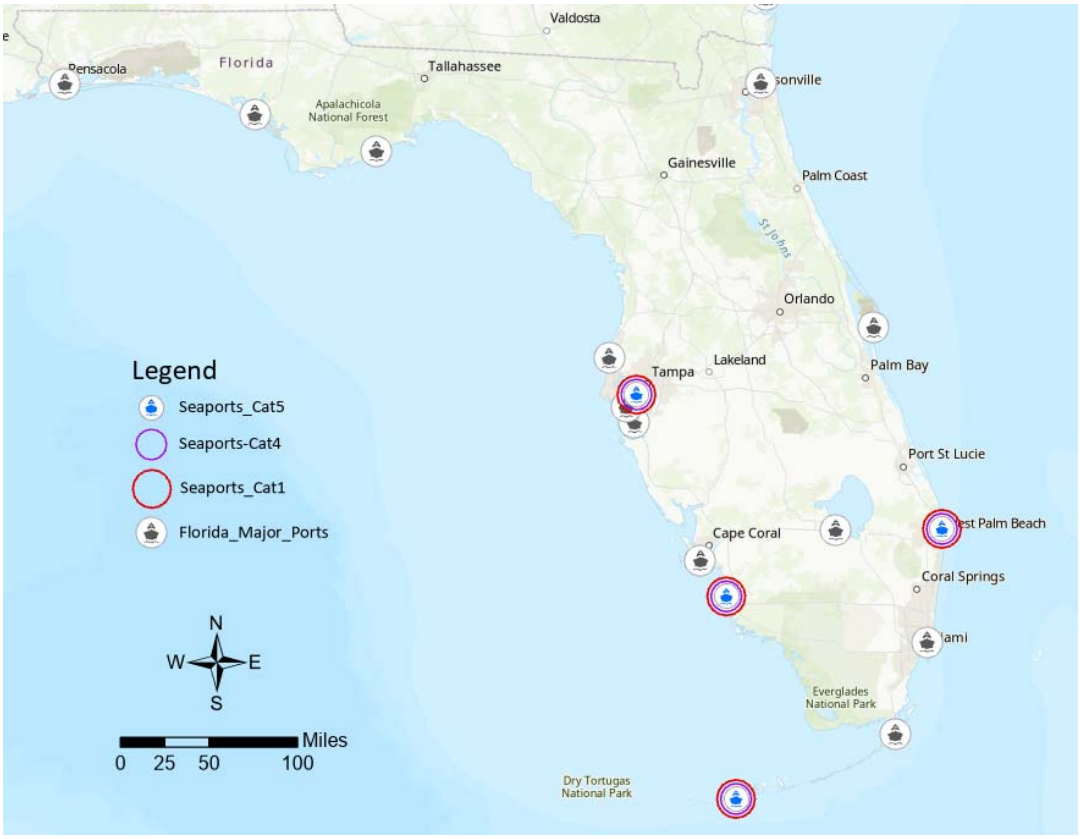
Tallahassee
Jacksonville
Apalachicola National Forest
Gainesville
Palm Coast
Orlando
Lakeland
Tampa
St Petersburg
Palm Bay
Fort St Lucie
Cape Coral
West Palm Beach
Coral Springs
Miami
Everglades National Park
Dry Tortugas National Park
Legend
Airport Runway_In Cat5 Storm Surge
Transportation_Airport Point
N
W
E
S
Miles
0 25 50 100


Valdosta
Florida
Tallahassee
Jacksonville
Apalachicola National Forest
Gainesville
Palm Coast
Orlando
Lakeland
Tampa
St Petersburg
Palm Bay
Fort St Lucie
Cape Coral
West Palm Beach
Coral Springs
Miami
Everglades National Park
Dry Tortugas National Park
Legend
Airport Runway_In Cat4 storm Surge
Transportation_Airport Point
N
W
E
S
Miles
0 25 50 100


Valdosta
Florida
Tallahassee
Jacksonville
Apalachicola National Forest
Gainesville
Palm Coast
Orlando
Palm Bay
Tampa
St Petersburg
Port St Lucie
West Palm Beach
Coral Springs
Miami
Everglades National Park
Dry Tortugas National Park
Legend
Airport Runway_In Cat1 Storm Surge
Transportation_Airport Point
N
W
E
S
Miles
0 25 50 100

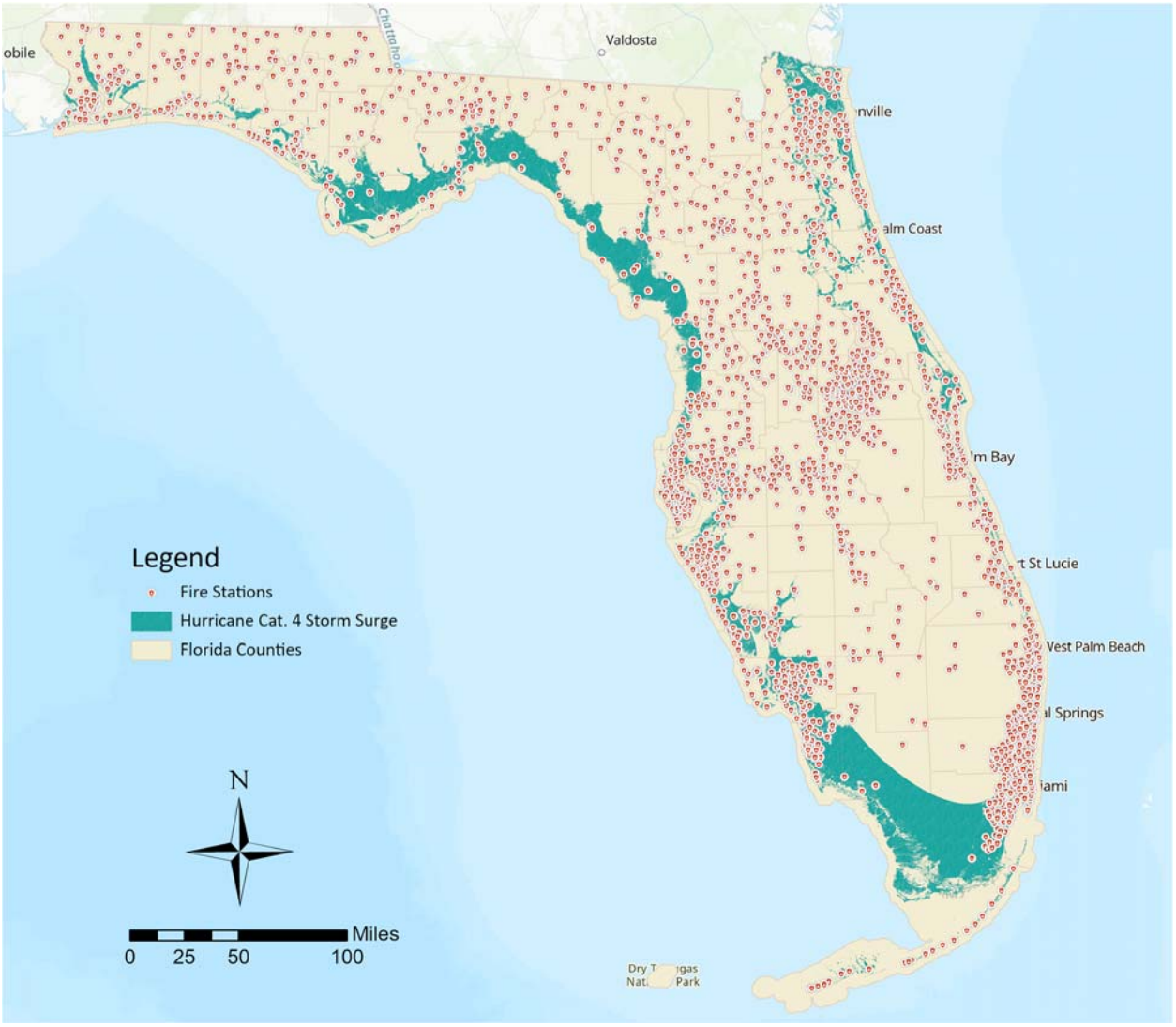
Facility	Total	Cat 1	Cat 4	Cat 5	1 ft. SLR	2 ft. SLR	In FEMA Flood Zones
Seaports	16	4	4	4	1	11	Data Issues

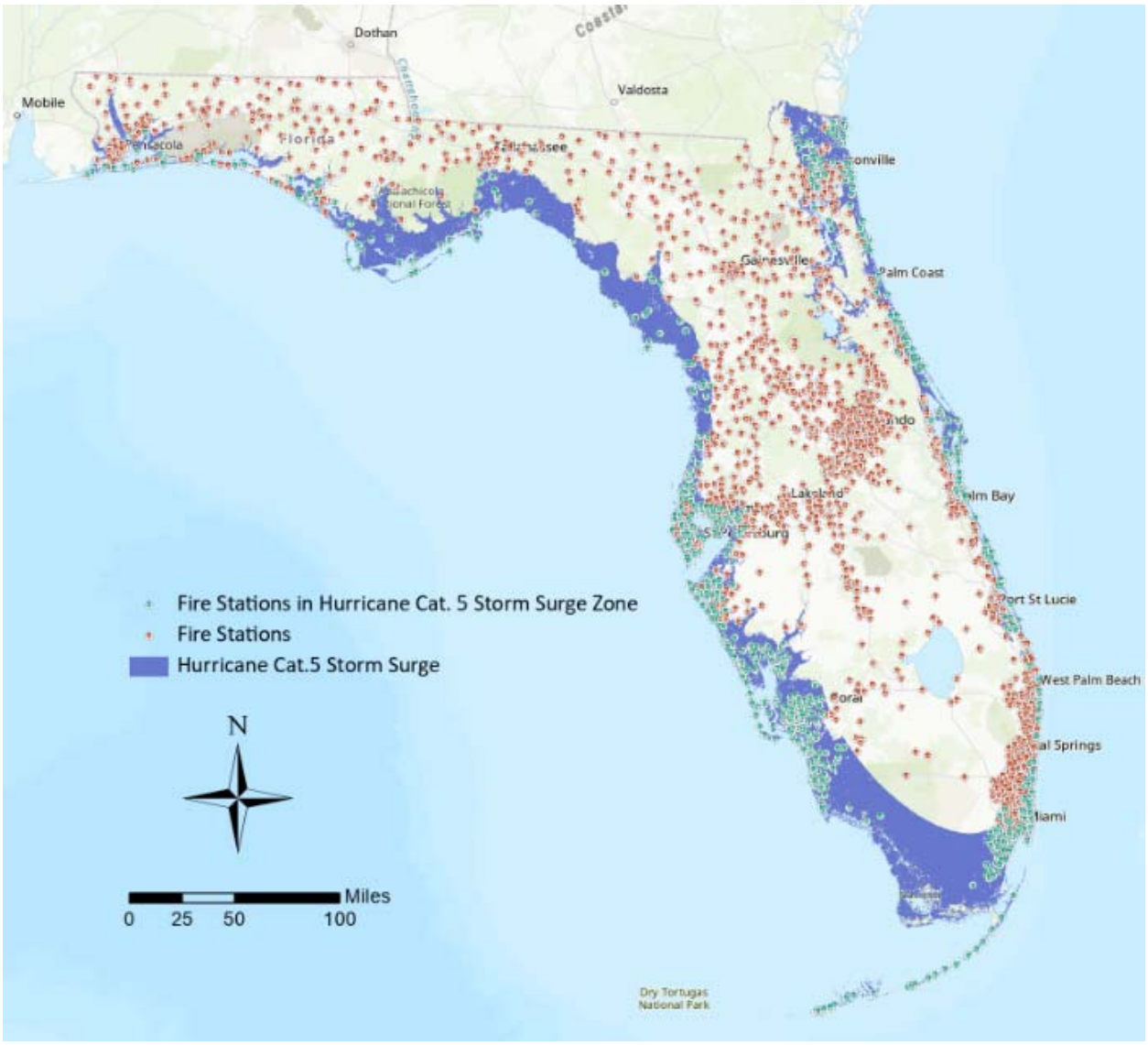


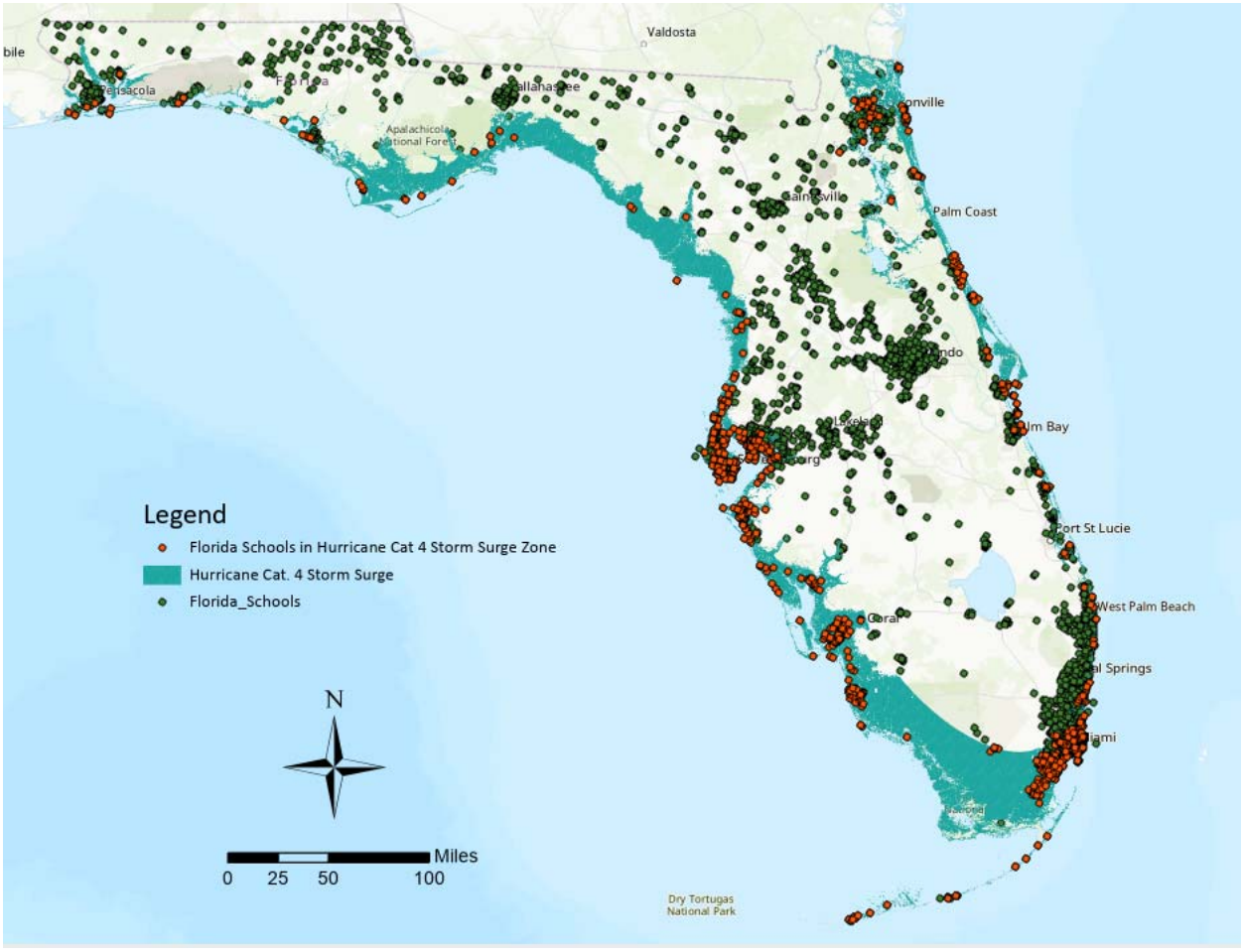

Valdosta
Florida
Tallahassee
Apalachicola
National Forest
Gainesville
Palm Coast
St Johns
Orlando
Lakeland
Tampa
Palm Bay
Port St Lucie
Cape Coral
Coral Springs
Everglades
National Park
Dry Tortugas
National Park
Legend
Seaports_1ft. SLR
Florida_Major_Ports
Seaports_2ft. SLR
N
W
E
S
Miles
0 25 50 100

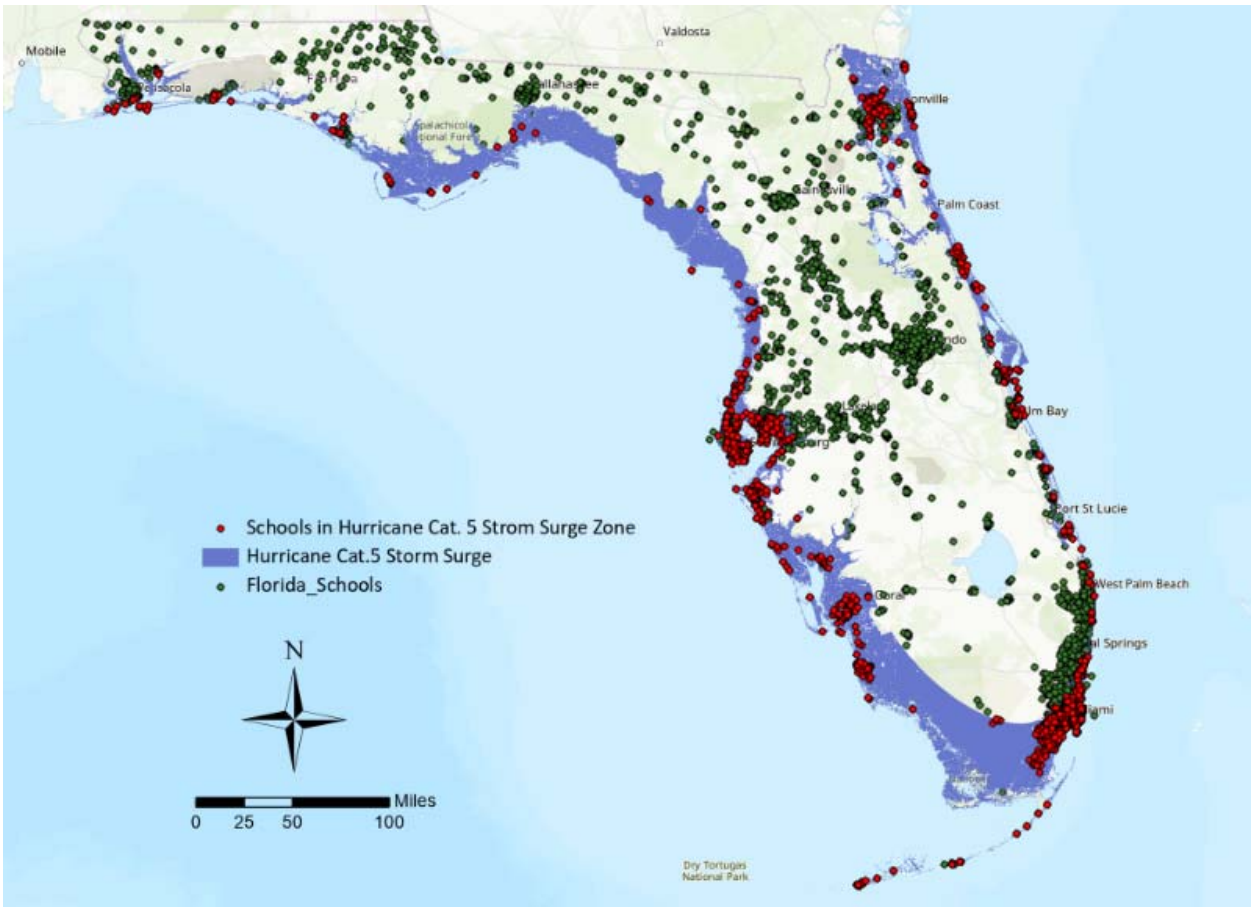
Appendix B: Critical Community and Emergency Facilities

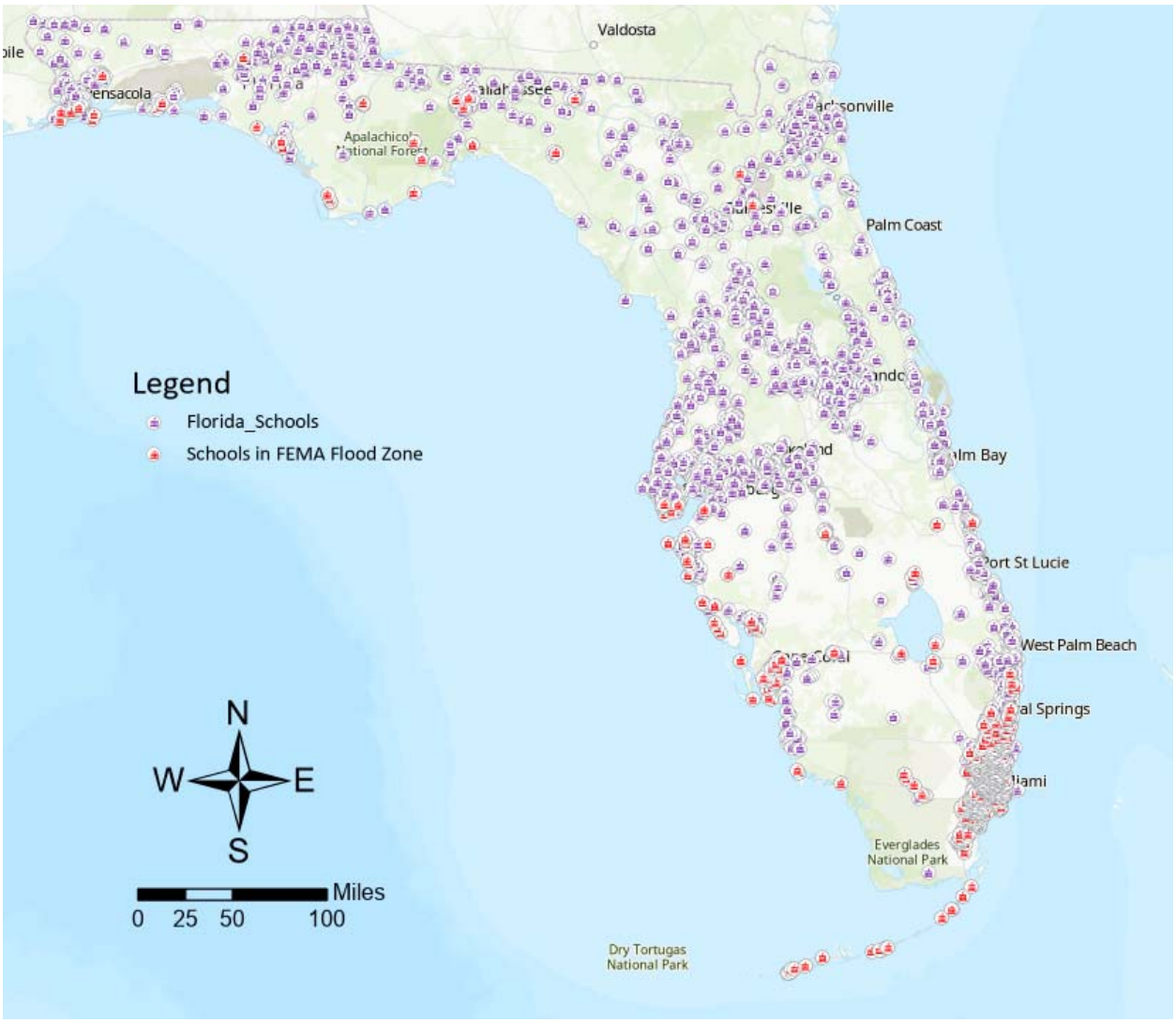
Maps showing fire stations, schools and hospitals located in various flooding zones. See Legends.

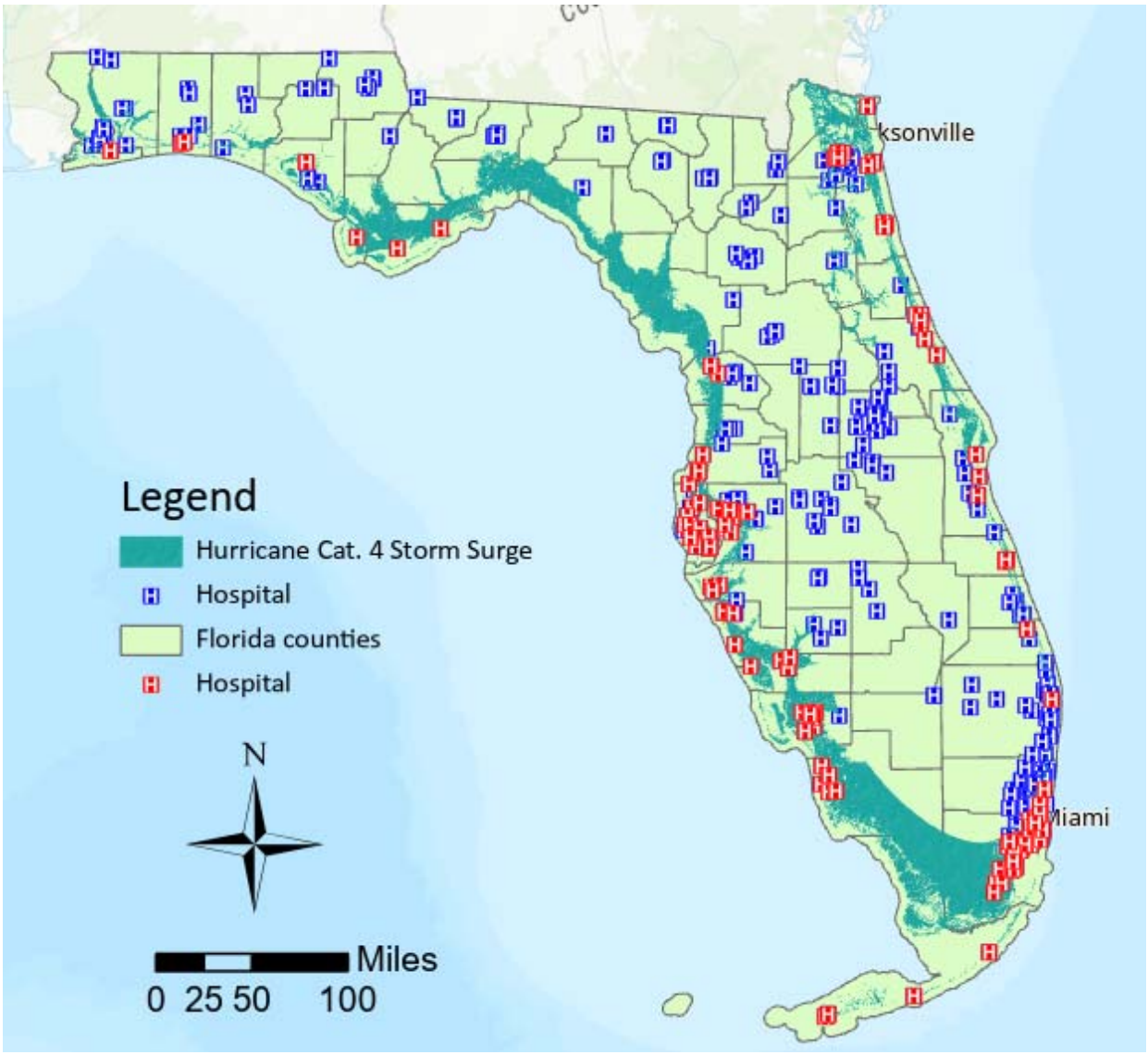


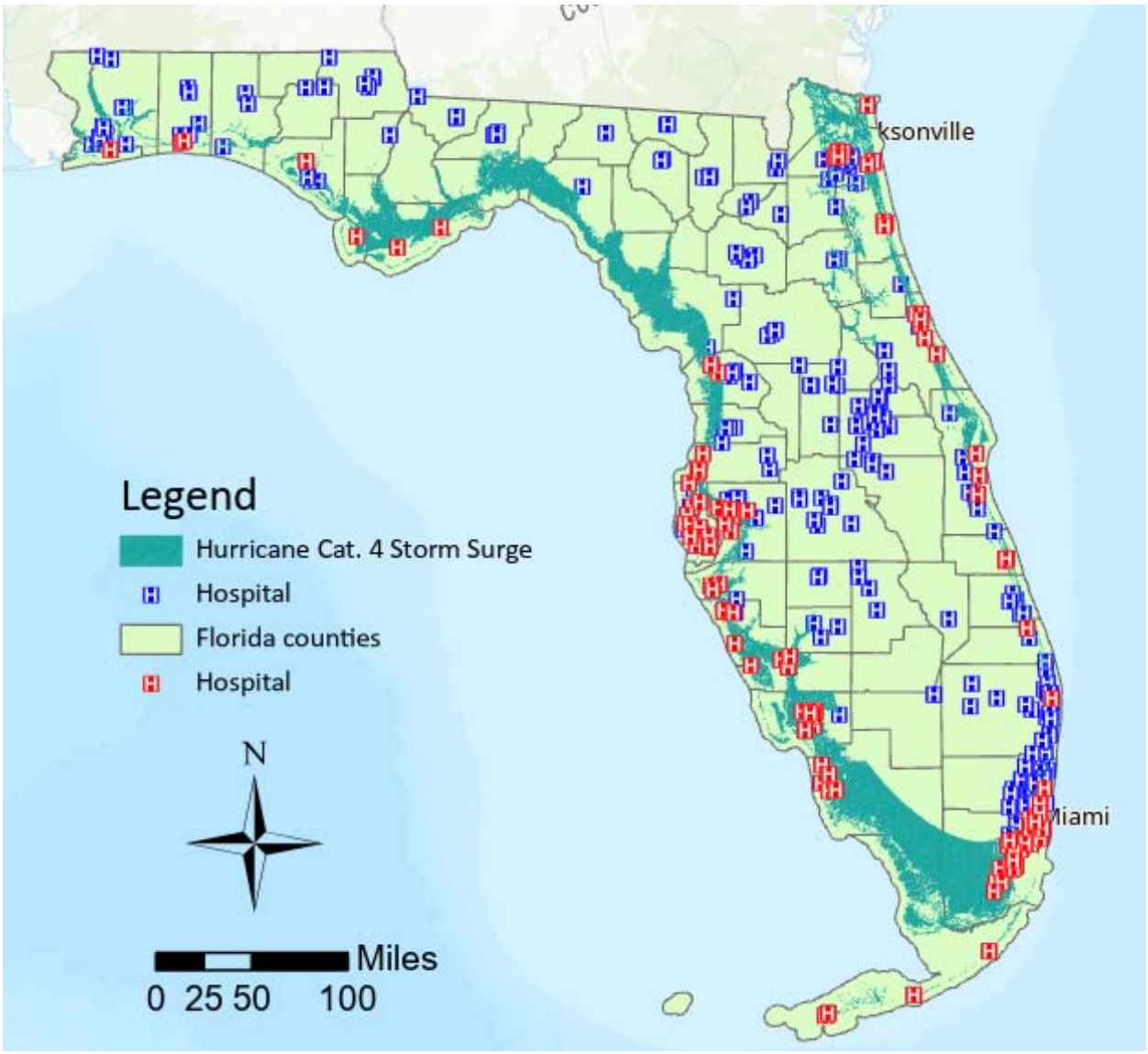

Dothan
Mobile
Valdosta
Florida
Gainesville
Palm Coast
Lakeland
West Palm Beach
Dry Tortugas
National Park
Fire Stations in Hurricane Cat. 5 Storm Surge Zone
Fire Stations
Hurricane Cat.5 Storm Surge
N
Miles
0 25 50 100

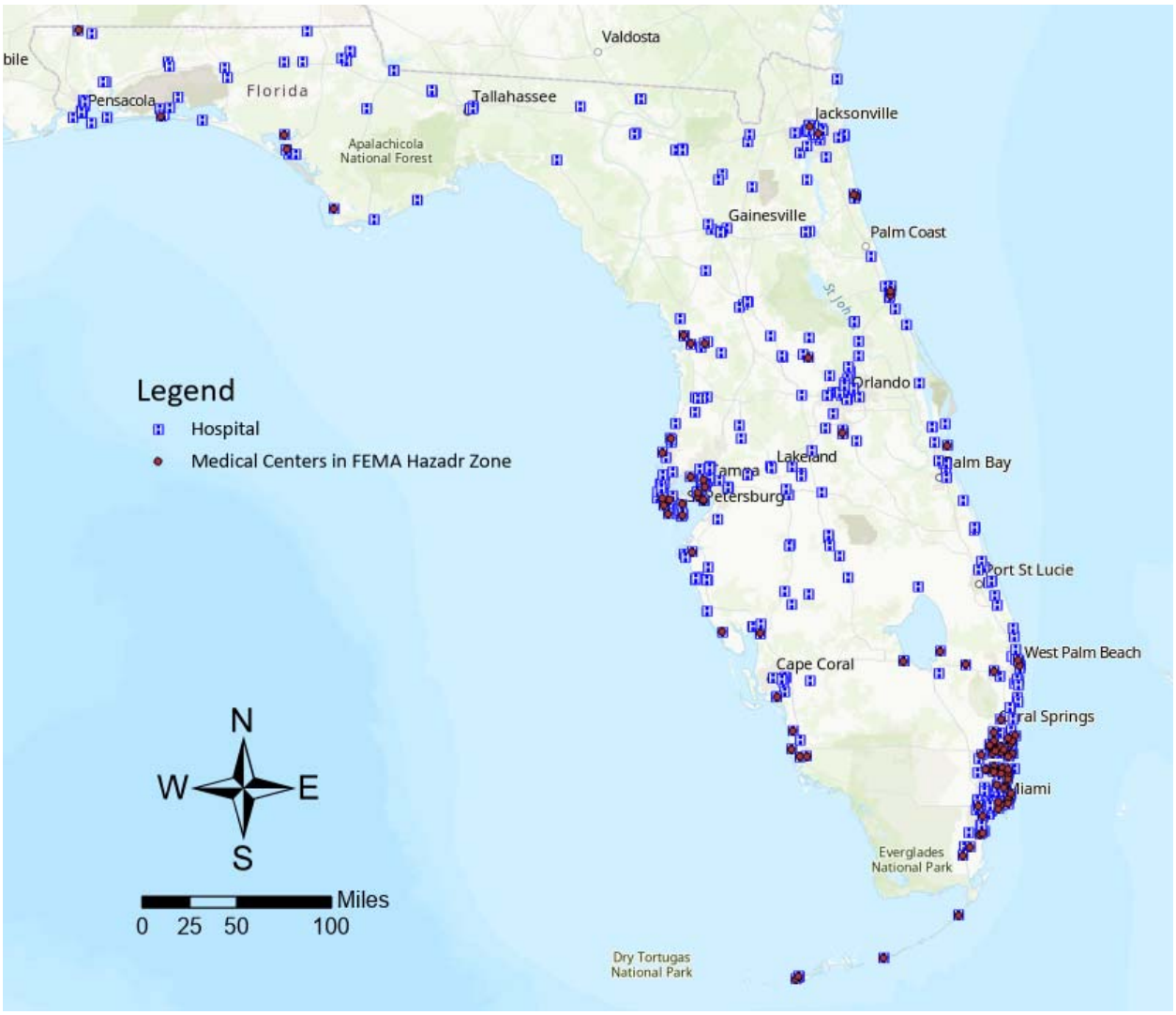

Valdosta
Pensacola
Palm Coast
West Palm Beach
Dry Tortugas
National Park
Legend
Florida Schools in Hurricane Cat 4 Storm Surge Zone
Hurricane Cat. 4 Storm Surge
Florida_Schools
N
Miles
0 25 50 100


Mobile
Valdosta
Palm Coast
Port St Lucie
West Palm Beach
Dry Tortugas National Park
Schools in Hurricane Cat. 5 Strom Surge Zone
Hurricane Cat.5 Storm Surge
Florida_Schools
N
Miles
0 25 50 100


Valdosta
Palm Coast
West Palm Beach
Everglades
National Park
Dry Tortugas
National Park
Legend
Florida_Schools
Schools in FEMA Flood Zone
N
W
E
S
Miles
0 25 50 100


ksonville
Miami
Legend
Hurricane Cat. 4 Storm Surge
Hospital
Florida counties
Hospital
N
Miles
0 25 50 100


ksonville
iami
Legend
Hurricane Cat. 4 Storm Surge
Hospital
Florida counties
Hospital
N
Miles
0 25 50 100


Valdosta
Florida
Pensacola
Tallahassee
Jacksonville
Apalachicola
National Forest
Gainesville
Palm Coast
Orlando
Lakeland
Tampa
Port St Lucie
West Palm Beach
Cape Coral
Miami
Everglades
National Park
Dry Tortugas
National Park
Legend
Hospital
Medical Centers in FEMA Hazadr Zone
N
W
E
S
Miles
0 25 50 100