2050 PATH FORWARD
Leading the Way for Transportation Innovation

Technical Memo: Regional Resiliency

August 2024

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NORTH FLORIDA TPO

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1.0 Introduction

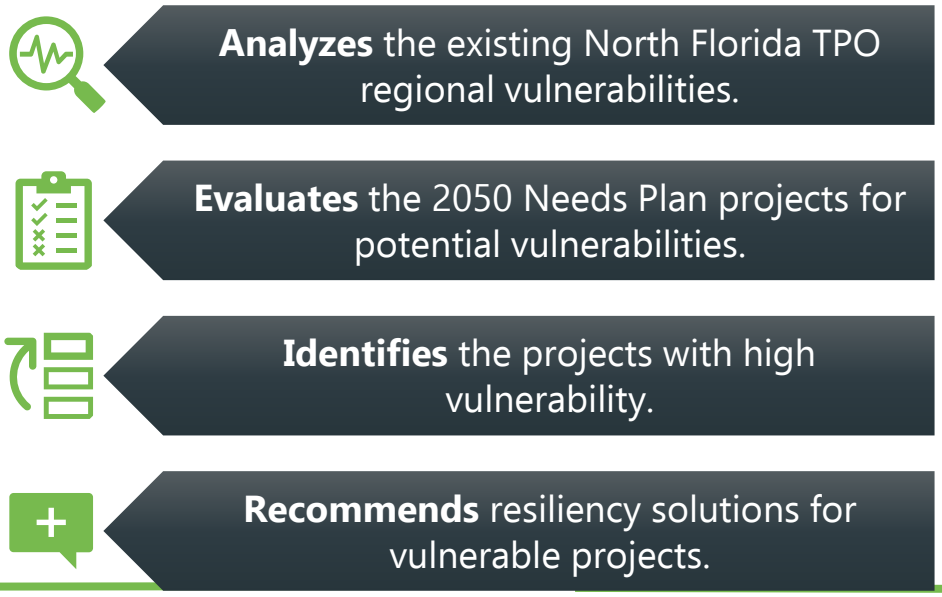
Resiliency in the context of transportation planning refers to the ability of transportation systems to withstand, adapt to, and recover from adverse conditions, such as extreme weather events, natural disasters, and long-term environmental changes. In North Florida, where the transportation infrastructure is frequently challenged by hurricanes, flooding, and other environmental factors, resiliency is particularly relevant.

Effective resiliency planning ensures that transportation networks remain functional and reliable during and after such events, minimizing disruptions and maintaining critical connectivity. This is crucial not only for the safety and mobility of residents but also for the economic stability and growth of the region. By integrating resiliency into transportation planning, the North Florida Transportation Planning Organization (TPO) can better protect its infrastructure investments, reduce recovery costs, and enhance the overall quality of life for its communities.

Given the region's susceptibility to extreme weather events and other climate-related challenges, it is crucial to integrate resiliency into the Long Range Transportation Plan (LRTP) to enhance the durability, reliability, and longevity of the region's transportation infrastructure. This technical memo provides a comprehensive analysis of susceptible locations within the region and identifies future projects that will fortify vulnerable facilities within the transportation network aimed at bolstering the resiliency of the regional transportation system. By proactively addressing these vulnerabilities, the North Florida TPO works to ensure a sustainable, efficient, and resilient transportation framework that can withstand and adapt to future adversities.

1.1 Approach

This memo evaluates regional resiliency using the following methodology:



1.2 Base Data

A comprehensive regional resiliency analysis for Northeast Florida requires an understanding of various environmental threats that impact the region's infrastructure and communities. Key data sets integral to this analysis include flood risk visualizations for both riverine and coastal areas, storm surge projections, and sea level rise scenarios.

Flood Risk Data: Encompasses riverine and coastal flood risk. Riverine flood risk provides insights into areas susceptible to flooding from rivers and streams, highlighting zones that face a 1% annual chance of flood, commonly referred to as the 100-year floodplain. Coastal flood risk data extends this analysis to include the impacts of tidal and storm-induced flooding on coastal communities.

Storm Surge Data: Predicts the abnormal rise of water levels due to storm events. Storm surge data is critical for assessing potential inundation and infrastructure damage during hurricanes and severe storms.

FDOT Resilience Action Plan: Identifies geographic areas that may be subject to water-related hazards. Additional information or detailed studies are needed to determine if the road or bridge itself would be impacted by a hazard based on specific characteristics of the facility and location.

Sea Level Rise Data: Offers long-term projections of rising ocean levels, essential for planning future infrastructure resilience in the face of gradual yet persistent changes in coastal water levels.

Collectively, these data sets form the basis of this resiliency analysis, enabling to the TPO to develop strategies that enhance the region's ability to withstand and recover from environmental challenges. Each of these data sets are described in further detail and displayed graphically for the region on the following pages.

Flood Risk

Analyzing flood risk in transportation planning informs the design and placement of infrastructure to enhance resiliency, ensuring routes remain operational during extreme weather events and mitigating long-term economic and safety impacts.

Flood risk within the region was evaluated using the National Risk Index (NRI)[1] published by the Federal Emergency Management Agency (FEMA). The National Risk Index is a dataset and online tool that helps to illustrate the areas most at risk for 18 natural hazards across the United States and territories. The NRI leverages available source data for natural hazard data to develop a baseline relative measurement.

The NRI data utilized in this resiliency analysis were coastal flood risk and riverine flood risk. The risk index is displayed in **Figures 1-1** and **1-2** by Census tract across the following categories: *Very Low, Relatively Low, Relatively Moderate, Relatively High and Very High.*

Coastal Flood Risk

Figure 1-1 displays the coastal flooding risk throughout the region. The areas within the region with relatively high coastal flooding risk are concentrated along the coast of St. Johns County generally east of the intracoastal waterway. Areas with relatively moderate coastal flooding risk are located along the coastal areas of the region, primarily west of the intracoastal waterway and in the vicinity of the St. Johns River. Areas within western Clay, Duval, and Nassau counties have the lowest coastal flood risk.

Riverine Flood Risk

Figure 1-2 displays the riverine flooding risk throughout the region. The areas within the region with lower riverine flooding risk are generally concentrated in western Clay and Nassau counties. The areas with higher flood risk are scattered throughout Duval and St. Johns counties, primarily near the creeks and intracoastal waterway. Clay and Nassau counties generally have relatively low to relatively moderate flood risk.

100 Year Floodplain

Figure 1-3 displays the areas within FEMA's 100-year floodplain across the region[2]. 100-year floodplain data identifies areas with a 1% annual chance of flooding.

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[1] The National Risk Index is a dataset and online tool that helps to illustrate the communities most at risk for 18 natural hazards across the United States and territories. The shapefile feature layer contains Census tract-level data and was updated in May 2023.

[2] The dataset was derived from the Digital Flood Insurance Rate Map (FIRM) database which depicts flood risk information. The dataset "DFIRM_100_DEC22" was downloaded from the Florida Geographic Data Library (FGDL) current data catalog.

Figure 1-1 Coastal Flooding Risk

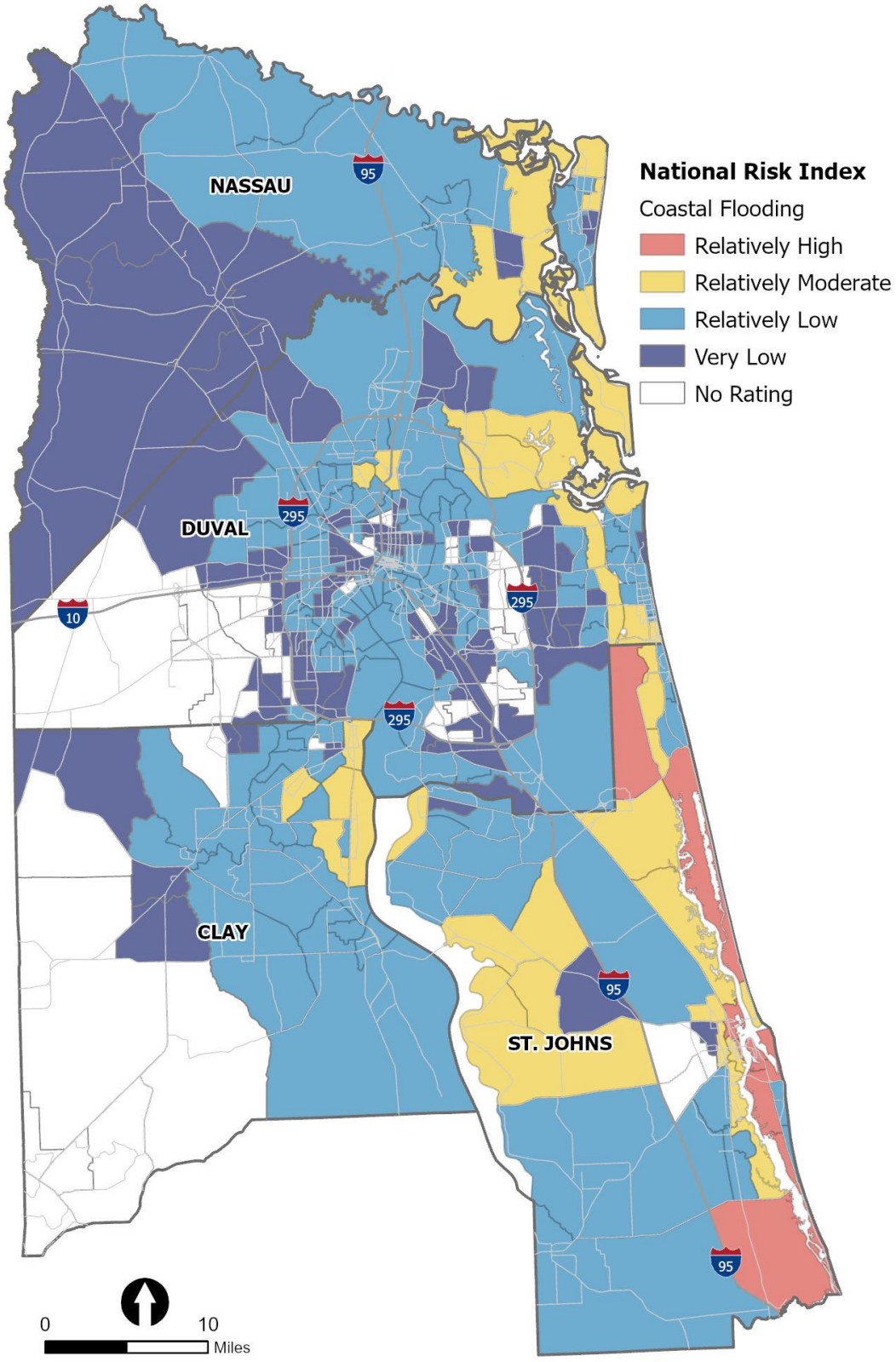


Figure 1-2 Riverine Flooding Risk

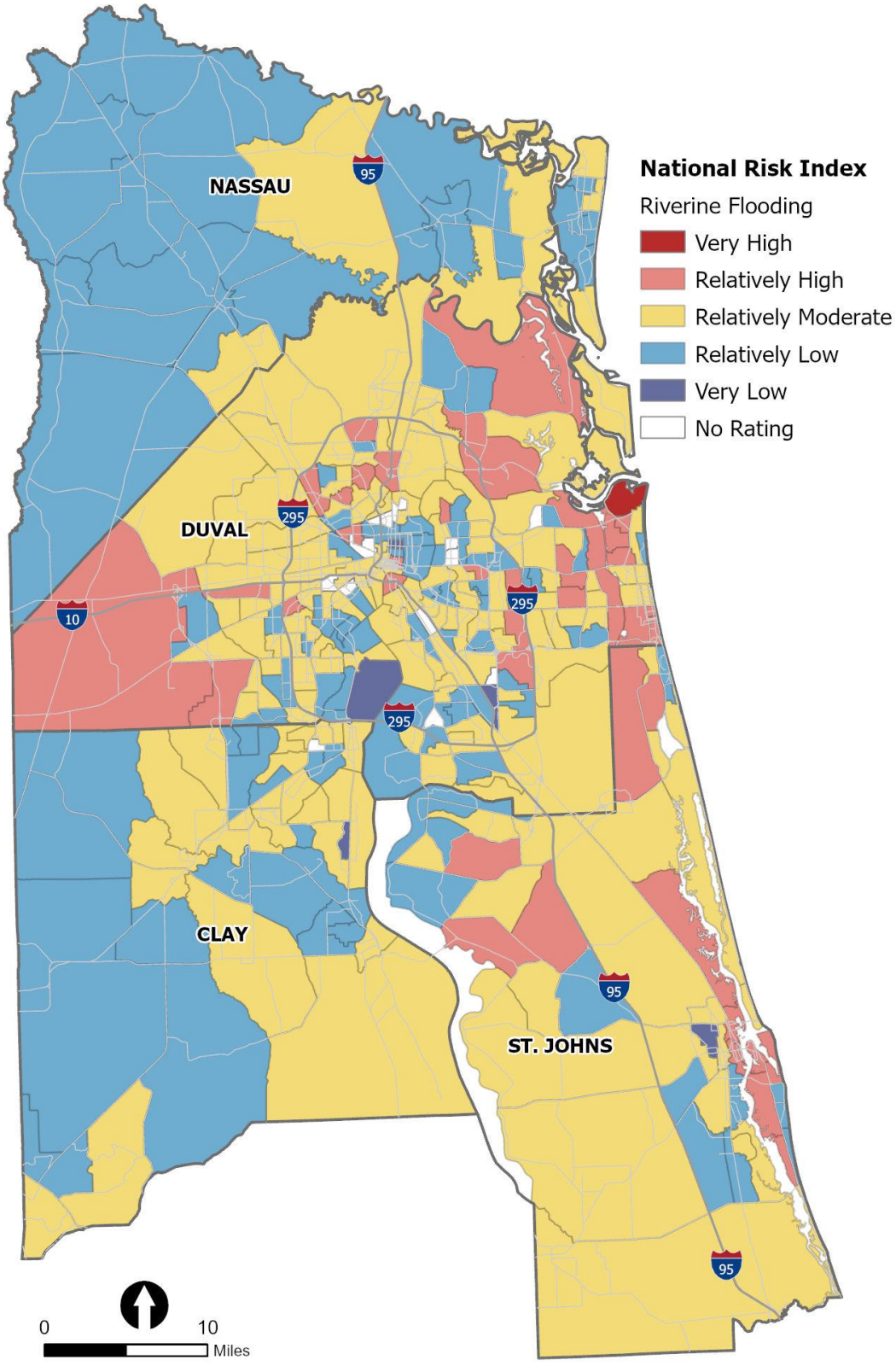
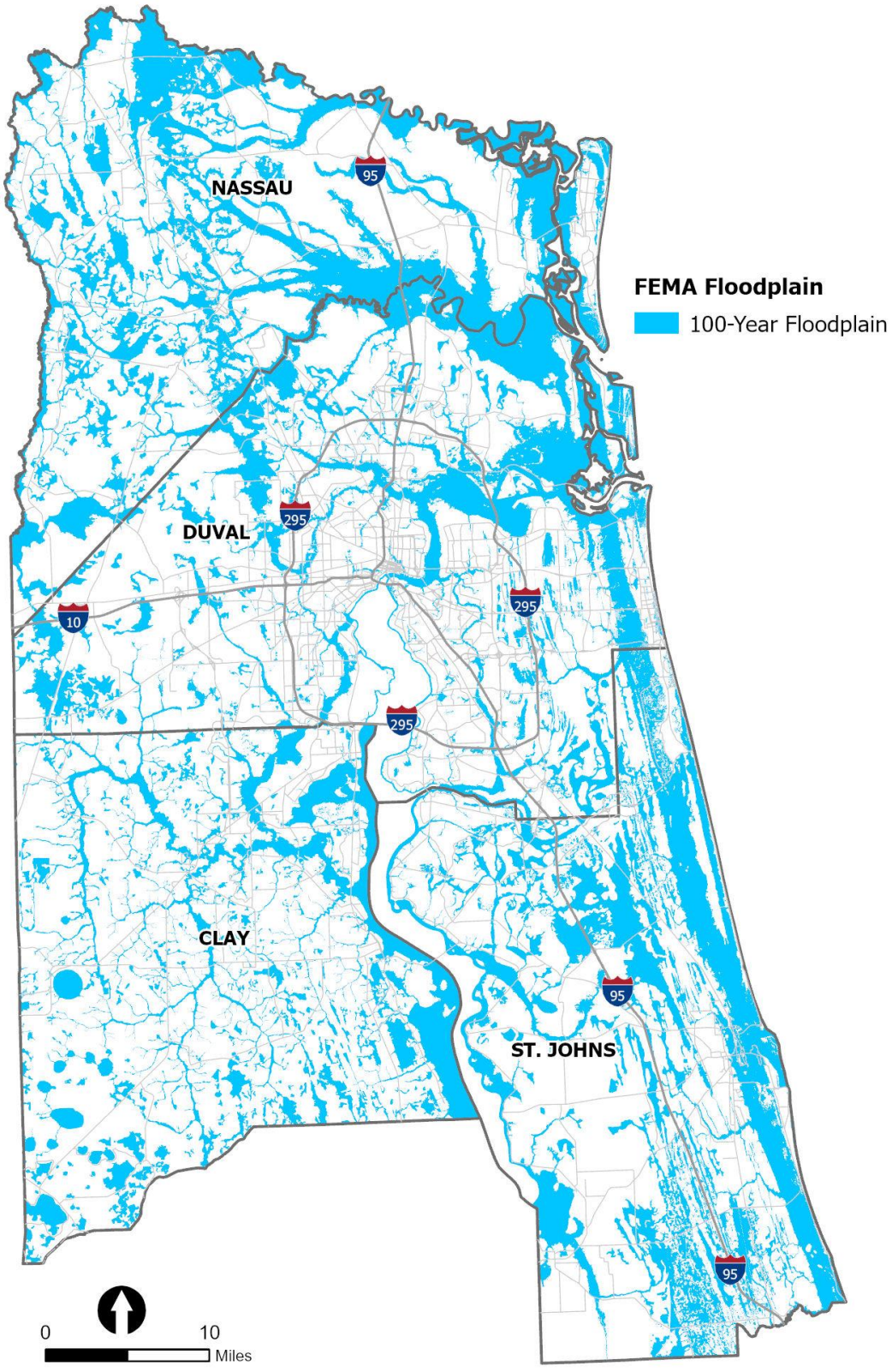


Figure 1-3 100-Year Floodplain



Storm Surge

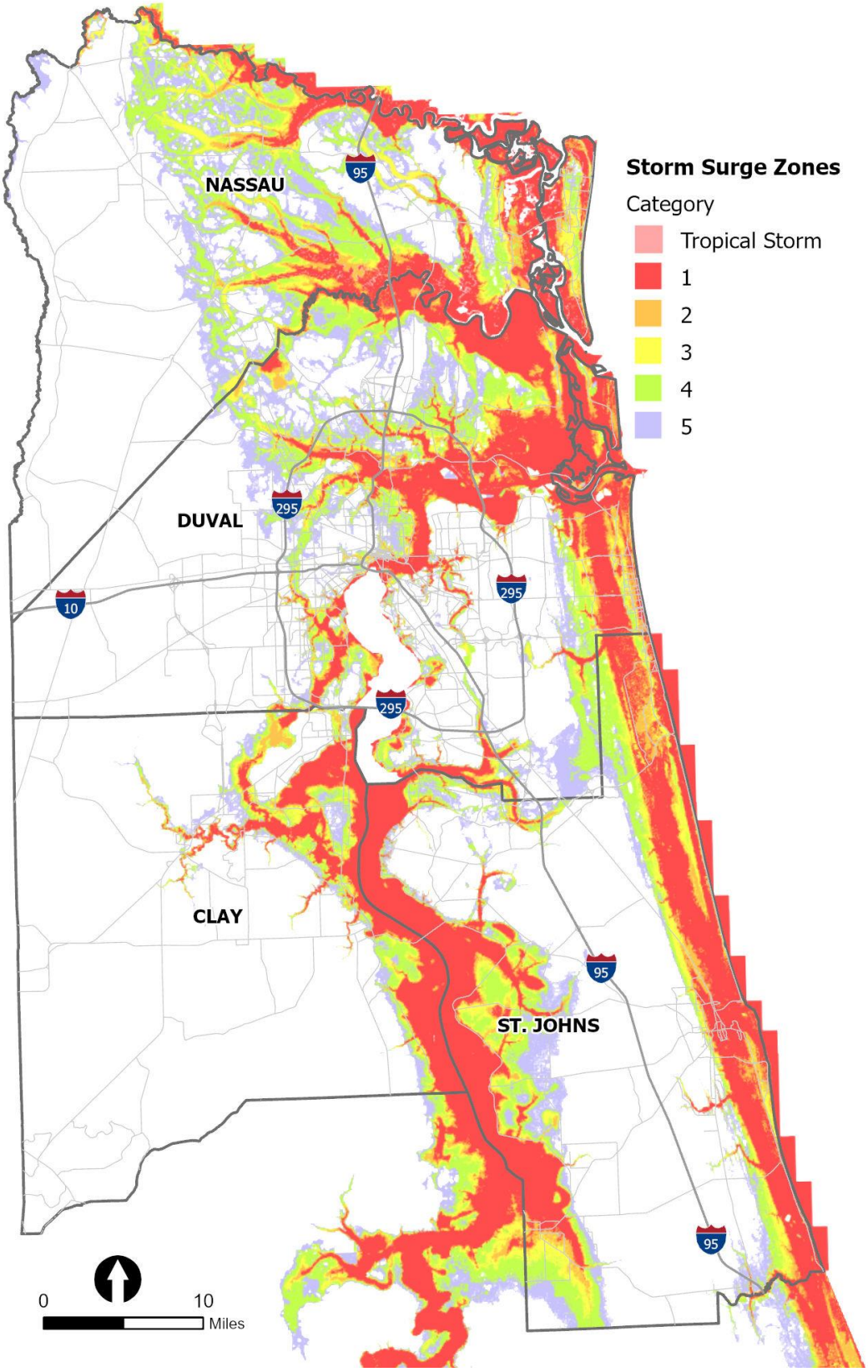
Storm surge, which is the atypical rise of water generated by a storm, poses significant risks to coastal areas, including Northeast Florida. This weather event, often exacerbated by hurricanes, can lead to severe flooding, infrastructure damage, and disruption of transportation networks. Long-term transportation planning within the region must incorporate strategies to mitigate these risks, such as elevating roadways, enhancing drainage systems, and designing resilient bridges. By proactively addressing storm surge threats, the region can better protect its transportation infrastructure, ensuring continued connectivity and economic stability in the face of extreme weather events.

Figure 1-4 displays the storm surge zones used for statewide regional evacuation studies provided by the Florida Division of Emergency Management (FDEM)[3]. The areas within the region that will be most impacted by storm surge are the coastal areas as well as those within the vicinity of the St. Johns River and surrounding creeks.

Hurricane storm surge, Florida, 2022. Photo source: Florida National Guard.

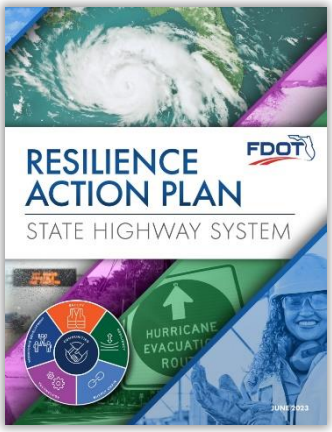
[3] Data layer provided directly from the Florida Division of Emergency Managements (FDEM) REST services. Storm surge zones from Statewide Regional Evacuation Studies (https://floridadisaster.org/res) clipped against 1:12,000 Florida shoreline.

Figure 1-4 Storm Surge Zones



FDOT Resilience Action Plan (RAP)

Published in June 2023, FDOT's Resilience Action Plan (RAP) examines the vulnerabilities of the State Highway System to flooding, storm surge, and other outside forces and identifies areas Florida can prioritize investments. Although the RAP focuses on the State Highway System, it also considers that county and local facilities are critical linkages in the transportation system as a whole and my also be impacted by the hazards.



The plan also identifies strategies for enhancing resilience in the planning, development, design, construction, operation, and maintenance of the State Highway System.

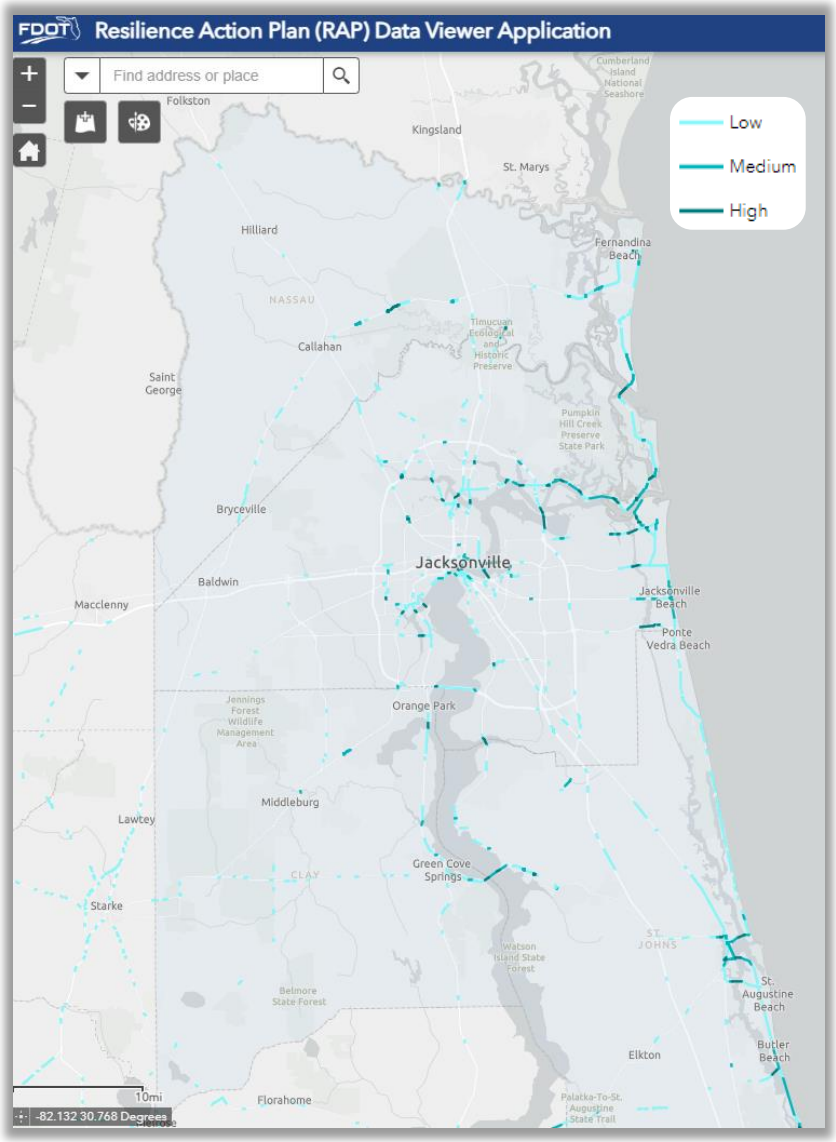
RAP Data Viewer

The key tool used in the North Florida TPO regional resiliency analysis is the interactive RAP Data Viewer provided by FDOT.

This data viewer displays the three tiers (low, medium, high) to prioritize segments within geographic areas that may experience impacts.

The interactive tool allows users to upload data to the application. For the analysis, the Needs Plan Projects shapefile was uploaded to the application. Projects that were identified within any of three tiers were added to the list of vulnerable projects.

FDOT noted that additional studies are needed on a project by project basis to determine if the road or bridge itself would be specifically impacts by water-related hazards.



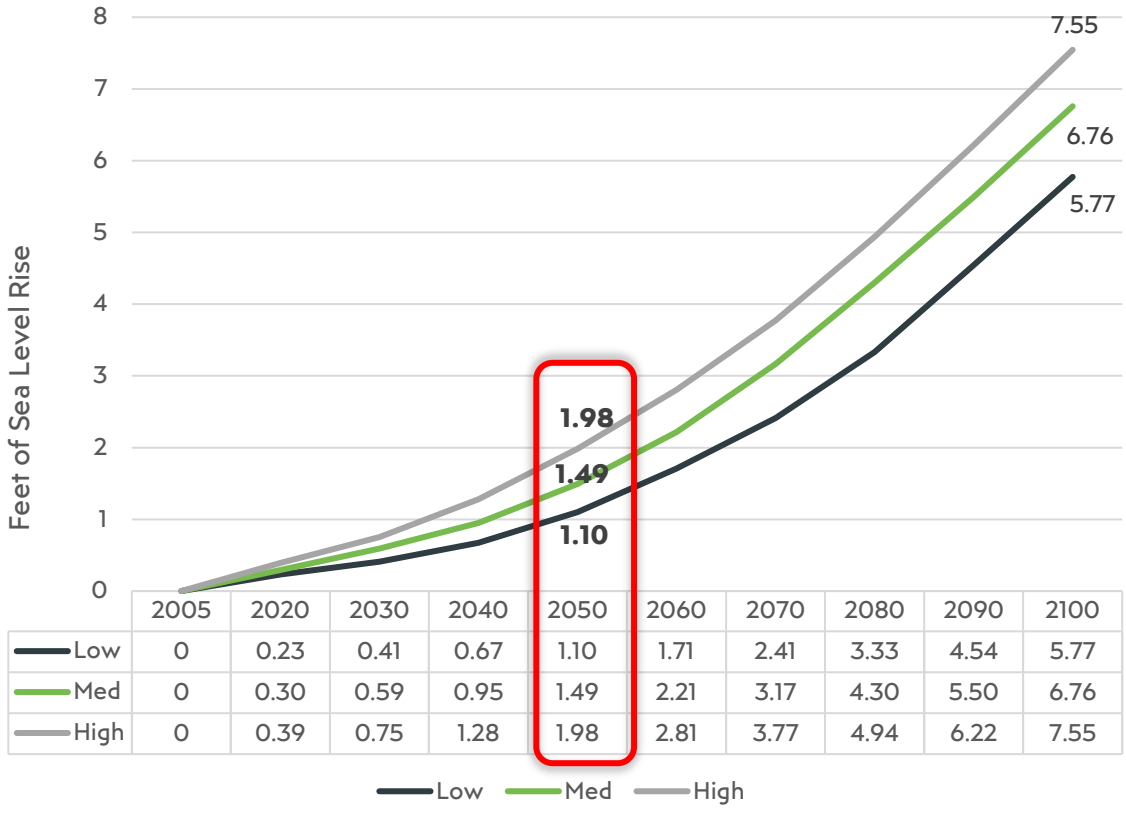
Screenshot from RAP Data Viewer Application, July 2024.

Sea Level Rise Projections

Sea level rise data for the region was extracted from the National Oceanic and Atmospheric Administration (NOAA) 2022 Sea Level Rise Projections dataset[4]. ***Table 1-1*** provides the high, medium, and low scenarios for the region. The data shown in this figure represents the average projections from the two water level station reporting sites within the region which are located in Fernandina Beach and Mayport. From these projections, there is estimated to be between a 1.10 and 1.98-foot rise of sea level within the region by 2050. By 2100, the sea level rise is projected to be between 5.77 feet and 7.55 feet. The 2-foot sea level rise is displayed graphically in ***Figure 1-5***.

The areas within the region that will be most affected by projected sea level rise are those areas along the Atlantic coast and intracoastal waterway, near the St. Johns River, and near the adjoining creeks.

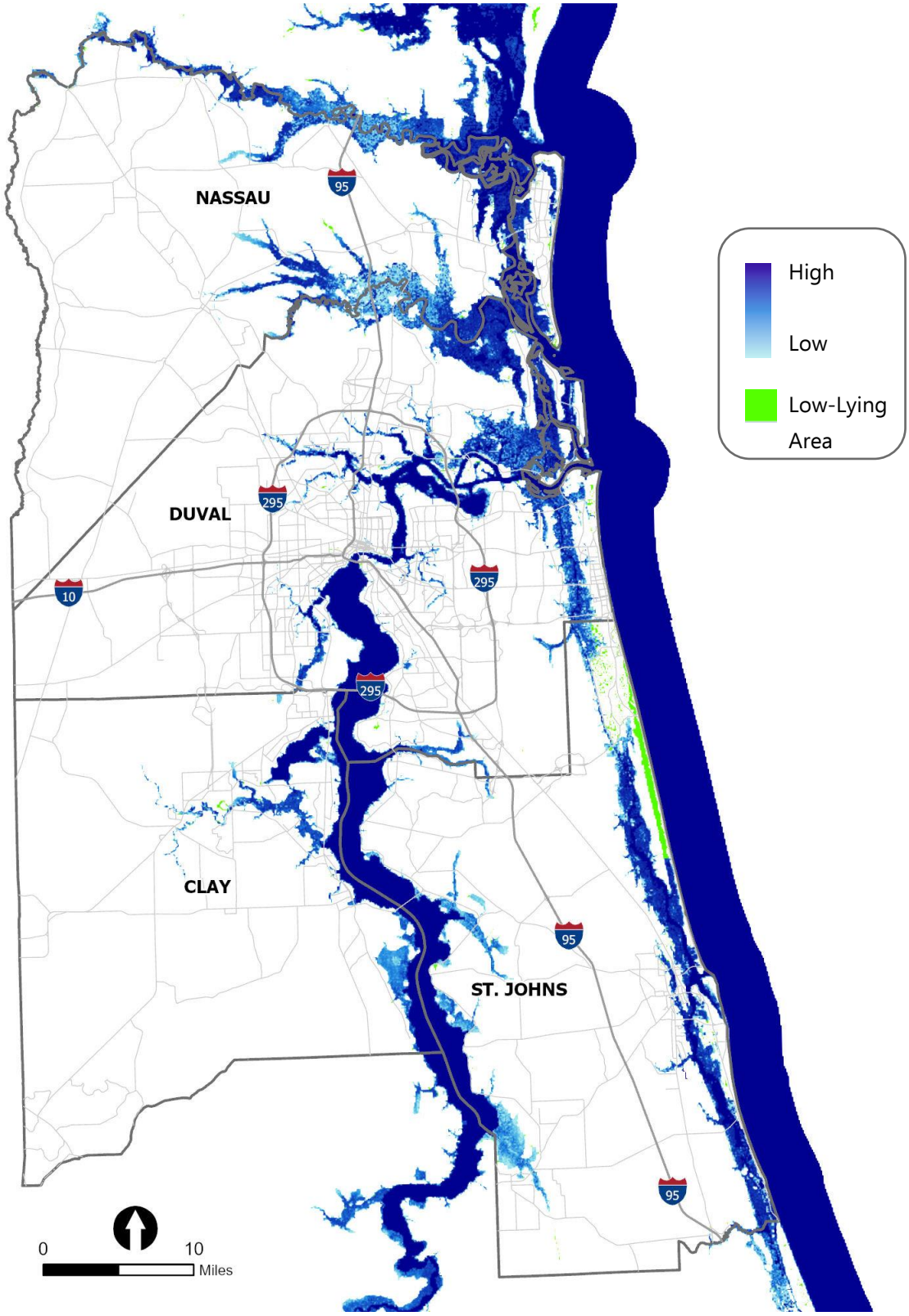
Table 1-1 North Florida Sea Level Rise Projections through 2100



	2005	2020	2030	2040	2050	2060	2070	2080	2090	2100
Low	0	0.23	0.41	0.67	1.10	1.71	2.41	3.33	4.54	5.77
Med	0	0.30	0.59	0.95	1.49	2.21	3.17	4.30	5.50	6.76
High	0	0.39	0.75	1.28	1.98	2.81	3.77	4.94	6.22	7.55

[4] *Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines. NOAA Technical Report NOS 01. National Oceanic and Atmospheric Administration, National Ocean Service, Silver Spring, MD, 111 pp. (2022). Two meter rise scenario utilized.*

Figure 1-5 Sea Level Rise, 2-Foot Scenaro



2.0 Resiliency Analysis

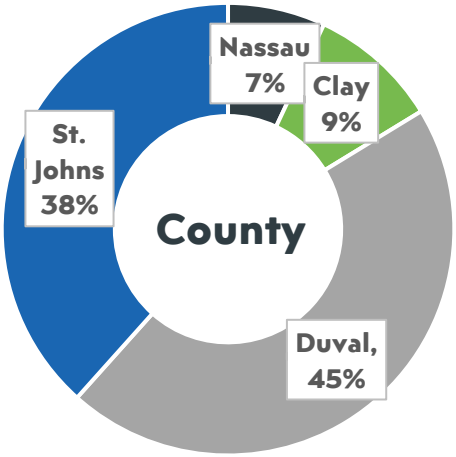
Using the resiliency base data for the region, the 2050 Needs Plan Projects were spatially evaluated for their potential future vulnerabilities. The analysis yielded a list of **86 projects** that would be candidates for resiliency mitigation strategies to address their potential vulnerabilities. A complete list of the vulnerable projects is on the following page in **Table 2-1**. **Figures 2-2 through 2-7** display the vulnerable projects layered on top of the base data.

Vulnerable Project Locations

A majority of these projects are along the Atlantic Coast or the intracoastal waterway, with some located within the vicinity of the St. Johns River or the adjoining creek system (see **Figure 2-2**). Most of the vulnerable projects are located in either Duval or St. Johns counties, each with over 30 identified projects. **Figure 2-1** provides the breakdown of projects by county.

Figure 2-1 Vulnerable Projects by County

County	# Projects	% Projects
Duval	39	45%
St. Johns	33	38%
Clay	7	9%
Nassau	5	7%
Grand Total	**70**	**100%**



Vulnerable Project Type

Every type of project within the needs plan was reflected in the vulnerable projects list. The most common project types were roadway widening, multimodal improvements, and freight improvements.

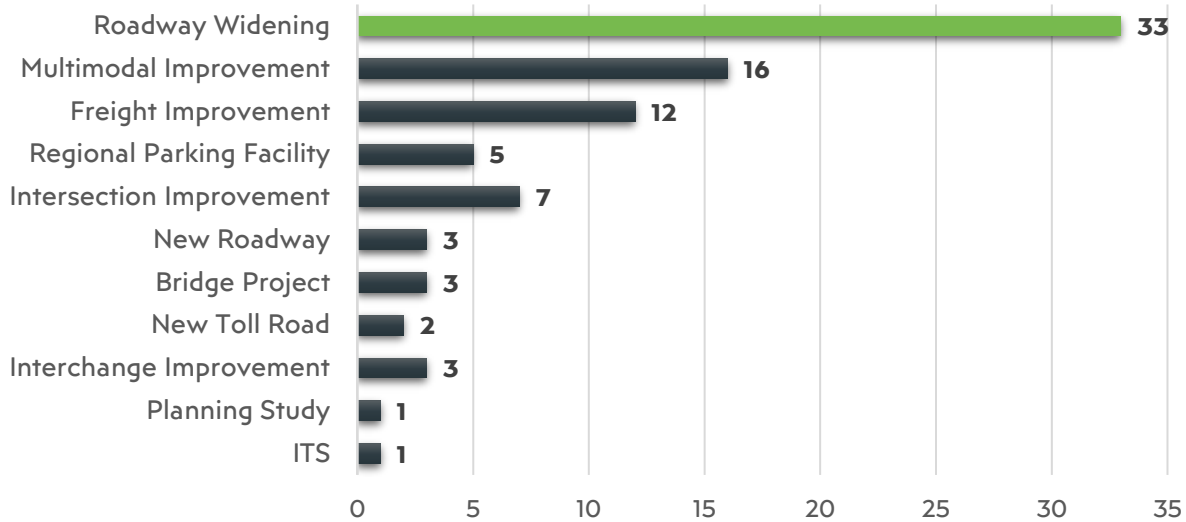


Table 2-1 Vulnerable Projects List

Proj. #	Facility	Limits	Improvement Type
Clay County Projects			
102	US 17	at Governors Creek Bridge	Intersection Improvement
106	CR 220	Henley Road to Knight Boxx Road	Roadway Widening
113	First Coast Expressway	East of CR 209 to CR 16A (SJC)	New Toll Road
123	SR 16	First Coast Expressway (SR 23) to Oakridge Avenue	Roadway Widening
131	Blanding Boulevard (SR 21)	Putnam County Line to Duval County Line	Multimodal Improvement
132	US 17	Orion Road to SR 16	Multimodal Improvement
136	CR 209 (Russell Road)	CR 315B to Henley Road	Roadway Widening
503	Kingsley Avenue (SR 224)	at CSX Railroad Crossing	Freight Improvement
Duval County Projects			
204	J. Turner Butler Boulevard (SR 202)	I-95 (SR 9) to SR A1A	Planning Study
207	Bay Street	I-95 to Festival Park Avenue	ITS
208	I-95 (SR 9)	at J. Turner Butler Boulevard (SR 202)	Roadway Widening
211	I-10 (SR 8)	I-295 (SR 9A) to I-95 (SR 9)	Roadway Widening
214	I-295 (SR 9A)	Beach Boulevard (SR 212) to JTB (SR 202)	Roadway Widening
217	I-95 (SR 9)	South of Emerson Street (SR 126) to Atlantic Boulevard (SR 10)	Roadway Widening
218	J. Turner Butler Boulevard (SR 202)	at San Pablo	Interchange Improvement
223	I-295 (SR 9A)	Dames Point Bridge to N of Pulaski	Roadway Widening
225	I-95 (SR 9)	SJC line to I-295 (SR 9A)	Roadway Widening
230	US 17 (Main Street)	New Berlin Road to Airport Center Drive	Roadway Widening
231	Alta Drive Realignment	Zoo Parkway (SR 105) to North of New Berlin Road (south)	New Roadway
232	Arlington Expressway (SR 115)	at University Boulevard (SR 109)	Interchange Improvement

Proj. #	Facility	Limits	Improvement Type
234	Atlantic Boulevard (SR 10)	at Hodges Boulevard	Intersection Improvement
235	Atlantic Boulevard (SR 10)	at San Pablo Boulevard	Intersection Improvement
236	Hart Bridge (SR 228)	South Bank to North Bank	Bridge Project
243	I-295 (SR 9A)	South of Roosevelt Boulevard (US 17) to Blanding Boulevard (SR 21)	Roadway Widening
244	I-295 (SR 9A)	North of New Kings Road South to West of I-95 (SR 9) Interchange	Roadway Widening
249	Main Street Bridge (US 90/SR 10)	South Bank to North Bank	Bridge Project
250	Mathews Bridge (SR 115)	East bank to west bank	Bridge Project
251	Mayport Road (SR 101)	SR A1A to Mayport Main Gate	Multimodal Improvement
253	Normandy Boulevard (SR 228)	US 301 to Bell Road (Equestrian Park)	Roadway Widening
255	Penman Road	Beach Boulevard (SR 212) to Atlantic Boulevard (SR 10)	Roadway Widening
256	Lem Turner Road (SR 115)	I-295 (SR 9A) to Nassau County Line	Roadway Widening
263	Phillips Highway (US 1/SR 5)	I-95 at the Avenues Mall to JTB (SR 202)	Roadway Widening
264	Phillips Highway (US 1/SR 5)	SR 9B to I-295 (SR 9A)	Roadway Widening
268	Main Street (US 17)	Pecan Park Road to Nassau County Line	Roadway Widening
276	Arlington Expressway	North Liberty Street to A. Philip Randolph Boulevard	Multimodal Improvements
278	Dunn Avenue (SR 104)	New Kings Road to I-295 (SR 9A)	Roadway Widening
280	North/South Connector	CR 210 (Nocatee Area)	New Roadway
282	Emerald Trail	Hogan's Creek to Riverwalk	Multimodal Improvements
283	Core to Coast: Zoo Parkway/Hecksher Drive (SR 105)	Main Street (US 17) to Ferry Entrance	Multimodal Improvements

Nassau			
300	SR 200 (A1A)	US 17 to CR 107/Old Nassauville Road	Roadway Widening
311	Semper Fi	Semper Fi Extension to Johnson Lake Road	Roadway Widening
313	Lem Turner Road (SR 115)	Duval County Line to US 1	Roadway Widening
315	US 17	Duval County line to Willliam Burgess Boulevard	Roadway Widening
319	SR 200 (SR A1A)	I-95 to Amelia Island Parkway	Multimodal Improvement
St. Johns			
400	SR 9B	Ramps to Duval Line	New Roadway
402	Racetrack Road	E of DCE to Bartram Park Boulevard	Roadway Widening
404	First Coast Expressway	E of CR 209 (Clay County) to CR 16A (St. Johns County)	New Toll Road
420	I-95 (SR 9)	South of International Golf Parkway to South of First Coast Expressway	Roadway Widening
421	I-95 (SR 9)	North of of First Coast Expressway to Duval County line	Roadway Widening
424	SR 16	Outlet Mall Entrance to SR 312	Roadway Widening
434	Racetrack Road	W Peyton Parkway to Bartram Springs Parkway	Roadway Widening
435	Racetrack Road	East Peyton Parkway to Bartram Springs Parkway	Roadway Widening
436	Racetrack Road	at US 1	Intersection Improvement
440	SR 207	I-95 (SR 9) to SR 312	Roadway Widening
442	SR 312	Sgt. Tutten Drive to Lakeside Avenue	Intersection Improvement
446	SR 312	Plantation Island Drive to SR A1A	Multimodal Improvement
447	SR A1A	at Red Cox/Coquina Road	Intersection Improvement
448	East Garage	Near Anastasia Boulevard, Comares Avenue, and Red Cox Drive	Regional Parking Facility
449	SR A1A	Mickler Road	Roadway Widening
450	Palm Valley Road	Intercoastal Bridge to Mickler Road	Roadway Widening
451	Palm Valley Road	at Mickler Road	Intersection Improvement
452	Mickler Road	Roundabout at Palm Valley Road to SR A1A	Roadway Widening

453	SR A1A	Mickler Road to Marsh Landing Parkway (county line)	Multimodal Improvement
456	CR 16A	SR 16 to Longleaf Pine Parkway	Roadway Widening
458	Regional Park and Ride	SR 312 at Anastasia Boulevard	Regional Parking Facility
459	South Garage	Near 207, Ice Plant Road, and US 1	Regional Parking Facility
460	North Garage	Near FEC, San Marco, US 1	Regional Parking Facility
461	West Garage	Near King Street, SR 207, and US 1	Regional Parking Facility
463	SR A1A	North St. Augustine Boulevard to Red Cox Drive/Old Quarry Road	Multimodal Improvement
464	SR A1A	Comares Avenue to Red Cox Road	Multimodal Improvement
465	Kings Street	Avenida Menendez to N Rodriguez Street	Multimodal Improvement
466	US 1	SR 207 to Kings Street	Multimodal Improvement
467	US 1	San Sebastian View to SR 16	Multimodal Improvement
469	SR A1A	Treasure Beach Road to Ocean Palm Entrance (San Julian Boulevard)	Multimodal Improvement
470	SR A1A (San Marco Avenue)	SR 16 to the Bridge of Lions	Multimodal Improvement
501	St. Johns River	at the Fulton Cut	Freight Improvement
506	Jaxport	at Blount Island	Freight Improvement
507	Jaxport	at Dames Point	Freight Improvement
508	Jaxport	at the Cruise Terminal	Freight Improvement
510	Blount Island Boulevard	Dave Rawls Boulevard/Channel View Drive to JEA power site	Freight Improvement
516	St. Johns River Bridge	Florida East Coast Railroad (FEC)	Freight Improvement
520	Timuquana Avenue (SR 134)	at FEC railroad crossing	Freight Improvement
521	Dave Rawls Boulevard (SR 105)	CSX Railroad crossing	Freight Improvement
525	Port of Fernandina	Port Entrance	Freight Improvement
527	SR 16	at FEC Railroad Crossing	Freight Improvement
528	I-95 (SR 9)	at US 1 South	Freight Improvement

Figure 2-2 Vulnerable Projects Map

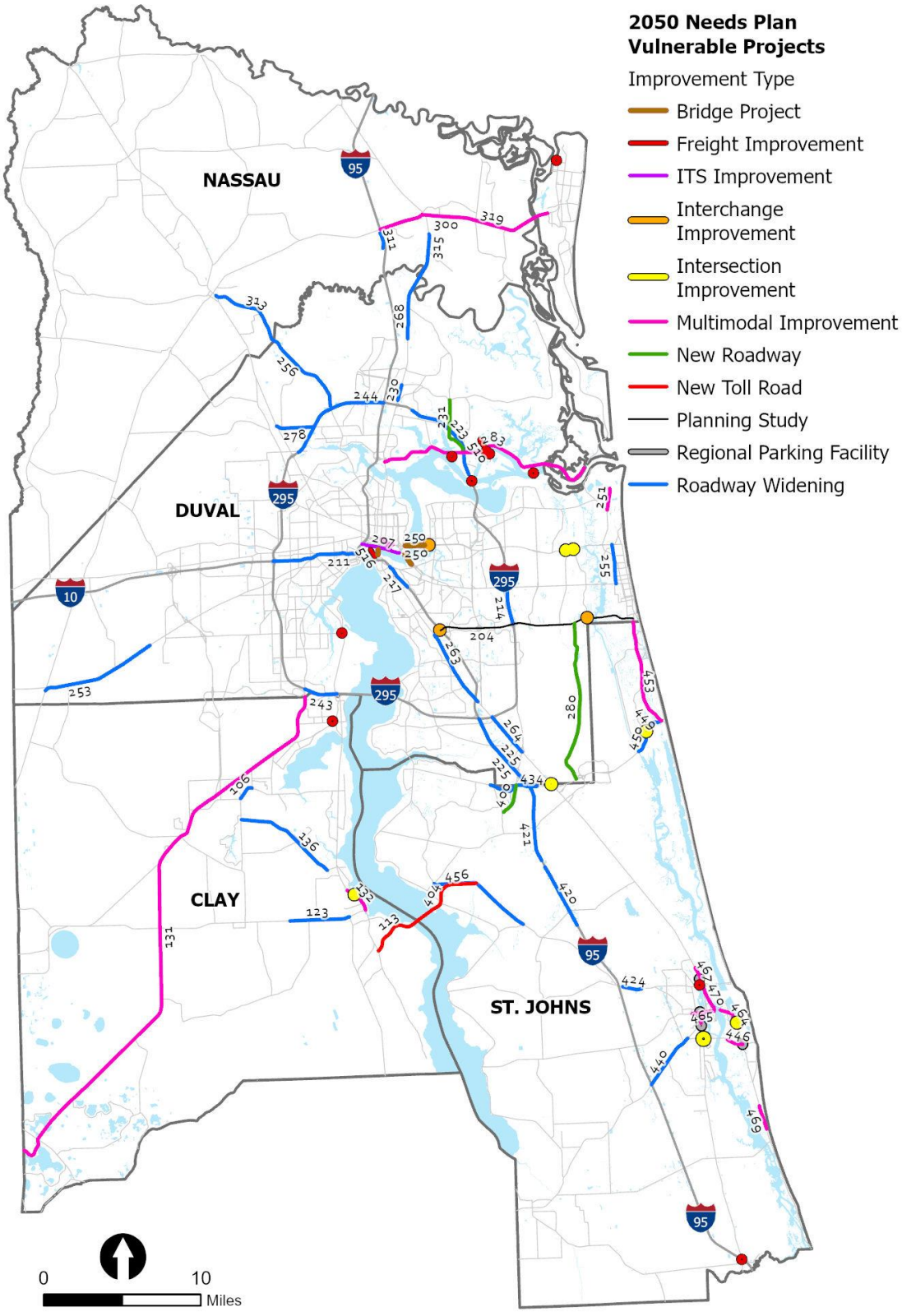


Figure 2-3 Vulnerable Projects and Riverine Flooding

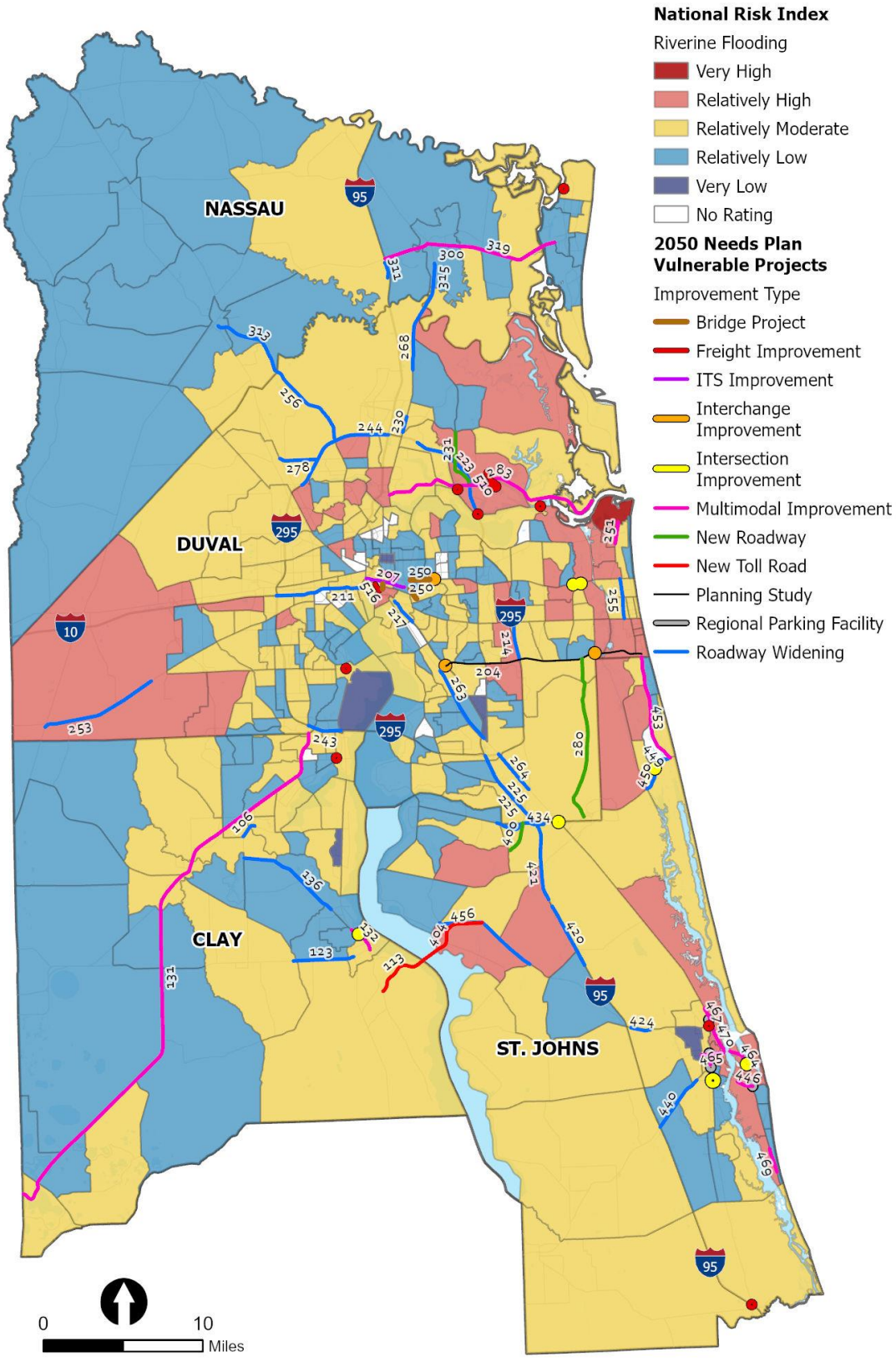


Figure 2-4 Vulnerable Projects and Coastal Flooding

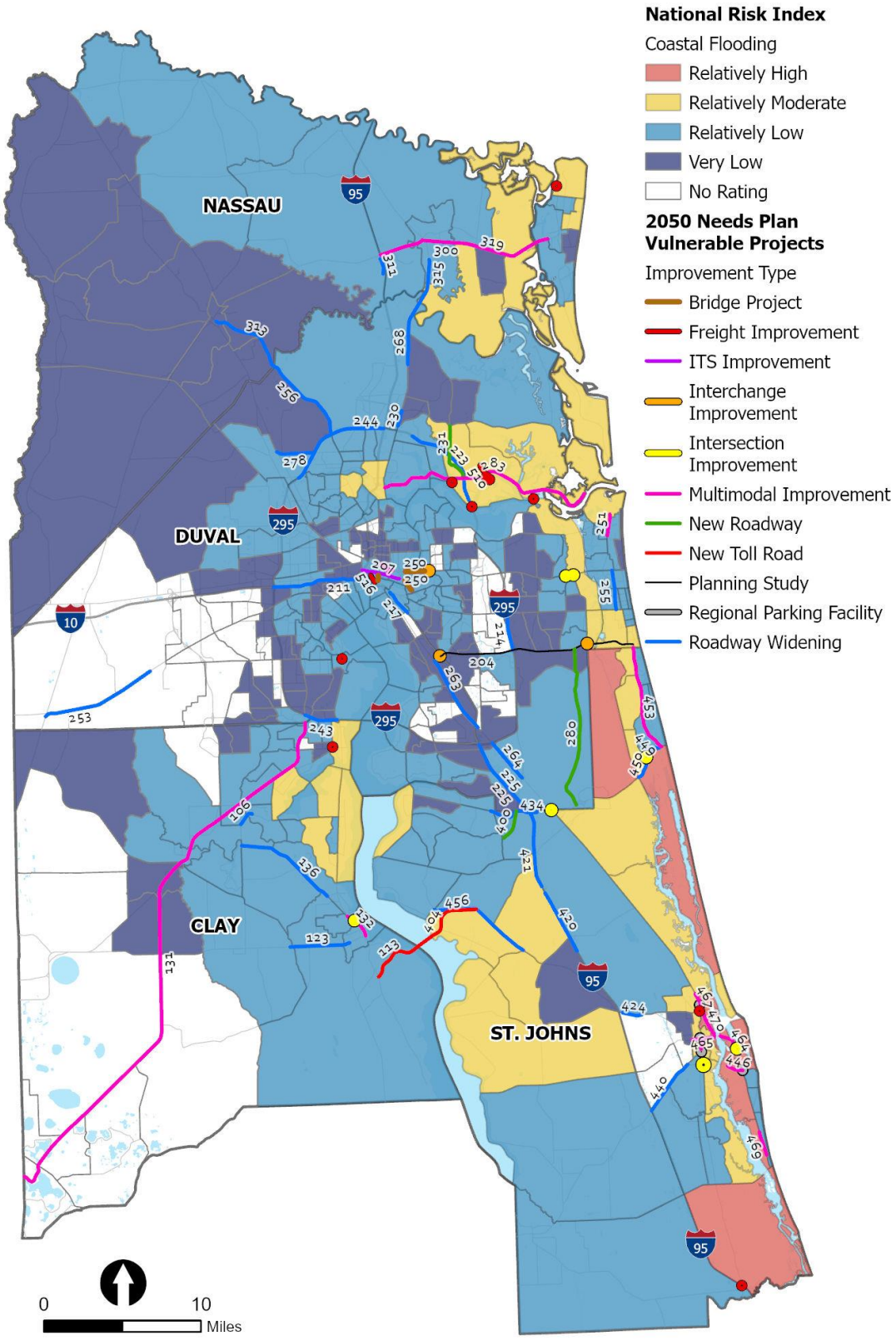


Figure 2-5 Vulnerable Projects and 100-Year Floodplain

Figure 2-6 Vulnerable Projects and Storm Surge

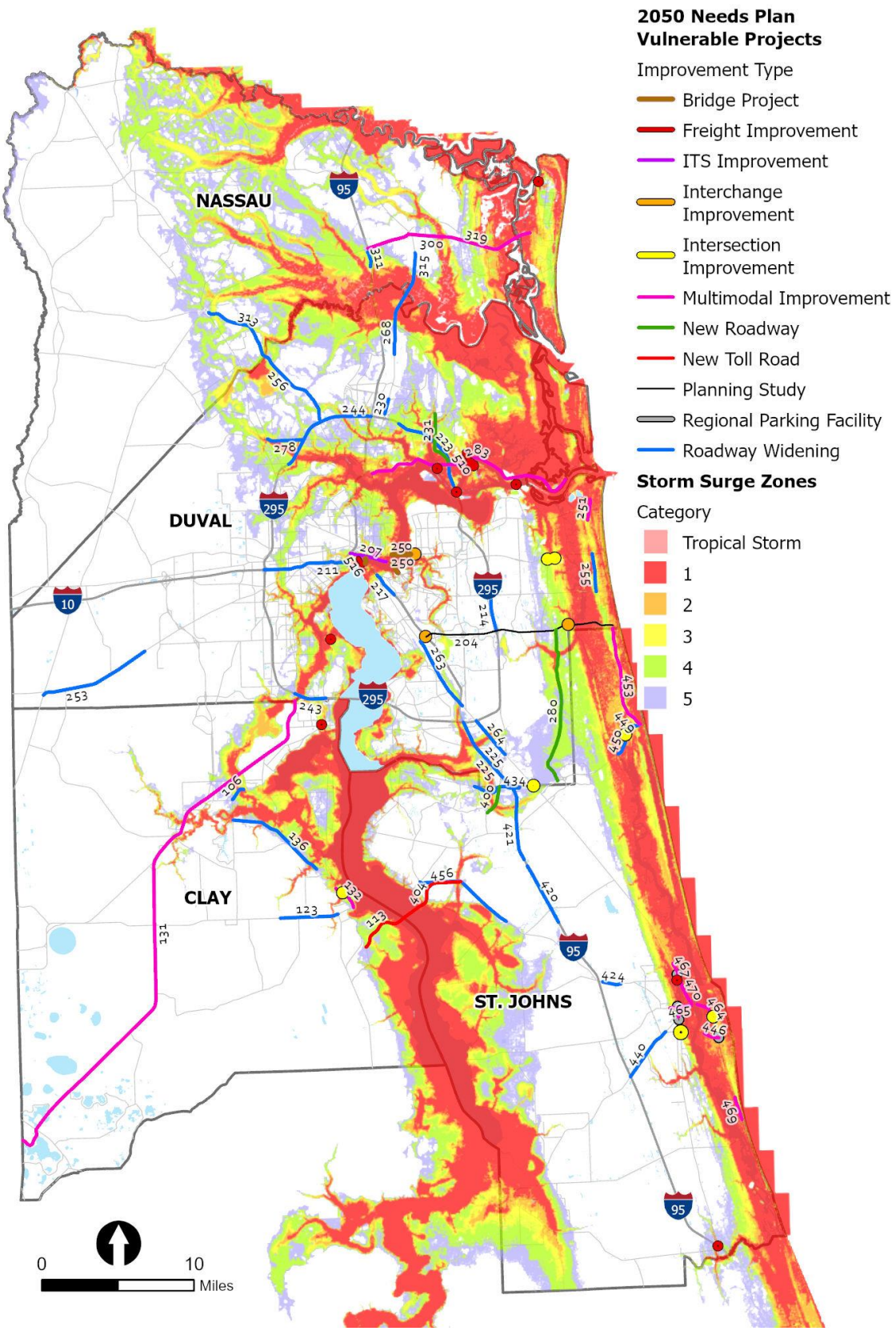
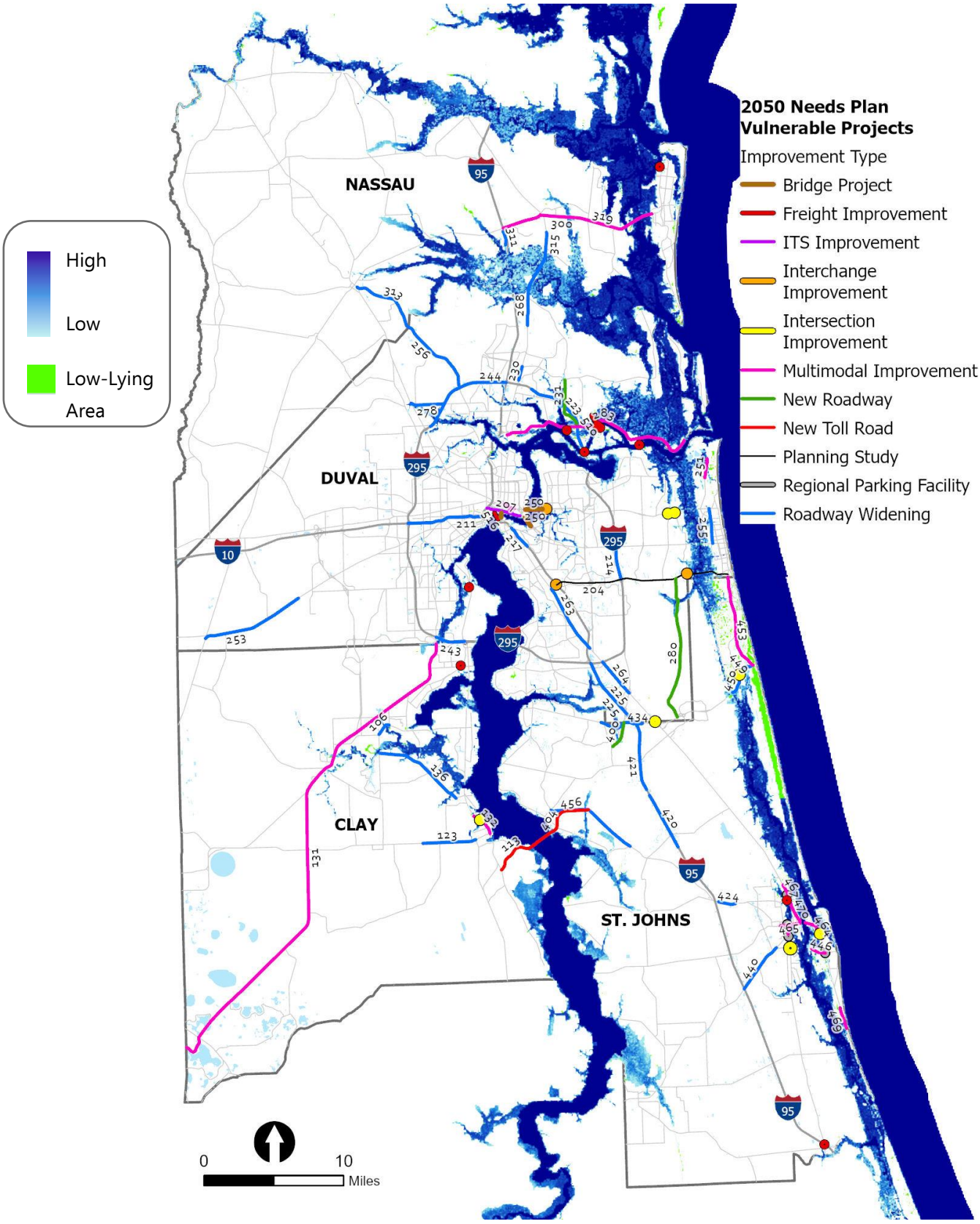


Figure 2-7 Vulnerable Projects and 2-foot SLR



3.0 Resiliency Solutions

To address the potential future vulnerabilities of the identified projects within the 2050 Needs Plan, a set of resiliency solutions were developed that provide a comprehensive array of strategies and measures tailored to enhance the resilience of transportation projects. The resiliency solutions listed in **Table 3-1** provide planners, engineers, and policymakers with practical solutions to mitigate the impacts of environmental impacts, extreme weather events, and sea level rise, ensuring the durability and reliability of North Florida's transportation network. By integrating these innovative approaches into the LRTP, the region can proactively safeguard its infrastructure, communities, and economy, fostering a more resilient and sustainable future.

Table 3-1 Resiliency Solutions

Solution	Type of Infrastructure Impacted					General Cost Estimate
	Bike/ Ped	*Bridge*	*Roadway*	*Transit*	*Regional Parking Facility*	
Develop a hazard mitigation plan to implement during emergencies	●	●	●	●	●	Low
Increase infrastructure monitoring during extreme weather events	●	●	●	●	●	Low
Incorporate sea level rise into infrastructure planning	●	●	●	●	●	Medium
Install green infrastructure	●	●	●	●		Low
Relocate facilities to higher elevations	●	●	●	●	●	High
Build flood barriers to protect infrastructure	●	●	●	●	●	Medium
Install erosion control measures and improve soil strength	●	●	●	●	●	Medium
Plan road alignments and structures to avoid floodplains, as feasible	●	●	●	●	●	Low
Improve detour/alternative routes		●	●			Low
Strengthen support structures and embankments		●	●			Medium
Improve drainage by reducing impervious surfaces and installing other streetscaping	●		●			Low