Resilient Cocoa

COCOA
FLORIDA

STORM SURGE | FLOODING | SEA LEVEL RISE | SEA LEVEL RISE + SURGE

2019

This report was prepared for the City of Cocoa the Florida Department of Environmental Protection and the National Oceanic and Atmospheric Administration by the East Central Florida Regional Planning Council.

TABLE OF CONTENTS

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EXECUTIVE SUMMARY

The overarching goal of the Resilient Cocoa Project is to strengthen the City's capacity to withstand and recover quickly from natural hazard events such as flooding, sea level rise, storm surge, and nuisance flooding. From December 2018 through June 2019, the ECFRPC worked with City officials to complete the following milestones:

- **Vulnerability Analysis**: Identified the City's exposure to effects from storm surge, flooding, sea level rise and nuisance flooding.
- **Public Engagement:** Gathered input from Cocoa residents and business owners through workshops and surveys to identify their priorities to address resiliency.
- **Economic Impact Analysis:** Used the REMI PI+ model to estimate the economic costs of not addressing flooding versus mitigating this weakness through the adoption of green infrastructure program.
- **Strategy and Policy Development:** Developed an Action Plan based on the findings from the vulnerability analysis, public input, economic analysis and national best practices. This part also included the formulation of comprehensive plan policies for compliance with SB 1094 (Peril of Flood).

The Resilient Cocoa Project found that three parts of the City are the most vulnerable to natural hazards: High Point, Diamond Square Community Redevelopment Area (CRA), and Cocoa Village. The report provides a detailed assessment of the impacts that these hazards will have on the City's transportation network, critical facilities, land development patterns, and tax revenues. All of these vary greatly depending on the type of vulnerability discussed.

The ECFRPC used various ways to gather input from the public for this project. In February, the City of Cocoa hosted a public workshop where citizens discussed some of the City's vulnerabilities, focus areas, and strategies to create a more resilient city. This information was used to develop an online survey which ran from March 20 to April 18. The objective of the survey was to gather public input about the areas that City officials need to prioritize to make Cocoa more resilient to natural disasters and sea level rise. A total of 152 participants completed the survey. The majority of respondents want government officials to focus their efforts on addressing inadequate infrastructure, hurricane and storm, and flooding issues within the City. Since Cocoa Village is one of the City's most vulnerable areas, the project team also worked on specific outreach efforts that targeted the local business community. This included hosting a business resiliency workshop on March 26. In addition to this event, the City's Economic Development Specialist met with individual businesses to help them fill out a business resiliency questionnaire.

Because flooding is one of Cocoa's major concerns, the ECFRPC used the REMI PI+ model to estimate the economic impact that strong precipitation events have on Cocoa Village businesses. This economic impact analysis is comprised of two scenarios. The "do nothing" simulation estimates the economic impact of not addressing the flooding events caused by intense precipitation. This scenario found that flooding events can have a deep impact on the local economy. The second scenario found that incorporating green infrastructure features within Cocoa Village could help ameliorate some of these negative impacts.

The ECFRPC used the information gathered from these previous tasks to develop a Resiliency Action Plan for the City of Cocoa. The plan includes a series of tasks focused around four main areas: Leadership and Strategy, Economic and Society, Infrastructure and Environment, and Health and Well Being. It also includes the appropriate City Department that will take on the task, its priority level, and recommended start year.

ABOUT THE ECFRPC

The ECFRPC was established in 1962 as an area-wide association of local governments. It is one of Florida's ten regional planning councils and serves governments and organizations located within Brevard, Lake, Orange, Osceola, Seminole, Sumter and Volusia counties. Council staff provides technical assistance in the areas of land use and environmental planning, emergency preparedness, geographic information systems (GIS), health, housing, urban design, transportation and economic and fiscal analysis among others. Because of the ECFRPC, member governments have received more than $10.6 million in federal grants since 2011. This represents a return on investment of $2.53 for every dollar paid in assessments

On September 19, 2018, the ECFRPC unanimously adopted a resolution to develop a process and framework for a regional resilience collaborative in east Central Florida. To date, two committees have been formed: a Council Sub-Committee and a Steering Committee. This regional collaborative will help build capacity and establish a shared mission and goals uniting knowledge, lessons learned, and future endeavors. The premise of the The City of Cocoa, along with the ECFRPC, Brevard County, and the Space Coast TPO have adopted the ECF RRAP. Others have the adoption resolution in the pipeline.

This report publication was funded in part, through a grant agreement from the Florida Department of Environmental Protection, Florida Coastal Management Program, by a grant provided by the Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act of 1972, as amended, National Oceanic and Atmospheric Administration Award No. CM743FederalNA16NOS4190120. The views, statements, findings, conclusions, and recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the State of Florida, NOAA or any of their sub-agencies.

The Senate Bill 1094 (2015):
Requires coastal jurisdictions to add a '*Peril of Flood*' component within the Coastal Element of their Comprehensive Plans.

House Bill 7207 (2011):
Creates the "Adaptation Action Area" (AAA) optional designation for *"areas that experience coastal flooding and are vulnerable to the related impacts of rising sea levels for the purpose of prioritizing funding for infrastructure needs and adaptation planning for the purpose of prioritizing funding for infrastructure needs and adaptation planning*".

east central florida
REGIONAL RESILIENCY ACTION PLAN

INTRODUCTION

Florida's coastal communities currently are experiencing more frequent flooding and storm surge events that are affecting their critical infrastructure, local economies, and the health and welfare of its residents. This has been recognized by the Florida Legislature, which recently passed *Peril of Flood* legislation to require the development of strategies that address sea level rise and flood hazards. Moreover, federal agencies such as the Federal Highway Administration, the U.S. Department of Housing and Urban Development, and the Federal Emergency Management Administration are now tying their funding programs to the long term environmental effects caused by sea level rise and flooding.

In order to address the effects of these naturally-occurring hazards, Florida's coastal communities must assess, plan and implement strategies to increase their resilience. To this effect, the ECFRPC collaborated with over 50 Brevard and Volusia County stakeholders to develop the East Central Florida Regional Resiliency Action Plan (RRAP). This RRAP identifies opportunities and gaps in planning for resilience and discusses local actions that could be implemented over a five-year timeframe to address climate-related vulnerabilities. Following the completion of the RRAP's process, the ECFRPC started working with local coastal governments to address resiliency issues. In 2018, the Florida Department of Environmental Protection's Florida Coastal Management Program (FCMP) and the National Oceanic and Atmospheric Administration (NOAA) awarded the City of Cocoa a grant to develop a community resilience plan. The Resilient Cocoa document contains several strategies to increase the City's resiliency to natural climate-related hazards based on the findings of a vulnerability analysis, several public engagement activities, and an economic impact analysis simulation,

Resilient Cocoa Project

Developed over a six-month period, the Resilient Cocoa project addresses resiliency issues in a holistic way by identifying the City's vulnerabilities using ArcGIS and NOAA data, receiving input from the public and business community, and performing an economic impact analysis. The projects main activities are described in more detail below.

Vulnerability Analysis:
The ECFRPC identified the social, economic, and functional vulnerabilities posed to the City from four natural hazards: storm surge, flooding, sea level rise, and coastal shallow flooding. This analysis was based on data from NOAA, the University of Florida's GEO Plan Center, and the Brevard County Property Appraiser, among others.

Public Engagement:
Cocoa citizens and business owners provided their input by participating at several public workshops and completing an online MetroQuest survey. In addition to these activities, the City's Economic Development Specialist met individually with several business owners to help them complete a business resiliency questionnaire.

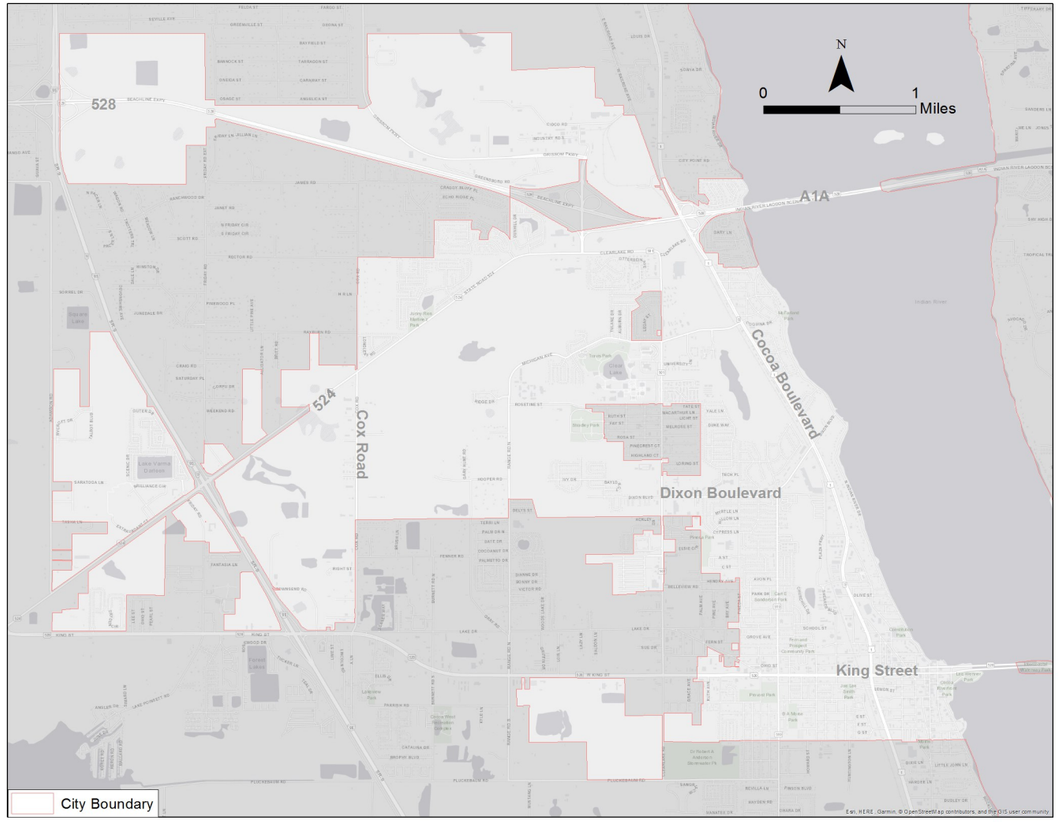
Economic Impact Analysis:
The ECFRPC used the REMI model to estimated the economic impact of resiliency mitigation efforts. Staff developed two different simulations: a "do-nothing" scenario and another where the City implemented a "green infrastructure" resiliency program.

Strategy and Policy Development:
Based on the findings from the previous analyses and best practices, the ECFRPC developed an Action Plan that contains strategies to address resiliency issues within the City of Cocoa. This process included the formulation of comprehensive plan policies for compliance with SB 1094 (Peril of Flood) legislation. The Data and maps developed as part of this study will be incorporated into the City of Cocoa's Coastal Element in order to fulfill this state requirement.

About Cocoa

Located on Florida's east coast, the City of Cocoa is bounded by Cidco Road to the north, Rosa L. Jones Drive to the south, the intersection of State Road 524 and State Road 520 to the west, and the Indian River Lagoon to the east. US-1 cuts vertically through the City and the Martin Andersen Beachline Expressway and Hubert Humphrey Bridge provide access to Merritt Island. Three miles west of City limits, Interstate 95 provides an important connection to north and south Florida. Cocoa is also located in close proximity to NASA, Patrick Air Force Base, and Cape the Canaveral Air Station.

The City's social and economic hub, Cocoa Village, is located on a small, southern peninsula that juts into the lagoon. First developed in the mid 1880s, this area remains a popular destination for events, shopping, and gourmet dining. Cocoa Village is home to several historical assets including the Playhouse Theater, the Porcher House, and the Florida Historical Society. The Playhouse is Cocoa's oldest theater. Opening it's doors to the public in 1924, the theater played silent movies but later showed Brevard's first "talkie" movie. Known as the "Broadway on Brevard", over 55,000 patrons view theater productions here each year. Additionally, The Porcher house is quintessential 20th century revival architecture. Sitting adjacent to the Cocoa Riverfront Park, the house was originally built in 1914 by Edward Porcher. The home was later purchased by the City to become City Hall and is now open to the public with rooms to rent for weddings and other special occasions. Also located in Cocoa Village, the Florida Historical Society is dedicated to preserving Florida's past through the collection and archival maintenance of historical documents and photographs, as well as publishing scholarly research on Florida history. It also educates the public about Florida history through a variety of history projects and programs.

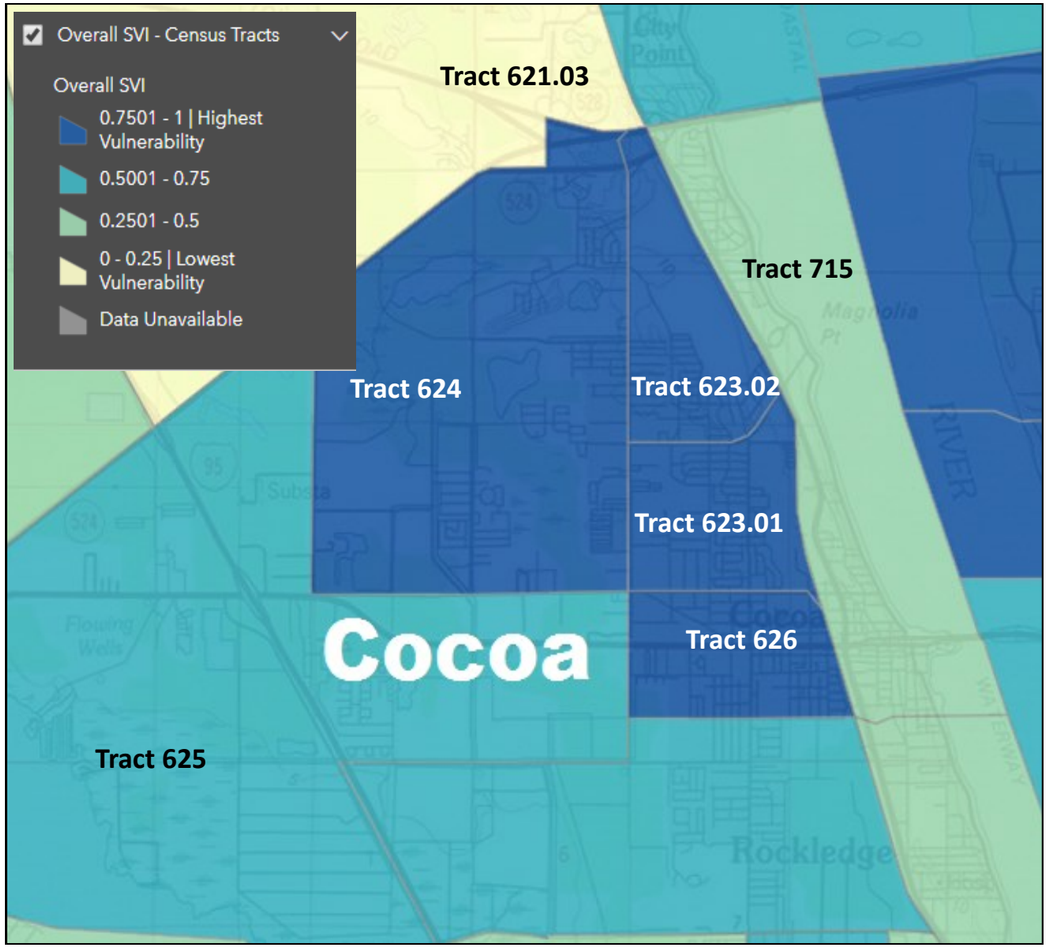


City Demographics and Vulnerable Populations

Understanding demographic and socioeconomic variables is important to help the City become more resilient to future natural hazards. Cocoa is currently home to 19,286 residents (2019 BEBR). The average age of City's residents is 38 years old, with about 30% of its population being 55 years and older (US Census Bureau). The average household income in Cocoa is $32,685 and 24% of residents considered to be living in poverty. These numbers contrast greatly with those of Brevard County, which has higher median incomes and lower poverty levels.

The Center for Disease Control developed the Social Vulnerability Index (SVI) to identify communities that may need support in preparing for hazards and recover from disaster. The SVI score groups 15 census-derived factors into four themes that summarize the extent in which an area is socially vulnerable to a disaster. These themes are *Socioeconomic Status*, *Household Composition/Disability*, *Race/Ethnicity/Language, and Housing/Transportation.* The SVI score scale goes from 0 (least vulnerable) to 1 (most vulnerable). According to the SVI, the approximate overall score for the City if Cocoa is .7077. Census Tract 621.03 is the City's less vulnerable area (SVI 0.16). The lower part of the City contains four highly vulnerable Census Tracts with scores ranging from .8718 (CT 624) to .9983 (CT 626).

According to the University of Florida's Shimberg Center, more than 31 percent the of the City's renter are severely cost burdened. This means that they spend 50 percent or more their salaries on housing. These households are more vulnerable to natural disasters and will need more assistance with emergency preparedness and recovery. Moreover, median income families living within the City spend about 53 percent of their incomes to cover both housing and transportation costs.



Data Set	Brevard	Brevard % Total	Cocoa	Cocoa % Total
Families Below Poverty Level	13,670	9.4	918	21.7
People Below Poverty Level	75,104	13.2	4,669	26.3
Population Age 65 and Over	129,240	22.7	2,949	16.6
Individuals who Speak English less than Very Well	18,527	3.3	973	5.5
Total Persons Unemployed	19,763	7.6	820	10.4
Occupied Household with No Vehicle	12,725	5.6	887	13.0

Source: ACS 2013-2017

VULNERABILITY ASSESSMENT

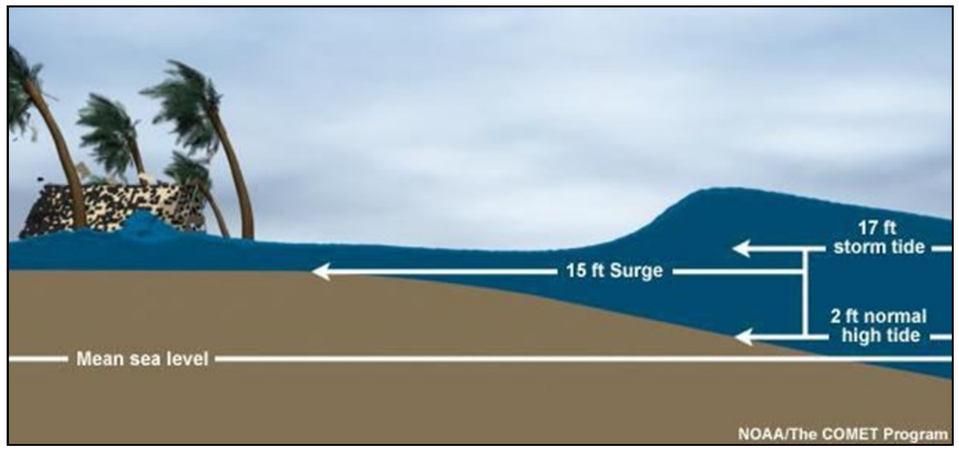
The vulnerabilities assessed in this analysis are: shallow coastal flooding, storm surge, sea level rise, the combination of storm surge and sea level rise, and FEMA flood areas. Modeling by the Tampa Bay Regional Planning Council also assessed storm surge combined with the effects of sea level rise.

Shallow Coastal Flooding

Shallow coastal flooding or nuisance flooding includes low-lying coastal areas susceptible to flooding during extreme high tides. According to NOAA, extreme high tides occur a few times per year because of the alignment of the sun, moon, and earth. Flood levels can increase due to rainfall or wind during storm events. Since the 1960's, high tide flooding occurrences have increased 5 - to 10-fold in several U.S. coastal cities.

Storm Surge

Storm surge is the rise of water past the normal tide level because of a storm. Storm winds push water farther up the shore. The destructive force of a storm surge can damage underground utilities and water mains, disable electrical equipment, erode seawalls and revetment systems, and destroy roadways, sidewalks, homes, and businesses.



Storm Surge

Shallow Coastal Flooding

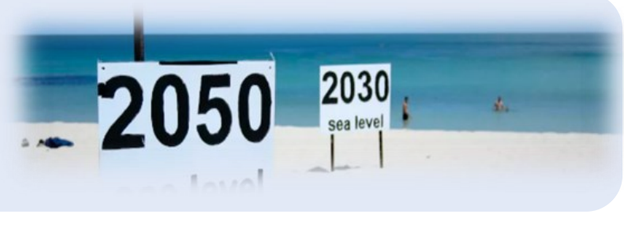
Nuisance flooding areas are areas that flood frequently during higher than average tide events.

Storm Surge

Storm surge occurs when hurricanes and tropical storms raise water levels in coastal areas which is pushed on shore.

Sea Level Rise

Sea level rise is occurring at an alarming pace along Florida's east coast. This is a long-term hazard.



Surge + Sea Level Rise

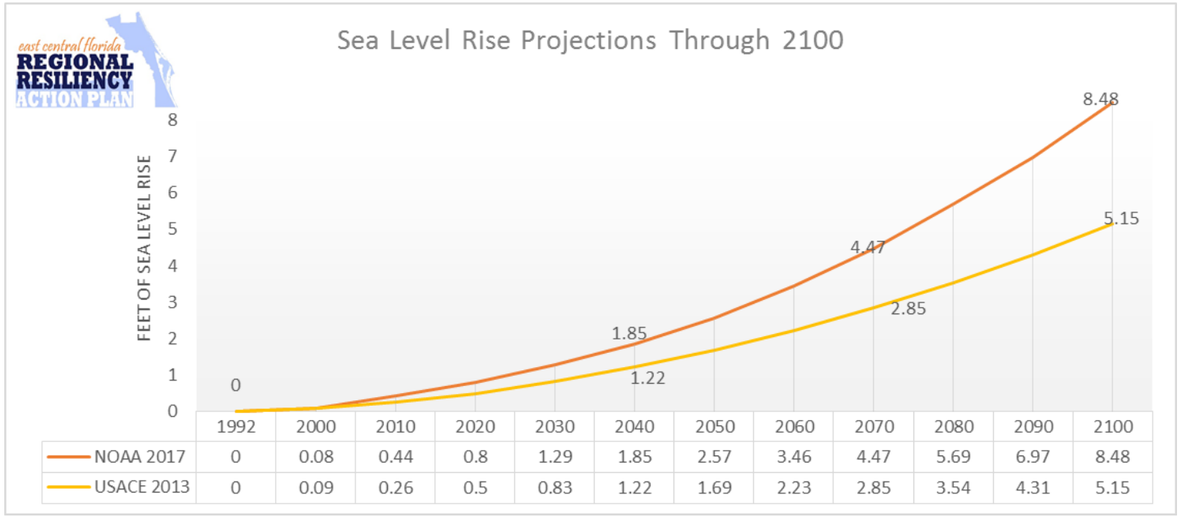
Referred to as the "Combined Hazard Zone", this includes the long-term effects of surge plus sea level rise.

100-Year Flood

The 100-year flood zone depicts areas that have a 1% annual chance of flooding.

Sea Level Rise

Sea level rise is the steady and continuous increase of water elevation along the coast which will push the shoreline inland. This analysis used two sea level rise projection curves: NOAA 2017 and United States Army Corps of Engineers 2013. The maps depict the potential areas of impact based upon the NOAA projection rate curve for the 2040, 2070, and 2100 planning horizons. While the maps show areas that will be inundated during MHHW, sea level rise effects may be seen prior to inundation through increased erosion and wave action, as well as failure of the stormwater systems.

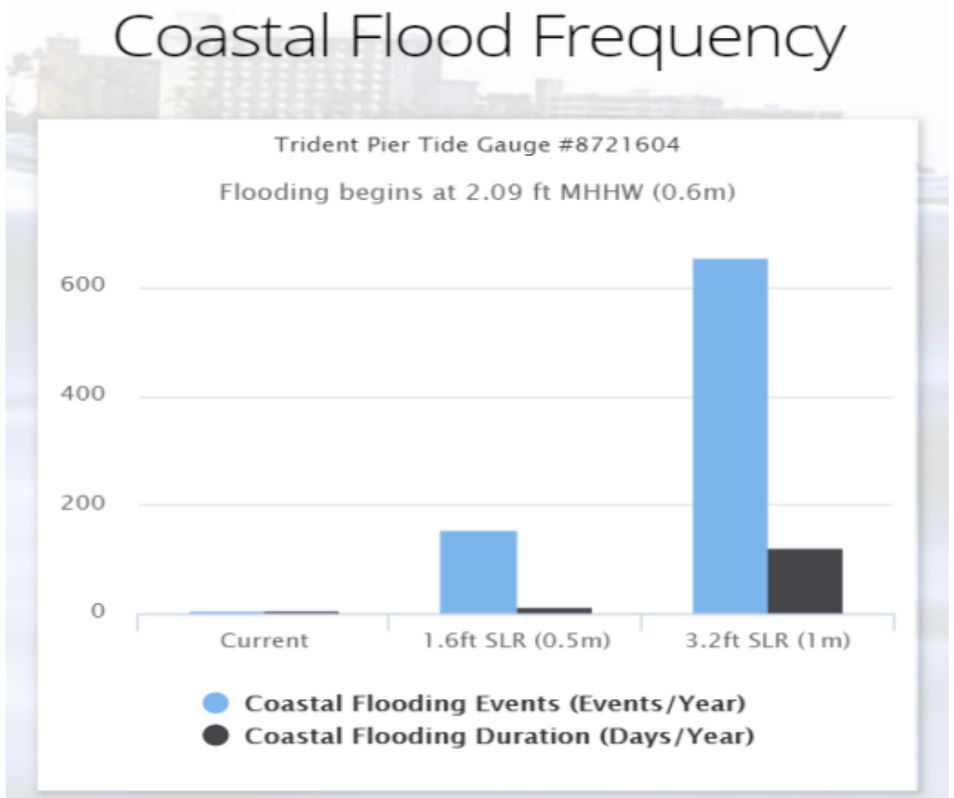


Storm Surge and Sea Level Rise

The combination of Category 3 storm surge and NOAA sea level rise projections are important in order to understand the effect that sea level rise has on coastal areas during tropical storms. Sea level rise in the near term is not dramatic when viewed on its own. However, coastal storm run-up and storm surge can be pushed past a tipping point when sea levels are higher than today.

FEMA Designated Flood Areas

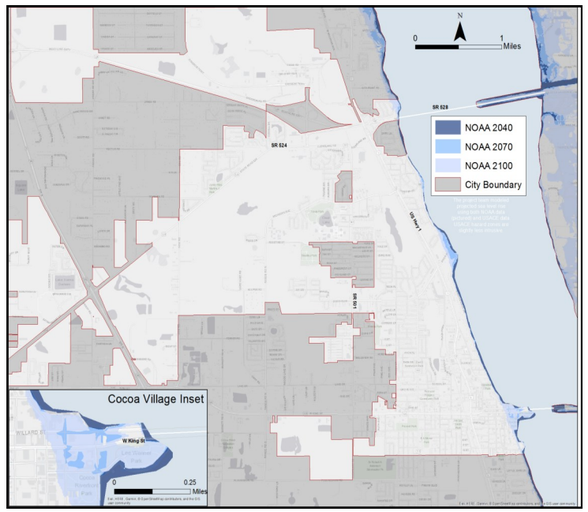
The FEMA Digital Flood Insurance Rate Maps (DFRIM) from 2014 were used to identify assets located in the 100- and 500-year flood zones. DFIRMS data indicates flood risk information derived from Flood Insurance Studies (FISs). According to FEMA, flood risk can change over time based on development patterns and environmental and watershed conditions. For this reason, FEMA has started to conduct a RiskMAP Coastal Restudy for Brevard County which includes revised DFRIMS. As of the time of this analysis, the study and revised DFIRMS have yet to be reviewed and adopted (December 2018). It is recommended that after the DFIRMS are adopted, the new analysis should include areas added to the flood zones.



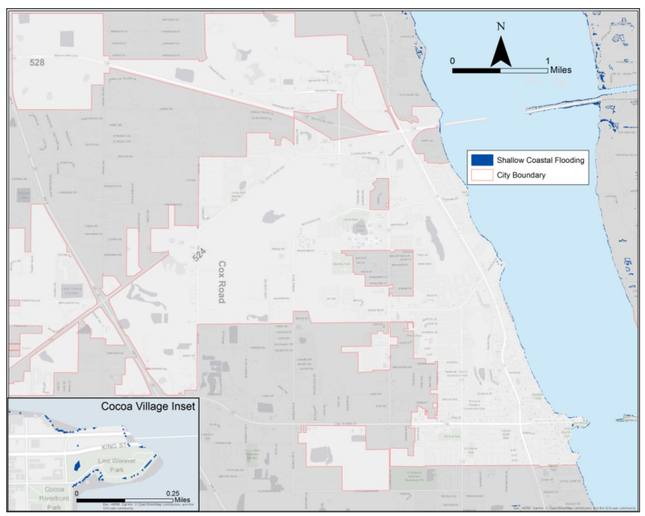
Major Findings

The findings section details the vulnerabilities of the City's transportation network, critical facilities, impacted land uses, and financial values for at-risk properties. Three areas within the City will be consistently impacted by all vulnerabilities. **High Point** is a residential area found in the north-east corner of the city. **Diamond Square Community Redevelopment Area,** a mix of residential, commercial and vacant land, sits on the center of Cocoa's vertical coastline and extends into the lagoon. Finally, **Cocoa Village** is the economic and social hub of the city and the third focus area. Larger versions of all the maps can be found on the Map Appendix at the end of this document.

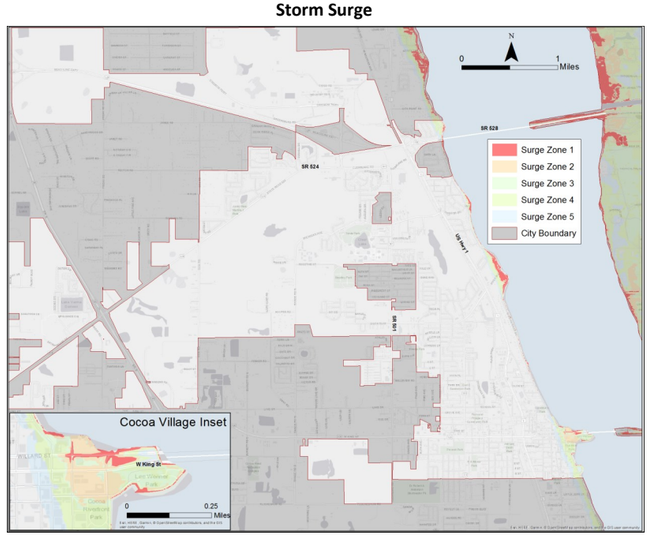
NOAA Sea Level Rise



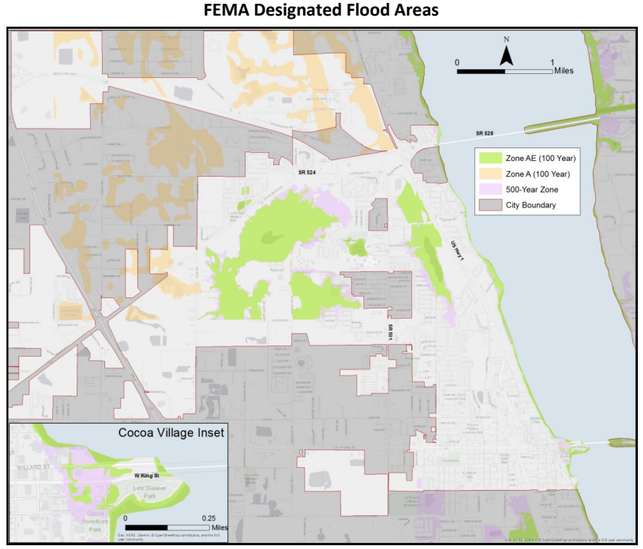
Shallow Coastal Flooding



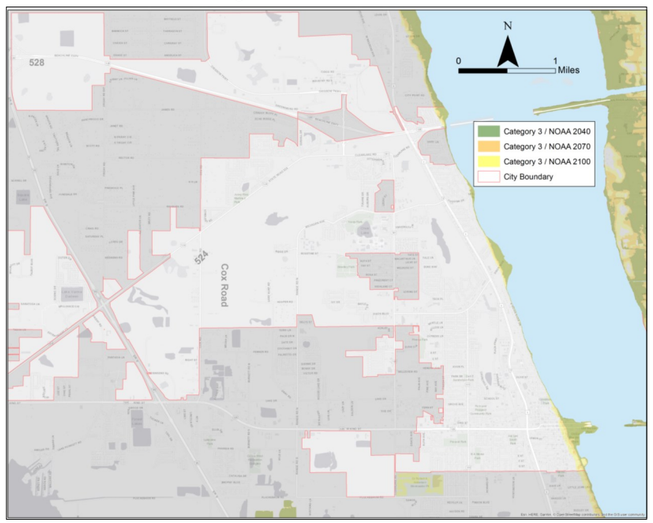
Storm Surge



FEMA Designated Flood Areas



Surge + Sea Level Rise Combo

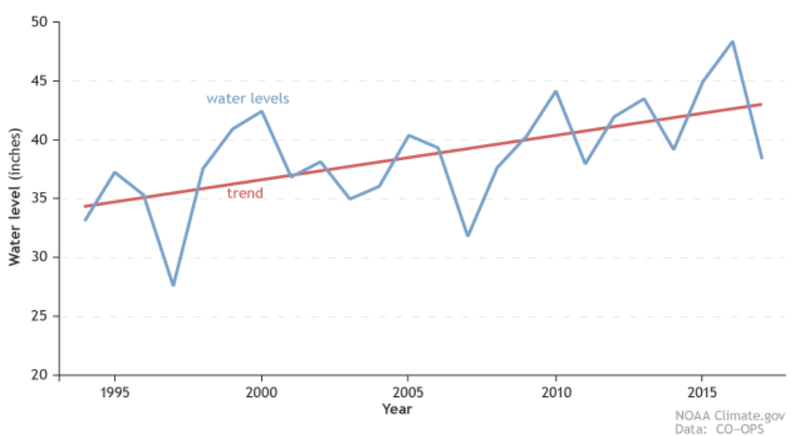


Transportation

Roadways, especially those found along coastal waters, are constantly enduring hazards that degrade their integrity. Flooding, storm surge, and erosion can disable and destroy vital transportation infrastructure. Important facilities and evacuation routes can become inaccessible, choking economic vitality and bottlenecking the city's traffic flow. Impacts should not only just be considered to the roadway itself but also the utilities that are associated with the roadway in its right of way or underground.

The table summarizes the impacts to roadways within the City of Cocoa by hazard and subdivided by Florida Department of Transportation (FDOT) classification. Local roads, a responsibility of the City, will suffer the greatest amount of inundation from sea level rise at horizon years 2070 and 2100. They are also the most impacted type of roadway for FEMA 100 Year Flood Zone, shallow coastal flooding, and the combined zone. King Street, a principal arterial road that is an entryway onto Hubert Humphrey Causeway, sees more than 12,000 Average Annual Daily Traffic (AADT). Willard Street, also in Cocoa Village, has an AADT of 29,000. Emergency response times and evacuation efforts could be severely disrupted when these roads become inundated.

Indian River Drive & Sunset Terrace washed out by Hurricane Irma 2017 (Via Twitter)



Roadway Classification *(FDOT)*	Storm Surge CHHZ *(Miles)*	NOAA SLR Year 2040 *(Miles)*	NOAA SLR Year 2070 *(Miles)*	NOAA SLR Year 2100 *(Miles)*	ACOE SLR Year 2040 *(Miles)*	ACOE SLR Year 2070 *(Miles)*	ACOE SLR Year 2100 *(Miles)*	100 Year Flood Zone *(Miles)*	Nuisance Flood Area *(Miles)*	Combined CHHZ *(Miles)*
Principal Arterial Expressway - Rural & Urban	1.26	0.34	0	0.34	0	0	0	0.4	0.15	2.21
Principal Arterial Other - Rural & Urban	1.89	0.59	0.14	0.4	0	0	0.28	0.7	3.3	6.54
Minor Arterial Rural & Urban	0	0	0	0	0	0	0	0.6	0	0
Major Collector Rural & Urban	0	0	0	0	0	0	0	0.27	0	0
Local - Major Roads	0	0	0.07	1.8	0	0.03	1.04	1.1	1.35	6.59
Local - Minor Roads	0	0	0.06	0.89	0	0	0.45	2.55	0.6	4.3
All Evacuation Routes	13.8	0.93	0.15	0.75	0	0	0.28	1.76	0.5	8.6

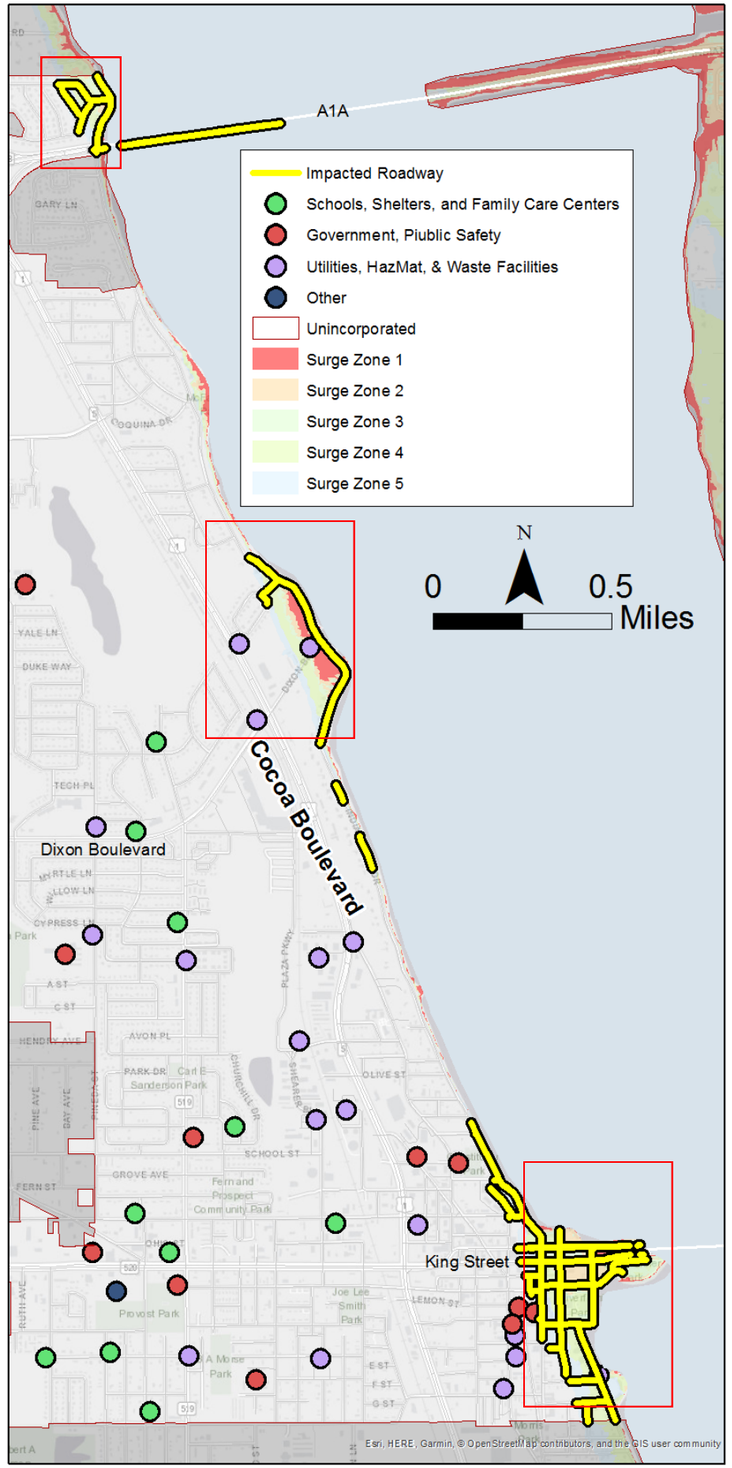
Storm Surge

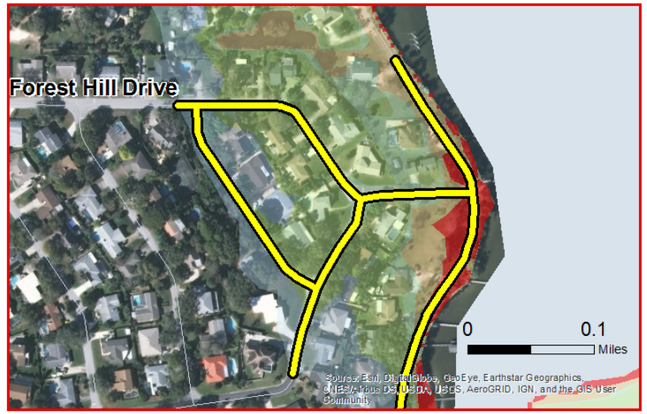
The total miles of vulnerable roadway to surge is as follows:

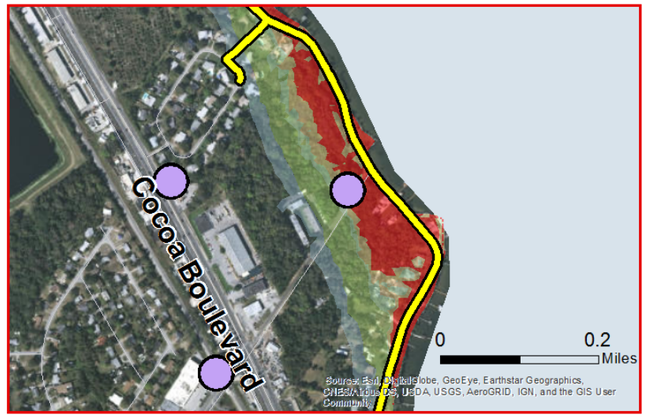
Road Name Classification	Storm Surge Categories				
	1	2	3	4	5
Willard Street* Principle Arterial - Other	0.12	0.3	0.49	0.75	1.07
State Road A1A* Principle Arterial - Freeway & Expressway	0.05	0.13	0.38	0.78	1.26
King Street* Principle Arterial - Other	0	0.11	0.27	0.51	0.83
State Highway 515 Local - Major Road	0.5	1.24	2.14	3.74	5
Brevard Local - Major Road	0	0	0.02	0.03	0.28
Riverside Local - Major Road	0	0	0.09	1.2	1.5
Church Local - Major Road	0	0	0	0.06	0.07
Total	0.67	1.78	3.39	7.07	10.01

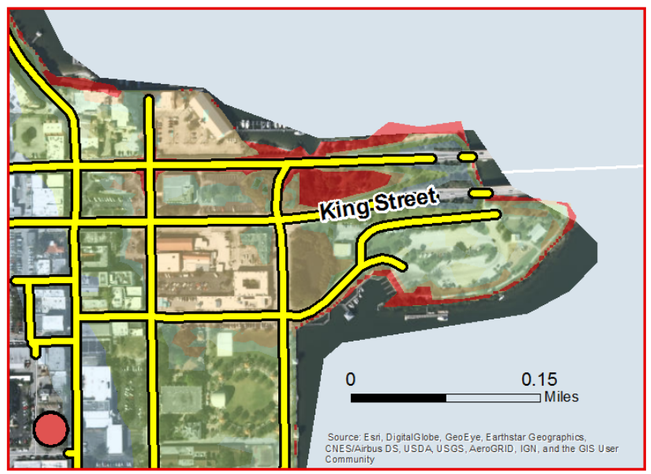
Measured in miles

Note that the total miles of roadway do not indicate a continuous stretch of impact but could represent smaller segments across the corridor.







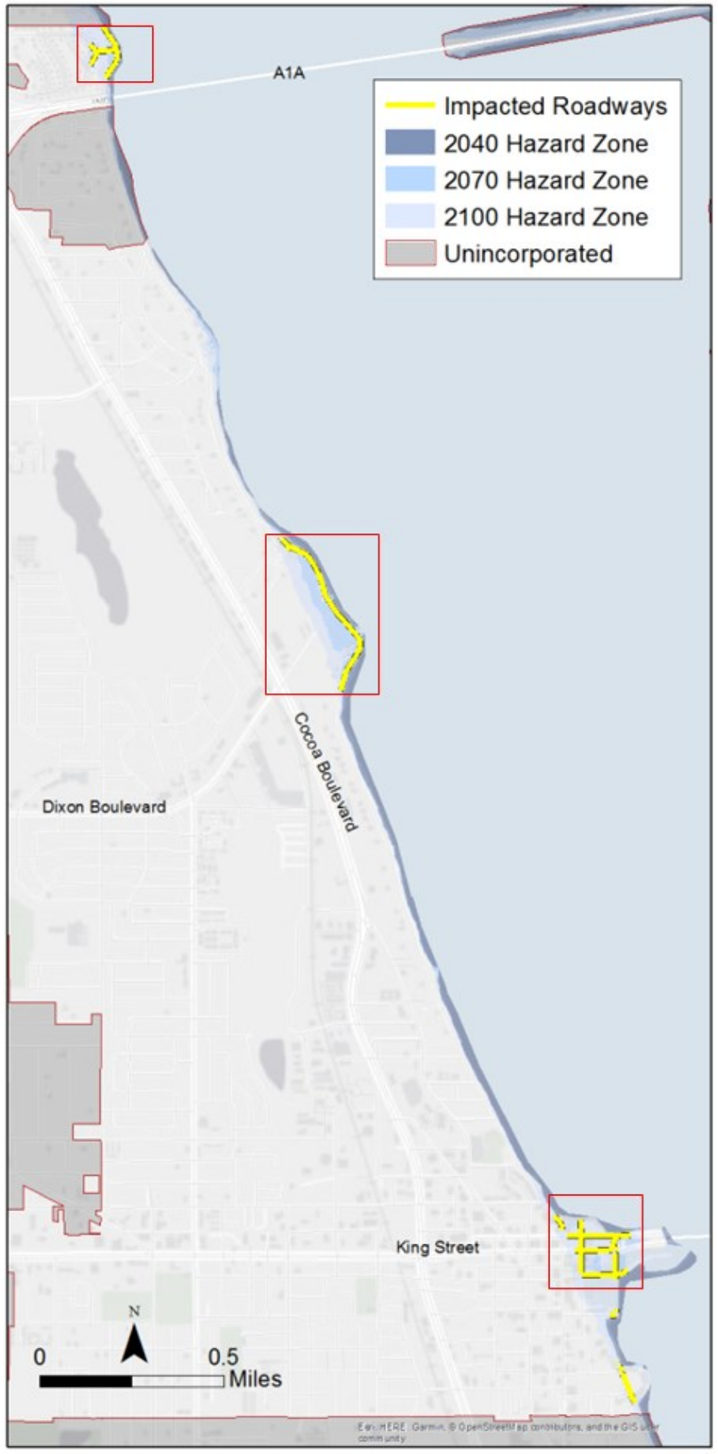


Sea Level Rise

The following table shows major roadway impacts. Note that the total miles of roadway do not indicate a continuous stretch of impact but could represent smaller segments across the corridor.

Road Name	ACOE Projection			NOAA Projection		
	2040	2070	2100	2040	2070	2100
State Hwy 515	0	0.03	0.92	0	0.63	1.41
Brevard	0	0	0.01	0	0	0.05
Riverside	0	0	0.11	0	0	0.29
Willard Street	0	0	0.17	0.29	0.13	0.22
King Street	0	0	0.11	0.29	0.02	0.19
State Road A1A	0	1	2	0.35	0.008	0.34
Church	0	0	0	0	0	0.01

Measured in miles

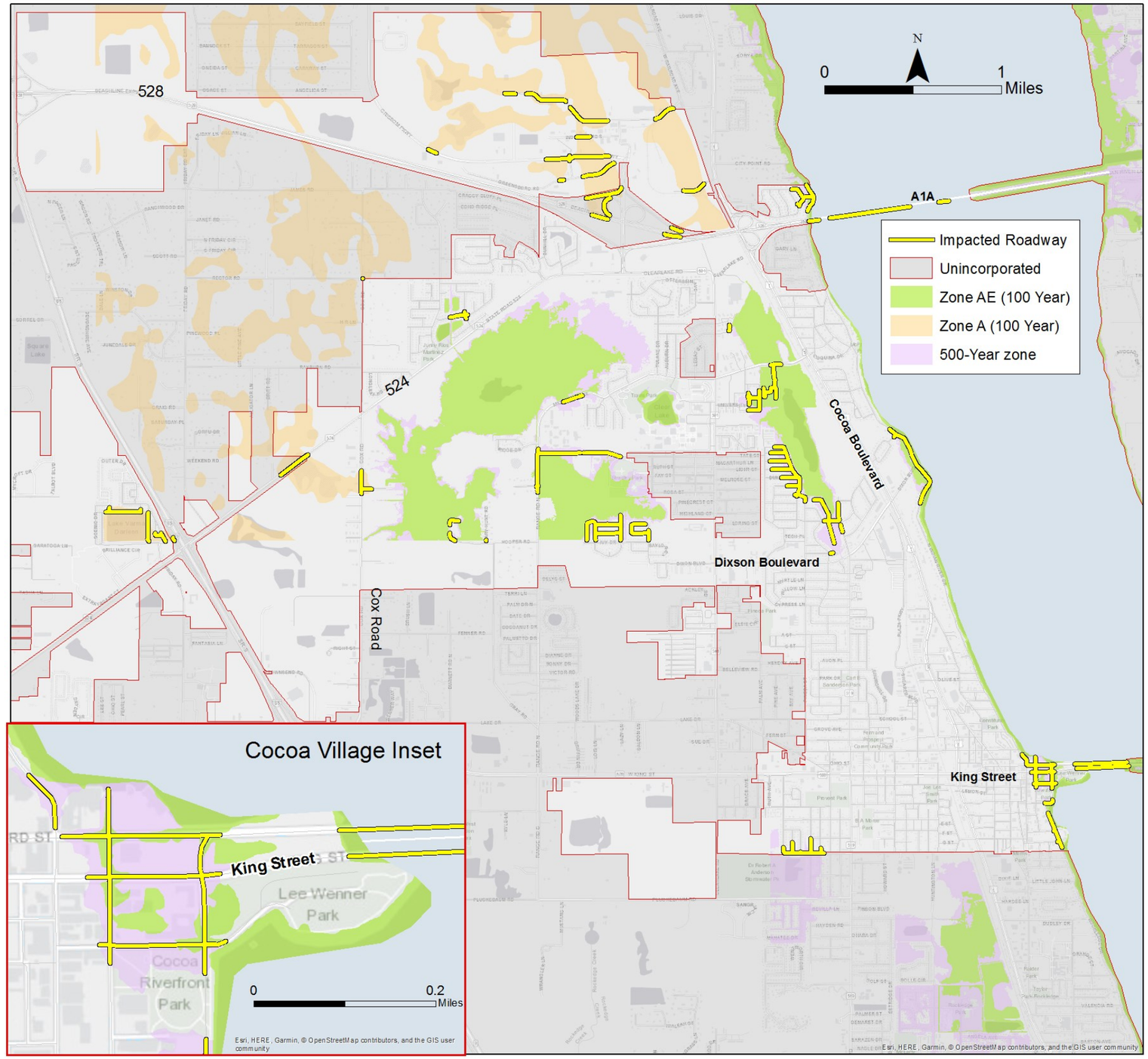


FEMA Designated Flood Areas

This map displays the impacted roadways along FEMA designated flood areas. Compared to the previous hazards, more roadways are affected by this flooding because of the widespread nature of the inundation.

The following table shows major roadway impacts. Note that the total miles of roadway do not indicate a continuous stretch of impact but could represent smaller segments across the corridor.

Road Name Classification	100-Year Flood Zones A, AE, AH, AO, VE --- Projected Inundation (miles)	500-Year Flood Projected Inundation (miles)
Range Road *Major Collector*	0.15	0.42
Cox Road *Major Collector*	0.12	0.13
Beeline Expressway *Principal Arterial*	0.18	0.18
State Road A1A *Principal Arterial*	0.22	0.57
King Street *Principal Arterial*	0.31	0.42
Willard Street *Principal Arterial*	0.42	0.45
Michigan Avenue Major Collector	0	0.12
State Highway 515 *Local - Major Road*	0.7	1.07



Land Use

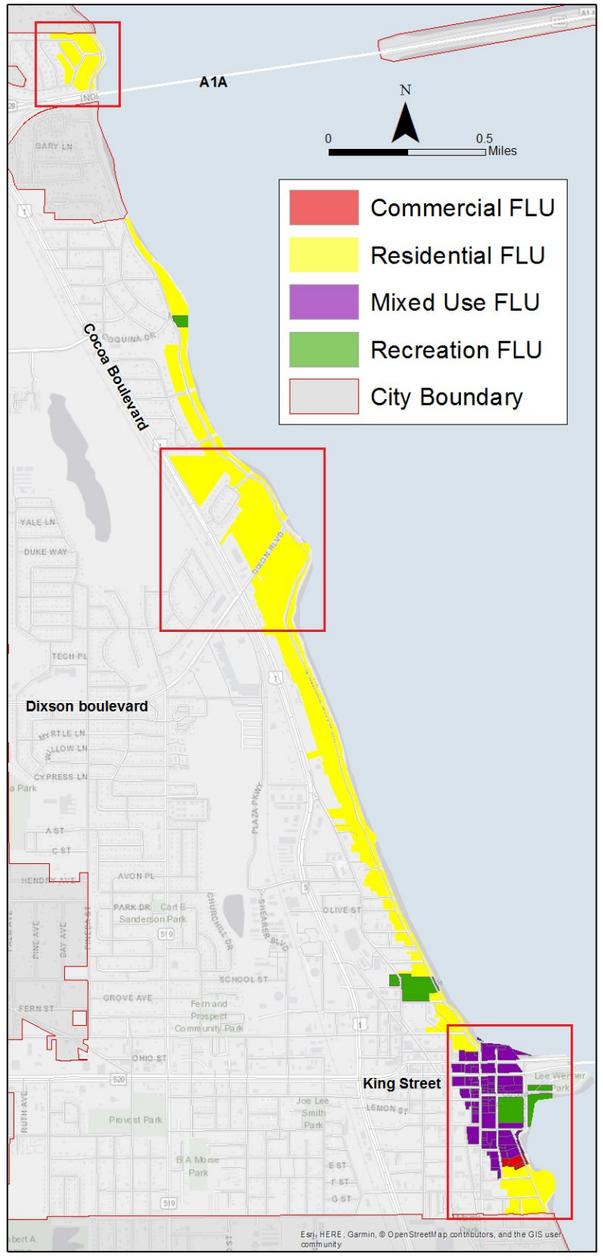
This analysis determines which types of parcels would be impacted. The FLU designations that were studied are as follows: Commercial, Low/ Medium/High Residential, Mixed Use, Industrial, Conservation and Public and Recreation.

Storm Surge

Storm surge can breach up to approximately 0.25 miles inland, depending on the category of storm. Upwards of 147 acres of residential property will be impacted by a category 5 storm surge. All 31.7 acres of exposed Mixed Use areas are located in Cocoa Village, as well as the surrounding Public & Recreation areas. High Point and Diamond Square CRA is mostly developed and will see its residential parcels impacted.

Storm Surge Zone	Commercial	Low Density Residential	Med. Density Residential	High Density Residential	Mixed Use	Public & Recreation
Category 1	1.0	92.8	1.5	14.9	11.2	11.3
Category 2	1.0	104.8	1.5	15.2	16.2	11.3
Category 3	1.0	107.2	3.3	15.6	17.8	11.3
Category 4	1.4	115.4	4.6	15.9	23.2	11.3
Category 5	1.4	119.7	8.5	19.1	31.7	15.9

Measured in acres



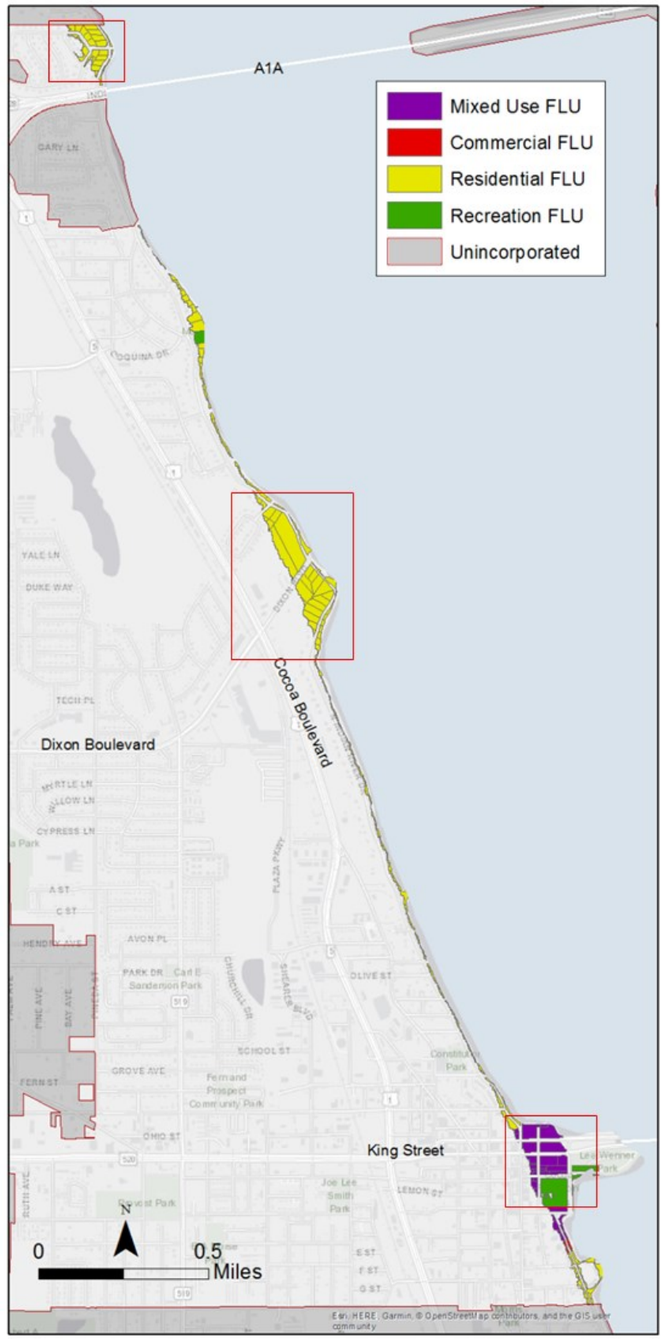
Sea Level Rise

The projected impacts of sea level rise vary depending on the curve, data source, and time horizon analyzed. For the purposes of this text analysis, the NOAA "High Curve" will be highlighted to show maximum modeled inundation.

The three focus areas, High Point, Diamond Square CRA, and Cocoa Village, will bare the largest burden of Cocoa's sea level rise vulnerabilities. Cocoa's shoreline is largely residential FLU and will see approximately 136 acres exposed to sea level rise inundation by 2100. In the downtown area, exposure is projected to infringe on properties with mixed-use FLU, as well as reaction areas. Single family houses that line the shore will be at risk of sea level rise inundation.

Flood Zone	Commercial	Low Density Residential	Medium Density Residential	High Density Residential	Mixed Use	Public & Recreation
2040 *ACOE Curve*	0	0	0	0	0	0
2070 *ACOE Curve*	0	3.6	0	0	0	2.0
2100 *ACOE Curve*	0.2	67.9	3.7	7.9	16.6	11.4
2040 *NOAA Curve*	1.2	83.6	1.5	17.7	10.7	17.1
2070 *NOAA Curve*	1.2	93.6	1.5	17.7	15.4	17.1
2100 *NOAA Curve*	1.2	114.8	3.7	17.7	20.8	17.1

Measured in acres

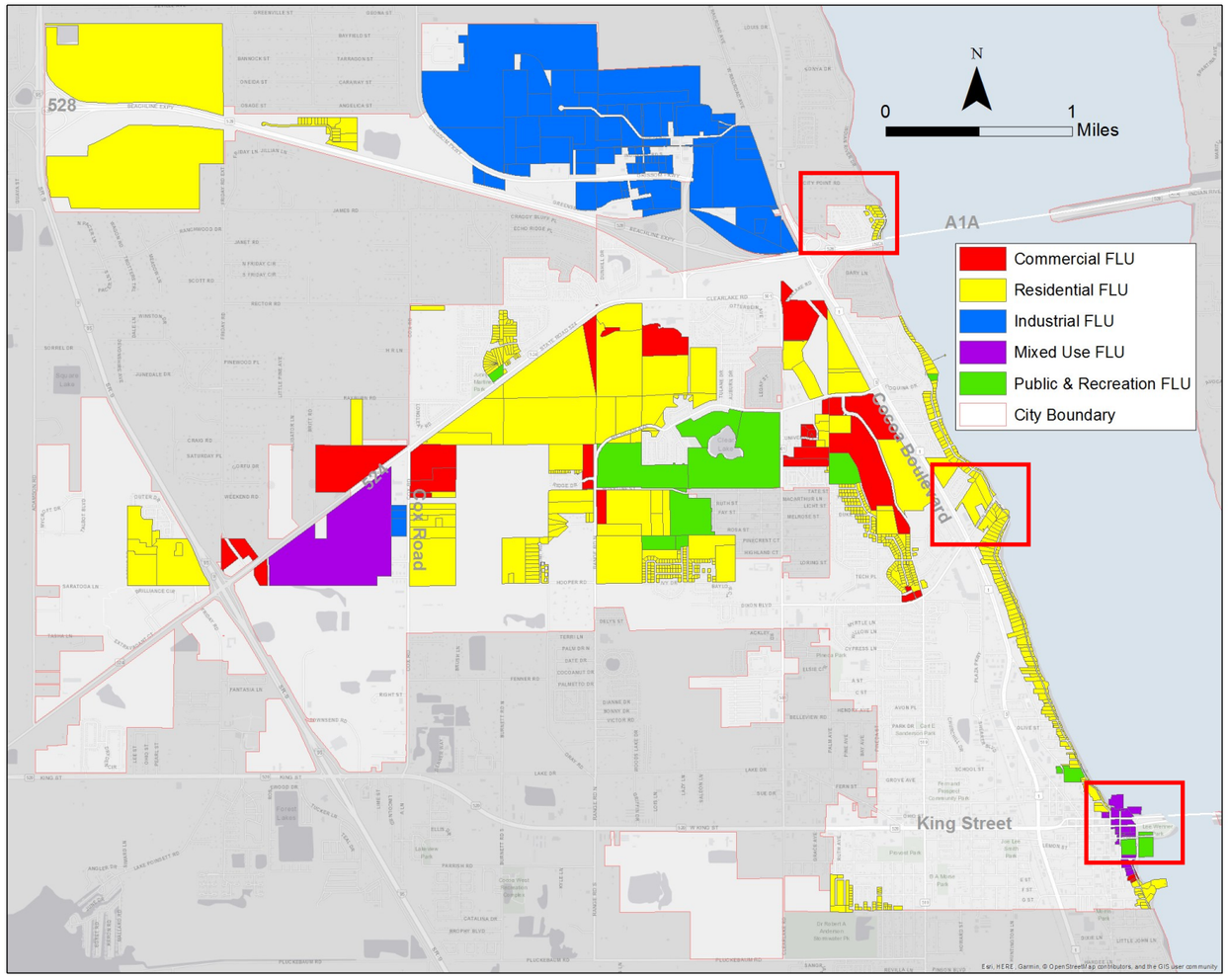


FEMA Designated Flood Areas

The City of Cocoa has large areas of land that are located in FEMA's 100 Year (Zone A, Zone AE) and 500 Year flood plain. This map displays the parcels that are projected to be impacted by FEMA designated flooding. Unlike the other hazards, industrial property is exposed to flooding. In total, approximately 3,311 acres of land are vulnerable to a 500-year flood event. Nearly 800 acres of industrial FLU are at risk, as well as over 1,500 acres of residential property. The following table shows the breakdown by FLU category.

Flood Zone	Commercial	Conservation	Low Density Residential	Medium Density Residential	High Density Residential	Industrial	Mixed Use	Public & Recreation
Zone A *(100 Year)*	69.3	0	494.4	76.3	0	783.1	158.7	0
Zone AE *(100 Year)*	181.9	226.8	626.1	256.2	17.7	0	15.3	245.3
500 Year *(Includes 100 Year)*	294	226.8	1227.7	340.3	17.7	783.1	176.9	245.3

Measured in acres



High Point

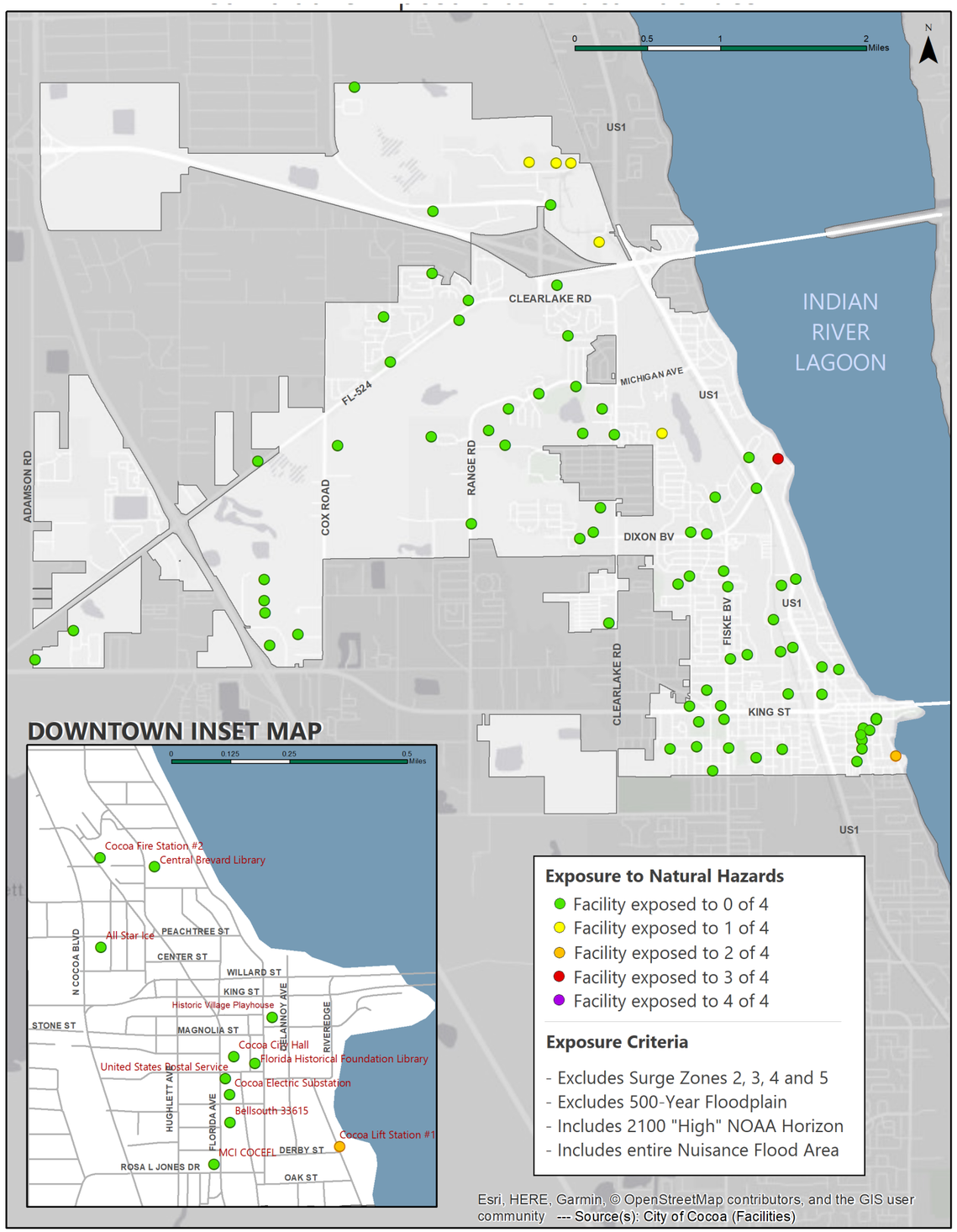
Magnolia Point

Cocoa Village

Critical Facilities

The critical facilities analysis in this report details the risk posed to infrastructure critical to the life, safety, health and continuity of city-wide operations following storm events. Eleven critical facilities are exposed to at least one hazard in Cocoa. All listed facilities are located in a flood zone. Three lift stations risk exposure to natural threats, with two stations impacted by storm surge, sea level rise, FEMA floods, and shallow coastal flooding. Facilities that are located in shallow coastal flooding areas should be assessed further by the City as they would potentially be the most vulnerable to flooding in the future. Cambridge Elementary School acts as a shelter in emergency situations and faces inundation threats by the Zone AE flooding. While this analysis was based on exposure of the building footprint to each vulnerability, as noted previously in the report, access to these facilities should also be considered.

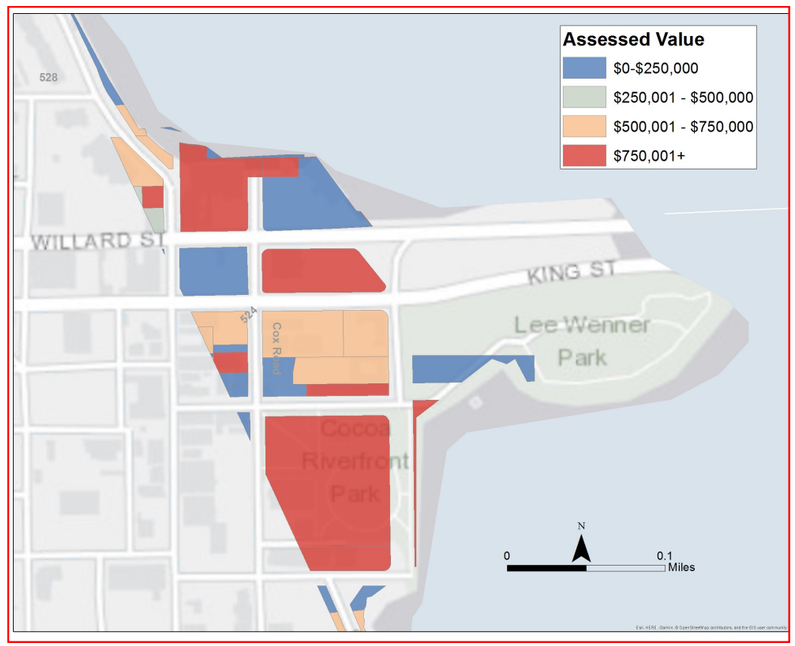
Facility	Facility Type	Storm Surge Zone	ACOE SLR Horizon	NOAA SLR Horizon	Flood Zone	Shallow Coastal Flood Area
ATM Recycling	Waste Facility	None	None	None	Zone A	No
Beyel Brothers Inc - Cocoa	Waste Facility	None	None	None	Zone A	No
Cambridge Elementary School	School (Shelter)	None	None	None	Zone AE	No
Central Brevard Library	Government	None	None	None	None	No
City Point Electric Substation	Utility	None	None	None	Zone A	No
Cocoa Lift Station #1	Utility	Category 4	2100	2100	500 Year	Yes
Cocoa Lift Station #24	Utility	None	None	None	500 Year	No
Cocoa Lift Station #45	Utility	Category 2	2100	2070	Zone AE	Yes
Eastern Florida State College	School	None	None	None	500 Year	No
Goodson Paving	HazMat Facility	None	None	None	Zone A	No
Vernita Jones Family Day Care	Day Care	None	None	None	500 Year	No



Adaption Action Area

An Adaptation Action Area (AAA) is a designation tool for prioritizing infrastructure development and policy implementation to areas impacted by both Category 3 Storm Surge and the Army Corps of Engineers' (ACOE) 2070 Sea Level Rise projection. The City of Cocoa is impacted by Storm Surge Category 3 and AOE 2070 Sea Level Rise along its coast. Cocoa's downtown area is completely vulnerable to these hazards and therefore should be within the Adaptation Action Area. Indian River Drive, which snakes along the coast, is the de facto boundary for the AAA. Gray and green infrastructure can be used to alleviate flooding urban areas. Implementing these strategies require an understanding of the existing and impending hazards, as well as the City's fiduciary responsibility. AAAs should incorporate synergetic and geographically focused elements to appropriate suite the environment.

Downtown Cocoa is home to some of the City's most expensive properties. These properties are exposed to nearly all hazards and pose a large financial liability for business and property owners.



Financial Impacts

Approximately 202 parcels in the City of Cocoa could be impacted by shallow coastal flooding. The assessed value of these properties is $170.3 million. Almost 60% of buildings on these vulnerable properties were constructed before 1968 which was food insurance was first required for properties in flood-prone areas beginning in 1968. The highest-value-clusters of lagoon-adjacent properties exposed to this hazard are located in Cocoa Village.

Storm surge is expected to have a large financial impact on the City of Cocoa. In the event of a category 1 surge, vulnerable land is assessed at $167,000,000. For the most severe surge, a category 5, assessed land value balloons to over $222,000,000. Forty-six percent of vulnerable structures in storm surge areas, are immediately at risk in a category 1 coastal high hazard event. Property in the City of Cocoa is also at risk to sea level rise. According to NOAA time horizons, the city will see substantial impacts as early as 2040. Property value of over $170,000,000 is susceptible to inundation by this year. Nearly 60% of all structures on property impacted by NOAA's 2040 curve were built pre-1968, meaning their construction standards are much lower than the modern standards in place today. The 2070 NOAA curve will see impacted property values creep to $182,00,000 and will exceed $200,000,000 by the 2100 horizon year.

The Army Corps of Engineers projection curves have a starkly different outlook. According to this projection, the City of Cocoa wont see property damage until the 2070 horizon year, where 9 parcels will impacted. This number jumps to 118 parcels and $138,000,000 worth of damages by 2100.

Nuisance Flooding Area					Built Pre-1968	Built 1968-2001	Built 2002 - 2018
Parcels in Zone	Number of Buildings	Land Value	Assessed Value	Taxable Value	# Buildings Total Value	# Buildings Total Value	# Buildings Total Value
139	116	$36,220,800	$170,315,380	$117,073,071	63 $38,238,830	37 $64,727,740	16 $63,219,240

Storm Surge Zone	# Parcels in Zone	Number of Buildings	Land Value	Assessed Value	Taxable Value	Built Pre-1968 # Buildings Total Value	Built 1968-2001 # Buildings Total Value	Built 2002 - 2018 # Buildings Total Value
Category 1	147	122	$38,567,030	$167,898,010	$121,344,197	66 $33,822,220	40 $65,957,240	16 $63,657,980
Category 2	166	136	$39,819,710	$175,722,620	$127,616,687	75 $38,182,150	43 $67,621,240	18 $65,165,580
Category 3	184	154	$41,045,970	$181,746,490	$131,793,427	88 $41,908,540	46 $68,147,950	20 $66,936,350
Category 4	238	199	$43,072,530	$198,929,200	$145,845,217	117 $50,163,740	61 $76,620,500	21 $67,172,190
Category 5	309	262	$46,605,680	$222,136,100	$158,197,081	168 $67,201,480	71 $81,779,220	23 $67,838,720

Horizon Year	# Parcels in Zone	Total Number of Buildings	Value of Parcels in Zone	Built Pre-1968 Buildings Total Value	Built 1968-2001 Buildings Total Value	Built 2002 - 2018 Buildings Total Value
2040 *ACOE Curve*	0	0	$0	0 $0	0 $0	0 $0
2070 *ACOE Curve*	9	5	$2,866,420	1 $381,930	4 $1,967,460	0 $0
2100 *ACOE Curve*	117	93	$138,096,960	45 $22,184,470	37 $63,097,470	11 $48,754,290
2040 *NOAA Curve*	139	118	$170,051,950	69 $40,726,030	34 $62,611,440	15 $62,788,110
2070 *NOAA Curve*	167	137	$182,276,330	79 $46,026,520	43 $67,583,770	16 $64,057,990
2100 *NOAA Curve*	220	186	$203,760,390	105 $54,672,340	61 $77,054,700	21 $67,172,190

PUBLIC ENGAGEMENT

This section of the report discusses the Resilient Cocoa project's public engagement process, which included several outreach activities targeting residents and business owners.

Public Workshop

The City hosted a public workshop on February 12, 2019 at the City of Cocoa Chambers, which was facilitated by ECFRPC. The first part of the meeting included a presentation that illustrated how Cocoa might be affected by nuisance flooding, storm surge, and sea level rise. This was followed by a series of community engagement activities where the meeting's participants identified vulnerabilities, focus areas, and strategies to create a more resilient city. The ECFRPC used this information to develop a public survey for the City's residents.

Open House

The City hosted an open house on May 21 that included presentations from the ECFRPC, Brevard County Emergency Management, and the County Environmental Services Office.

Public Survey

As part of the community outreach process, the ECFRPC prepared an online survey using the MetroQuest public engagement software. The objective of the survey was to gather public input about the areas that City officials need to prioritize to make Cocoa more resilient to natural disasters and sea level rise. This survey was launched on March 20, 2019 and ended on April 18, 2019. City of Cocoa officials used a variety of methods to advertise the survey including the City's Facebook page. Moreover, Spectrum News 13 ran a story about the project on March 25, which included a link to the survey. Because of these efforts, a total of 152 participants completed the survey. Close to 70% of the respondents where either full-time or seasonal Cocoa residents. The majority of the participants were either newcomers to the City (less than five years) or long- time residents (21+years). Finally, most of the respondents were over 40 years old, which follows the City's demographics very closely.

The city of Cocoa is working with residents to best prevent catastrophic flooding. (Spectrum News image)

Experts: Cocoa Could Face More Flooding Due to Sea Level Rising

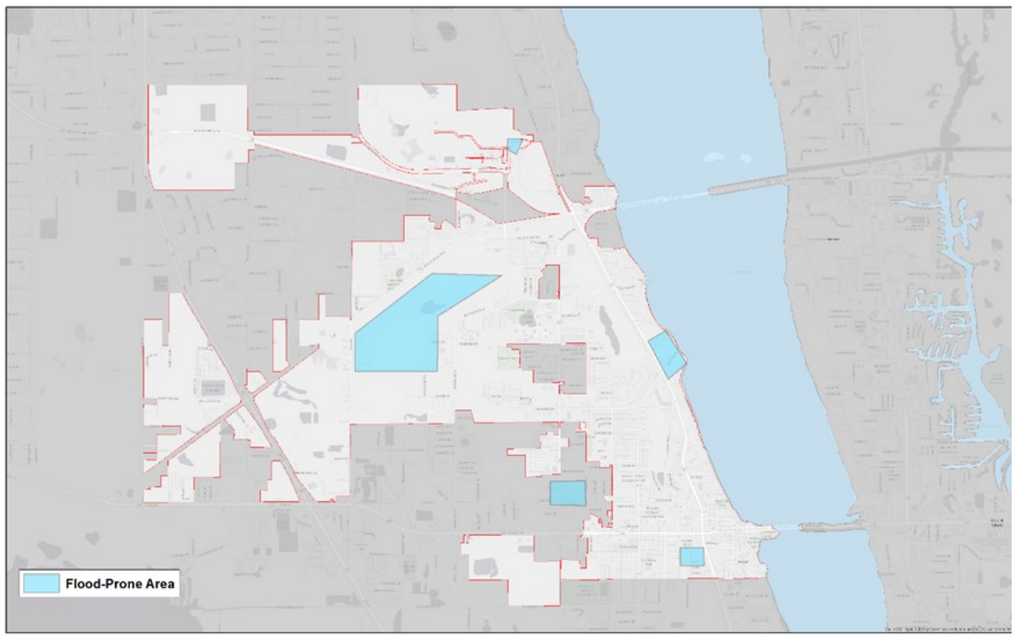
By Krystel Knowles

PUBLISHED 5:46 PM EDT Mar. 25, 2019 | UPDATED 6:09 PM ET Mar. 25, 2019

SHARE

COCOA, Fla. — The city of Cocoa is working to prevent potentially serious flooding. According to new data, the coastal city might be even more prone to flooding. Now, officials are looking for some help from residents.

- Sea level rising could make Cocoa more prone to flooding
- City asking residents to take survey to help with curbing damage
- LINK: Take the Cocoa survey here

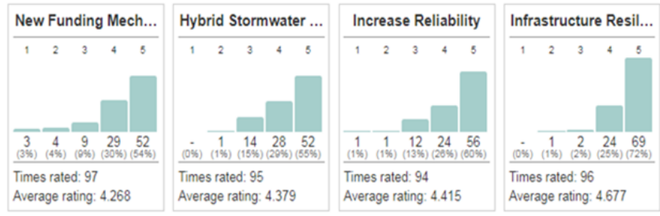


The first question of the survey asked participants to rank five vulnerabilities, which were based on input from the public workshop and the Brevard County Local Mitigation Study. Based on the combined survey results, the top three vulnerabilities were Inadequate Infrastructure, Hurricane and Storm Surge, and Flooding. After choosing their top three vulnerabilities, participants were then asked to show their support for several defined strategies by rating them on a one to five scale.

The highest rated strategies under the Inadequate Infrastructure vulnerability were identifying aging storm water/drainage infrastructure, requiring all infrastructure to incorporate new loads and meet current demand, and incorporating engineering and natural features to manage surface runoff. Under the Hurricane and Storm Surge vulnerability, survey participants want the City of Cocoa to focus on identifying critical infrastructure needs for storm preparedness recovery, using vegetative solutions along the Indian Rive Lagoon to reduce storm surge impact, and adapting the City's building and land development codes for greater resiliency standards. To address flooding, respondents also want the City to identify areas and corridors to prone to recurrent inundation, increase the number of green spaces that could be used for storm water retention, and develop a plan that incorporates best practices for grey and green infrastructure.

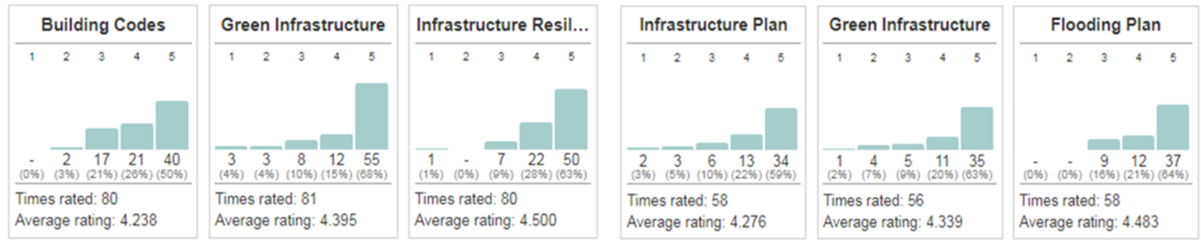
Finally, the survey asked respondents to prioritize areas that City officials should emphasize to create a more resilient Cocoa. The selected priorities include determining appropriate measures to mitigate, adapt or relocate critical infrastructure and assets vulnerable to extensive flooding and storm surge, updating codes & policies to promote the use of conservation lands and on-site natural features to protect water quality and manage storm water runoff, and promoting redevelopment in the least vulnerable areas.

Inadequate Infrastructure



Hurricane and Storm Surge

Flooding



Vulnerability	Vulnerability Description	Survey Rank
Economic Resiliency	Natural disasters can disrupt business operations and in the worst case scenario lead to closures and jobs losses in the community	4
Flooding	Standing water due to rainfall, tropical events, and high tides	3
Inadequate Infrastructure	Storm water infrastructure (retention ponds, ditches, curbs, sewer pipes) helps to manage water from rain events and prevent flooding. Failing septic tanks can pollute nearby water bodies such as the Indian River Lagoon	1
Hurricane and Storm Surge	Elements associated with hurricanes including wind, rain, utility failure, and surge from ocean and lagoon waters	2
Vulnerable Populations	Certain groups such as the elderly and the poor are particularly vulnerable when a disaster strikes	5

Business Outreach

Different from other concurrent studies, the Resilient Cocoa project included a business resiliency component. The ECFRPC and City reached out to Cocoa businesses in two ways. First, the ECFRPC hosted a business workshop on March 26, 2019. This event introduced attendees to the concept of resilience, explained the goals of the project, and finished with an interactive public engagement exercise using the Mentimeter polling software. The objective here was to identify the main challenges faced by businesses after a major storm event, and determine the most critical City services before and after a natural disaster. According to the meeting attendees, the most useful services before the storm were sand bags, tree trimming, and debris removal. After the storm, businesses benefited the most from water restoration, law enforcement, and debris clean up. Most of these businesses reported that they closed for at least a week after Hurricane Irma.

In addition to holding this event, the ECFRPC also prepared a survey for businesses. This questionnaire was shared by the City of Cocoa's Economic Development Specialist during her site visits with the area businesses. The survey questions were very similar to the ones asked at the business workshop. However, it also inquired businesses if they would be interested in developing a business continuity plan. City staff and the ECFRPC will be following up with those establishments that requested learning more about this process.

COCOA FLORIDA

Is Your Business Prepared for an Emergency?

The City of Cocoa and the East Central Florida Regional Planning Council are developing a plan to create a more resilient Cocoa. Resiliency is the capacity of communities and businesses within a city to bounce back after a natural disaster.

As part of this process, the City will be hosting a business workshop to learn how Cocoa businesses are preparing for natural disasters. For more information about this meeting, please contact Samia Singleton at (321) 433-8577 or via-mail at ssingleton@cocoafl.org.

ECONOMIC IMPACT ANALYSIS

According to most scientists, changes in the climate over the next decades will lead to an increase in the number and intensity of heavy rainfall events. From 1900 to 2015, the United States experienced a four percent increase in annual average precipitation nationwide. The frequency of these intense rain events could increase between two and five times if emissions are not curtailed (Center for Climate and Energy Solutions, 2017). In Brevard County, Tropical Storm Fay (2008) and Hurricane Irma (2017) brought relentless precipitation that overwhelmed storm water infrastructure and caused inundation throughout the area.

Urban areas are especially susceptible to flooding because of the abundance of impervious surfaces (parking lots, rooftops) and lack of vegetation and soil that could slow and filter the water. These flash flooding events are not merely an inconvenience for both urban dwellers and workers, but can also have devastating events for small firms. Based on the preliminary results from the Cocoa Business Resiliency surveys, most local businesses were closed between two and five days after hurricane Irma. Several of them listed flooding as one of the causes for their involuntary closing. Therefore, preparing our commercial corridors for these intense precipitation events is of utmost importance for improving economic resiliency.

As part of the Resilient Cocoa project, the ECFRPC used the REMI PI+ model to explore how small businesses can be affected by strong precipitation events. This economic impact analysis is comprised of two scenarios. The "do nothing" simulation estimates the economic impact of not addressing the flooding events. The second scenario assumes that the City of Cocoa will use green infrastructure features to alleviate this situation.

Flooding along Delannoy Avenue in Cocoa Village (FloridaToday.com)

About the REMI PI+ model

Since 2005, The ECFRPC has been using the Regional Economic Models, Inc. (REMI) Policy Insight economic model to calculate the economic effects of a variety of policies and investments. The REMI model builds on the strengths of four major modeling approaches: Input-Output, General Equilibrium, Econometric, and Economic Geography. More detailed information about the model can be found at www.remi.com.

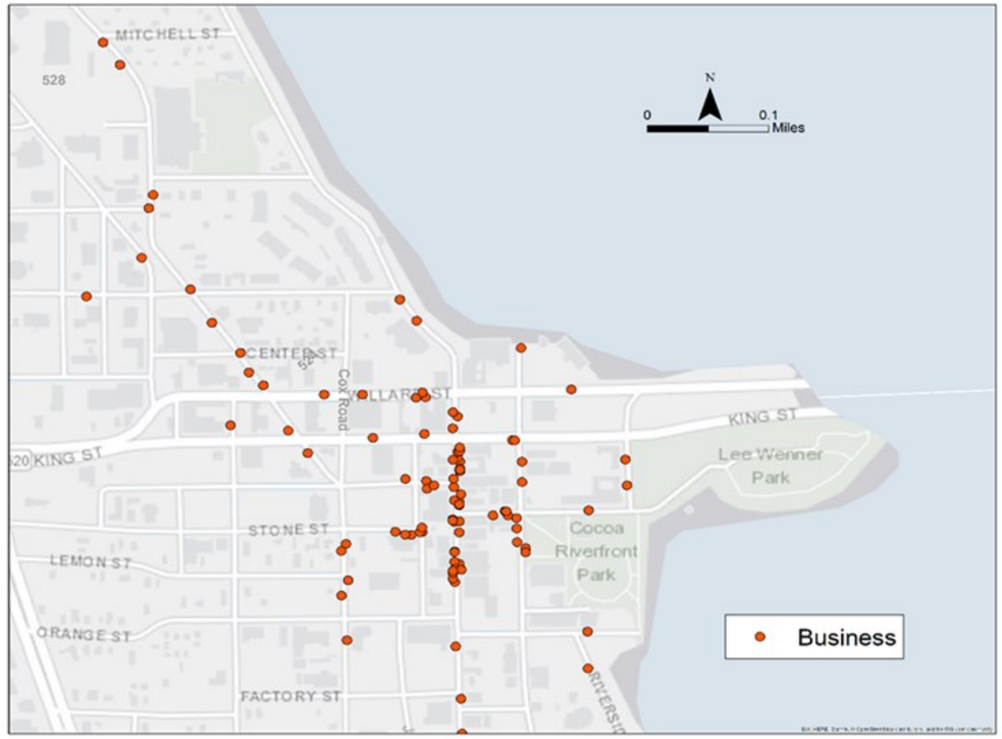
Methodology, Inputs and Assumptions

One of the areas affected by urban flooding events is Cocoa Village, which is the social and business hub. To develop the actual simulation, the ECFRPC identified all establishments located within Cocoa Village using Infogroup's Reference USA database and City Business Tax Receipt data. Home businesses, government offices, and those firms without a website or other form of verification were eliminated. This left a total of 181 business that employ close to 1,000 people. Most of Cocoa Village's businesses are within the Professional, Scientific and Technical Services category, which includes accounting, engineering, and law firms. This followed by Retail Trade establishments and Restaurants.

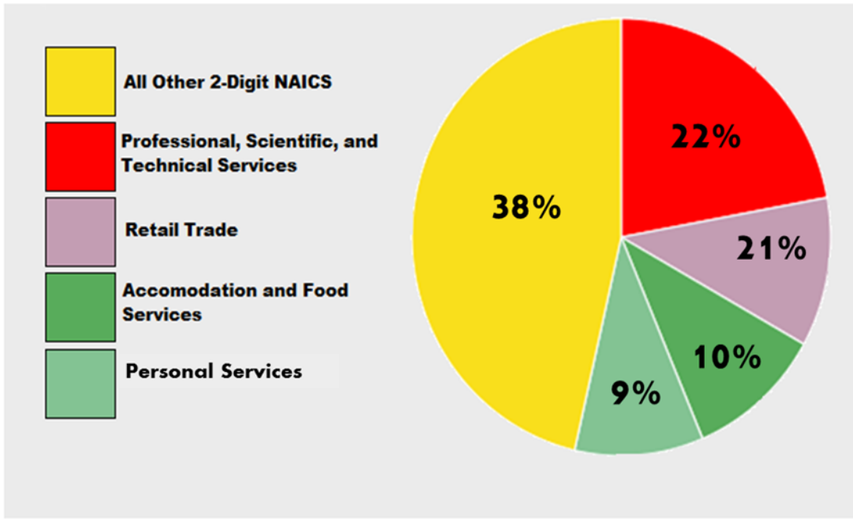
To calculate the economic impact of these business losses, the ECFRPC used total annual business sales (output) as provided by Infogroup. In the case where the business record did not have that information, the ECFRPC multiplied the total number of employees by REMI's labor productivity industry numbers for Brevard County to calculate the total output. In addition to this, staff also modified some of the NAICS codes for businesses that were obviously misclassified and recalculated the output using the labor productivity rates. A few of the establishments did not have any employment data. Here, the ECFRPC relied on the company webpages to estimate the number of employees. Based on Infogroup data and ECFRPC estimates, Cocoa Village businesses have a total of $139.5 million in annual sales.

More often than not, it is very difficult for businesses to recoup the amount of sales lost because of a weather event. Because of this, the ECFRPC decided to estimate the effect that these momentary business closures could have in Brevard County's economy over a long term period using Cocoa Village as a case study. The economic impact was measured based on changes to the total output/sales of Cocoa Village businesses.

Cocoa Village Business District



Cocoa Village Business Structure



Scenario 1: Do Nothing Scenario

The ECFRPC developed the first scenario of increasing business closing days based on changes to the weather patterns over a 31-year period. Staff aggregated annual business sales by industry and then divided this number by 365 to get the total daily output. This number was then multiplied by the total number of days that the businesses will be closed because of a flooding event. Based on the literature examined for this project and the results of the business surveys, the ECFRPC assumed that the total number of days would be increasing gradually over the next three decades. All numbers were entered as negative.

According to REMI, on average, the reduction of Cocoa Village's business sales results in the loss of 1,370 jobs when compared to the regular forecast. This employment estimate includes full-time, part-time, and temporary positions, which the model gives equal weight. Often referred to as total sales volume, output measures the gross level of business revenue which includes both the costs of labor and materials (intermediate inputs) and value added activities (compensation and profits). Since business output is the broadest measure of economic activity, it tends to generate the largest numbers. This new scenario shows that on average there will be a decrease of $111 million in sales during the study period. Personal income refers to total earnings from employee compensation, wage supplements, rents, transfer payments, and other business ventures. There will be a loss of $128 million. Finally, gross regional product (GRP) represents the market value of all goods and services produced by labor and property, regardless of nationality. Based on the results of this simulation, these flooding events will reduce facility will Brevard County's GRP by $56 million.

Total Sales/Output by Industry in Cocoa Village

Industry	Annual Sales	Daily Sales
Retail Trade	$22,445,185	$61,494
Wholesale Trade	$18,012,974	$49,351
Full Service Restaurants	$15,208,075	$41,666
Legal Services	$11,708,000	$32,077
Real Estate	$11,698,868	$32,052
All Other Industries	$60,429,933	$165,561
Total	$139,503,035	$382,200

Sources: Infogroup, ECFRPC Calculations

Annual Output Losses by Number of Flooding Days

Forecast Period	Number of Flooding Days	Annual Output Loss
2020-2030	3	-$1,146,600
2031-2040	5	-$1,911,000
2041-2050	7	-$2,675,401

Sources: Infogroup, ECFRPC Calculations

Scenario 2: Adoption of Green Infrastructure Scenario

The second scenario estimates the economic impact of adopting a green infrastructure program to alleviate flooding within the Cocoa Village district. Smart Growth America and the Center for Climate and Energy Solutions (C2ES) promote the use of green features such as rain gardens and green roofs to help manage storm water in urban areas. One problem encountered when constructing this model is that none of the literature studied for this report stated the degree to which green infrastructure can help alleviate flooding. Therefore, the ECFRPC assumed that there will be one less flooding day because of the incorporation of green infrastructure elements. This would in turn reduce the amount of business output lost during the study period.

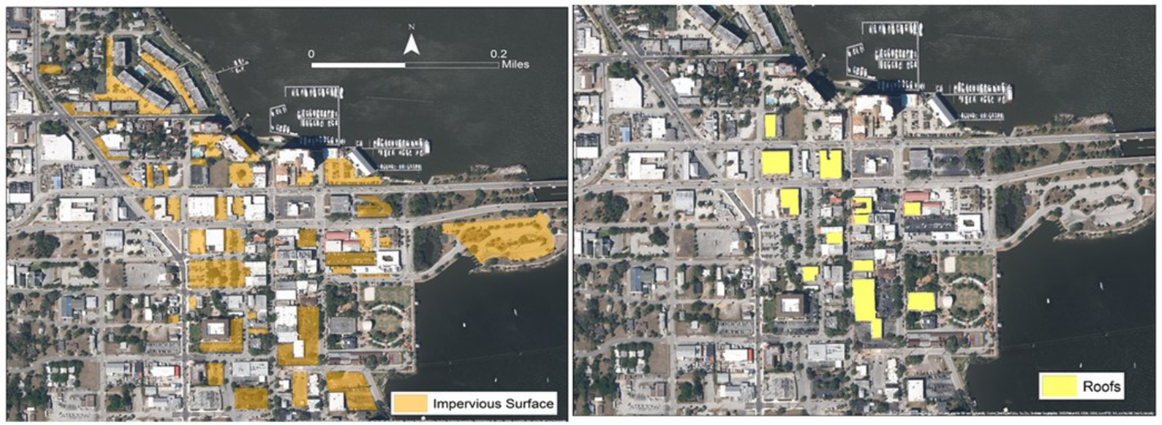
Incorporating this new infrastructure would certainly have its costs. According to C2ES, the price for installing green features ranges from $7 per square foot for permeable concrete pavement to $10 for rain gardens and green roofs. A rain barrel can sell for about $50. To estimate the total costs for installing these features, the ECFRPC identified several parking lots and large commercial buildings with flat roofs within the Cocoa Village district. Staff used ArcGIS software to estimate the total square footage of these areas and then multiplied this amount by the unit/cost. The ECFRPC also estimated annual maintenance costs based on numbers provided by C2ES and the U.S. Environmental Protection Agency. Green infrastructure costs were entered into the model as a positive for Construction Industry Sales and as negative for the Local Government Spending. This means that while the construction industry will benefit from the new investment, the local government will have less money to pay for other goods and services. Maintenance costs were also calculated based on square footage, and were added annually as Construction-Building Repair and Maintenance.

Annual Output Losses by Number of Flooding Days with Green Infrastructure Intervention

Forecast Period	Number of Flooding Days	Annual Output Loss
2020-2030	2	-$764,400
2031-2040	4	-$1,528,800
2041-2050	6	-$2,293,201

Sources: Infogroup, ECFRPC Calculations

Largest Impervious Areas and Flat Roofs



Total Installation Costs

Green Infrastructure	Unit Cost	Total Square Footage	Installation Costs
Permeable Concrete Pavement	$7.00	390,130	$2,730,910
Rain Garden	$10.00	300,000	$3,000,000
Green Roofs	$10.00	105,760	$1,057,600

Sources: Brevard County Property Appraiser, ECFRPC Calculations

As explained on Scenario 1, failure to address flooding within the Cocoa Village District could cost 1,370 jobs, $111 million in sales, $128 million in personal income over a 31-year period. It would also reduce Brevard County's GRP $56 million. While these are countywide numbers, it can be assumed that the City of Cocoa would bear the brunt of these losses. On the other hand, Scenario 2 shows that introducing green infrastructure features in Cocoa Village would help to ameliorate the negative impacts that urban flooding can have on the economy. The economic indicators show the loss of 23 jobs, $2.8 million in sales, $3.8 million in personal income, and a reduction of $1.6 million to Brevard's GRP.

These results are based on the inputs and assumptions used to develop this scenario. Because of the dearth of quantitative data explaining the cost/ benefit ratio of incorporating green infrastructure projects into urban areas, the ECFRPC assumed that these improvements would only slightly reduce the number of flooding days experienced by Cocoa Village. The effectiveness of this approach to combat urban flooding could in reality be much greater than was presented in this simulation. However, using conservative assumptions is the best practice when developing economic impact scenarios.

Total Installation Costs

Green Infrastructure	Unit Cost	Total Square Footage	Installation Costs
Permeable Concrete Pavement	$7.00	390,130	$2,730,910
Rain Garden	$10.00	300,000	$3,000,000
Green Roofs	$10.00	105,760	$1,057,600

Sources: Brevard County Property Appraiser, ECFRPC Calculations

Comparison of Do Nothing and Mitigation Scenarios

Economic Indicator	Do Nothing Scenario	Mitigation Scenario
Total Employment	-1,370	-23
Output	-111,294,143	-2,870,968
Personal Income	-128,250,113	-3,806,452
Gross Regional Product	-56,004,711	-1,645,161

Sources: REMI PI+ East Central Florida Region v 2.2

RESILIENCE ACTION PLAN 2019- 2024

The City of Cocoa Resilience Action Plan is a culmination of the information collected as part of the vulnerability assessment and threat and hazard identification and reduction analysis (THIRA) , citizen input, and the East Central Florida Regional Resilience Action Plan (ECF RRAP), adopted by the City. The action plan is formatted and structured in a way to provide consistency between the City's action plan the ECF RRAP.

The East Central Florida Regional Resiliency Action Plan, completed in 2018 by the East Central Florida Regional Planning Council, was used as a model for some of the actions developed in this section of the report including the plan's goals and objectives. The ECFRPC also included strategies to address the findings of the vulnerability analysis, the public engagement process, and the economic impact analysis report.

The plan is organized by each goal and objective, includes the appropriate City department for ownership of each task, a level of priority and recommended year for which each task should be completed. Some tasks are labeled as "on-going" which signifies this task is recommended to be completed every year or continuously.

"Coming together is a beginning; keeping together is progress; working together is success."

– Henry Ford

Goals and Objectives

Goal #1: Leadership & Strategy | Promote leadership, education, and empowerment to foster resiliency

- Incorporate resiliency into local plans, policies and objectives.
- Plan fiscally to implement resilient and sustainable solutions to long term impacts.
- Implement strategies to promote adaptive measures that keep people and property safe.
- Engage and educate private sector stakeholders, elected officials, and others about ways to increase community resiliency.

Goal #2: Economic & Society | Provide opportunities to foster economic prosperity and social equity

- Protect high value assets from natural hazards.
- Educate businesses about access to funding and financial services related to resiliency.
- Facilitate and support the efficient recovery of business operations after an event.
- Improve social inclusion in decision making processes.

Goal #3: Infrastructure & Environment | Encourage responsible development and infrastructure solutions

- Prioritize the use of green infrastructure as a first line of defense.
- Promote interconnectivity of natural lands for habitat migration.
- Enhance stormwater systems to be more resilient.
- Improve water quality in surface water bodies.
- Incorporate resiliency into local plans, policies and objectives.
- Preserve and adapt the built environment to keep people and property safe.
- Improve community mobility while improving vulnerable transportation infrastructure.

Goal #4: Health & Well Being |Facilitate opportunities to improve community and environmental health

- Improve the capacity of the City to better respond to hazard events.
- Improve capacity of medical facility operations to prepare for and recover from hazards.
- Promote sustainable practices in government-owned facilities.
- Engage residents and business owners with locally relevant information.
- Improve access to resources for the homeless, special needs, elderly and poor.

Leadership and Strategy

Objective	Task / Recommendation	Department	Priority	Year
LS-3 **Promote Adaptive Measures to Protect People and Property from Natural Hazards**	Update Land Development Code to allow onsite-storm water management infrastructure such as rain gardens, native vegetation, living shorelines on private property.	Community Services SJRWMD UF IFAS Extension	High	1
	Partner with Brevard County Natural Resources to determine where living shorelines are appropriate. Prioritize areas for implementation.	Public Works Brevard Natural Resources	High	2
	Plan and conduct a workshop with residents and businesses to determine obstacles that they face in improving their property to be more resilient to natural hazards and how the City can help.	Community Services Public Works	Low	2
	Research best practices for community parking standards and strategies to address the heat island effect.	Community Services	Medium	2
	Identify publicly-owned parking lots that could be retrofitted using green infrastructure and permeable surfaces.	Community Services	Medium	2
	Update City's Land Development Code to adopt best practices to mitigate the heat island effect.	Community Services	Medium	3
LS-4 **Educate local stakeholders about ways to increase community resiliency**	Identify elected and non-elected resiliency advocates to participate in regional initiatives such as the East Central Florida Regional Resilience Collaborative.	All Departments	High	1
	Educate newly-elected officials about the City's primary vulnerabilities and hazard mitigation strategies.	City Administration ECFRPC Florida Sea Grant	Medium	2
	Develop or partner to conduct at least one workshop a year or various one-on-one meetings with private sector stakeholders to educate and train them on sustainable practices, such as continuity of operations plans, the importance of emergency generators, and other topics.	Emergency Management	Low	2
	Create social media venues to encourage Sustainability and Resiliency efforts.	City Administration	Low	2
	Encourage hands-on community education and volunteer activities to educate residents about resiliency.	Community Services UF IFAS Extension Brevard Public Schools Surfrider Foundation	Low	3
	Create and mail infographics to educate the public about the economic and environmental benefits associated with the property improvement strategies covered in the City's Sustainability Plan.	City Administration	Medium	4
	Re-evaluate workshops and educational materials to determine gaps and lessons learned.	Community Services	Low	5+

Health and Wellbeing				
Objective	**Task / Recommendation**	**Department**	**Priority**	**Year**
HW-3 **Promote sustainable practices in government-owned facilities.**	Assess the feasibility of creating an incentive program to promote sustainability within the City of Cocoa.	Community Services	High	1
	Assess and update future land use and zoning codes to limit or mitigate the placement of government buildings in vulnerable areas.	Community Services	High	1
	Identify locations for electric charging stations, especially near/at publicly-owned properties and high employment areas.	Community Services Public Works	Low	2
	Update local codes and policies to promote sustainable and Low Impact Development practices for government owned facilities.	Community Services	Medium	2
	Conduct an energy audit within the City and develop strategies to mitigate the effects of the greenhouse gas effect.	Public Works	Medium	3
	Partner or develop programs/incentives to install community gardens and green roofs on public buildings.	Community Services Public Works	Medium	4
	Work with the Brevard Public Schools (BPS) to promote the use of green building techniques and sustainable practices.	Brevard Public Schools Community Services	Low	4
	Reassess sustainability plan and metrics associated with the implementation of sustainable building practices in government facilities.	Community Services Public Works	Medium	5+
HW-4 **Engage residents and business owners with locally relevant information about expected future changes in natural hazards and sustainable practices.**	Evaluate existing programs in other jurisdictions and agencies aimed at educating residents and business owners about imminent natural hazards and sustainable practices.	Community Services Emergency Management	Medium	2
	Develop an in-depth community outreach program, outside of the storm season and following an event, to identify needs and barriers associated with resource accessibility and disaster response.	FEMA Emergency Management	Medium	2
	Develop an incentive program to increase the energy efficiency and resilience of homes and businesses.	Community Services	Medium	3
	Evaluate the creation of a tree canopy program to educate community about best landscaping practices, appropriate tree maintenance protocols, and yard debris removal.	Community Services	Medium	3
	Host a minimum of four events annually to educate the community about best sustainability and resiliency practices.	Community Services Emergency Management	Medium	3
	Develop a Return on Investment Infographic to be shared with homeowners and businesses that details the benefits of adopting a variety of resilient and sustainable practices.	Community Services	Low	4
HW-5 **Improve access to resources for the homeless, special needs, elderly, low income, and English-limited residents.**	Create/Continue “primary” social media account to relay all disaster-related information.	City Administration Emergency Management	High	1
	Develop and implement strategies to encourage greater pre-registration for special needs and seniors within the community.	City Administration Emergency Management	High	1
	Partner with the IDignity Program to ensure residents have essential documents before disasters.	City Administration Emergency Management	Medium	1
	Assess plans and policies to require development of future affordable housing choices outside of vulnerable areas and with access to transit, jobs, and resources.	Community Services	Medium	2

Economy and Society				
Objective	**Task / Recommendation**	**Department**	**Priority**	**Year**
ES-1 **Protect high-value assets from natural hazards.**	Develop and adopt policy language that prohibits the development of high value assets in vulnerable areas or if necessary, are mitigated to the greatest extent possible.	Community Services Public Works Emergency Management	Medium	1
	Work with the community to identify local businesses such as gas stations, food suppliers or others that provide specific services or resources vital for recovery.	Emergency Management Community Services	High	2
	Identify resilience strategies and policies related to resilient rebuilding, relocation, fortification, mitigation or adaptation for critical facilities in identified vulnerable areas.	Public Works Utilities Emergency Management Community Services	Medium	2
	Develop a long-term financial plan for loss of or restructure of tax base in highly vulnerable areas.	City Administration	Low	5
ES-2 **Educate business about access to funding and financing services related to resiliency and sustainability**	Create, update and disseminate an educational infographic for businesses with funding and financing services for pre/post- disaster needs and sustainable practices.	Emergency Management Economic Development Chamber of Commerce Community Services	Medium	1
	Conduct a follow up workshop with business owners to determine status, needs, wants and constraints as related to implementing resilient and sustainable practices.	Economic Development Community Services ECFRPC	Medium	2

ES-3 **Facilitate and support the efficient recovery of business operations after an event**	Designate government official to serve as a liaison between the business community and the local government for resiliency efforts.	City Administration	High	1
	Develop a section on the City's website focused on disaster preparedness and include links to business continuity plan and employee disaster plan templates.	City Administration	Medium	2
	Research available templates for business and employee preparedness plans and create an outreach proposal for businesses to update these templates.	Community Services ECFRPC	High	2
	Develop a "one-pager" with best practices and links for responding to and preparing for hazard events. Create/update and disseminate an educational infographic for businesses with emergency information to access for post disaster needs.	Emergency Management Community Services Chamber of Commerce Career Source Brevard	Medium	2
	Develop a media package/press kit to implement after a disaster event to bring tourists back by showcasing that the area is open for business.	City Administration Economic Development Tourism Development Council	High	3
	Work with the identified local critical facility businesses to determine resources needed to aid in timely recovery efforts such as generators, mitigation projects, etc.	Emergency Management Community Services	Medium	3
	Consider implementing a long-term recovery plan for businesses to retain employees as soon as possible following a storm event.	Emergency Management Community Services	Low	4
ES-4 **Improve social inclusion in decision making process**	Apply for funding opportunities that could help finance resiliency projects such as onsite stormwater management, living shorelines, etc…	Public Works Community Services	Medium	Ongoing
	Host community meetings in underserved, low income communities to discuss projects within and just outside the community.	All Departments	High	1
	Engage with communities to identify gaps and priorities in the decision making process to improve social inclusion.	Community Services	High	1
	Train Community Services staff on Health Impact Assessments	ECFRPC	Medium	2
	Partner with local organizations and faith-based organizations to provide feedback concerning needs and opportunities specific to a project or program.	All Departments	High	2
	Create an outreach plan to involve all communities in the City to engage in local decisions.	Community Services	Low	2
	Create a timeline to develop and implement strategies identified in the City's Sustainability Plan as they relate to Civic Engagement.	Ciity Administration	Medium	3
	Implement the directive to conduct health impact assessments when considering projects that may affect underserved, low income communities, and determine benchmark health outcomes.	Community Services	Medium	3
	Implement the outreach plan.	City Administration	Low	3
	Reassess the gaps that remain in community involvement outcomes.	City Administration	Low	5+

Infrastructure and Environment

Objective	Task / Recommendation	Department	Priority	Year
IE-4 **Improve water quality in surface water bodies.**	Coordinate with other agencies/organizations to educate property owners about best management practices (BMP's) for reducing nutrient loads flowing into surface waters via residential, commercial, industrial and agricultural lands.	Community Services Indian River Lagoon Council SJRWMD	Medium	Ongoing
	Determine whether currently property buffers along the Indian River Lagoon are sufficient or could be enhanced to allow for the introduction of native vegetation that could help capture and filter storm water.	Water Resources	High	1
	Assess City's fertilizer ordinance to determine appropriateness of mirroring the County's ordinance.	Community Services Marine Resource Council UF IFAS Extension	Medium	2
IE-5 **Incorporate resiliency into local plans, policies, processes and objectives.**	Audit Comprehensive plan against other plans (i.e. Sustainability Plan, CRA plans, Downtown Development Plans, Economic Development Plans, LDRs,) to ensure compatibility of addressing resiliency and future development based on future conditions.	Community Services Public Works Utilities	High	1
	Assess other plans to reference the Coastal Community Services Area and incorporate language as appropriate.	Community Services	High	1
	Add and adopt policies to Comprehensive Plan, and other plans, that result from the recommendations identified in the Sustainability Plan.	Community Services	Medium	2
	Update Land Development Code to require all new development to design for a "net-zero" discharge or natural runoff.	Community Services	Medium	3
	Adopt Urban Design Guidelines that could protect and buffer structures from the impact of vulnerability hazard such as sea level rise, storm surge, flooding, wind damage, and the urban heat island effect.	Community Services	Low	4
	Develop prioritization process and funding mechanisms for infrastructure projects in the Coastal Community Services Area. Incorporate into CIP, the Stormwater master plan, long range transportation plan, and other appropriate plans and procedures.	Public Works	Low	5
	Continue to monitor sea level rise projections over time. Consider installing water monitoring stations to measure sea level rise within the City.	All Departments	Low	5+

IE-6 **Preserve and adapt the built environment to keep people and property safe**	Update Comprehensive Plan and Codes to ensure all affordable or low income developments are located outside of the Coastal Community Services Area and the 100-year flood zone.	Community Services	High	1
	Provide dedicated funding for annual tree maintenance near power lines to help prevent storm damage and allow access for electricity providers to fix broken power lines in an efficient manner following a natural disaster.	City Administration Public Works	Medium	2
	Research appropriate strategies for at-risk public infrastructure identified as part of the natural hazard vulnerability assessment.	Utilities Public Works	Medium	3
	Develop incentives for developers to build outside vulnerable areas or build in a resilient/sustainable way in vulnerable areas, using methods consistent with Low Impact Development (LID) standards, Florida Green Building Coalition, and others.	Community Services	Medium	5
	Conduct a risk assessment to determine wellfields, groundwater and underground infrastructure at risk to saltwater intrusion in Cocoa and areas of service.	Utilities Public Works	Medium	5+
IE-7 **Improve community mobility while improving vulnerable transportation infrastructure.**	Identify areas where bicycle and pedestrian improvements (including use of green strategies) can be included in transportation projects that mitigate roadways vulnerable to natural hazards (green streets).	Space Coast Transportation Planning Organization Public Works	Low	3

Selected References

Link	Reference Page
https://www.flsenate.gov/Committees/BillSummaries/2015/html/1100	4
https://www.flsenate.gov/Session/Bill/2011/7207/BillText/er/PDF	4
https://www.cocoavillageplayhouse.com/	6
https://www.cocoafl.org/Facilities/Facility/Details/1	6
https://myfloridahistory.org/default	6
https://svi.cdc.gov/map.html	7
http://www.shimberg.ufl.edu/	7
https://coast.noaa.gov/floodexposure/@-9041447,3241151,8z	10
https://msc.fema.gov/portal/search	11
https://www.geoplan.ufl.edu/	12

Appendices

Lift Station Name	Storm Surge Zone	ACOE SLR Horizon	NOAA SLR Horizon	Flood Zone	Nuisance Flood Area	Combined Zone
Lift Station 1	Surge 3	2100	2100	500 Year	Yes	2100
Lift Station 2	Surge 2	2100	2100	500 Year	Yes	2100
Lift Station 3	Surge 3		2100	None	Yes	2100
Lift Station 4	None		None	None	None	None
Lift Station 5	None		None	None	None	None
Lift Station 6	None		None	500 Year	None	None
Lift Station 7	None		None	None	None	None
Lift Station 8	None		None	None	None	None
Lift Station 9	None		None		None	None
Lift Station 10	None		None	None	None	None
Lift Station 11	None		None	None	None	None
Lift Station 12	None		None	None	None	None
Lift Station 13	None		None	None	None	None
Lift Station 14	None		None	None	None	None
Lift Station 15	None		None		Yes	None
Lift Station 16	None		None	None	None	None
Lift Station 17	None		None	None	None	None
Lift Station 18	None		None	None	None	None
Lift Station 19	Surge 2	2100	2100	Zone AE	Yes	2100
Lift Station 20	None	None	None	None	None	None
Lift Station 23	None	None	None	None	None	None
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Lift Station 26	None	None	None	None	None	None
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Lift Station 45	Surge 2	2100	2100	Zone AE	Yes	2100
Lift Station 46	None	None	None	None	None	None
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Lift Station 51	None	None	None	None	None	None
Lift Station 54	None	None	None	Zone AE	None	None

Technical Appendix: The Science Behind the Resilient Cocoa Project

The ECFRPC relied on several models to assess the economic impacts that each natural hazard would have on the City of Cocoa. These models have been developed by federal agencies, universities, and regional planning councils. This section provides more information about each model.

Storm Surge

The ECFRPC used the Sea, Lake, and Overland Surges from Hurricanes (SLOSH) Model developed by the National Weather Service to estimate storm surge heights. This model combines historical, hypothetical, and predicted hurricane data with atmospheric pressure, size, forward speed, and track data to determine the wind field that will drive the storm surge. The Atlantic coastline SLOSH model is divided into 32 regions or basins, categorized by their particularly vulnerable features: inlets, population densities, low-lying topography, and ports. In 2017, Florida's six basins were combined to form the South Florida Super Basin, which covers nearly all of South Florida and much of the peninsula's coastline. The storm surge analysis uses the NHC's Saffir-Simpson Hurricane Wind Scale to illustrate the storm's sustained winds, which ranges from a Category 1 to 5.

Sea Level Rise

This analysis uses two sea level rise projection curves: NOAA 2017 and US Army Corps of Engineers (USACE) 2013. The NOAA 2017 curve data was downloaded from NOAA's Digital Coast Sea Level Rise Viewer. It depicts the potential coastal inundation areas resulting from a 1- 10-foot rise in sea level above current Mean Higher High Water (MHHW) conditions. The data was produced using a "modified bathtub model" that accounts for local and regional tidal variability and hydrological connectivity. Two datasets are used to create the final inundation data: Digital Elevation Model (DEM) of the area and a tidal surface model that represents spatial tidal variability. This data does not account for erosion, subsidence or any other future changes in an area's hydrodynamics. The USACE data was obtained from the University of Florida's GeoPlan Center. This analysis also uses a "modified bathtub model" that applies a filter to remove isolated inundation areas not connected to a major waterway. The resulting inundation files represent the specific projection rate curve mapped on top of MHHW. Unfortunately, the USACE data curve begins in 2050.

Shallow Coastal Flooding

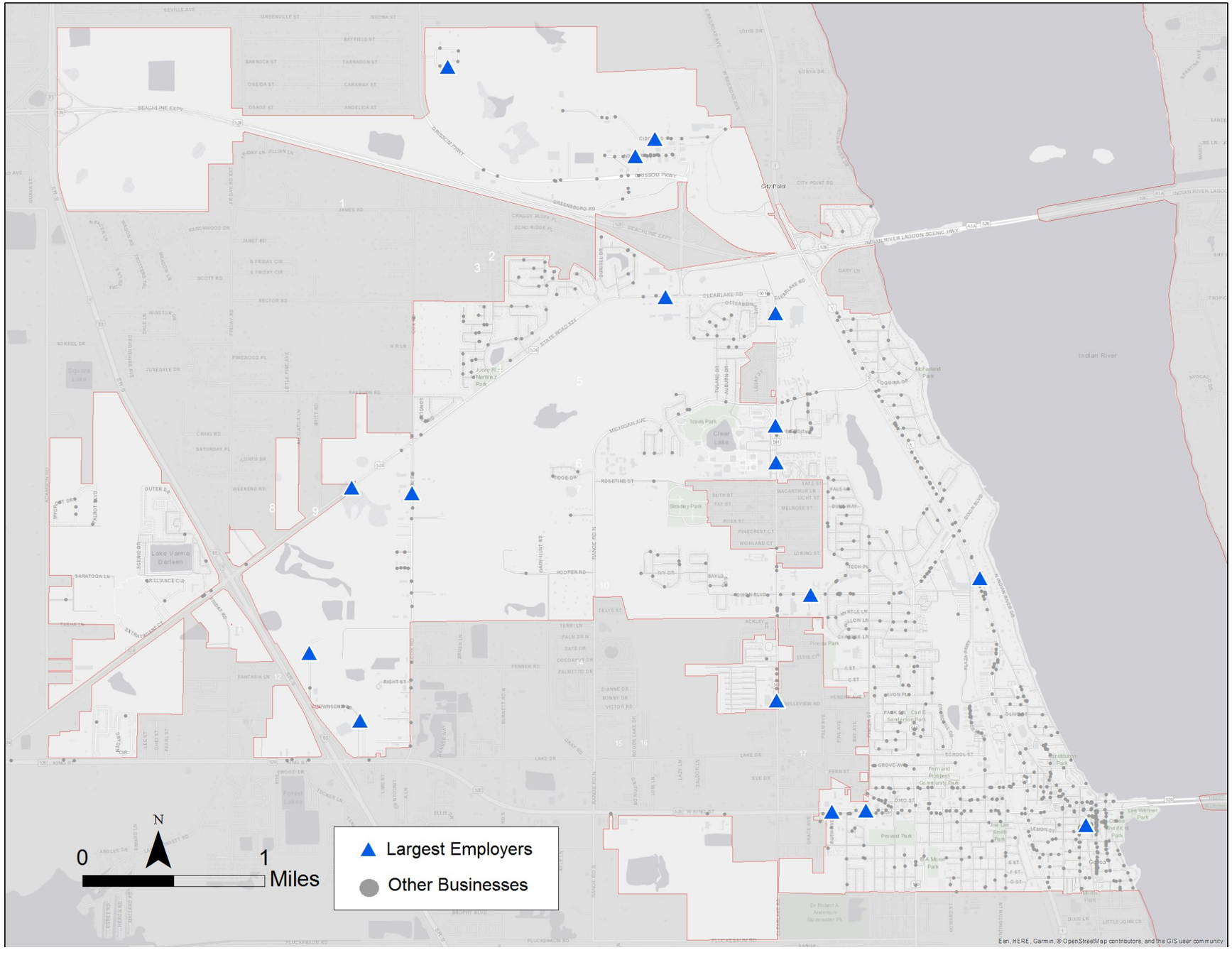
Coastal flood data was obtained from NOAA's Coastal Flood Exposure Mapper. The flood thresholds are derived from NOAA's Technical Report NOS CO-OPS 086: Patterns and Projections of High Tide Flooding along the U.S. Coastline Using a Common Impact Threshold. The report indicates that Brevard County's derived threshold for minor flooding (high tide) is 1.8 ft above mean higher high water height (MHHW). This data replaces the flood thresholds previously provided by the National Weather Service.

Storm Surge and Sea Level Rise

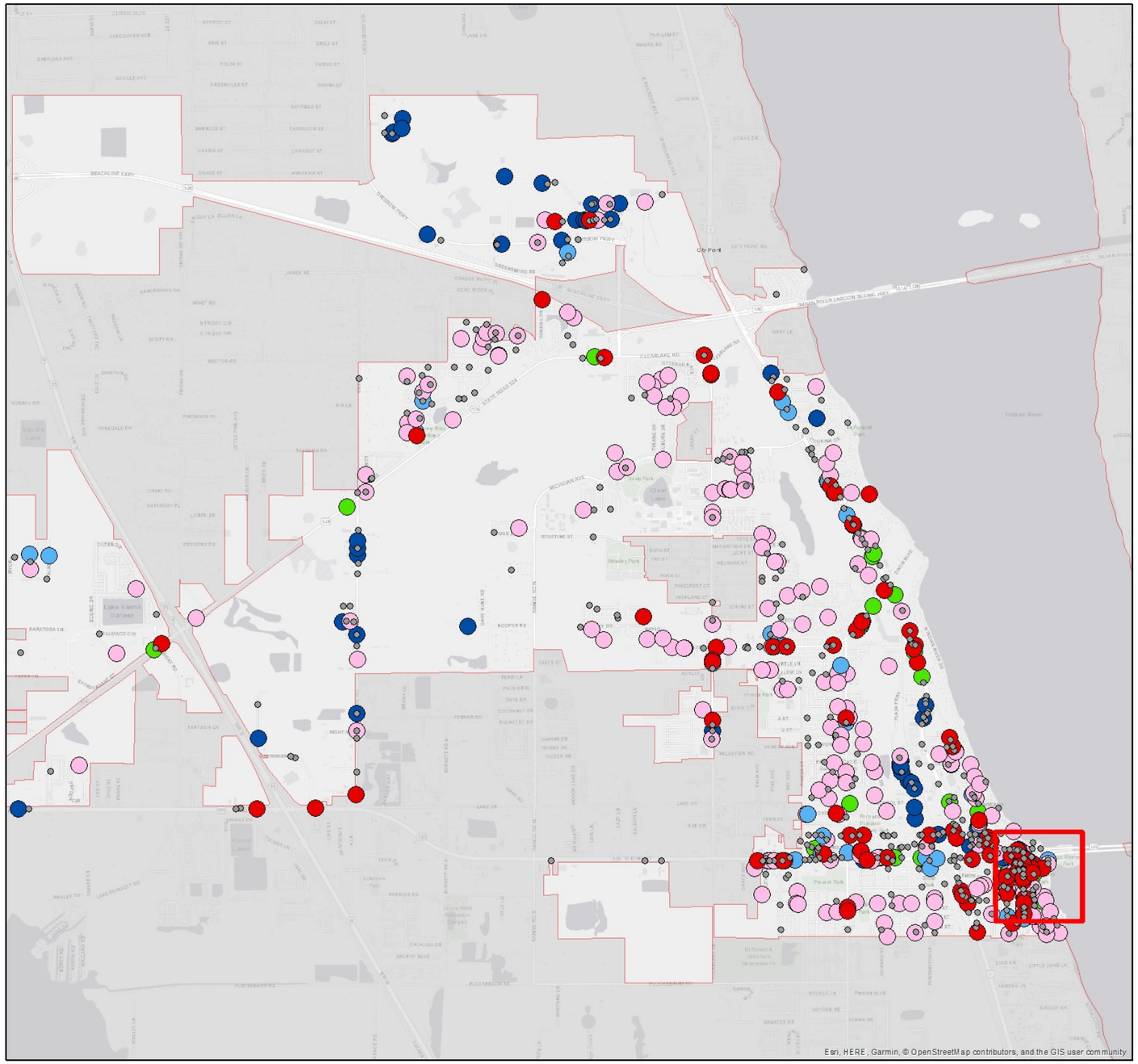
The Tampa Bay Regional Planning Council developed an ArcGIS Add-In Tool to model how future sea level rise conditions affect surge based on new National Hurricane Center's SLOSH "super basins" that provide greater resolution of data for storm surge modeling. The model allows users to analyze certain levels of sea level rise (ex: 4 feet) depending on what Horizon SLR curve they choose. The tool uses several data sources including Digital Elevation Model (DEM), SLOSH Basin, Sea Layer with hydrologic connectivity, and NOAA tidal gauges.

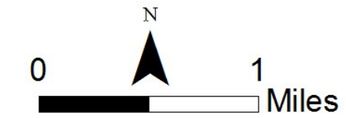
Maps

Largest Employers

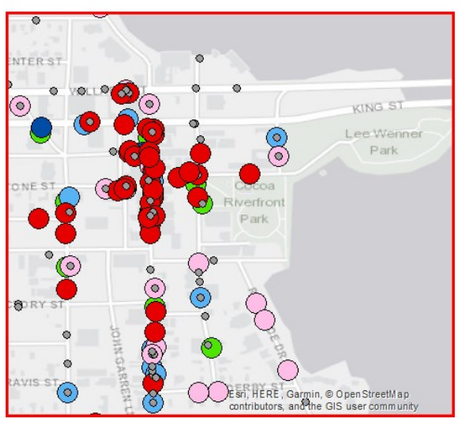


Total businesses by Type

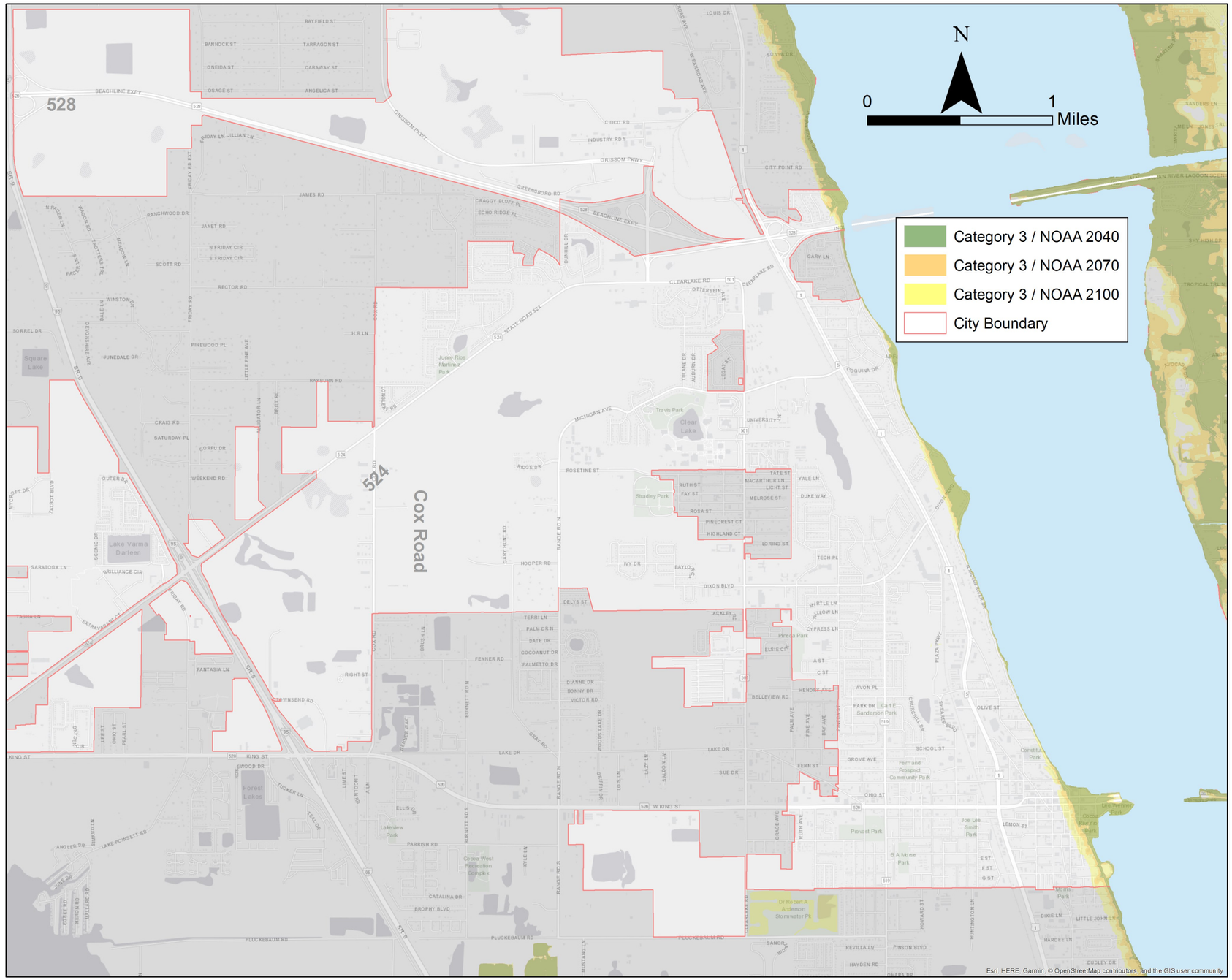




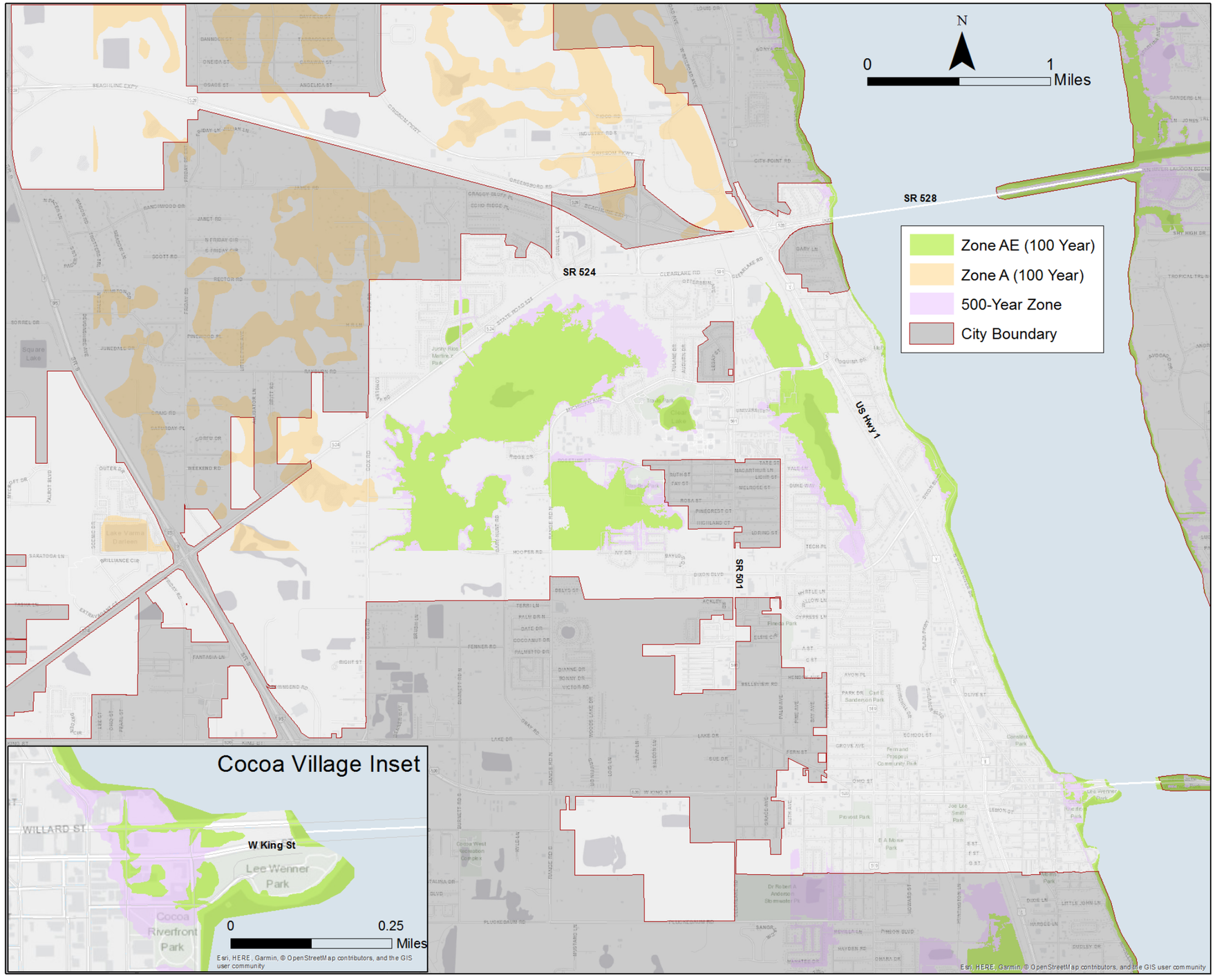
- Accomodation and Food Services
- Manufacturing
- Other Personal Services
- Real Estate
- Retail
- All Other Business Types



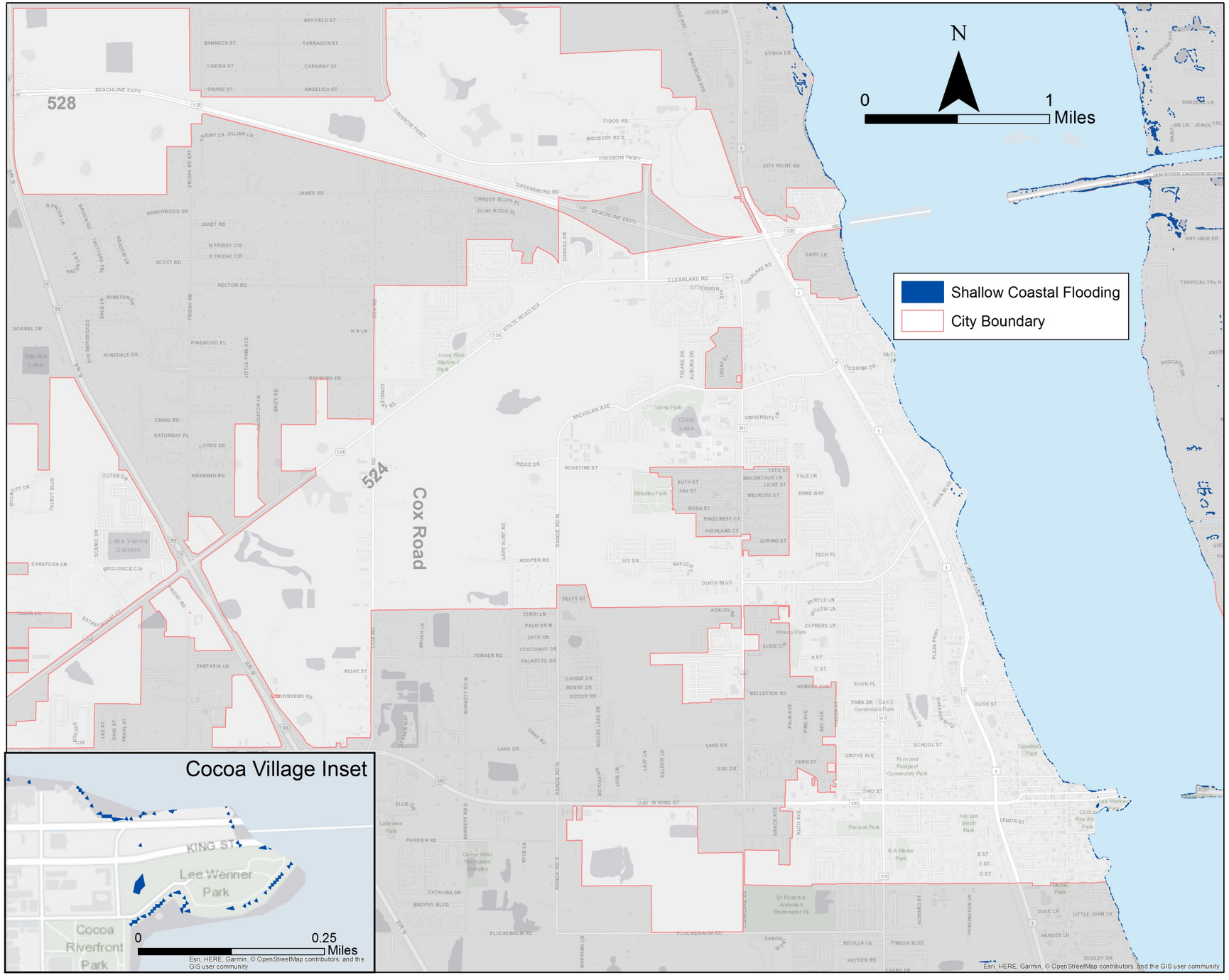
Storm Surge +Sea Level Rise Combo



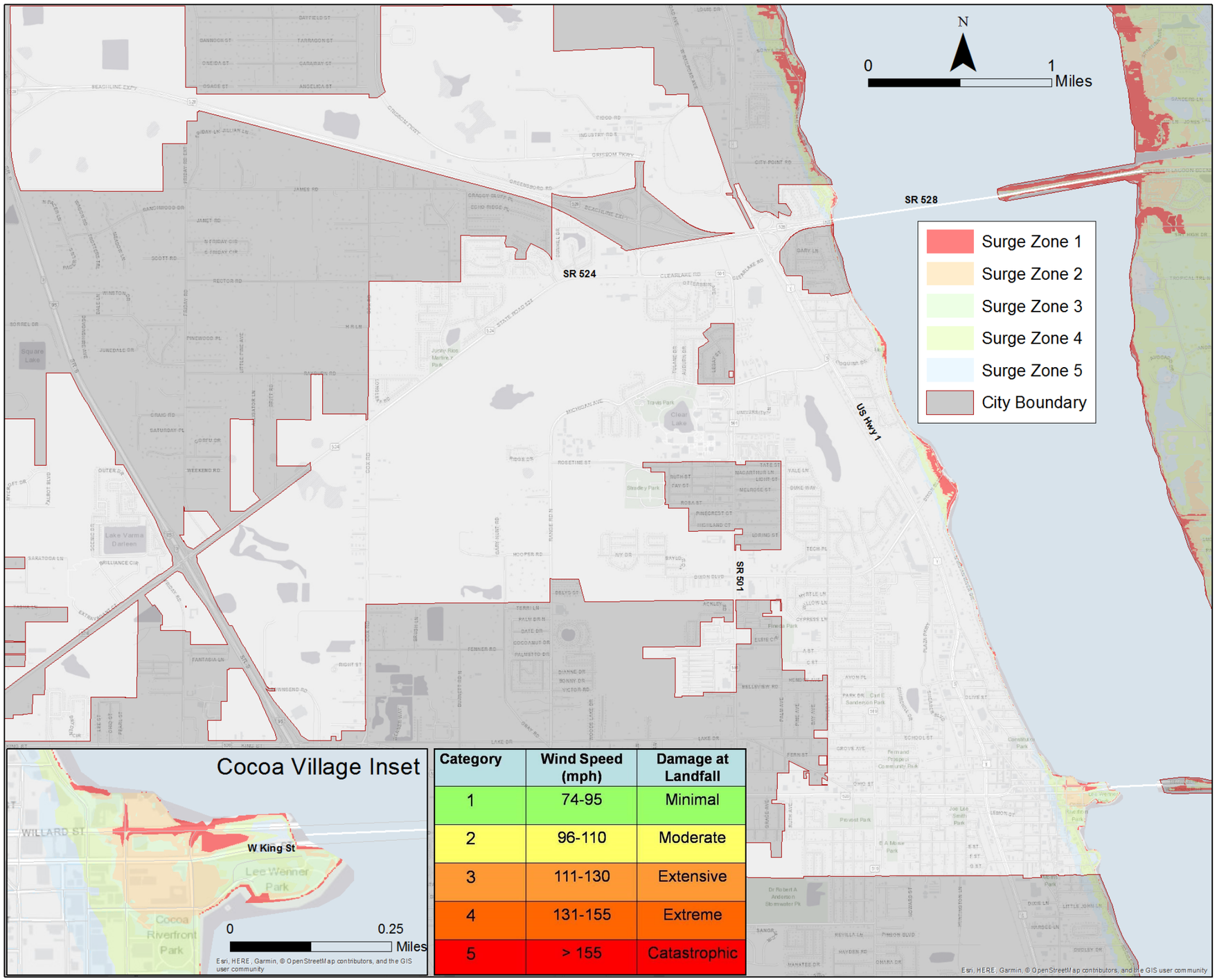
FEMA 100-Year and 500-Year Flood Zones



Shallow Coastal Flooding Map



Hurricane Storm Surge Zone



Category	Wind Speed (mph)	Damage at Landfall
1	74-95	Minimal
2	96-110	Moderate
3	111-130	Extensive
4	131-155	Extreme
5	> 155	Catastrophic