COASTAL RESILIENCE PARTNERSHIP
SOUTHEAST PALM BEACH COUNTY

Climate Change Vulnerability Assessment

Executive Summary

Welcome to the Coastal Resilience Partnership of Southeast Palm Beach County

The Coastal Resilience Partnership of Southeast Palm Beach County Climate Change Vulnerability Assessment is a comprehensive multi-threat assessment geared towards evaluating critical questions related to climate change throughout the southeastern portion of Palm Beach County.

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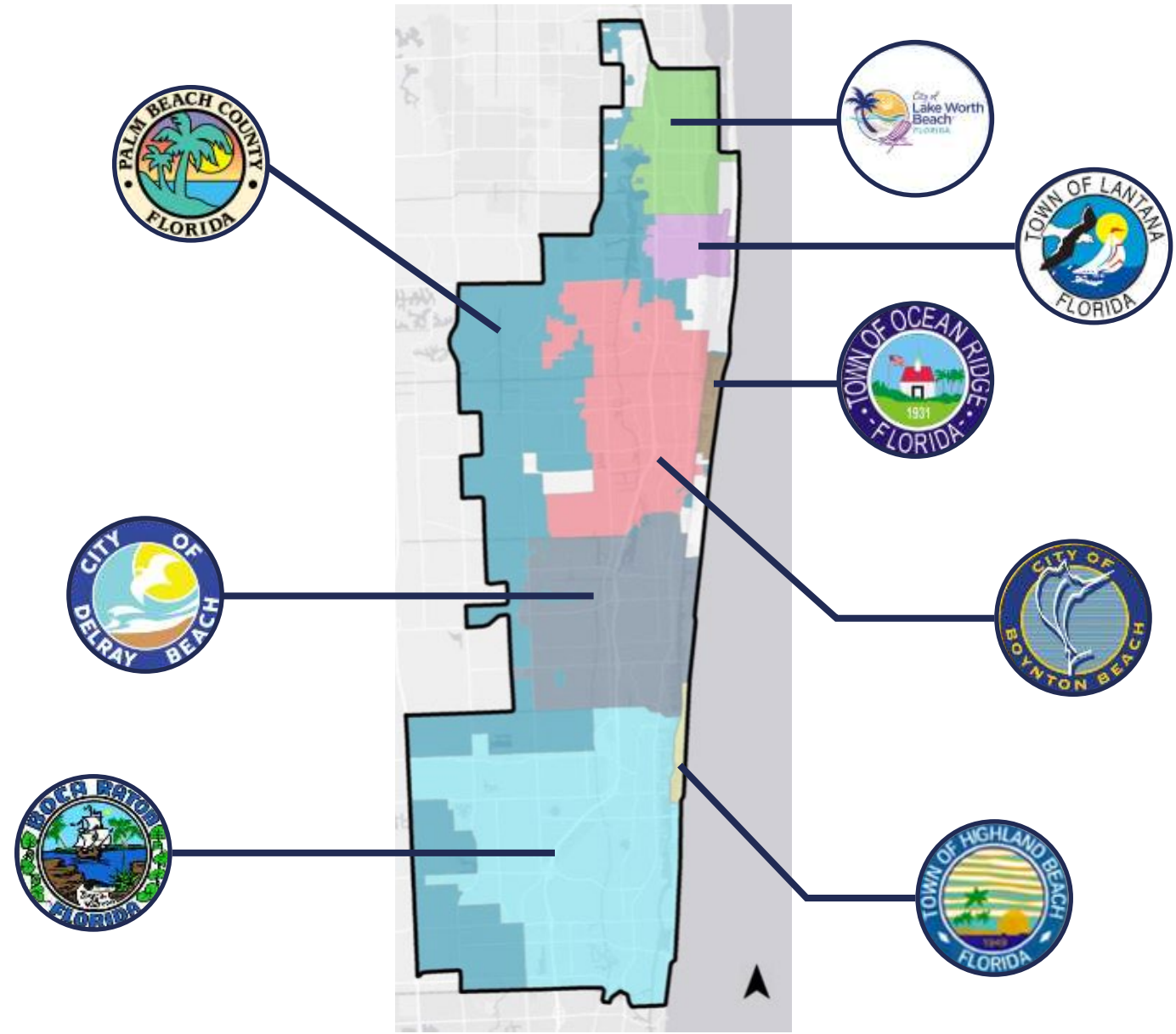
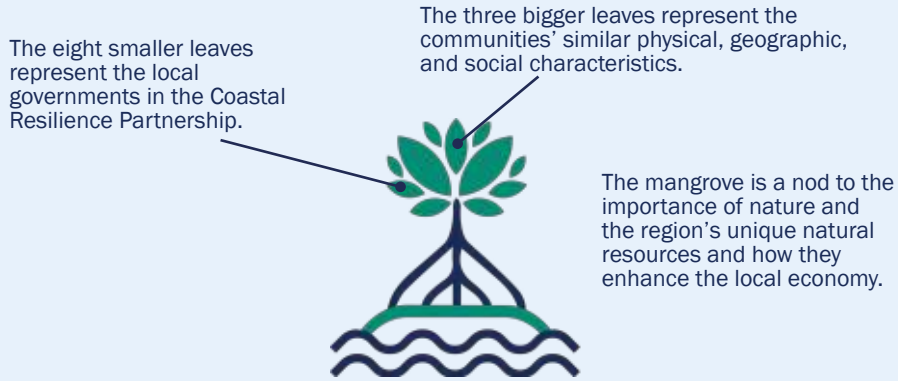


This map represents the study area for the Coastal Resilience Partnership of Southeast Palm Beach County Climate Change Vulnerabilty Assessment

About The Coastal Resilience Partnership

Officially formed in 2019, the Coastal Resilience Partnership (CRP) of Southeast Palm Beach County consists of seven municipalities and the County working together to complete a joint Climate Change Vulnerability Assessment (CCVA) covering the geographic area shown on Page 2. The CRP fosters collaboration and cooperation in climate adaptation research and planning among jurisdictions sharing similar physical, geographic, and social characteristics in the southeast portion of Palm Beach County. All jurisdictions are vulnerable to climate change; however, levels of vulnerability to future conditions vary across jurisdictions and over time. Notably, all jurisdictions rely on each other for critical services, such as emergency shelter. For these reasons, the ultimate goal of the CRP of Southeast Palm Beach County and the joint effort in this CCVA is to install, inform, and implement long-term resilience and adaptation strategies into all participating local governments.

Coastal Resilience Partnership Logo Explanation



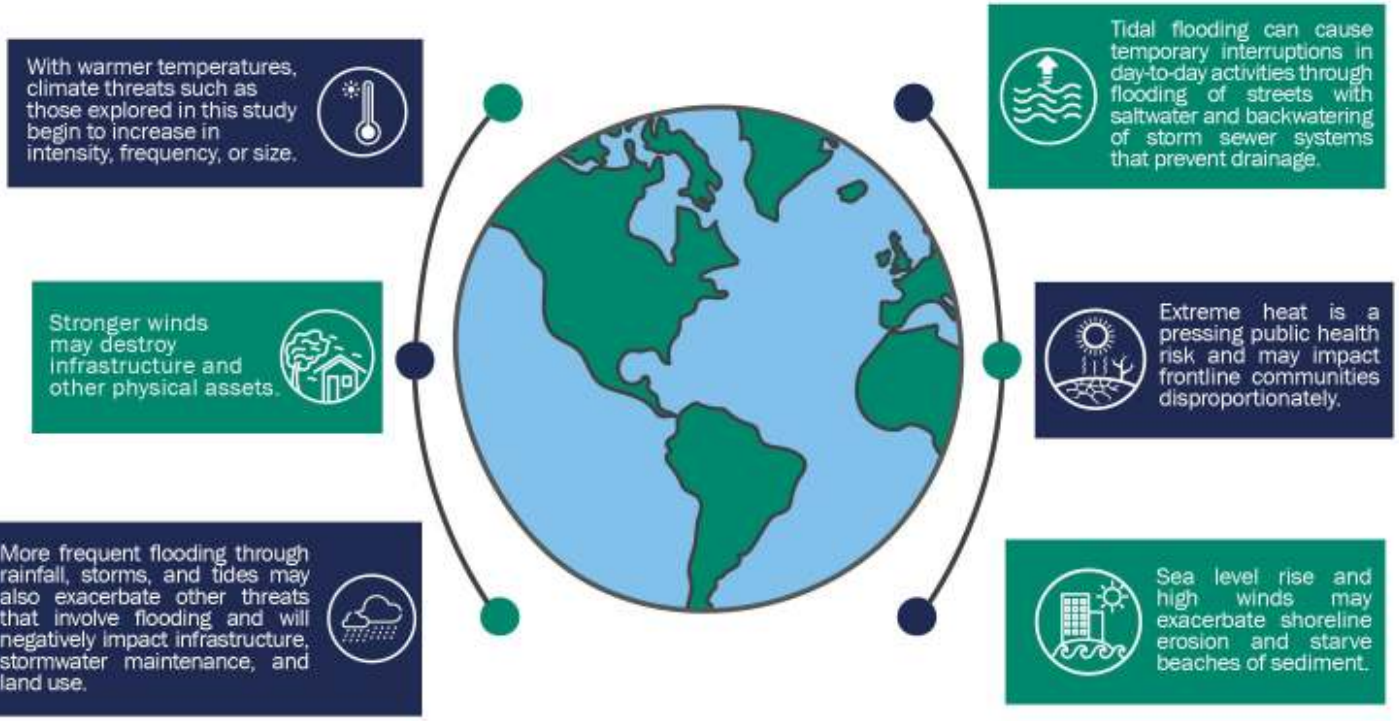
What is a Climate Change Vulnerability Assessment?

A vulnerability assessment provides a foundational understanding of the risks a certain community, place, or asset faces as it relates to specific threats. For this particular CCVA, 12 climate threats were identified. To determine vulnerability, sophisticated modeling, and data analysis were utilized to assess the specific properties, locations, and components within the community that may be at risk of experiencing any of the climate threats identified as part of this study. Once each facility or asset is intersected with the location of extreme events, the vulnerability of all public infrastructure, private property, and social and natural assets may be defined.

It is also crucial to note the importance of vulnerable populations and socioeconomics superimposed on these threats. Socioeconomics were considered throughout this assessment, and the outcome of various vulnerable populations is a critical aspect of this study. Furthermore, sea level rise is a multiplier for many of the threats that the CRP is interested in. Sea level rise is not considered as a threat itself, but as a stressor that exacerbates several of the threats assessed in the CCVA. Threats that are heavily influenced by sea level rise include storm surge, tidal flooding, groundwater inundation, saltwater intrusion, rainfall-induced flooding, and shoreline recession.

Climate Change Impacts 101

Climate is referred to as the usual weather conditions expected for a particular location. Climate change is the change in those usual weather conditions, such as how much rain a location will receive or the average temperature. Increased greenhouse gas emissions by humans is causing changes in our climate on a global scale.



Key Terminology

Below are some key terms that you will see throughout this report

Adaptive Capacity - The ability of an asset to adjust or cope in response to hazards

Assets - The core systems of each jurisdiction: the specific property classes, services, economic strengths, people/socioeconomics, and infrastructure located throughout these communities

Census Tract Scale - A geographic area utilized by the US Census Bureau for data collection and assessment

Climate Threats - Major hazard events or chronic disruptions that negatively impact community assets

Exposure Mapping - Spatially analyzing where assets are in harm's way

Frontline Communities - Communities that will feel the impacts of climate change first and hardest

Sensitivity - The range or magnitude of how much an asset may be hurt by a threat

Social Equity - The ability for all members of the community to equally prosper through collective planning and action

Potential Impacts - How assets are affected by threats due to their sensitivity

Risk - Both threat and asset characteristics used to indicate levels of probability of a particular climate event and its associated consequence

Vulnerability - The output of an analysis and its evaluation of the intersection of various asset characteristics used to indicate levels of sensitivity, potential impact, and adaptive capacity

The Assessment Process

As part of the assessment, the team utilized the recently released *Unified Sea Level Rise Projections in Southeast Florida 2019 Update* executed by the Southeast Florida Regional Climate Change Compact's Sea Level Rise Ad Hoc Work Group, specifically using the 2040 and 2070 projections. For the purpose of this assessment, the 2040 and 2070 projections and findings can also be interpreted as "+5" Sea Level Rise" (SLR) as the low-end projection for 2040 (IPCC Median), "+13" SLR" as the high-end projection for 2040 (NOAA High) and low-end projection for 2070 (IPCC Median), and "+33'' SLR" as the moderately high-end projection for 2070 (NOAA Intermediate High). Three main types of analysis were undertaken: narrative analysis, spatial analysis, and hybrid analysis. Narrative analysis consists primarily of literature review and review of relevant reports to the risk assessment. Narrative analyses were performed for drought, groundwater inundation, pest and disease, saltwater intrusion, and wildfire risks. Spatial analysis consists of reviewing spatial and/or numerical datasets relevant to the risk assessment and utilizes robust modeling to identify the intersections among various components of vulnerability and risk. Spatial analyses were performed on high winds, rainfall-induced flooding, storm surge, and tidal flooding threats. A hybrid analysis consists of both literature review and review of spatial and/or numerical datasets relevant to the risk assessment. Hybrid analyses were performed on harmful algal blooms (HABs), extreme heat, and shoreline recession.

For the spatial analysis assessments, the vulnerability and risk assessment components were applied at the asset scale. For example, commercial property and tidal flooding were assessed at the parcel or property level. A data-driven technique with rulesets developed by the project team was based on factors consistent with the framework concepts. Classifications of vulnerability and risk were assigned using data attributes and spatial analysis. Most asset-threat pairs were assessed through vulnerability and risk (rainfall-induced flooding, tidal flooding, storm surge); however, a few threats were assessed only for vulnerability (high winds, extreme heat, shoreline recession). Due to data limitations, some threats were not spatially analyzed on an asset scale. Harmful algal blooms, drought, wildfire, pest and disease, groundwater flooding, and saltwater intrusion were all primarily narrative-based threat assessments.

Overview of Climate Threats

This section summarizes the threats that were analyzed for the CCVA. For the purposes of this study, threats are defined as major hazard events or chronic disruptions that negatively impact community assets. The interconnections among threats, as well as socioeconomic factors affecting each asset-threat pair, are stressed throughout the study.

Drought

A period of persistent dry weather that occurs long enough to cause environmental and public health challenges. Climate stressors that worsen droughts include increased global temperatures, increased evapotranspiration, and changing rainfall patterns. Non-climate stressors such as increases in freshwater consumption can also worsen the impact of droughts on a population.

Extreme Heat

Extreme heat is a pressing public health risk, particularly for socio economically disadvantaged and elderly communities living in developed areas with low tree canopy cover. In many heavily developed areas, man-made structures such as buildings and roadways trap heat and contribute to what is known as the Heat Island Effect. Extreme heat is a serious threat in South Florida, where it can worsen air quality, exacerbate public health issues, negatively impact crop production, and increase stress on the local economy.

Harmful Algal Blooms

Harmful algal blooms are a complex ecological process that is accelerated by several factors related to climate change. Increased urbanization has accelerated and intensified nutrient loads to water bodies throughout Florida. Southeast Palm Beach County is no exception. This nutrient loading, paired with warmer waters related to climate change and other complex factors, can cause specific species of algae to grow out of control and produce toxins that can harm people, fish, shellfish, marine mammals, and birds. Non-climate stressors that can worsen harmful algal blooms include both human-induced and natural hydrologic alterations, as well as additional pollutants in runoff.

High Winds

Here in South Florida, high winds from tropical systems or hurricanes are prevalent threats that can lead to numerous issues including power outages, disruptions to roadways and transportation, and damage to infrastructure, including critical infrastructure in particular. Hurricanes can be catastrophic events significantly impacting communities. Due to climate change, the strongest hurricanes (Category 3-5) are expected to increase in frequency. Non-climate stressors that magnify the threat of high winds include changes to building conditions, such as wind load criteria, and less resilient landscaping.

Groundwater Inundation

This type of flooding occurs when there is a rise in groundwater, which is generally associated with a rise in sea level. In addition to sea level rise, other climate stressors include changes in precipitation patterns that result in an increase in the amount of water present at any given time. Non-climate stressors that worsen groundwater inundation include both the land subsidence, or the settling of land, and the potential need to fix or repair large-scale stormwater management systems.

Pest & Disease Outbreaks

A pest outbreak is when a destructive insect or other animal population dramatically increases and heightens the potential threat of illnesses. Pest outbreaks also affect crops and the ability to produce healthy and sellable food commodities. Whereas pest outbreaks are a rapid increase in an insect's population, disease outbreaks are sudden increases in a particular illness that is carried or spread. Climate stressors that exacerbate this problem include extreme heat and changes in rainfall patterns. Additionally, non-climate stressors include rapid population growth, urbanization, and densification.

Rainfall-Induced Flooding

Changes in rainfall patterns can cause flooding on normally dry land, which can be exacerbated by sea level rise. Non-climate stressors that further increase challenges related to rainfall-induced flooding include aging infrastructure, floodplain alterations, increases in impervious structures, and maintenance issues concerning stormwater infrastructure.

Saltwater Intrusion

As sea level rises, the fresh water-saltwater interface (or boundary) moves further inland and closer to the water supply wells, leading to water-quality deterioration. Saltwater intrusion is a serious threat, and the associated non-climate stressors include changes to large-scale stormwater management systems and changes in the amount of water taken from the aquifer.

Shoreline Recession

This threat occurs when waves and currents remove sand from the beach system by carrying it permanently offshore. This movement and removal of sand leads to a narrower beach and lower elevation, ultimately leaving coastal properties and infrastructure vulnerable to future storms. Sea level rise will exacerbate shoreline recession. Similar to other threats, with eroded beaches and a lack of shoreline, there will be an influx of problems, including further impacts to infrastructure, changes to design and development in high-risk coastal areas, and changes to Level of Service (LOS) requirements.

Storm Surge

As sea level rises, there will be an excess of water coming onto land. Coastal flooding caused by an abnormal rise in the tide from a storm or hurricane will push water further inland and increase the water level well above the natural tide. A climate stressor that further fuels problematic storm surge is the presence of more frequent and stronger storms. Non-climate stressors that exacerbate the hazards associated include increased development in high-risk coastal areas and aging infrastructure.

Tidal Flooding

Tidal flooding is defined by exceptionally high-tidal events that result in the temporary inundation of low-lying areas. This occurs when an increase in water levels causes water to overtop seawalls and flow onto coastal lands. Sea level rise will increase the frequency and intensity of tidal flooding. Non-climate stressors that exacerbate tidal flooding hazards include aging infrastructure and drainage systems that were designed for previous conditions.

Wildfire

Although much of the region is urbanized, wildfires can still impact Southeast Palm Beach County. This threat is examined through the potential for wildfire in the wildland urban interface and its impact on communities, including homes and the critical services people rely on. Wildfires have the ability to significantly damage critical and delicate ecosystems as well as urbanized communities. With wildfires present, air quality greatly diminishes, and infrastructure becomes vulnerable. Climate-related stressors that worsen wildfire conditions include: temperature increase, which can increase drought, precipitation variability, and lightning frequency.

Overview of Assets

Assets relate to the core systems of each jurisdiction – the specific property classes, services, economic strengths, and infrastructure located throughout these communities.

Critical Facilities

These are lifeline facilities that are pivotal to communities because they provide crucial services that ensure the smooth function of everyday life. To consider the range of assets within this theme, the following asset categories will be used: Public Safety, Food, Water, Shelter, Health and Medical, Energy and Communications, and Government Facilities (including all schools).

Water Infrastructure

Water infrastructure facilities are a critical aspect to societies, as individuals rely heavily upon the distribution of clean and safe water, the proper management of drainage systems, and the continual protection of water quality. Within water infrastructure, the asset categories are Wastewater Treatment Facilities and Collection Systems, Water Treatment Facilities and Distribution Systems, Stormwater Treatment, Conveyance, Treatment Systems, and Septic Tanks. Green infrastructure also falls within this asset category, and for the purposes of this study, some green infrastructure (swales, bioswales, retention/detention ponds, etc.) are included within the category of stormwater.

Economic Factors

A prospering society depends on businesses staying open and continuing to contribute to the overall economy. Economic factors are important for the assessment to consider, especially as they relate to the potential for business disruption. This asset theme will consider the two main economic factors through the following asset categories: Annual Sales Volumes and Jobs. The assessment will provide insights into how the vulnerability of properties and business locations translates to potential disruptions to sales and jobs.

Natural Resources

Natural resource assets are critical to the region in how they support recreation and tourism and provide ecosystem services. These assets are also critical in how they mitigate threats, such as flooding and extreme heat. The following asset categories will be considered within this theme: Beaches, Coastal Areas, Natural Areas, and Parks (including water resources).

People & Socioeconomics

This asset theme can be defined as socially vulnerable populations that may be disproportionately vulnerable to climate threats. The Centers for Disease Control and Prevention, (CDC), classifies social vulnerability through a number of factors, including but not limited to socioeconomic status, housing and transportation, and household composition. These communities may be affected by external stressors that impact human health and productivity, such as pandemics and extreme weather. This theme includes the following asset categories: Social Vulnerability, Food SNAP Retailers, and Public Housing.

Property

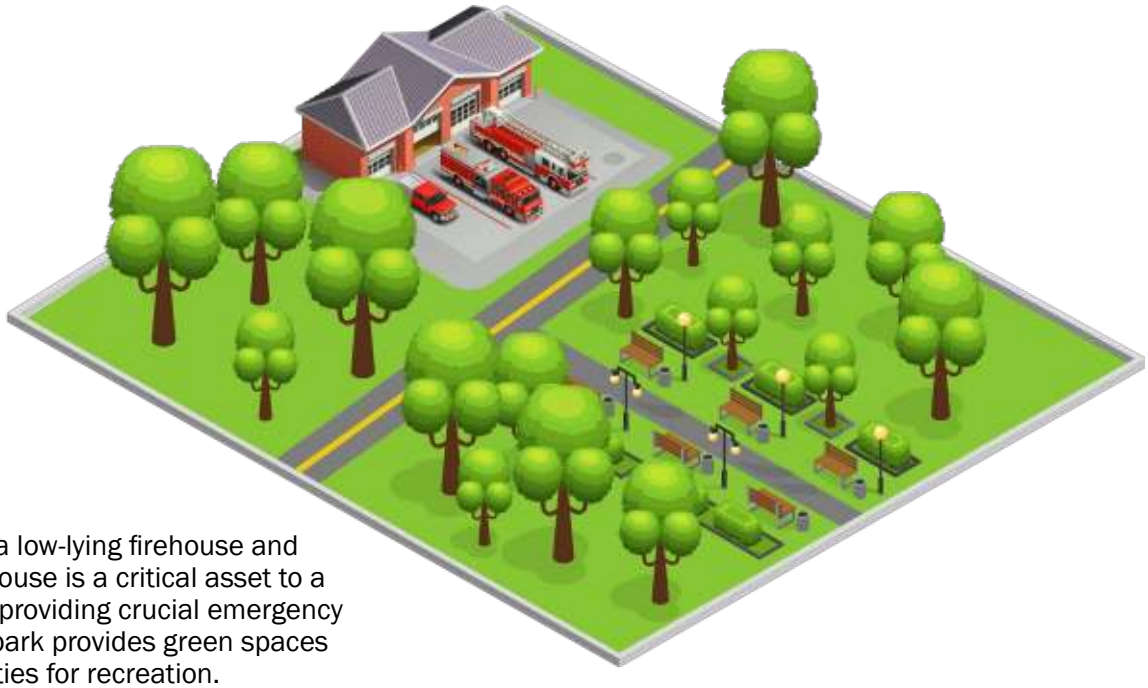
For this asset theme, commercial, cultural, and residential properties are analyzed to determine the likelihood of climate threats influencing or burdening properties. This can be amplified when socially vulnerable communities intersect with physically vulnerable properties. The following asset categories that fall within this theme are Commercial (including industrial), Cultural, and Residential.

Transportation & Mobility

The ability to move and be mobile as a community is pivotal to the continued flow of everyday life. Particularly in Florida, roadways and other major transportation facilities are inherently vulnerable to climate threats such as flooding because of their relatively low elevation. Asset categories within this theme are Roads (major and minor) and Railways, Bridges, and Transportation Facilities.

Vulnerability Explained

Vulnerability not only looks at exposure, but also how sensitive an asset is to a threat. It is also important to understand how easily an asset can change or adapt.



Here we have a low-lying firehouse and park. The firehouse is a critical asset to a community by providing crucial emergency services. The park provides green spaces and opportunities for recreation.

Even if both have the same exposure, a low-lying firehouse is more vulnerable than a park. A few inches of water can significantly disrupt a firehouse, while a park flooding a few inches will likely not cause damage or significant long-term disruptions.

Assessing Asset-Threat Pairs

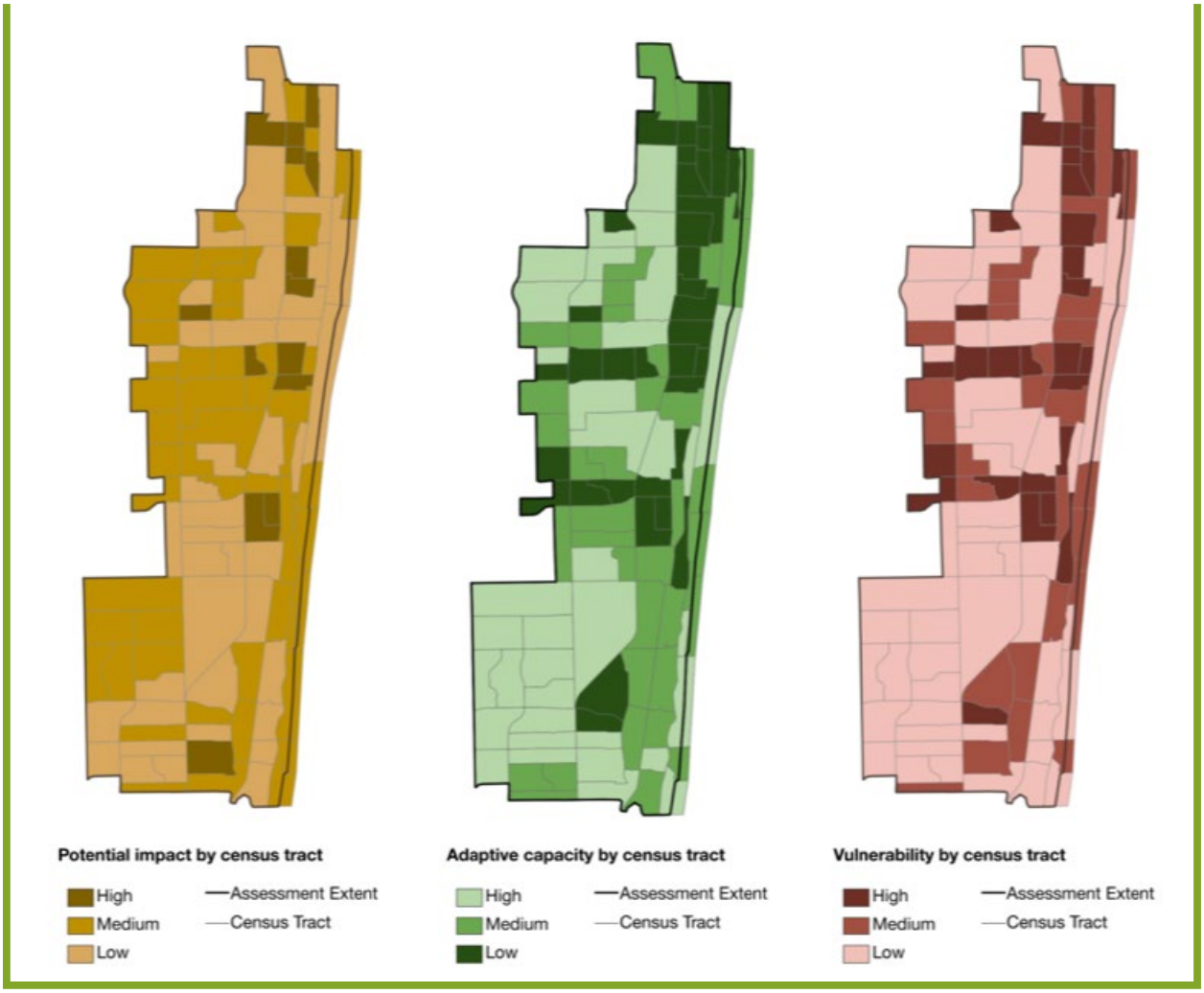
The project team applied a vulnerability and risk assessment framework to the threats and assets that were identified. These are referred to as asset-threat pairs and each was evaluated separately, even though some threats may also be interrelated (e.g., rainfall-induced flooding and tidal flooding). These asset-threat pairs are important for the assessment to inform asset-specific insights regarding the impacts from climate threats. (For example impacts to a commercial corridor are inherently different from the impacts to a residential neighborhood.)

In turn, these insights allow the CRP to develop adaptation strategies that are tailored to address the specific types and locations of vulnerabilities across the jurisdictions. For most asset-threat pairs, the vulnerability and risk assessment components will be applied at the asset scale. Below is an example of how the project team assessed an asset-threat pair.

Extreme Heat

Extreme heat was assessed on the census tract scale. Below are maps of the two inputs – potential impact and adaptive capacity – and the resulting vulnerability output map. Areas with low adaptive capacity have less tree canopy and higher socioeconomic vulnerability. Areas with high potential impact have a high number of sensitive populations, such as those older than 65 or under 18, and a high percentage of developed land. The most vulnerable areas (darker red) in the right-most map represent the intersection of those two factors. Interestingly, every CRP jurisdiction includes one or more census tracts with at least medium vulnerability to extreme heat. For the entire study area, the census tracts with medium or high vulnerability include the following sensitive populations:

- 33,900 households with members 65 years of age or older
- 18,400 households with members under 18 years of age
- 85,715 households below the poverty line, or about 48% of the regional households.



Summary of Regional Vulnerability and Risk

The following is an overview of some of the key regional findings from the assessment.

- Residential properties are vulnerable to all types of flooding: rainfall-induced, tidal, and storm surge. The vulnerability is driven by many factors, including but not limited to coastal proximity, density of development/imperviousness, whether it was built before base flood elevation (BFE) requirements were in place, and impacts to floodplains/native hydrology.
- Critical facilities are often vulnerable to multiple threats (e.g., high winds and flooding).
- Road access is the most widespread vulnerability associated with future tidal flooding.
- Socioeconomic disparities within the region indicate people in certain areas will be disproportionately impacted by climate threats (especially by extreme heat, high winds, and rainfall-induced flooding).
- Sea level rise and climate change will exacerbate existing threats and present new challenges to the region.
- Most climate threats are interconnected.

Findings from the assessment also suggest three main types of vulnerabilities for the CRP to consider in the development and prioritization of adaptation strategies.

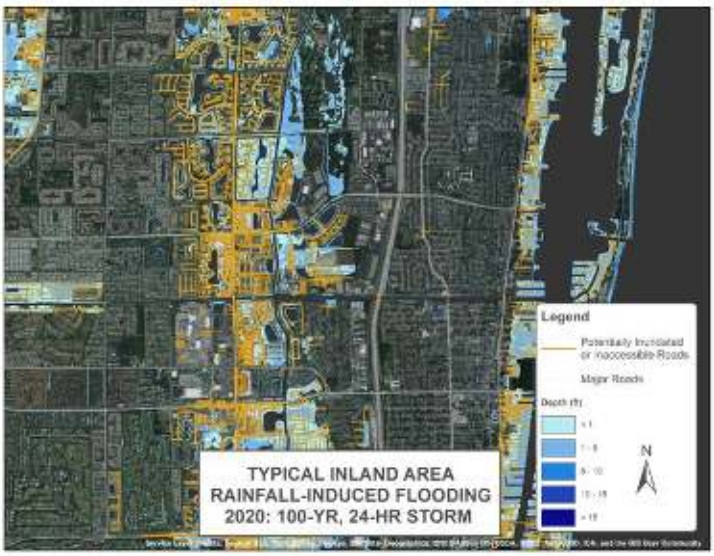
- Near-term vulnerabilities: These threats include rainfall-induced flooding, extreme heat, and tidal flooding.
- Mid to long-term vulnerabilities associated with future conditions and change: Future tidal flooding, groundwater inundation, shoreline recession, drought, and harmful algal blooms.
- High-impact event vulnerabilities: Rainfall-induced flooding, storm surge, high winds.

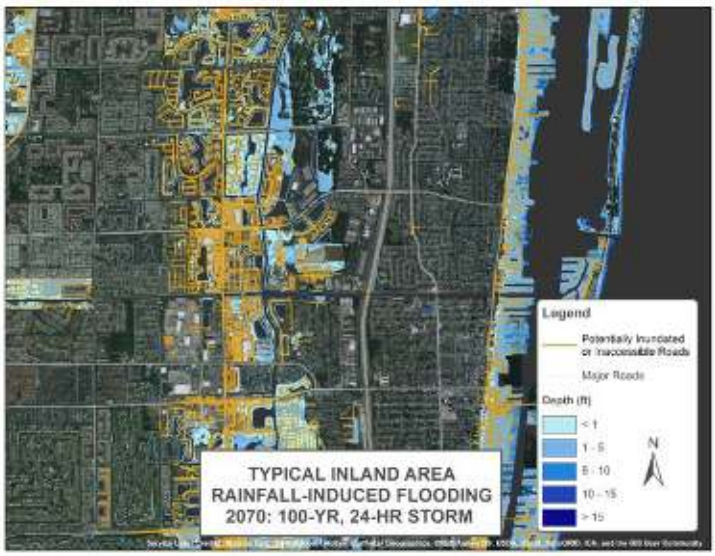
Tidal Flooding

The study revealed a substantial number of waterfront properties across the CRP region are exposed and vulnerable to tidal flooding under existing and all sea level rise (SLR) conditions. This includes neighborhoods as far as two miles from the coast, because increased water levels are pushed up the canal systems that connect these neighborhoods to the Lake Worth Lagoon and Intracoastal Waterway. None of the flooding depicted in the tidal conditions under SLR seems to be a hazard in and of itself. However, if rain-induced or storm surge events were to take place during King Tide events in future sea level rise conditions, then the effects of flooding would be significantly exacerbated.

Rainfall-Induced Flooding

The threat of rainfall-induced flooding presents the greatest exposure and highest levels of vulnerability and risk of all flooding threats assessed in this regional study. Both inland and coastal areas are vulnerable to rainfall-induced flooding. One key insight from this threat assessment is the extent to which assets are vulnerable to the 500-year flood event. While the 500-year event has a lower relative likelihood or risk probability compared to the 100-year or 25-year event, it is one to which the CRP is especially vulnerable. The 500-year inundation mapping and assessment result shows that, of the nearly 73,000 properties in the region that are exposed to the potential for rainfall-induced flooding, only about 36% are found within the current regulatory floodplain extent - the other 64% being outside the current regulatory extent (based on the 2017 FEMA study).

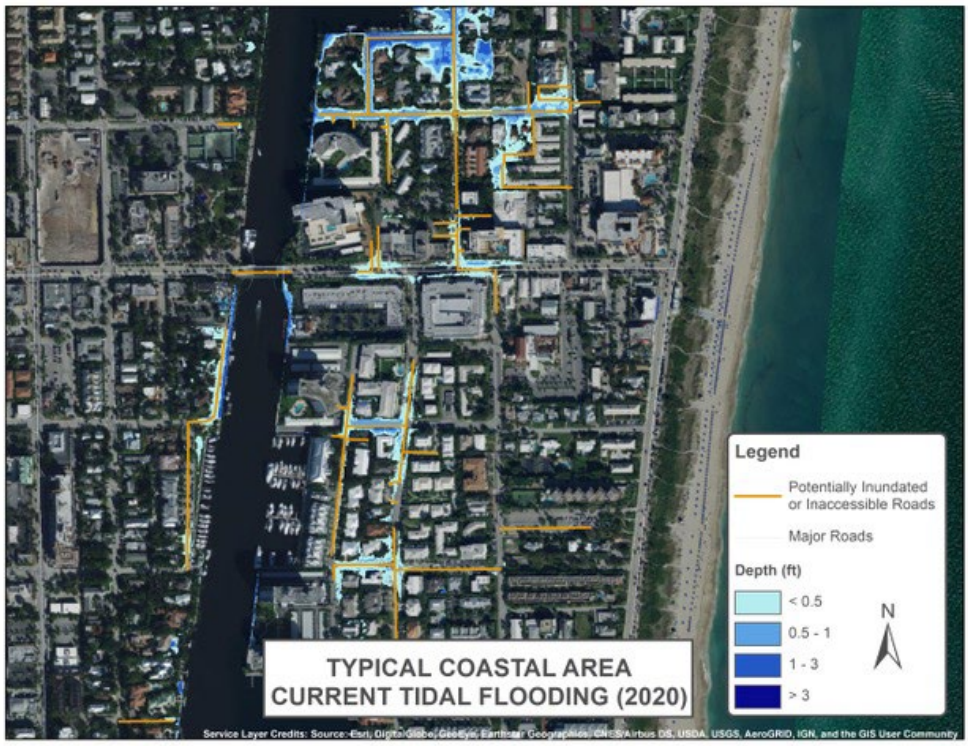


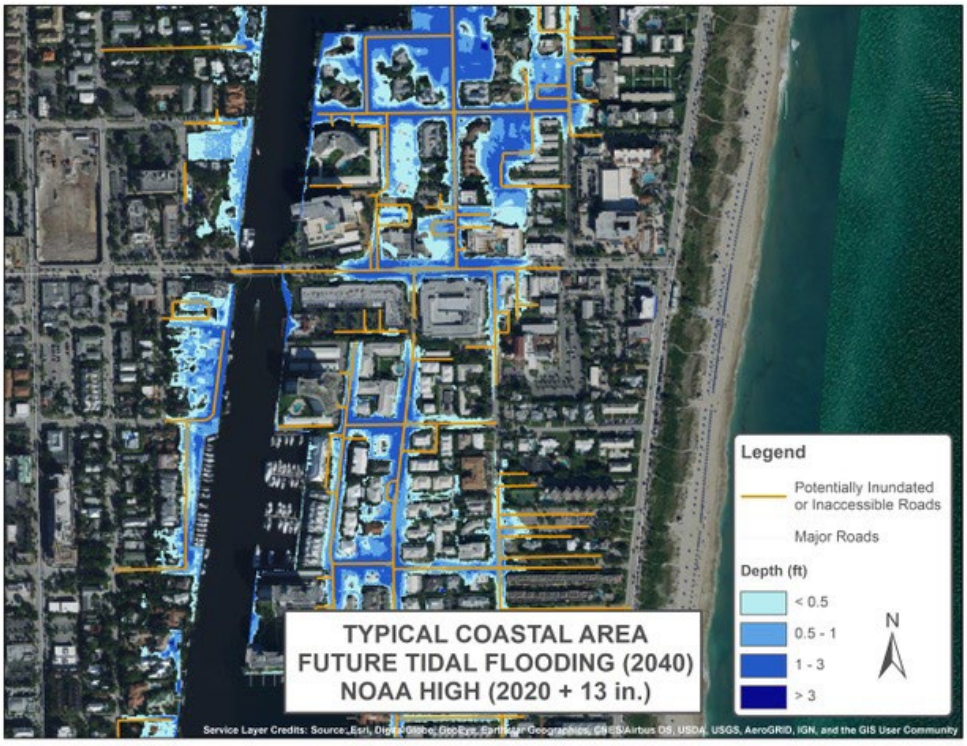


Comparisons of the existing (2020) rainfall-induced flooding and the future (2070) rainfall-induced flooding were assessed for the 100-year, 24-hr storm. The increase in flood extents appears to remain approximately the same, but the depth of inundation increases with the future storm.

Tidal Flooding Example

Tidal flooding is of top importance and special interest to coastal communities that are already frequently experiencing the impacts associated with this type of flooding. For the purposes of this assessment, tidal flooding may also be referred to as tidal inundation. The comparison of the existing (2020) tidal flooding and the future (2040) NOAA High tidal flooding (+13" SLR from 2020) were assessed and represented in the maps below. The increase in flood extents and depths are seen here. Greater lengths of roadway are affected as well. It is important to understand access concerns with tidal flooding, as many of the barrier island communities have limited-access roadways off the barrier island. Flooding in neighboring communities may significantly impact access requiring regional coordination.



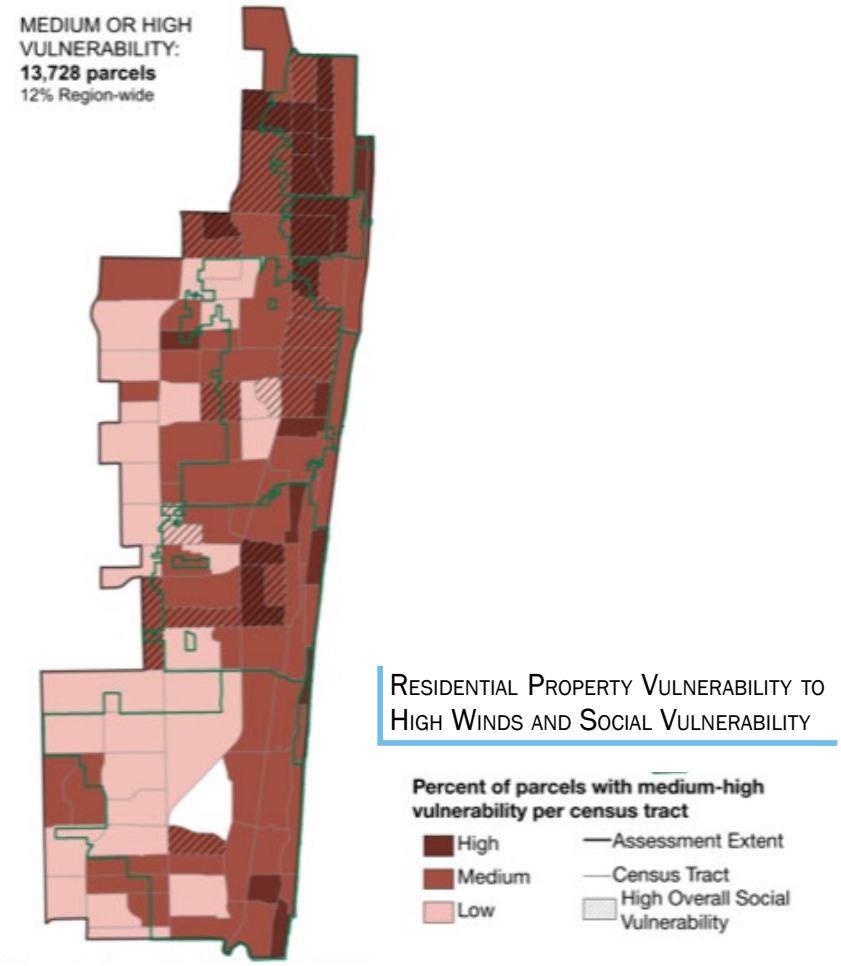


High Winds

Sustained high winds are typically associated with tropical storms in Southeast Florida and can substantially damage or destroy infrastructure and assets. As our climate changes, the strongest and most damaging tropical systems (Category 3-5 hurricanes) are anticipated to occur more often. For this study, a property-level screening assessment was developed in order to estimate vulnerability. This property-level screening assessment shows properties that may be more vulnerable to high winds based on use type and relevant wind-related building design regulations at the time the primary structure was built. For this assessment, multi-residential and multi-business properties were considered to have a greater potential impact to the threat of high winds. The following property types are considered to be highly sensitive to high winds:

- Multi-residences (due to a great number of people potentially affected)
- Mobile homes
- Assisted housing
- Critical use (fire/police, safety response, electric utility, communications)
- Multi-commercial (multiple retail business locations)

- Health & Medical and Energy & Comms have the highest percentages of vulnerability (largely due to the year of construction).
- About 12% of the residential properties in the region have medium or high vulnerability to high winds. About 9% of all residential properties in the region were constructed before the first building code in 1974.
- About 37% of residential properties in the region were constructed since 1995. The percentage of residential property vulnerability also varies across jurisdictions (from about 5% to 58%).
- Vulnerability to the threat of high winds has a high co-occurrence with socially vulnerable populations. Of the 22 most vulnerable residential areas, 18 are also among the most socially vulnerable.



Residential Property Vulnerability to High Winds and Social Vulnerability

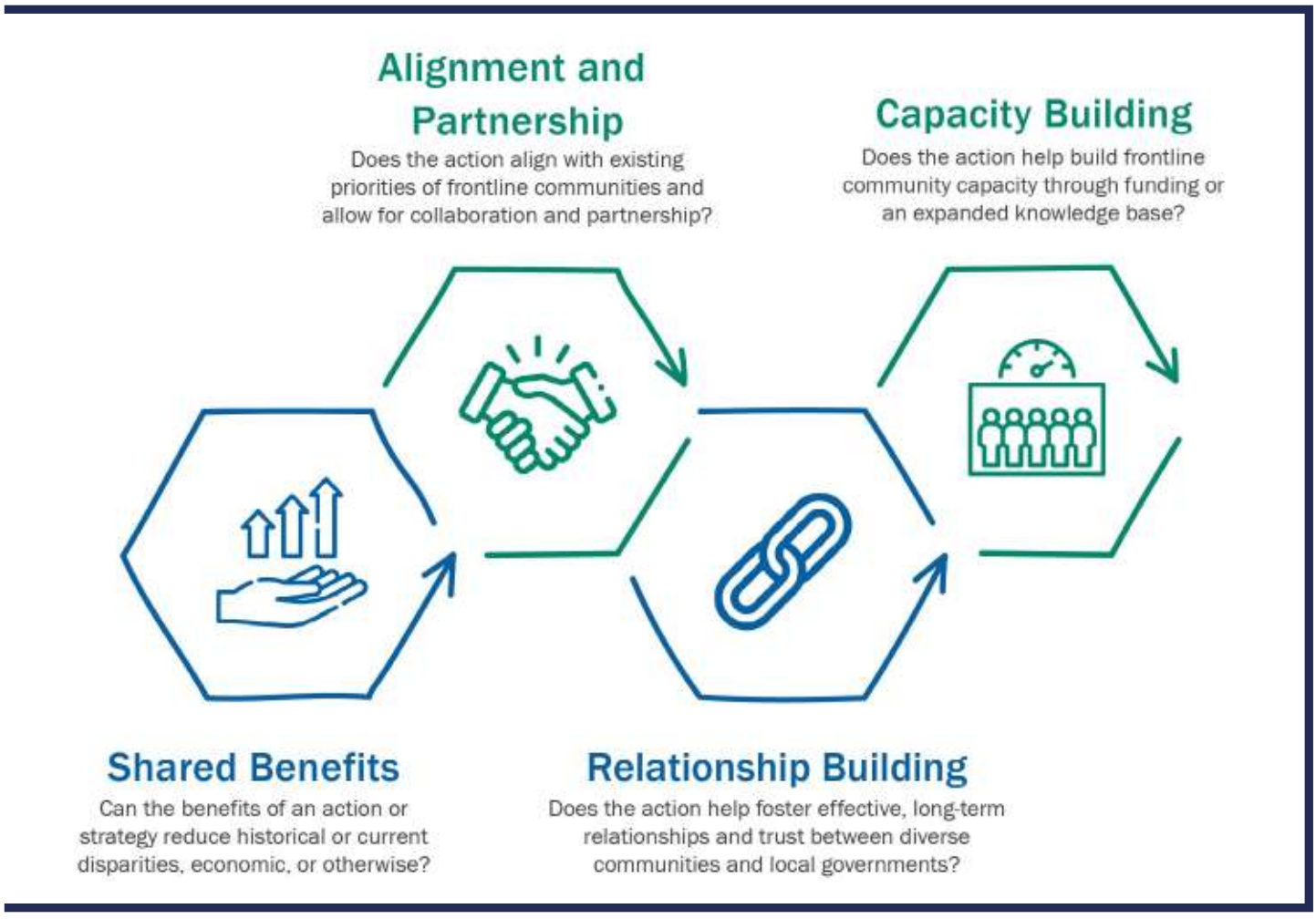
Social Vulnerability and Social Equity

The assessment recognizes that socially vulnerable populations are disproportionately impacted by climate threats. Therefore, social vulnerability and equity are foundational to the methodology and insights of the assessment and were weighted as crucial factors in the development of adaptation strategies. The complexities that arise in relation to social vulnerability and equity also call for a multifaceted approach when building resilience and adaptation.

Within the context of adaptation planning and implementation, equity has two main dimensions: 1) Procedural Equity and 2) Substantive Equitable Outcomes. Procedural equity is about ensuring that overburdened and underrepresented communities have a meaningful voice in the early stages of planning and formulation of adaptation strategies, as well as during implementation and monitoring of those strategies. This means that long-term community engagement objectives should go beyond awareness and education to include building trusting relationships and providing true opportunities to shape decision-making. Equitable involvement of the community is not enough by itself. Adaptation strategies should be designed to achieve substantive equitable outcomes by prioritizing investments in communities experiencing disproportionate impacts, addressing the root causes of disparities, and building social cohesion.

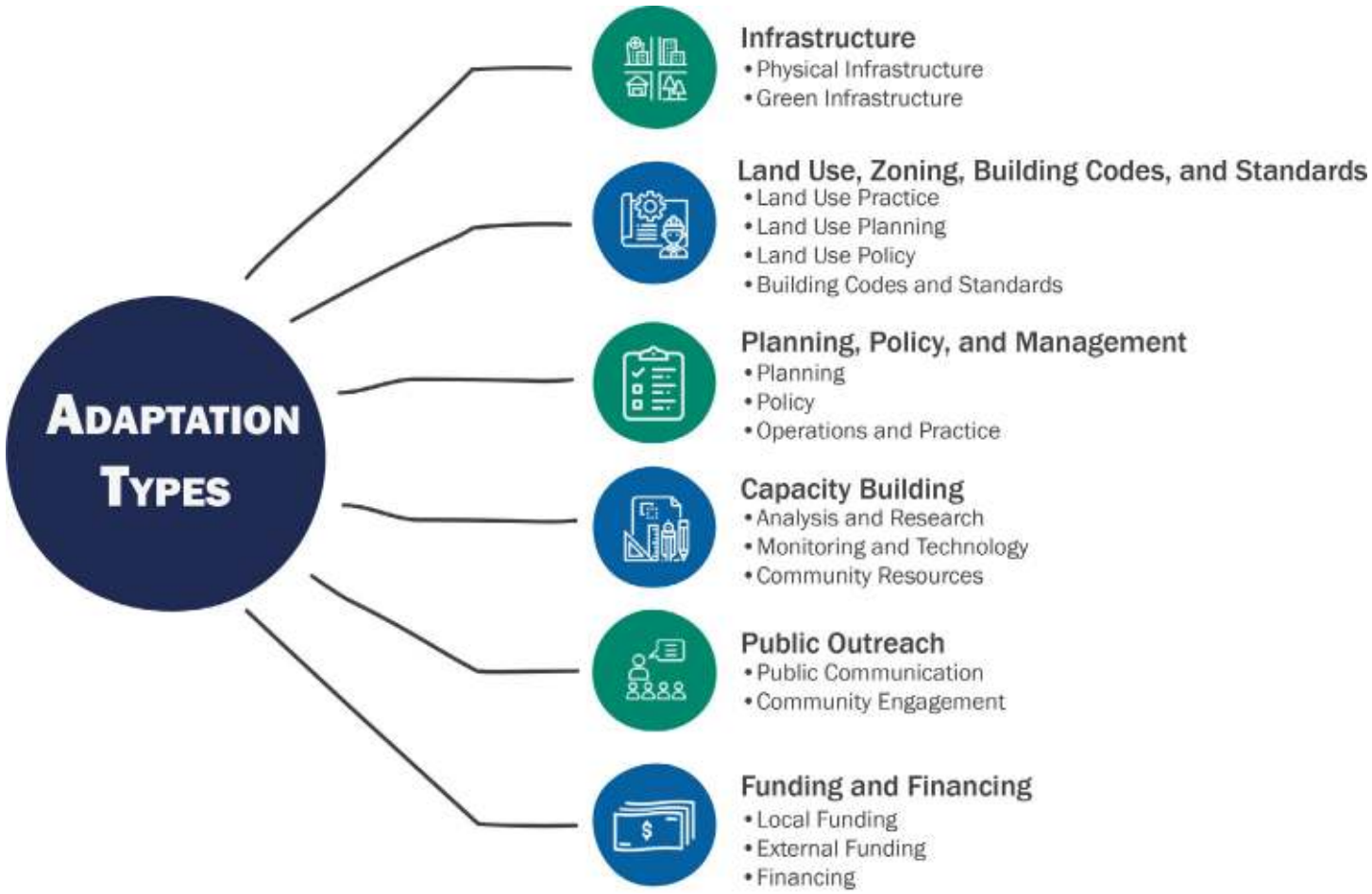
Major Features of Equitable Adaptation Strategies

When considering equitable adaptation strategies, the assessment team utilized the framework developed in the *City of Portland and Multnomah County Climate Action Through Equity Report*. The graphic below highlights some of the features in that framework that were taken into account when identifying and selecting adaptation strategies. Additional considerations include designing strategies that promote economic opportunity and workforce development, devising accountability metrics that ensure vulnerable communities are not disproportionately harmed by an action, and ensuring benefits of a strategy are broadly accessible.



Adaptation Types

To effectively address the climate threats studied in this CCVA, it will be important for the region and local governments to develop and implement a diverse set of adaptation and mitigation strategies. Through a climate change lens, adaptation entails changing or creating a new way of functioning to suit changing environmental conditions. Mitigation may be defined as actions that reduce the severity of an event and minimize the potential impacts. While adaptation strategies are emphasized, mitigation options were also taken into account. Below you will find the six major adaptation categories that the CRP has considered.



Adaptation Types Explained

Infrastructure

Engineering standards and current paradigms of design need to address policy that affects the design, construction, maintenance, operations, and entire life cycle of infrastructure with climate change in mind. Within this category exists both gray infrastructure, such as seawalls and stormwater drainage systems, and green infrastructure, such as living shorelines and bioswales. Incorporating a combination of these types of infrastructure will greatly increase resilience and reduce the impacts of climate change.

Land Use, Zoning, Building Codes, and Standards

Building codes and standards regulate how a building should be built, and in the future, climate change must be a key consideration for these codes. Adaptation strategies discussed here examine land use and zoning, building codes, and standards associated with land use. These actions generally include modifying or implementing new land use management policies, integrating climate into land use planning, and actions that modifying policies related to how land will be used and where development can occur. One such land use authority local governments can utilize is Adaptation Action Areas (AAA).

Planning, Policy, and Management

Adaptation strategies in this category generally examine the future needs of the community, and those that are not specific to land use. Many of these policies correspond to how a local government plans and operates. These actions integrate climate into existing planning processes, such as those focused on creating new regulations or revising existing regulations (other than those related to land use), as well as actions that change operations, management, and programs that include the impacts of climate change.

Capacity Building

Capacity building is defined here as actions, investments, and other activities that grow an entity's capability to identify, assess, and implement actions for adaptation and building resilience. These capacity strategies can come in a variety of forms but generally fall into the following areas: external partnerships, analysis and research, monitoring and technology, community resources, and City/Town staff capacity.

Public Outreach

An overarching approach to public outreach aims to gain public support for the suggested adaptation strategies, and also build public understanding of the intricacies among flooding, property concerns, adaptation implementation, and more. Navigating the public's current perceptions, reframing the conversation on resilience and adaptation, and building approachability to these topics are essential facets to effectively engaging members of the public.

Funding and Financing

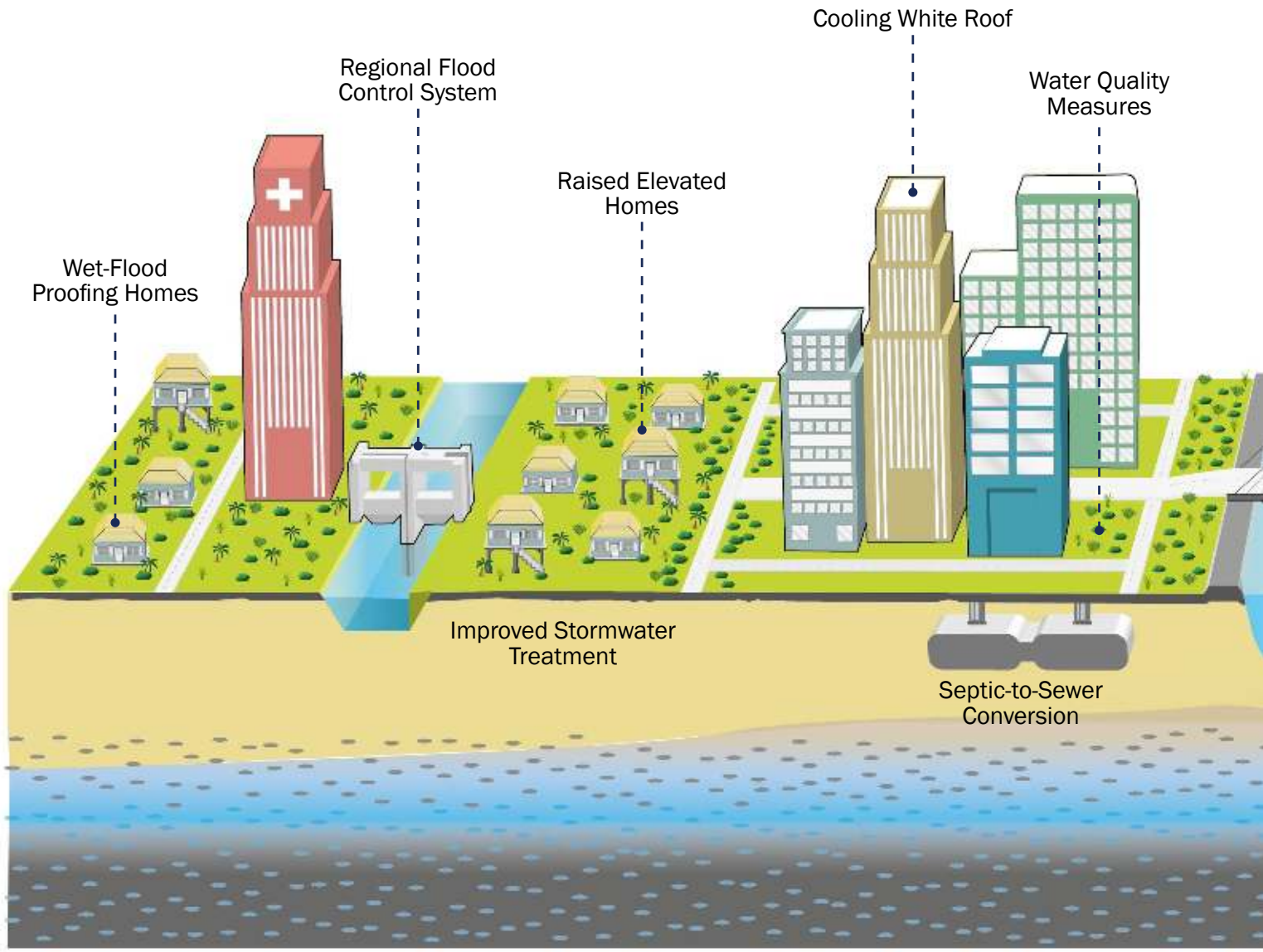
The cost of adapting to and mitigating the effects of climate change will be significant, especially for coastal communities. Nearly every facet of government operation will need to respond and adjust. Local governments in Southeast Palm Beach County have generally limited revenue options – property, sales, and other taxes, charges and fees; and funding from the federal and state governments. Funding and financing climate adaptation and mitigation will require innovation and persistence.

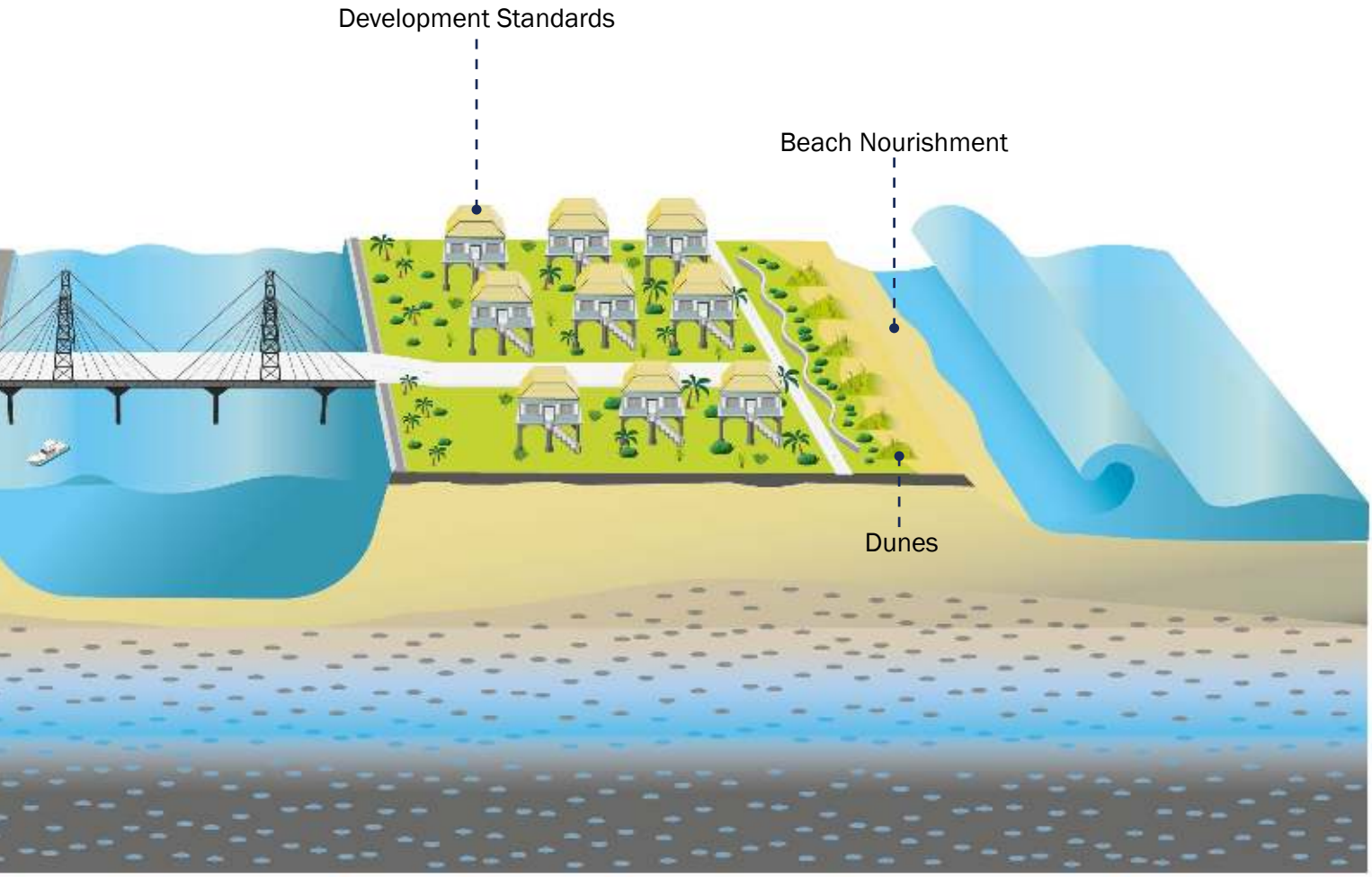
Climate Adaptation Strategies

The cost of adapting to and mitigating the effects of climate change will be significant, especially for coastal communities. Each climate threat will create its own set of disruptions and challenge each community differently. However, nearly every facet of government operation can contribute to resilient solutions for all types of communities through investments made today. While costly, investments in resilience have demonstrated a high return in value.

The Southeast Florida Climate Change Compact Business Case for Resilience found that for every $1 invested in community-wide adaptation, there will be a $2 return in benefits, indicating a 2:1 benefit-cost ratio. Understanding and leveraging the benefits that come with climate adaptation and mitigation will require innovation and persistence, and can encourage local governments to search for funding mechanisms, as well as federal and state grant opportunities. Planning for future climate conditions through regional coordination alongisde investments in resilience will foster prosperous communities that are able to withstand the impacts of these changing conditions.

Below are a variety of adaptation examples, including community-wide and building-level, that can be implemented across the region to address climate challenges such as those explored in this study.




Development Standards
Beach Nourishment
Dunes

Portfolio of Regional Adaptation Strategies

	DESCRIPTION	APPLICABLE THREAT(S)
Infrastructure	Based on the results of this study, evaluate key infrastructure vulnerabilities, and work regionally with regulators to minimize gaps in services: utilities (water, wastewater, and stormwater), schools, critical care, emergency buildings, etc. Special attention should be paid to the locations of vulnerable populations based on the findings of this study.	All
	Build partnerships and opportunities for increasing green infrastructure projects and/or voluntary incentives. Participate in the statewide development of stormwater rules that award Environmental Resource Permit (ERP) credit for use of Low Impact Development measures.	Harmful Algal Blooms (HABs), All Flood Threats, Drought, Extreme Heat, Pest & Disease
	Work as the CRP to facilitate more living shoreline projects in vulnerable locations. Special attention should be paid to the results of this study and how these projects can be used to mitigate climate impacts for socioeconomically challenged areas. Projects that leverage healthy mangroves should also be strategically considered.	Shoreline Recession, High Winds, HABs, Storm Surge
	Deploy mobile food markets connecting residents to food distribution centers and grocery stores in order to address food deserts and other food equity issues. These markets could be strategically deployed based on need – as well as after flooding and adverse weather conditions.	Pest & Disease, Extreme Heat, All Flood Threats
	Collaborate as the CRP to encourage the development of non-motorized transportation facilities (e.g., trails, separated bike paths) that are cross-jurisdictional when possible, to enable impacted populations to access public service/health needs. Shade and safe access to drinking water should be considered as a part of this strategy.	Extreme Heat, Pest & Disease

Portfolio of Regional Adaptation Strategies Cont'd

	DESCRIPTION	APPLICABLE THREAT(S)
 **Land Use, Zoning, Building Codes, and Standards**	In appropriate areas, develop a regional plan to restore wetlands and shoreline to provide more resilient habitats, improve water quality, and slow storm surge. This initiative would be particularly effective near the coastline and waterbodies with impacted water quality and should be linked to other co-benefits when possible (public education, recreation, biodiversity protection, etc.).	Shoreline Recession, HABs, Storm Surge, Pest & Disease
	Using the results of this study, collaborate to identify incentives to divert future development from vulnerable areas, such as transfer of development rights and density bonuses. These provisions for incentives would reduce the introduction of new investments in high-hazard zones and help ensure the long-term economic resiliency and competitiveness of the area.	Tidal Flooding, Storm Surge, Rainfall-Induced Flooding
	Advocate for the consideration of resilience in regional transportation plan updates. Consider sea level rise and future hydrology as factors for funding new transportation projects.	All

	DESCRIPTION	APPLICABLE THREAT(S)
 **Planning, Policy, and Management**	Collaborate and advocate for the regional creation of a green infrastructure/low impact development (GI/LID) manual to provide a toolbox of green infrastructure practices and site design options for municipal staff and consulting engineers and architects. The design manual should include pollutant removal efficiencies, design constraints, and appropriate settings and materials for Southeast Palm Beach County. Link this strategy to other engagements with Florida Department of Environmental Protection (FDEP) and South Florida Water Management District (SFWMD) to award ERP credit for LID usage in Palm Beach County.	HABs, All Flood Threats, Pest & Disease, Extreme Heat, Drought, Shoreline Recession
	Explore the concept of Adaptation Urbanism – integrating compact development, sustainable transport, blue and green infrastructure, and equity – and work with regional partners to identify opportunities to apply it to street-level resilience projects in the CRP area.	All
	Collaborate across the CRP to create a program inspired by the Building Efficiency 305 Program in Miami geared towards increasing water and energy efficiency in large buildings. Click here for more information.	Drought, Extreme Heat
	Collaborate as the CRP and with other local agencies to encourage the creation of watershed datasets, models, and floodplain maps. Develop regional maps that reflect build-out and future hydrology that can be updated every 5 years. The work can build upon Palm Beach County's efforts to delineate watersheds for the Community Rating System Program, as well as the watershed approach taken by the Lake Worth Lagoon Initiative.	All Flood Threats, HABs, Drought, Groundwater Inundation

Portfolio of Regional Adaptation Strategies Cont'd

	DESCRIPTION	APPLICABLE THREAT(S)
Capacity Building	Collaborate as the CRP to compile resources to encourage sustainable landscaping practices, pervious surfaces, and downspout disconnection for homeowners and businesses. Tie the initiative to existing resources that encourage Florida-Friendly Landscaping™ and those that reduce fertilizer usage. Cater the specific measures to Southeast Palm Beach County so that the resources are easier for the public to use (plant menus, instructions, local resources, etc.). Tap into the resources provided by the Institute of Food and Agricultural Sciences (IFAS) Extension at the University of Florida and the local Palm Beach County Cooperative Extension.	HABs, All Flood Threats, Pest & Disease, Extreme Heat, Drought, Shoreline Recession
	Study and plan to reduce nutrient loads to receiving waterbodies through planning, modeling, enhanced best management practices, land development regulation updates and other strategies. Water quality requires a watershed approach to be successful, so this is a critical regional strategy. Regional water quality partnerships will also increase opportunities for funding. Coordinate activities strategically with Municipal Separate Storm Sewer System (MS4) permitting and Total Maximum Daily Load (TMDL) reporting/activities.	All Flood Threats, HABs, Drought, Groundwater Inundation, Pest & Disease
	Engage Lake Worth Drainage District (LWDD) and SFWMD regarding the impacts of current and future flood events on the secondary and primary canal systems in Southeast Palm Beach County. Also consider potential of algal blooms and how they would affect structure operations. Work with both parties to develop models and eventually a decision support system that can adapt to further mitigate future flood events. Partnering will also increase the likelihood of funding for some grant opportunities. Establish liaisons and a plan for engagement and/or use existing programs (e.g., Palm Beach County Water Resources Task Force).	Groundwater Inundation, Saltwater Intrusion, Rainfall-Induced Flooding, Drought
	Collaborate on development of neighborhood-based resilience hubs to facilitate communication, distribute resources, and provide services to residents before, during, and after climate disruptions. Use the USDN Guide to Developing Resilience Hubs as a starting point for local and regional knowledge exchange. Seek funding opportunities for a regional network of hubs across the CRP.	All
	Work as the CRP to share information on the use of Adaptation Action Areas throughout the region and the State of Florida.	Tidal Flooding, Storm Surge, Rainfall-Induced Flooding
	Engage SFWMD on an ongoing basis regarding the need for rainfall curves, groundwater models, watershed models, and various datasets that can be used to design resilient infrastructure in Southeast Palm Beach County. Establish liaisons and a plan for engagement and/or use existing programs (e.g., Palm Beach County Water Resources Task Force).	Groundwater Inundation, Saltwater Intrusion, Rainfall-Induced Flooding, Drought, HABs
	Start a regional program to encourage more natural management of littoral zones for residential communities, commercial/mixed use, and golf courses. Consolidate and distribute educational resources regarding appropriate fertilizer usage.	HABs, Extreme Heat, Pest & Disease

Portfolio of Regional Adaptation Strategies Cont'd

	DESCRIPTION	APPLICABLE THREAT(S)
Public Outreach	Host regional public meetings about climate threats and solutions that are easily accessible to vulnerable populations. Meetings should be: (a) physically accessible (near public transport); (b) safe for all members; (c) located in places that the community values as gathering spaces (e.g., community centers and cultural centers); (d) led in, or translated into, the primary language(s) of the community; and (e) Scheduled at various times to accommodate different schedules.	All
	Engage artists, activists, youth, and elders in public climate change education. Since Palm Beach County has strong cultural resources, this strategy should leverage existing programs and networks.	All
	Further the discussions related to the results of this study, and continue regionally important conversations regarding climate change, sustainability, and resilience.	All
	Collect data through citizen science initiatives/programs. For example, map urban heat islands with citizen input to inform development of policies to mitigate their effects.	All

	DESCRIPTION	APPLICABLE THREAT(S)
Funding and Financing	Identify grant opportunities to fund adaptation strategies. Share information on these resources via the CRP and other established Palm Beach County governmental groups. Partner strategically and proactively on projects. Review this strategy as part of every CRP meeting and update annually for new funding sources.	Shoreline Recession, HABs, All Flood Threats, Drought
	Continue leadership as a region through collaborative partnerships with strategic partners (e.g., the Palm Beach County League of Cities, Chambers of Commerce, etc.) with a focus on strategic funding for the region to build resilience throughout Southeast Palm Beach County.	All
	Collaborate as the CRP to identify and share resources and tools to assist individuals with financing home or business adaptation efforts.	All
	Engage in the implementation of the new landmark 'Always Ready' resilience law, and ensure the CRP has taken the necessary steps to be at the front of the line when planning and infrastructure funds become available.	All

Consultant Team

Collective Water Resources

Brizaga — Assess. Communicate. Adapt.

ATM Design Engineering Consulting — Applied Technology & Management, Inc.

Chen·Moore & Associates

UNC Asheville NEMAC+FernLeaf

Erin L. Deady, P.A.

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Conclusion

The work of the Coastal Resilience Partnership is a model of how neighboring local governments can come together to address regional climate challenges. Understanding the problem, identifying the impacts, and developing a menu of strategies is only the first step. Preparing our communities for a changing climate will require a sustained effort and collaboration across all levels of government. The Coastal Resilience Partnership is committed to continuing its efforts in creating a more resilient and climate-ready Southeast Palm Beach County.