

Climate Change Vulnerability Assessment and Adaptation Planning

Task 3

April 7, 2021



Prepared per the scope approved by the City of North Miami

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Section 1: Executive Summary



Acknowledgements

The consultant team would like to sincerely thank the entire CCVA working team for providing critical input and feedback at each stage of this project.

Image Credits

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Disclaimer

The assessment is based on the best available information for specific threats and assets at the time the analysis was conducted. Quantitative results presented herein are based on data with inherent uncertainties and generalized assumptions; site-specific evaluations of vulnerability and risk are beyond the scope of this assessment and should be reserved for a detailed evaluation of specific adaptation measures. Values should be interpreted as indicators of relative risk among different areas within the city. This analysis does not offer engineering or safety advice; this analysis is for informational purposes only and is not meant as a substitute for professional engineering or safety advice. Maps and analysis products contained in this report are for graphical purposes only and do not represent a legal survey.

Report authored April, 7 2021

A Foundation for Building Resilience

Like other coastal communities across the United States, the City of North Miami is experiencing increasing impacts from climate threats that are expected to become more frequent and/or severe in the future. The challenges that North Miami faces are both immediate and forthcoming. In a public survey for the project, participants were vision for a climate-resilient North Miami included a more green, dry, safe and equitable city that also preserves cultural diversity. Through this assessment, the City of North Miami has begun an iterative process to fulfill those visions and more.

The City of North Miami has a long history of adaptation and sustainability efforts. In 2007, the City was first in the State to add a climate change element to its comprehensive plan. More recently, the City inaugurated the Good Neighbor Stormwater Park - a repetitive flood loss site that is now held up as a best practice for addressing flooding issues creatively. This assessment broadens and deepens the City's understanding of its assets, climate-related threats, and provides a systematic framework so that the City can continue identifying strategies and taking action towards a more resilient future.



Threats and Assets

The assessment identified four threats in total, including three different types of flooding, all assessed using trusted federal, state, and local data. Several of the threats selected for this assessment impact North Miami currently, but changing climate conditions and sea level rise will cause changes in the frequency or severity of these threats and hence the vulnerabilities the city faces.

Assets specific to the City were identified to represent the built environment of North Miami and include that includes places where people live, work, and recreate, as well as facilities that provide valuable services to the community. The asset themes that serve as a basis for the assessment are at right:



Critical Services & Community Facilities

- Public Safety Facilities (police and fire)
- Medical Facilities
- Government-owned Properties
- Cultural & religious Properties
- Parks



Residential & Commercial Properties

- Residential Properties
- Commercial Properties
- Industrial Properties



Roads & Mobility

- Major & Minor Roads



Economic Factors

- Annual Sales Volume
- Jobs and Employees

Threats were selected by the CCVA theme as those that have the potential to pose some of the most significant risks to the North Miami community and modeled data are publicly available from trusted sources. The threats assessed are at right:

Threats

- FEMA Floodplain Inundation
- Storm Surge
- Tidal Flooding and Sea Level Rise
- Extreme Heat

Key Vulnerabilities Identified

The assessment highlighted the following key vulnerabilities to the people and assets of North Miami. This list provides findings that were discussed during the working group meetings, rather than an exhaustive summary of all climate-related vulnerabilities.

Widespread vulnerabilities from extreme flooding to residential and commercial properties is indicated by two threat assessments: 1) worst-case storm surge resulting from a Category 3-5 hurricane and 2) floodplain inundation from 100- and 500-year flood events. This vulnerability is driven by a significant portion of the City being located in the floodplain, older construction in the regulatory floodplain, and construction outside the regulatory floodplain that has potential for flooding during a major event. Additionally, the potential for widespread road inaccessibility that could cause significant temporary disruptions for emergency services is a result of severe flooding. Worst-case surge from a Category 3 or higher storm could leave most of the City east of I-95 temporarily inaccessible, including several areas that would remain dry but could still be inaccessible to emergency response services.

As sea level continues to rise, so will the city's risk of high tide flooding. Over the next ten years, with a foot of sea level rise (SLR), overland flooding from periodic high tides (i.e., a 2 feet tide) may impact about 12% of coastal residential properties. This number rises to 42% for coastal properties and about 11% of inland properties along the canal in the next 30 years with projected SLR of 2 feet. Note that the assessment considers surface flooding from seawater moving inland along the coast or up and out of the canals. Additional flooding impacts are likely from back-flows from storm drains but is not modeled for this study. The commercial corridor along Biscayne Boulevard will also see significant impacts during periodic tidal flooding events with 2 feet of projected SLR by 2050. By 2050, most roads and properties in the Keystone and Sans Souci areas may be temporarily inaccessible several times a year during annual high tide events.

Critical facilities and community resources are vulnerable and could result in cascading impacts. The City Hall building is in the 100-year floodplain and is an older structure built before floodplains were mapped, making it highly vulnerable to a major flooding event. In addition, four out of five community centers are highly vulnerable to floodplain inundation and storm surge from a Category 3-5 hurricane.

Many non-city owned facilities that provide critical services to the community are highly vulnerable to major flooding. Almost all medical facilities are highly vulnerable to floodplain inundation and all but two are highly vulnerable to surge from a major storm (Category 3-5 event) during which many of the facilities are potentially exposed to flood depths of 3 feet or greater (near worst-case storm surge). Out of 28 school buildings, 25 are highly vulnerable to floodplain inundation, many of which were built before floodplains were mapped and are assumed to be built below the base flood elevation.

Extreme heat vulnerability is widespread throughout the City. This is both due to environmental factors of highly developed landscape and low tree canopy cover in most areas of the city combined with socioeconomically-driven low capacity of individuals and households to cope with heat-related impacts.

Strategies to Build Resilience

The assessment is not just about identifying problems—it also recognizes opportunities and North Miami’s ability to manage and prioritize with limited resources. Using information from the assessment, the project team and city staff identified strategies for key vulnerabilities identified in the assessment. These strategies fall into the following six categories:



Infrastructure



Capacity Building



Land Use, Building
Codes & Standards



Public Outreach



Planning, Policy, &
Management



Funding & Financing

Example Strategies Identified

City staff will continue to expand and refine strategies identified in the assessment, a few example strategies identified are provided below.

Capacity Building

Investigate the effectiveness of investing in a “resilience hub” — a community hub that offers resources and fosters a sense of place from day to day while also providing critical, food, shelter and social services during and/or in the aftermath of an extreme event such as heat waves or hurricanes.

Infrastructure

Continue making improvements to the aging pump station infrastructure. Identify opportunities to for investments to target vulnerabilities associated with both current and future challenges.

Public Outreach

Develop a citizen-science monitoring program, in partnership with stakeholders such as the FIU Sea Level Solutions Lab, that provides the public with a real-time method for reporting frequent flooding issues, especially related to high tides, in a way that produces highly localized information that can be used to identify appropriate interventions while also increasing public understanding of the causes.

Example Strategies Identified (continued)

Land Use, Building Codes, & Standards

Incorporate Sea Level Rise considerations in the upcoming Comprehensive Plan Update. Incorporate into comprehensive and economic development plan where it makes sense to encourage economic growth based on this assessment.

Planning, Policy, & Management

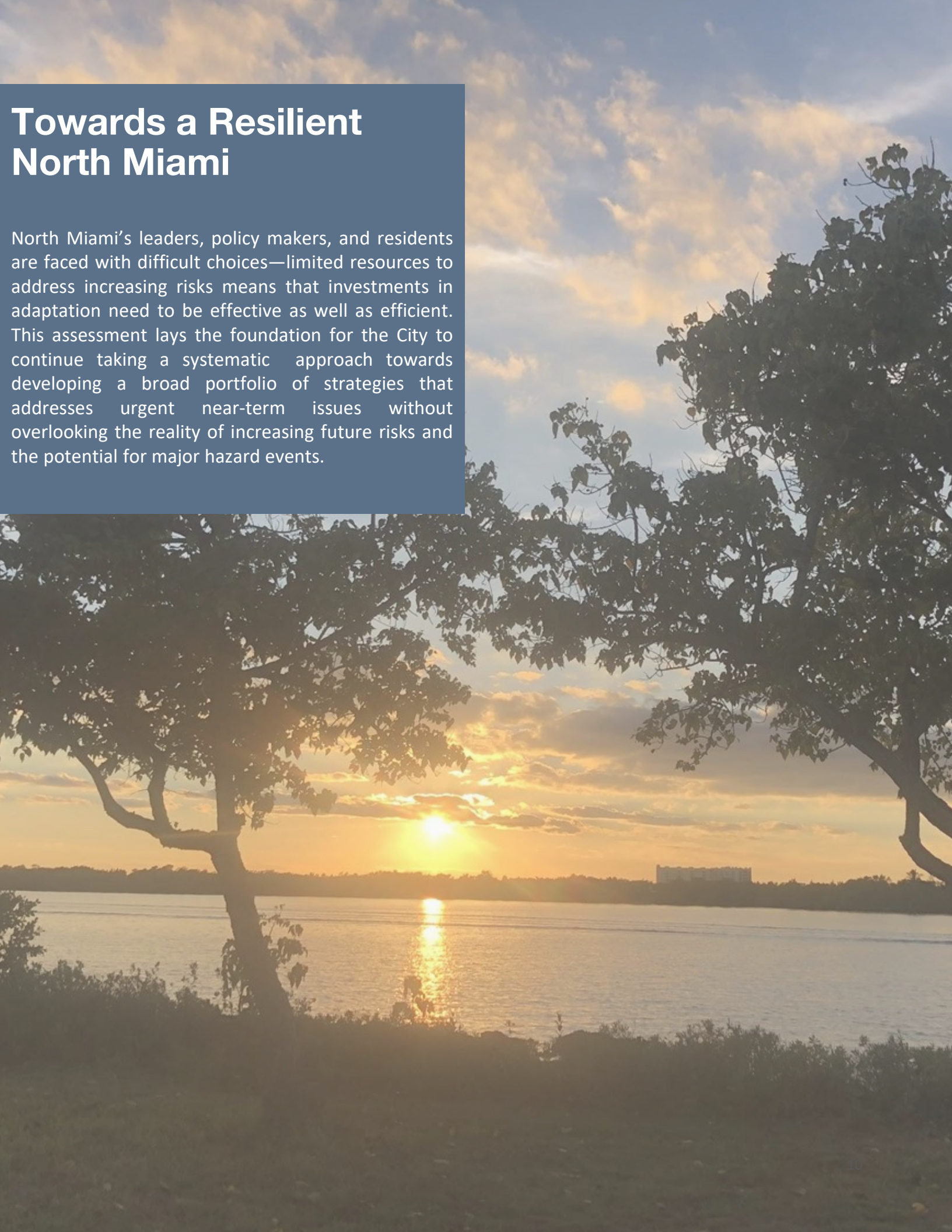
Identify ways to modify existing workflows for routine infrastructure maintenance and improvements so that opportunities to take into account SLR can be identified (in areas that will be affected over the next thirty years).

Funding & Financing

Seek funding to increase adequate access to cooling, such as for energy upgrades for homes and apartments or by providing air conditioning units to renters.

Towards a Resilient North Miami

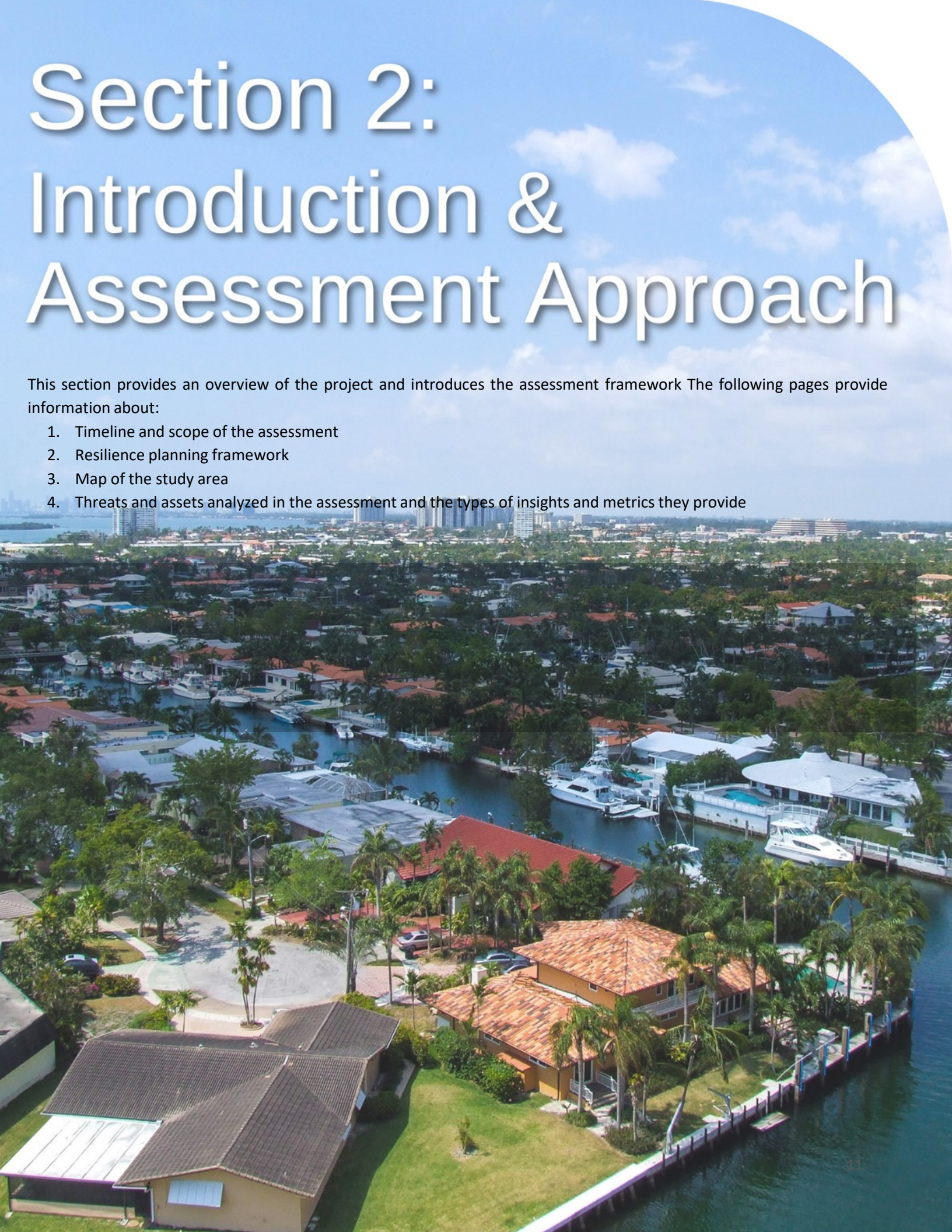
North Miami's leaders, policy makers, and residents are faced with difficult choices—limited resources to address increasing risks means that investments in adaptation need to be effective as well as efficient. This assessment lays the foundation for the City to continue taking a systematic approach towards developing a broad portfolio of strategies that addresses urgent near-term issues without overlooking the reality of increasing future risks and the potential for major hazard events.



Section 2: Introduction & Assessment Approach

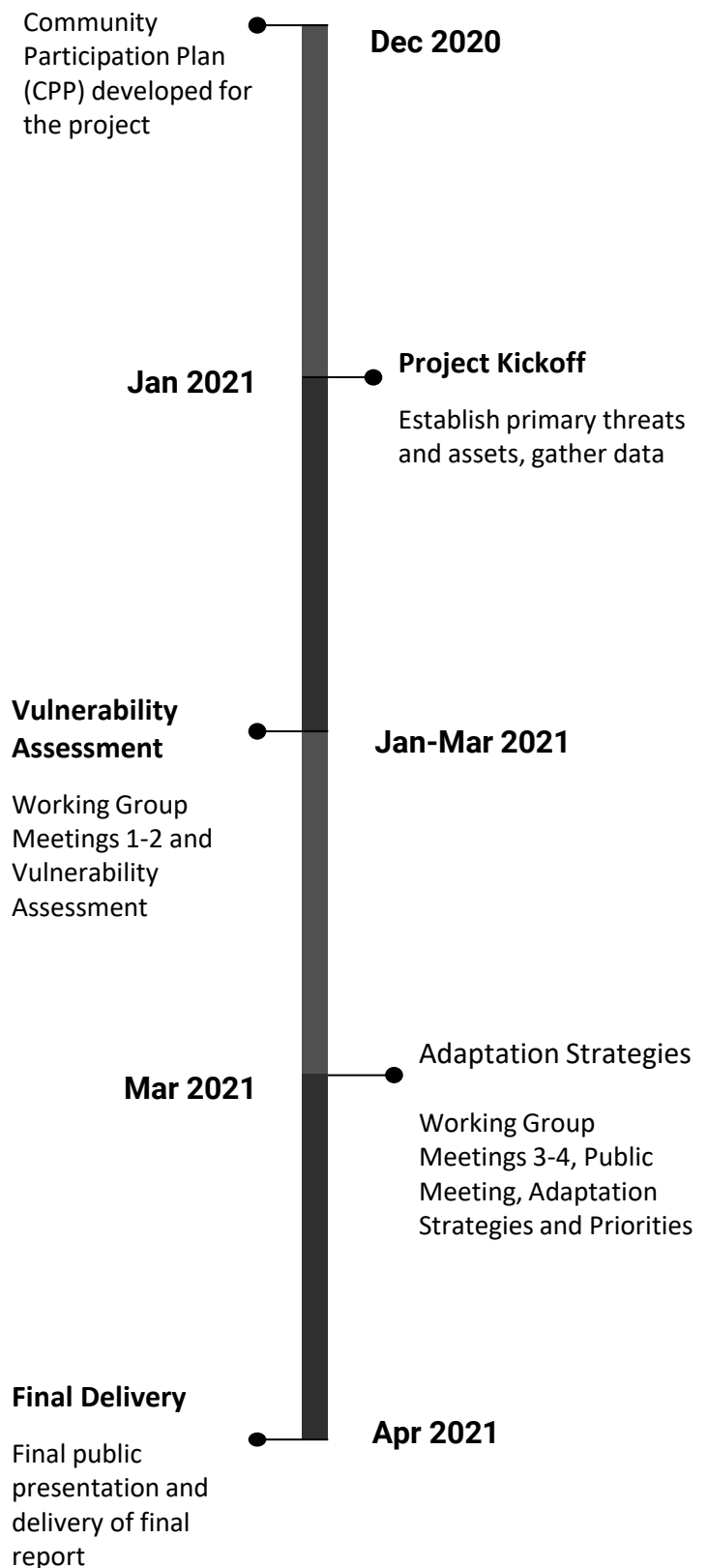
This section provides an overview of the project and introduces the assessment framework. The following pages provide information about:

1. Timeline and scope of the assessment
2. Resilience planning framework
3. Map of the study area
4. Threats and assets analyzed in the assessment and the types of insights and metrics they provide



Project Approach and Timeline

A project team was assembled in November 2020. This was a collaborative, multi-departmental effort led by the City's Community Planning and Development Office, which served as the coordinating entity for the entire process. A core team was assembled and was responsible for logistical coordination, information gathering and participation in planning needed throughout the the process. A team of consultants led by NEMAC+FernLeaf provided facilitation and scientific analysis and technical support of the rapid assessment process and identified focus areas, which were iterated on with the core team to help build momentum throughout the project. The project commenced in April 2021.



What is Resilience?

Resilience can be defined as the capacity of a community, business, or natural system to prevent, withstand, respond to, and recover from a disruption.^{1,2} In the southeast and across the nation, many local governments are recognizing the need to build resilience to increasingly frequent and/or severe extreme weather events. Changes in climate will result in existing threats becoming more frequent and/or severe.³

Efforts to increase resilience to climate and non-climate impacts are built on the foundation of understanding—and reducing—vulnerability. *Vulnerability* is a ubiquitous term often used to describe susceptibility to harm. In the context of building resilience, a vulnerability assessment is a structured process that identifies ways in which an organization or community is susceptible to harm from existing or potential threats.

Vulnerability assessments include three main components: (1) exposure; (2) potential impact; and (3) adaptive capacity, where both physical and socioeconomic dimensions are considered.⁴ Another key concept used in a resilience assessment is the understanding of risk. Risk involves the likelihood and consequence of a threat.

Together, the concepts of vulnerability and risk within a resilience framework can serve to inform the development of strategies to reduce the vulnerability or risk. By taking an integrated viewpoint of these concepts, efforts can focus on building resilience for the assets that are most susceptible and most likely to be impacted. This approach also complements hazard mitigation activities and management practices.

Another important aspect of a resilience assessment is to recognize the iterative nature of the process. Once strategies are implemented, it is necessary to monitor their effectiveness and to update the plan.

The Steps to Resilience

The U.S. Climate Resilience Toolkit⁵ provides an iterative, five-step process for communities to follow when planning for climate resilience. This framework—known as the Steps to Resilience—is used as the foundation of this vulnerability and risk assessment. The framework integrates the components of resilience that can be used and integrated with planning processes at the local level.

Step One: Explore threats

This first step explores past experiences with climate and weather events and regional climate trends and projections to understand how assets (people, infrastructure, services, or resources) may be threatened. This can include identifying stressors—both climate and non-climate—that can cause or contribute to a threat event.

Step Two: Assess Vulnerability and Risks

The purpose of this step is to understand how community assets are susceptible to the threats identified during Step One. This assessment then becomes the foundation for developing options and setting priorities to build resilience in Steps Three and Four.

As stated earlier, *vulnerability* is defined as the susceptibility of societal assets to be impacted due to both physical and social factors. To define vulnerability, the assessment examines both potential impact and adaptive capacity. *Potential impact* includes evaluating sensitivity, or the degree to which exposed assets are potentially affected. *Adaptive capacity* is the ability to cope with identified impacts with minimal disruption or cost.^{1,2,6} Risk scoping is informed by the probability of an event happening and the consequence of that event.

Step Three: Investigate Options

The ultimate goal of Step Three is to have strategies and actions identified to build resilience for the assets that are most vulnerable and at risk. An option could have the potential for building resilience in a variety of ways, such as by (1) removing assets from harm's way, (2) increasing the asset's ability to cope with impacts, or (3) supporting response and recovery. These can also include a range in the focus of strategies from land use and infrastructure to policy and capacity building.

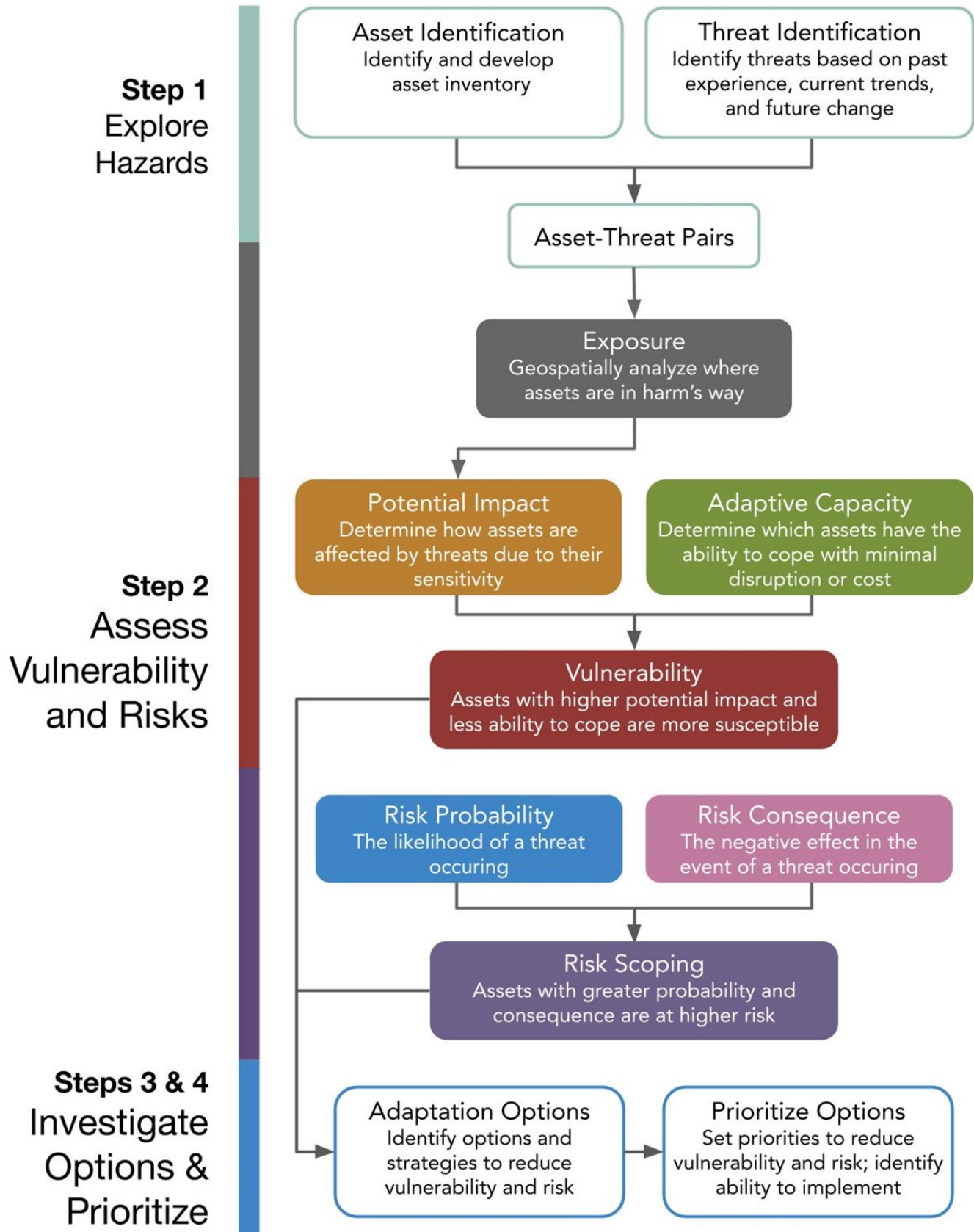
Step Four: Prioritize and Plan

Step Three often yields a large number of options, and it can be difficult to evaluate and compare them all. Prioritization can involve looking at the actions that will have the most impact in terms of targeting key vulnerabilities and can involve forming a portfolio of strategies aimed at targeting both near and long-term issues, but also the potential for high-impact events.

Step Five: Take Action

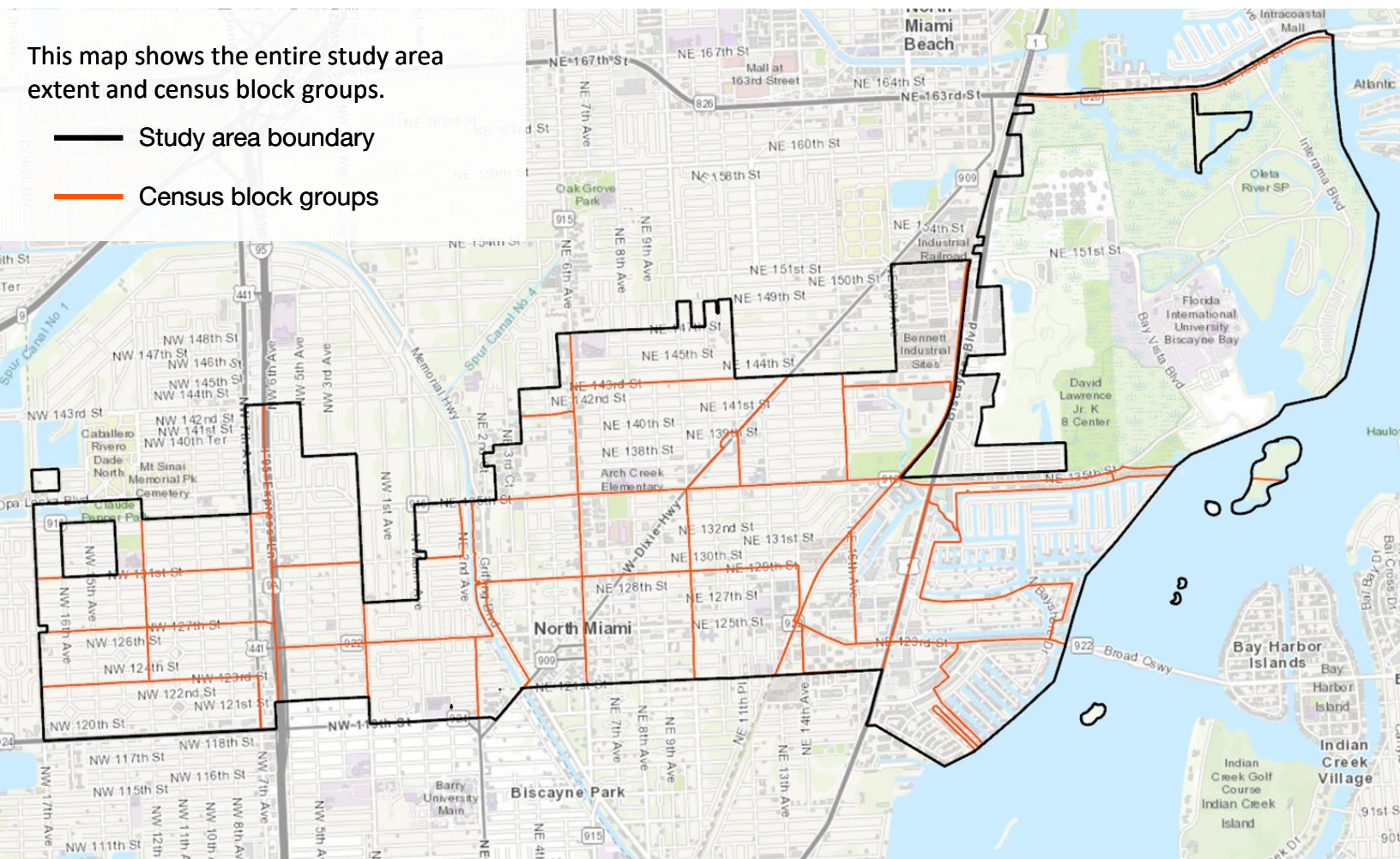
Step Five can be viewed as the most important, as it involves implementing a plan to build community resilience. This step can take years to fully implement, and it is critical for the community to monitor results over time. This is to be expected, and the community should be open to modifying its approach as needed and as new information becomes available.

The diagram below shows each component of Steps 1-4 of the Steps to Resilience framework as applied to the assets in the built environment.



Assessment Area

The map below shows the City boundary, which was used as the extent of the vulnerability and risk assessment (black outline). In addition to this, census block group areas were used for assessment summaries and for neighborhood-level insights. These census boundaries were also used in order to integrate with and draw insights related to socioeconomic characteristics of neighborhood areas within the City. Therefore, these census block group areas are used throughout the assessment to explore aspects of vulnerability and risk and for summary purposes.



Threats and Assets Evaluated in this Assessment

Climate-related Threats

The following threats were selected by the CCVA team as they have the potential to pose some of the most significant risks to the City of North Miami community. The choice of threats was also driven by availability of modeled data from trusted sources such as the National Oceanic and Atmospheric Administration (NOAA) and the Federal Emergency Management Agency (FEMA):

- FEMA Floodplain Inundation
- Storm Surge
- Tidal Flooding (current and future)
- Extreme Heat

These threats are covered in detail in section 3 of this report.

Community Assets

The term “asset” refers to the built environment of North Miami that includes places where people live, work, and recreate, as well as facilities that provide valuable services to the community. The following asset themes serve as a basis for the assessment:

- **Critical Services & Community Facilities.** Assessment of critical services facilities that are both private and government-owned. Assessments consider property- and building-level characteristics and the services they provide in defining vulnerability and risk. These facilities typically provide emergency response and are considered critical to community members
- **Residential & Commercial Property.** Direct impact assessments for residential and commercial property assets. These assessments consider property- and building-level characteristics and the services they provide in defining vulnerability and risk.
- **Roads & Mobility.** Road connectivity and road network assessments that consider: (1) how roads could be directly impacted (e.g., inundated by flooding); (2) roads that may not be directly impacted but could become inaccessible by emergency response; and (3) properties that could become isolated and inaccessible during threat events.
- **Economic Factors.** Assessment of three potential economic impact factors: (1) tax assessed value; (2) total annual sales volume; and (3) number of jobs/employees. These economic factors are related to the property-based assessments to provide insight into the proportion of sales and jobs that could be affected by each threat.

These themes and the parcel categorization process were further refined during the first two workshops with the Internal Working Group.

The primary source of asset data for this study is the Miami-Dade County Parcel dataset that was obtained from the County’s GIS Data Portal (accessed in Nov 2020). The parcel-use information as specified in the ‘DOR_CODE_C’ and the ‘DOR_DESC’ attributes of the dataset provided the basis for categories of assets within each theme. The following page provides more details on these asset themes and categories, including descriptions for each, and the number of parcels or assets that were evaluated for the assessment.



CRITICAL SERVICES & COMMUNITY FACILITIES

Asset Categories and Descriptions	Total
Critical Facilities & Govt-Owned Property This asset theme includes city-owned or private facilities that provide critical services to the people of North Miami, as well as other government-owned properties within the city boundaries. The category includes medical facilities, schools, food pantries and stores accepting snap benefits, police and fire stations, utility facilities, and City Hall. Also included are all other properties listed as owned by the federal, state or city government, except parks and community centers.	137 parcels
Parks, Cultural, and Entertainment Property This asset theme includes places of worship, community centers, parks, museums, libraries as well as commercial, private, or exempt properties used for community gatherings and entertainment.	53 parcels



RESIDENTIAL & COMMERCIAL PROPERTY

Residential Property This asset theme includes properties where people live or shelter. It includes single and multifamily houses, condominiums, mobile homes, group homes, residential medical facilities and retirement homes. Vacant parcels with use codes specifying residential use are also included.	9,645 parcels
Commercial & Industrial Property This asset theme includes retail, office, restaurant, hotel, industrial, parking and mixed-use properties which include businesses and support commerce, jobs and tourism. Vacant parcels with use codes specifying commercial use are also included.	516 parcels



ROADS & MOBILITY

Major Roads Includes all major and secondary roads and considers the critical access they provide for emergency services. Road connectivity and accessibility by fire/emergency services was also considered.	330 lane miles
Minor Roads Includes all residential and tertiary roads. Road connectivity and accessibility by fire/emergency services was also considered.	1,514 lane miles



ECONOMIC FACTORS

Annual Sales Volume Total reported annual sales volume for individual companies and businesses.	\$2.5B annual sales vol.
Jobs/Employees Total number of jobs or employees reported for individual companies and businesses.	16,443 jobs

Social Vulnerability

The concept of social vulnerability recognizes the ways in which individuals, households and neighborhoods may be disproportionately harmed by climate change due to a variety of social, economic, cultural and demographic factors. Disproportionate climate-related impacts arise from a number of reasons: socially vulnerable communities are often located in areas prone to multiple threats or face displacement pressures when they are not; they may have limited access to resources needed to prepare for and recover from disaster, and are often not represented in policies and decisions that affect them; historically, been well-positioned to benefit from disaster funding and adaptation investments. These are just a few examples of existing societal inequities that exacerbate the impacts of climate change.

In this assessment, social vulnerability is considered through social and economic metrics at the block group levels from the 2018 American Community Survey (5-year) and through the Center for Disease Control's (CDC) Social Vulnerability Index that provides relative measures of household composition and disability, socioeconomic status, minority status and language, and housing type and transportation at the census tract level. Each of these themes provide a lens into different areas or types of social vulnerability and can help in understanding the unique combination of pressures that communities face at the citywide or regional level that need to be considered in both defining and building resilience.

Another way of focusing on social vulnerability within such an assessment is by evaluating the potential for loss or disruption of important community services. For example, community centers, food pantries and SNAP retailers, long-term care facilities, and medical clinics are considered critical assets in this assessment. Through the community asset themes described on the previous page, certain community resources and values can be examined in the assessment through the lens of not only direct impacts some of these resources may face but also the loss of critical community services that may be disrupted or lost due to their vulnerabilities.

Section 3: Vulnerability & Assessment Findings



This section summarizes the vulnerability assessment findings. It is organized by four threats that were analyzed for this project:

1. Floodplain Inundation
2. Storm Surge
3. Tidal Flooding and Sea Level Rise
4. Extreme Heat

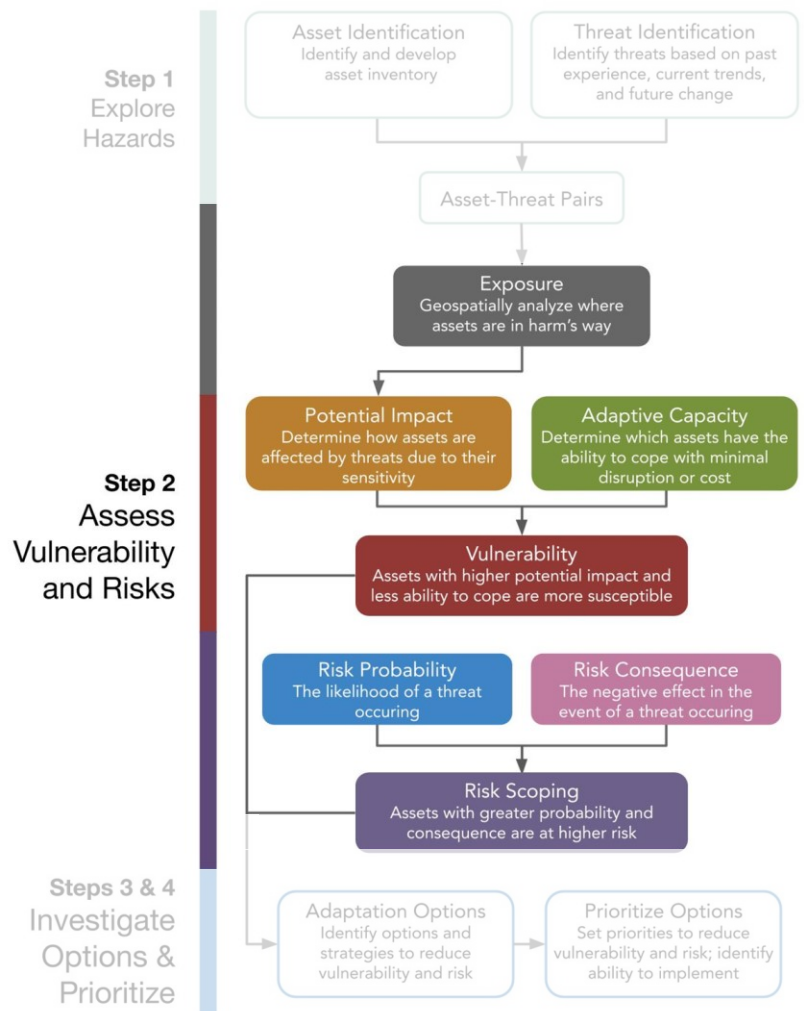
The section begins with a quick overview of the quantitative vulnerability assessment process and a tabular summary of city-wide vulnerability and risk for all property-based analyses. Following this, a narrative description is provided for each threat which includes, its definition, how it was assessed, and city-wide as well as neighborhood-level patterns of vulnerability and risk for that threat.

Vulnerability And Risk Assessment Process

The project team applied a vulnerability and risk assessment framework to every combination of threats and assets identified. These combinations are referred to as asset-threat pairs and each was evaluated separately, even though some threats may be interrelated (e.g., floodplain inundation and tidal flooding). The flowchart at right shows each component of the assessment framework and how they come together. Each of these core concepts and the resulting assessments were explored in detail during the workshops and working sessions with the project team.

For most asset-threats pairs, the vulnerability and risk assessment components were applied at the asset scale. The exception to this is the extreme heat assessment which was conducted at the block group level

Classifications of vulnerability and risk were assigned using data attributes and spatial analysis. Most asset-threat pairs were assessed through vulnerability and risk; however, a few threats were assessed only through vulnerability (tidal flooding & sea level rise and extreme heat).



Definitions

Exposure: The presence of assets in harm's way.

Vulnerability: The susceptibility of exposed assets based on the two core concepts: (1) potential impact—the degree to which an asset is affected due to its sensitivity; and (2) adaptive capacity—the ability the asset has to cope with a potential impact with minimal disruption or cost.

Risk: The probability (likelihood) and the consequence, or negative outcome, of a threat occurring.

Summary Table of Vulnerability And Risk

The summary table below shows the number of assets with medium or high vulnerability or combined vulnerability and risk for every threat assessed. The first column “Asset Total” shows the number of assets in the City with the levels of vulnerability and risk under a separate column for each threat assessed. Percentages reflect the percent of assets City-wide that have medium to high vulnerability and risk.

The Economic Factors section of the table summarizes the extent of potential losses that could occur in the form of sum of improvement values for all vulnerable properties in the City as well as the sum of annual sales volume and jobs associated with vulnerable commercial properties.

More information on each assessment summarized in the table below is provided in the following sections with information about how each threat was defined and assessed as well as a series of key findings about how people

Theme and Asset	Asset Total	Floodplain Inundation (FEMA)	Storm Surge		Tidal Flooding and SLR (vulnerability)		
			Cat 1-2	Cat 3-5	2 ft + MHHW	3 ft + MHHW	4 ft + MHHW
Critical Services & Community Facilities							
Critical Facilities & Govt-Owned	137	77 (56%)	16 (12%)	97 (71%)	1 (1%)	2 (1%)	17 (12%)
Parks, Cultural, & Entertainment	53	25 (47%)	9 (17%)	30 (57%)	NA	2 (4%)	7 (13%)
Residential & Commercial Property							
Residential	9,645	4,736 (49%)	1,093 (11%)	5,498 (57%)	48 (<1%)	160 (2%)	845 (9%)
Commercial & Industrial	516	299 (58%)	33 (6%)	350 (68%)	4 (1%)	7 (1%)	42 (8%)
Roads & Mobility							
Major Roads Inaccessible (Lane miles)	330	236 (71%)	65 (20%)	251 (76%)	44 (13%)	73 (22%)	106 (32%)
Minor Roads Inaccessible (Lane miles)	1,514	1,122 (74%)	317 (21%)	1,225 (81%)	102 (7%)	269 (18%)	432 (28%)
Inaccessible Property	6,145	5,093 (83%)	1,052 (17%)	6,069 (99%)	2 (<1%)	94 (1.5%)	831 (13%)
Economic Factors							
Improvement Value (assessed)	\$3.5B	\$2.7B (78%)	\$990M (28%)	\$3.5B (99%)	\$75M (2%)	\$154M (4%)	\$686M (19%)
Annual Sales Volume	\$2.5B	\$2.3B (89%)	\$517M (20%)	\$2.5B (97%)	\$58M (2%)	\$130M (5%)	\$712M (27%)
Jobs / Employees	16,443	15,059 (91%)	3,037 (18%)	16,125 (98%)	232 (1%)	723 (4%)	4,771 (29%)

1. Asset total column reflect citywide totals. Percentages reflect the percent of assets citywide vulnerable and at risk.
2. Inaccessible property refers to all properties regardless of type.
3. Tidal Flooding and SLR shows vulnerability-only assessments.
4. Economic factors report sales and employees associated with business locations.

Floodplain Inundation

Floodplain Inundation Defined

Floodplain inundation threat in this assessment refers to the flood zones mapped by the Federal Emergency Management Agency (FEMA). In coastal areas such as North Miami, FEMA flood zones represent flooding from both excessive rainfall as well as storm surge from severe storms.

FEMA flood zones are characterized primarily by how likely a certain level, or extent, of flooding is likely to recur or be exceeded over a time period. For example, the terms “100-year flood” or “1-percent annual exceedance probability (AEP) flood” are used to refer to a magnitude of a flood that has a greater than 1-percent chance of occurring or being exceeded in any given year. Put differently, a 100-year flood has a 26% chance of occurring over the course of 30 years or a 39.5% chance over the course of 50 years.

Survey Responses:
Have you or a family member’s home or neighborhood been affected by flooding in the past?

48%

of respondents said they or a family member have experienced flooding in the past

How Floodplain Inundation Was Assessed

The assessment uses the most recent floodway, wave action, 100-year floodplain, and 500-year floodplain in the Flood Insurance Rate Map (FIRM) developed by FEMA (NFHL 12086C; effective date 9/22/2009, LOMR 11/18/2020)⁶.

The assessment of floodplain inundation focused on identifying assets that have greater potential impact, such as critical assets (e.g., medical facilities) or where more people could be affected (e.g., apartment buildings). The assessment also considered how buildings would cope with flooding based on the year they were built and the Base Flood Elevation (BFE) requirement in place at the time they were built.

Assessment Factors

- ✓ Criticality of buildings in floodplain
- ✓ Floodplain development BFE requirements
- ✓ Likelihood of flooding (e.g., 100-year vs. 500-year flood risk)

Summary of Findings



CRITICAL SERVICES & COMMUNITY FACILITIES

South Central, North Central, Sans Souci

The majority of critical facilities and government-owned properties are east of the canal, 56% of which are highly vulnerable.



RESIDENTIAL & COMMERCIAL PROPERTY

South Central, North Central, Sans Souci, Keystone

There is widespread vulnerability to flooding: almost half, 49%, of residential properties and 58% of commercial and industrial properties are highly vulnerable city-wide.



ROADS & MOBILITY

North Central, South Central, Keystone

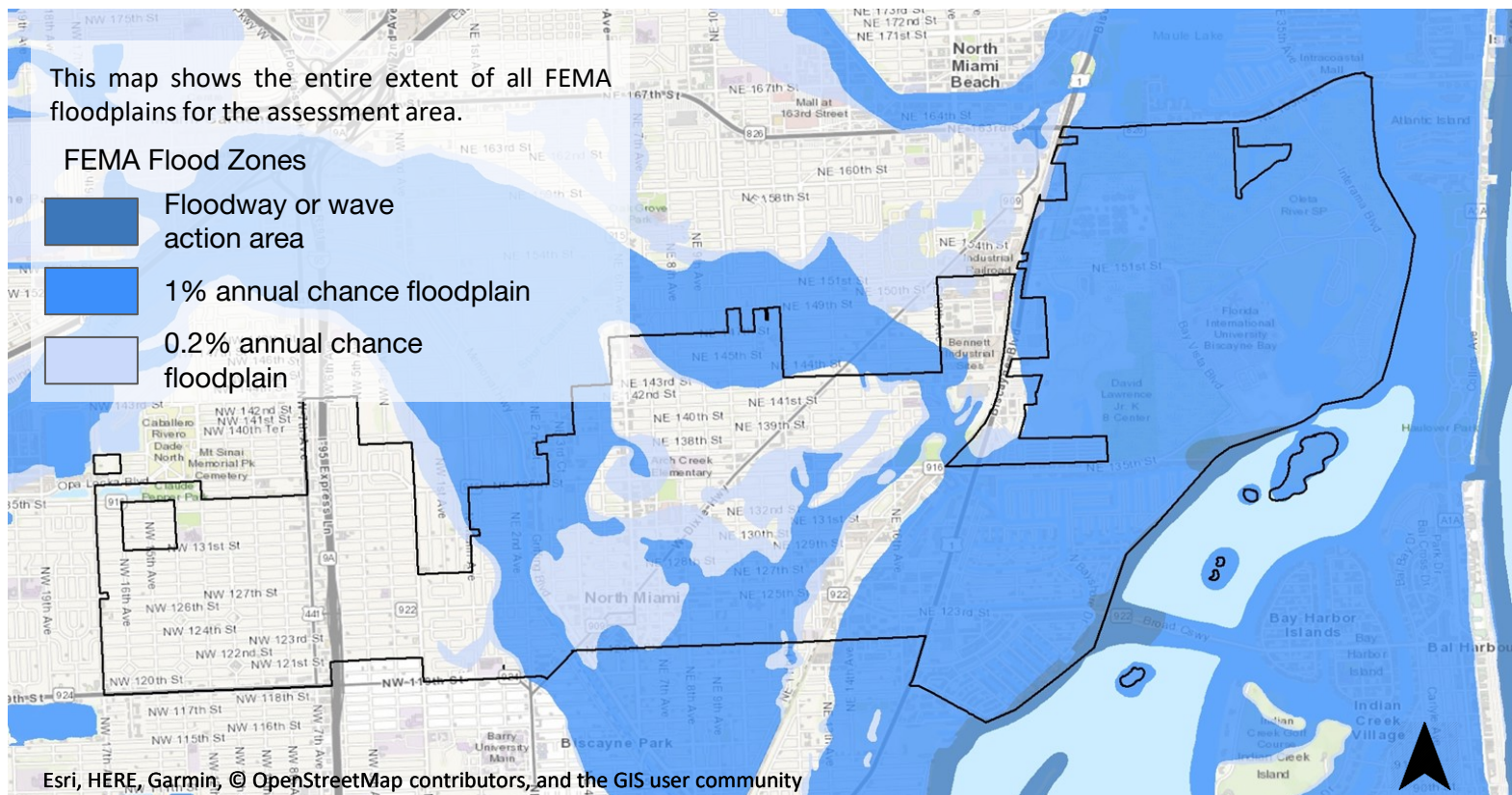
Widespread potential for inaccessibility and isolation in all neighborhoods east of the canal.



ECONOMIC FACTORS

South Central, Sans Souci

A large portion of the city's annual sales volume and jobs/employees are highly vulnerable: 89% and 91% respectively.





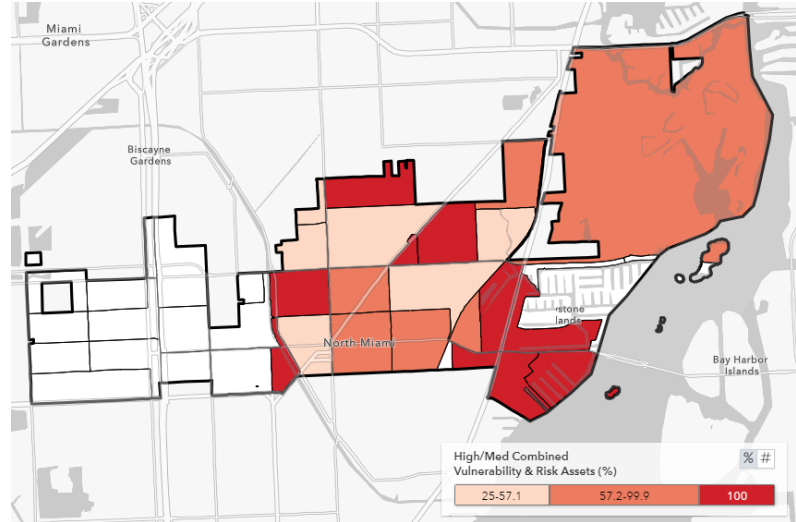
Floodplain Inundation Impacts on Critical Services & Community Facilities

South Central, North Central, Sans Souci

The majority of critical facilities and government-owned properties are east of the canal, 56% of which are highly vulnerable. The map at right shows the locations of concentrations of high vulnerability (red, bottom). Properties that provide critical services are highly vulnerable, including:

- 3 (60%) public safety properties (including fire and police)
- 22 (81%) schools
- 12 (67%) medical facility properties
- 2 (25%) utility properties

Critical Facilities & Government-Owned Properties

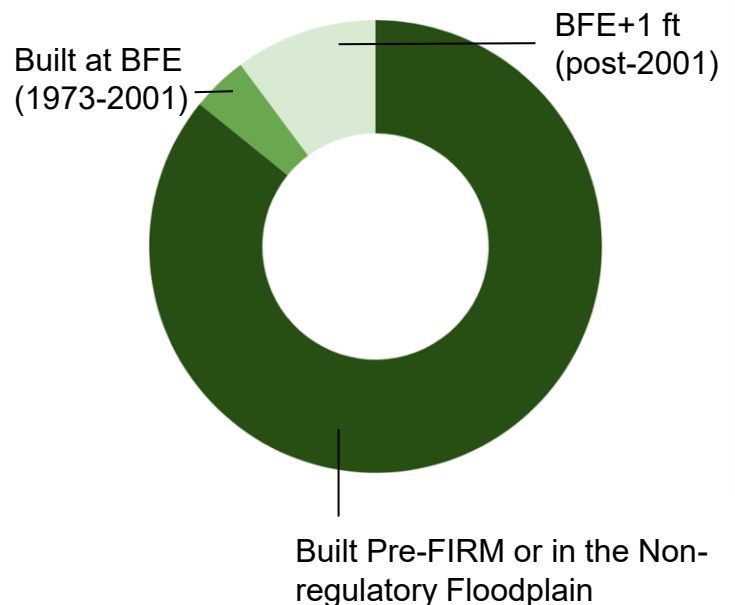


Floodplain Inundation Impacts on Residential & Commercial Properties

South Central, North Central, Sans Souci, Keystone

There is widespread vulnerability to flooding: almost half, 49%, of residential properties and 58% of commercial and industrial properties are highly vulnerable city-wide. Many properties (86%) were constructed pre-FIRM (or before flood insurance rate maps were in place) and before floodplain development requirements were in place (see dark green in graphic to the right). These properties have low adaptive capacity to flooding, which contributes to their high vulnerability.

Levels of Adaptive Capacity for Residential and Commercial Properties



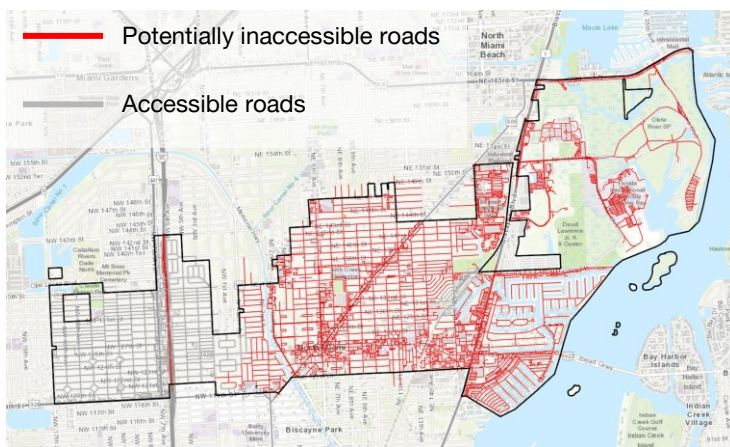


Floodplain Inundation Impacts on Roads & Mobility

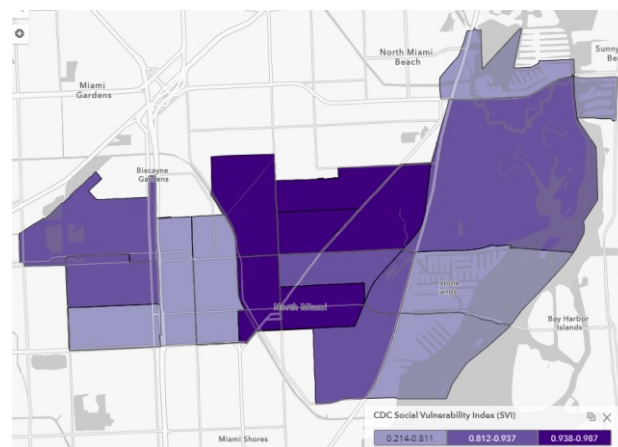
North Central, South Central, Keystone

Widespread inaccessibility and isolation in all neighborhoods east of the canal. City-wide about 71% of major roads and 74% of minor roads are inaccessible due to floodplain inundation. These include roads that provide access to emergency response and critical services. Some of the most socially vulnerable areas in the city also include the North and South Central neighborhoods, which can become completely isolated based on the floodplain extents. The maps below show roads potentially inaccessible (left) and census tracts with levels of social vulnerability (right).

Potentially Inaccessible Roads



CDC Social Vulnerability Index

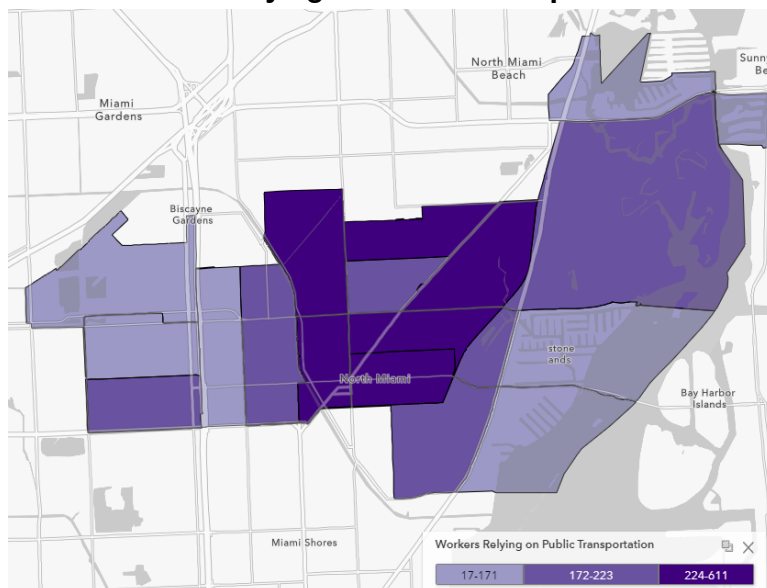


Floodplain Inundation Impacts on Economic Factors

South Central, Sans Souci

A large portion of the city's annual sales volume and jobs/employees are highly vulnerable: 89% and 91% respectively. These numbers are based on reported sales volume and number of employees at businesses where the properties have high or medium vulnerability and risk. These include only direct impact vulnerability; excluded are the amount of sales or jobs that may be associated with indirect impacts, such as business interruption, inaccessibility, and other impacts. The majority of these are located in the South Central neighborhood, where there is also a very large proportion of workers that rely on public transportation (map at right).

Workers Relying on Public Transportation



Storm Surge

Storm Surge Defined

Storm surge is flooding caused by an abnormal rise in tide from a severe storm (e.g., hurricane) over and above the usual, astronomical tide.

Storm surges arise when the wind and air pressure from a storm pushes the water toward the shore, leading to an increase in water level above the natural tide. The height of the storm surge depends on the intensity of the storm, how fast the storm is moving, the size of the storm, the direction it's coming from, and the shape of the shoreline. The height of the storm surge is added on top of the height of the tide; thus, a storm surge that occurs during a high tide will cause more flooding than one that occurs during a low tide. The sum of a storm surge and the astronomical tide is called a "storm tide."

Two of the highest storm tides recorded at the Virginia Key gage in Biscayne Bay- one of the closest NOAA gage to North Miami - was 3.63 feet about Mean Higher High Water (MHHW; i.e., multi-year average highest daily tide) during Hurricane Irma in 2017 and 2.55 feet above MHHW during Hurricane Wilma.

How Storm Surge Was Assessed

The assessment uses the National Storm Surge threat Maps Version 2 created by NOAA. This dataset is based on NOAA-National Hurricane Center's Sea, Lake, and Overland Surge from Hurricanes (SLOSH) Maximum of the Maximum Envelopes of Water (MOM) modeling product. This dataset represents the scale of potential "near worst case" flooding from a hypothetical "ideal" storm for each Saffir Simpson Storm Category.⁷ *This dataset represents a "worst-case" scenario of flooding resulting from an "ideal" storm that hits a region directly.*

Assessments of this threat at performed separately for relatively moderate storms of Category 1 and 2 and severe storms of Category 3, 4 and 5. The summary findings on subsequent pages are presented accordingly.

Like other inundation threats, vulnerability is based on assessing buildings in the inundation extents and criticality/use of the property (for potential impact), as well as the year the structures were built to determine which base flood elevation (BFE) applies to buildings on the properties (to determine adaptive capacity). This assumes that buildings built under more stringent BFE requirements will cope better to a storm surge event. Risk scoping analysis was based on storm category levels, with a lower category storm being relatively more likely, and maximum depth of flooding above ground.

Assessment Factors

- ✓ Criticality of buildings in inundation extent
- ✓ Floodplain development BFE requirements
- ✓ Storm category level (Cat 1–2, Cat 3–5)
- ✓ Potential depth of flooding above ground

Summary of Key Findings: Storm Surge | Moderate Storms (Cat 1-2)



CRITICAL SERVICES & COMMUNITY FACILITIES

Sans Souci, South Central

City-wide, 12% of critical facilities and government-owned properties are highly vulnerable, with a higher percentage exposed to this threat (28%).



RESIDENTIAL & COMMERCIAL PROPERTY

Sans Souci, Keystone, South Central

Several commercial properties along Biscayne Blvd and 135th St. corridor are highly vulnerable.



ROADS & MOBILITY

Sans Souci, Keystone, Northeast/FIU campus area

Neighborhoods east of Biscayne Blvd are the areas of the City that are most likely to be isolated during a moderate storm.



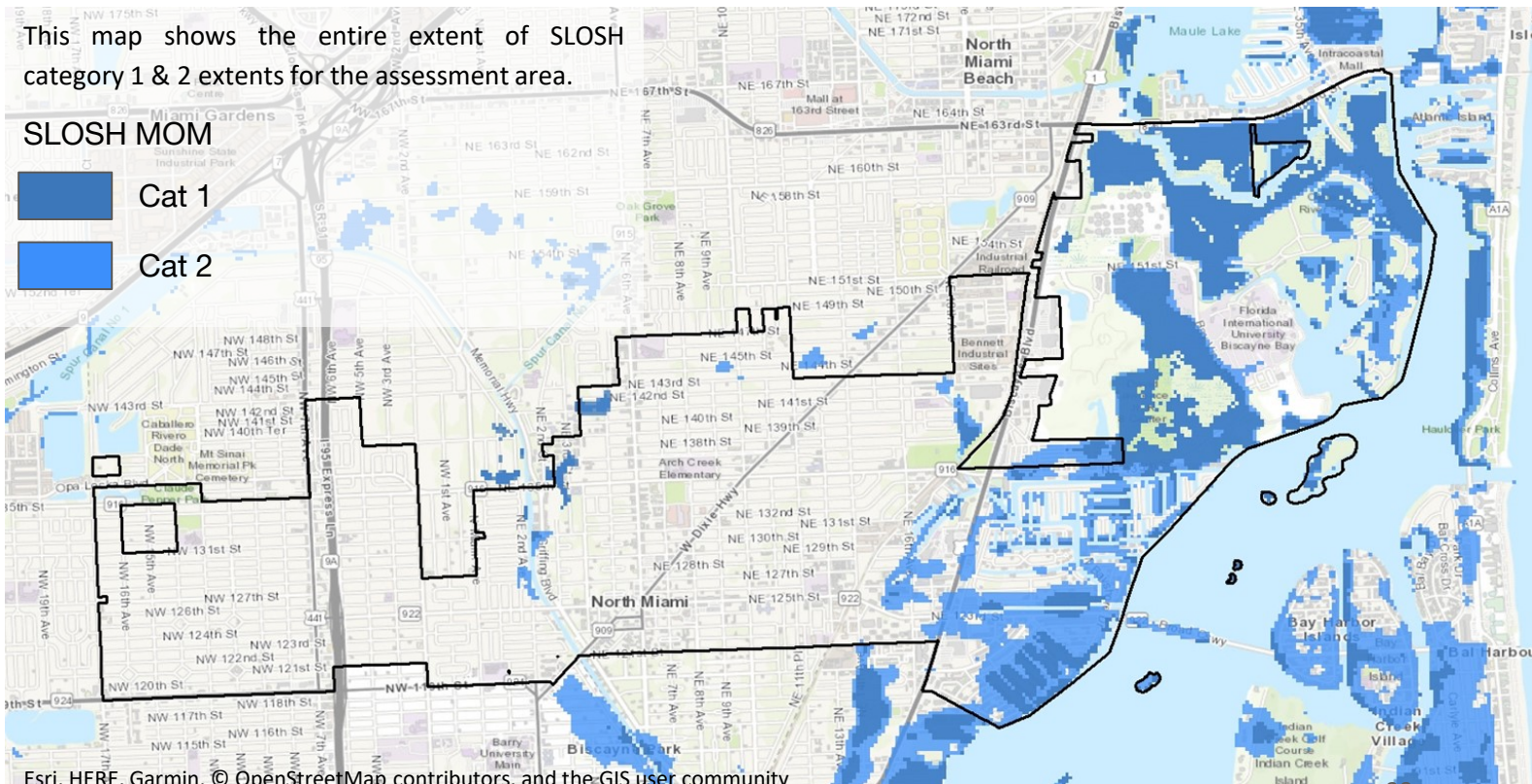
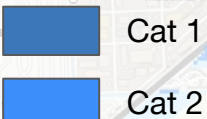
ECONOMIC FACTORS

South Central, Keystone

Sales volume and jobs are most impacted through the Biscayne Blvd commercial corridor, bordering the South Central and Keystone neighborhoods.

This map shows the entire extent of SLOSH category 1 & 2 extents for the assessment area.

SLOSH MOM





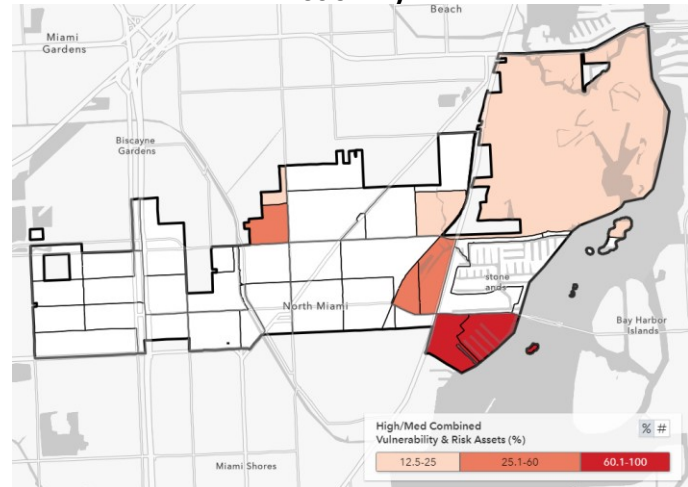
Moderate Storm Surge Impacts on Critical Services & Community Facilities

Sans Souci, South Central

City-wide, 12% of critical facilities and government-owned properties are highly vulnerable. When considering exposure alone, this number jumps to 28%. The maps at right shows highly vulnerable critical facilities and government owned properties throughout the city. The facilities that have the highest vulnerability and risk are those that have:

- High potential impact, meaning the structure is in the inundation extent and the property is a fire station, food pantry, medical facility, police station, school, or SNAP retailer;
- Low adaptive capacity, or were built before building BFE regulations were in place;
- High risk probability and risk consequence (higher potential flood depth).

Critical Facilities & Government-Owned Properties (high vulnerability, storm surge cat 1-2)

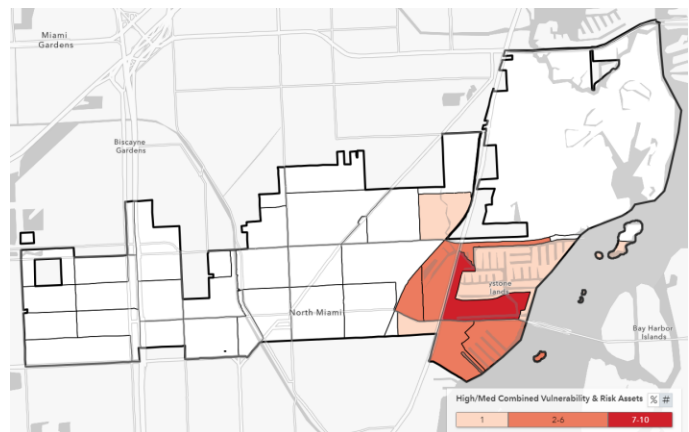


Moderate Storm Surge Impacts on Residential & Commercial Properties

Sans Souci, Keystone, South Central

Several commercial properties along Biscayne Boulevard are highly vulnerable. Out of the 58 commercial and industrial properties on the the map at right, 20 (34%) of them are highly vulnerable to a moderate storm surge. City-wide, about 6% of commercial and industrial properties are highly vulnerable. A larger number of residential properties, 11%, are highly vulnerable to a moderate storm surge throughout the San Souci/Keystone neighborhood areas and along the 135th St. corridor.

Commercial & Industrial Properties (count of high vulnerability, storm surge cat 1-2)



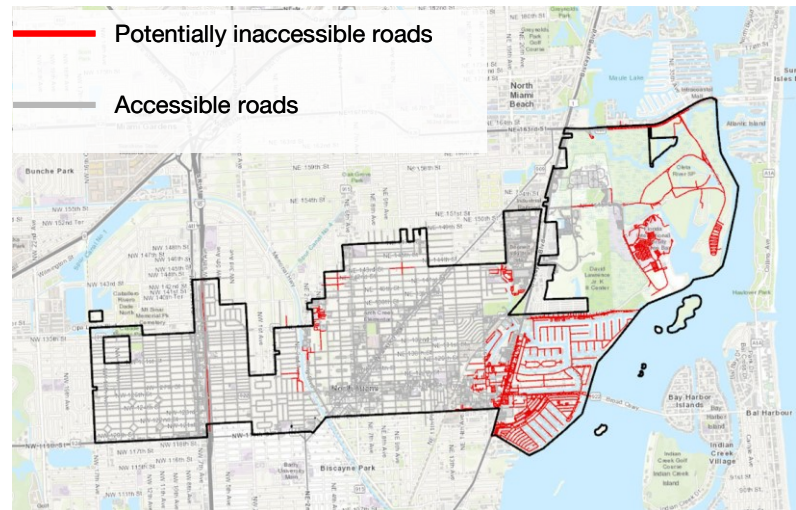


Moderate Storm Surge Impacts on Roads & Mobility

Sans Souci, Keystone, Northeast/FIU campus area

Neighborhoods east of Biscayne Blvd are the areas of the City that are most likely to be isolated during a moderate storm. City-wide about 20% of major roads and 21% of minor roads are inaccessible due to surge from a category 1-2 storm. These include roads that provide access to emergency response and critical services, such as hospitals. Although the issue of isolation is centered around these neighborhoods, there are small pockets of isolation inland as well, seen in the map at right.

Potentially Inaccessible Roads

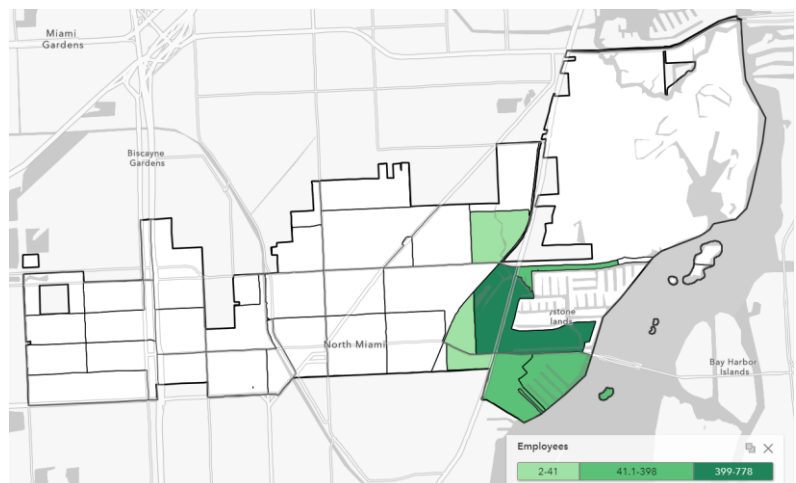


Moderate Storm Surge Impacts on Economic Factors

South Central, Keystone

Sales volume and jobs are most impacted through the Biscayne Blvd commercial corridor, bordering the South Central and Keystone neighborhoods. Sales volume and employees include only direct impact vulnerability; excluded are the amount of sales or jobs that may be associated with indirect impacts, such as business interruption, inaccessibility, and other impacts. The highest concentration of employees affected by moderate storm surge is along Biscayne Blvd and is represented by the dark green areas on the map at right.

Employees affected by moderate storm surge



Summary of Key Findings: Storm Surge | Major Storms (Cat 3-5)



CRITICAL SERVICES & COMMUNITY FACILITIES

South Central, Northeast/FIU campus area, Keystone

Four out of five community centers are highly vulnerable to major storm surge, two of which were built before any BFE requirements were established.



RESIDENTIAL & COMMERCIAL PROPERTY

South Central, Sans Souci, Keystone, Northeast/FIU campus area

Of the City's highly vulnerable residential properties, 20% of them are in the South Central neighborhood.



ROADS & MOBILITY

North Central, South Central, Keystone

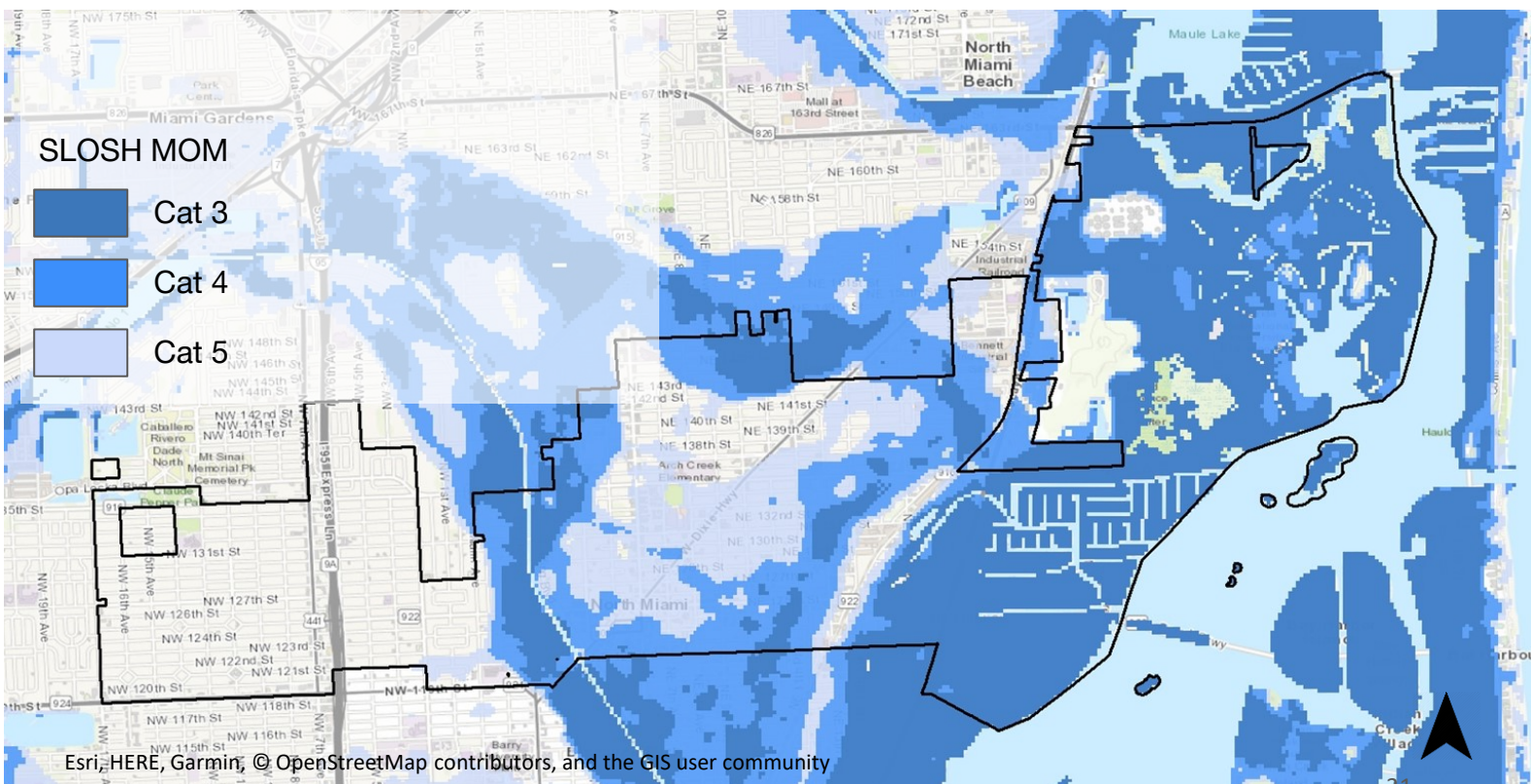
Widespread inaccessibility east of N Miami Ave, with the largest concentrations of exposed assets in the North Central and Keystone neighborhoods.



ECONOMIC FACTORS

South Central, Sans Souci, Keystone

Both employees and sales volume are affected east of the canal, with concentrations highly impacted in South Central, Keystone, and Sans Souci.





Major Storm Surge Impacts on Critical Services & Community Facilities

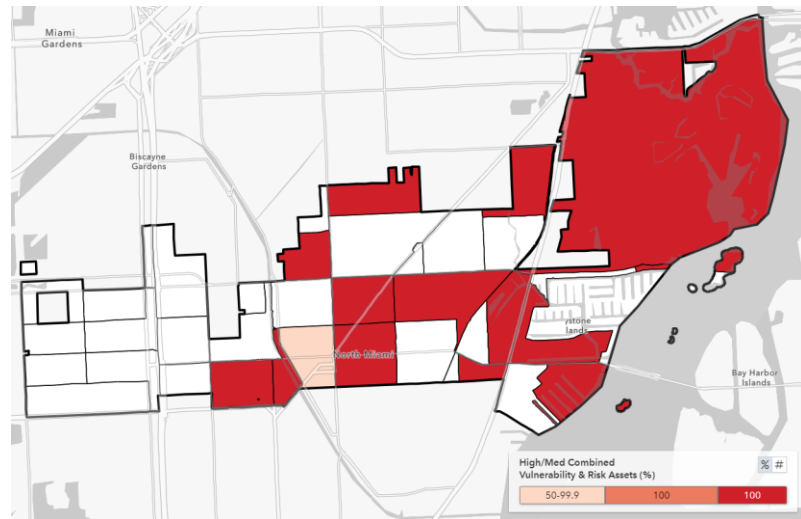
South Central, Northeast/FIU campus area, Keystone

Four out of five community centers are highly vulnerable to major storm surge, two of which were built before any BFE requirements were established. The map at right shows community facilities, such as parks, cultural properties (including community centers), and entertainment properties. The darkest red block groups are those that are most vulnerable.

Other critical services are highly vulnerable, including:

- 4 (80%) public safety properties (including fire and police)
- 22 (81%) schools
- 12 (67%) medical facility properties
- 5 (62%) energy and utility properties

Parks, Cultural, & Entertainment properties

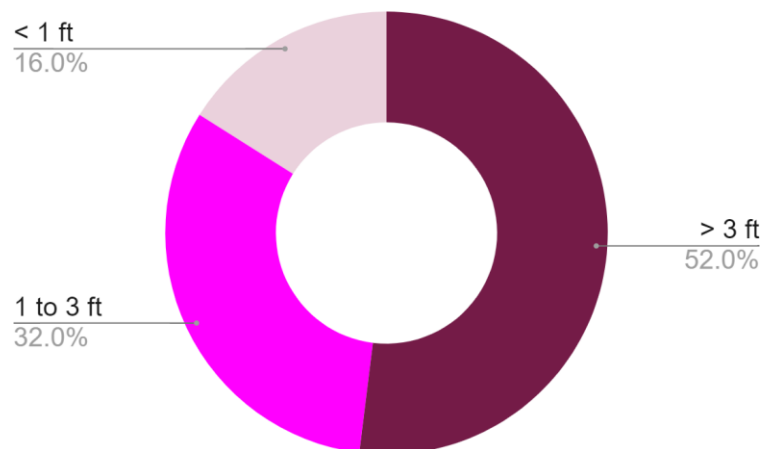


Major Storm Surge Impacts on Residential & Commercial Properties

South Central, Sans Souci, Keystone, Northeast/FIU campus area

Residential and commercial properties have high levels of vulnerable and risk to major storm surge. Of the City's highly vulnerable residential properties, 20% of them are in the South Central neighborhood. Residential and commercial properties have a high percentage of vulnerable properties (57% and 68%, respectively). While the majority of buildings in the City, 86%, were built before any BFE requirements were established, levels of risk consequence are also especially high due to the potential depth of flooding. As the graphic shows to the right, more than half (52%) of the properties exposed to major storm surge have a potential flood depth of more than 3 feet (see dark purple).

Potential Flood Depth for Residential and Commercial Properties



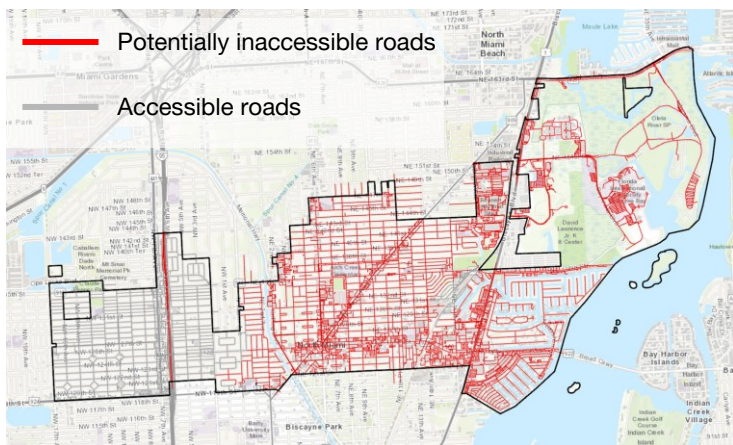


Major Storm Surge Impacts on Roads & Mobility

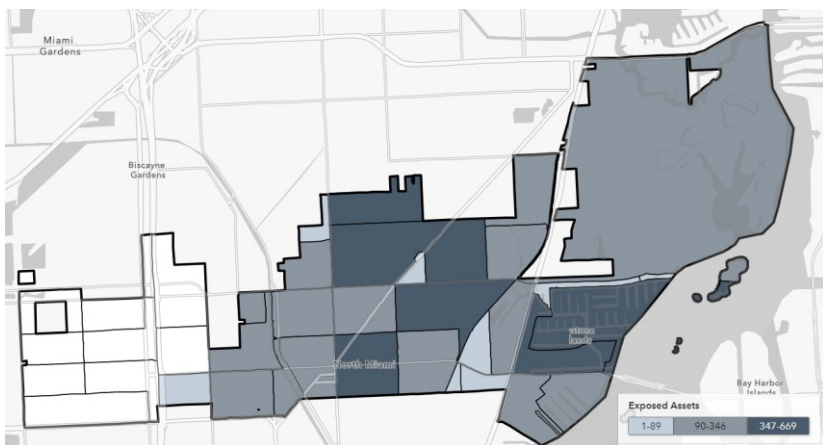
North Central, South Central, Keystone

Widespread inaccessibility east of N Miami Ave, with the largest concentrations of exposed assets in the North Central and Keystone neighborhoods. City-wide about 76% of major roads and 81% of minor roads are inaccessible due to surge from a major storm (category 3-5). All of the inaccessible roads are east of North Miami Ave (below left). There are large concentrations of potentially inaccessible property in the North and South Central neighborhoods, as well as Keystone (below right)

Potentially Inaccessible Roads



Potentially Inaccessible Property

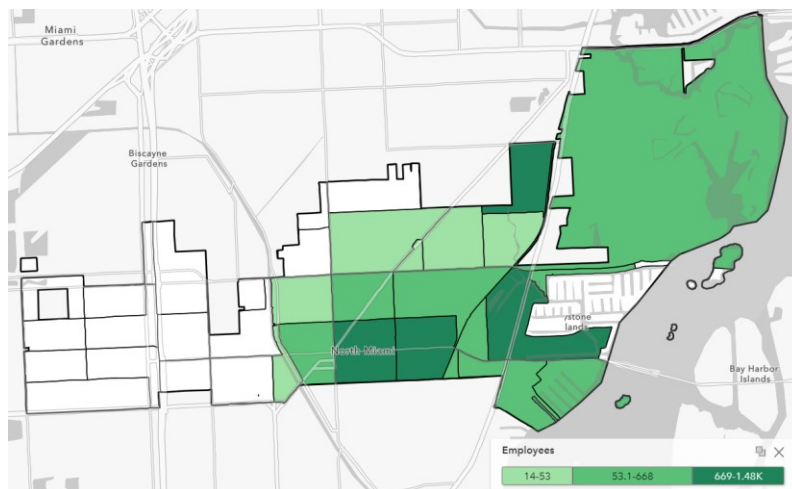


Major Storm Surge Impacts on Economic Factors

South Central, Sans Souci, Keystone

Both employees and sales volume are affected east of the canal, with concentrations highly impacted in South Central, Keystone, and Sans Souci. The map at right shows total employees affected by a major storm. City-wide, over 90% of jobs and annual sales volume in the City are associated with highly vulnerable business locations. These numbers are based on reported sales volume and number of employees at businesses where the properties have high or medium vulnerability and risk. These include only direct impact vulnerability; excluded are the amount of sales or jobs that may be associated with indirect impacts, such as business interruption, inaccessibility, and other economic impacts.

Employees Affected by Storm Surge (Cat 3-5)



High Tide Flooding & Sea Level Rise

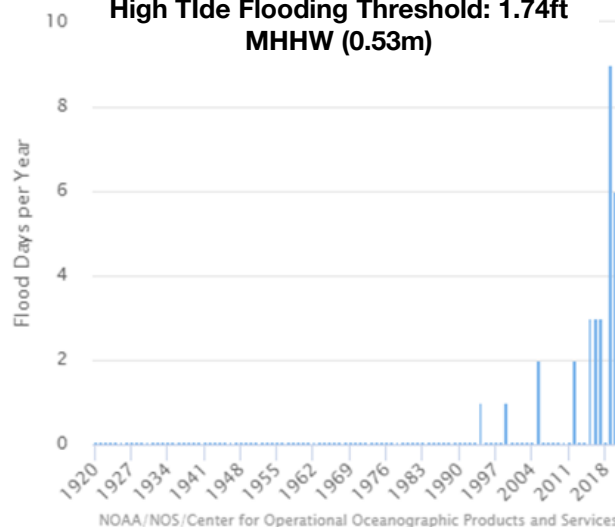
High Tide Flooding and Sea Level Rise Defined

High Tide flooding is flooding of the low-lying land during a high tide that is not associated with a severe storm. Flooding from seasonal high tides is also referred to as “king tide,” or “sunny day” flooding. High tide flooding has increased largely due to climate-related rise in average sea levels relative to the land.

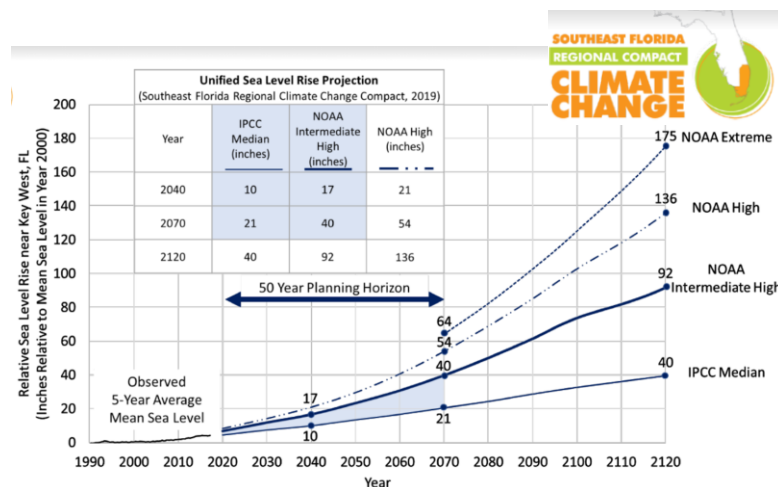
The height of a daily tide varies seasonally and from year to year, depending on the relative position of the Earth, the sun, and the moon (i.e., astronomical factors), local wind conditions, ocean and wind currents, and changes in ocean circulation (such as El Niño/La Niña). While the local tides vary daily, seasonally, and from year to year, the average of all measurements over a specified time period is called *mean sea level*.

At the Virginia Key gauge in Biscayne Bay, the mean sea level rose 2.97 mm/year between 1930 and 2020, which is equivalent to a change of 0.97 feet in 100 years.⁸ With a higher mean sea level, high tides are occurring more frequently and reaching farther. The change is evident in the figure on the right, which shows the number of days that tides have been higher than 1.74 feet above the average daily higher tide (or *Mean Higher High Water*)⁹. The threshold of 1.74 feet above Mean Higher High Water (MHHW) is established by NOAA’s National Ocean Services (NOS) as the high tide flooding threshold where impacts begin to be felt in low-lying areas.¹⁰

Virginia Key, FL Tide Gauge #8723214
High Tide Flooding Threshold: 1.74ft
MHHW (0.53m)



A scenario approach is generally used to understand and plan for the increase in severity and frequency of tidal flooding due to sea level rise (SLR). Scenarios of global mean SLR are translated to regional scenarios by accounting for factors such as vertical land movement or ocean currents such as the Gulf Stream that also affect local sea levels. The Southeast Florida Regional Climate Change Compact (“the Compact”) provides periodically updated SLR projections for the region. The figure on the right shows the 2019 Unified Sea Level Rise Projection for multiple scenarios developed by the Compact.¹¹



How High Tide Flooding and Sea Level Rise was Assessed

To assess the threat from sea level rise in coastal communities, sea level changes of different thresholds are mapped on top of current tidal datums—such as mean sea level, mean higher high water, etc.—to map the extent of flooding. This assessment uses NOAA National Ocean Service dataset of flooding extents for up to 10 feet of water level above Mean Higher High Water that were mapped using a ‘modified bathtub approach’.⁹ For this assessment, three of these extents were selected and a water level approach was used to interpret these thresholds.

A water level approach recognizes that the extent of inundation for a given sea level rise threshold will be experienced decades earlier as periodic high tide flooding events. So, flooding mapped for a single threshold can indicate both, the initial threat from tidal flooding as well as the threat of near-permanent inundation over time. The graphic on the right below illustrates this for the threshold of 3 ft above *current* Mean Higher High Water (3ft+MHHW): Under the NOAA Intermediate-High scenario, this level of water will be experienced as high tides about every other day. In addition, this same level of water will also be observed as a high tide (a 2ft tide) a few times a year as early as 2030 with about 1 foot of SLR projected to occur by then under the NOAA Intermediate-High scenario.

The graphic on the right illustrates this for the threshold of 3 ft above *current* Mean Higher High Water (3ft+MHHW): Under the NOAA Intermediate-High scenario, this level of water will be experienced as high tides about every other day. In addition, this same level of water will also be observed as a high tide (a 2ft tide) a few times a year as early as 2030 with about 1 foot of SLR projected to occur by then under the NOAA Intermediate-High scenario.

E.g. Water Level of 3ft above MHHW



Based on discussions in the working group which took into account the Compact’s guidance, the assessment focuses on two time periods: 1) near-term/ 2030-2040s and 2) mid-term/ 2050s. Three water levels of 2, 3 and 4 ft above MHHW were chosen to assess the high tide flooding and persistent inundation vulnerability for these time periods. Together, these three water levels can be used to understand the increase in severity (area affected) of high tide flooding in the future and the threat of near-permanent inundation for five scenarios relevant to North Miami (as shown in the table below).

Water Level	2ft + MHHW	3ft + MHHW	4ft + MHHW
Persistent Inundation	2050 (NOAA Int-High)	2070 (NOAA Int-High)	
High Tide (2ft above MHHW)	Current High Tide Flooding ~ NOAA-NOS HTF Threshold	2030 (NOAA Int-High) 2040 (IPCC-Median) +1ft of SLR	2050 (NOAA Int-High) +2ft of SLR

How High Tide Flooding and Sea Level Rise was Assessed (Continued)

It is important to note that these modeled extents do not consider factors such as potential change in coastal geomorphology and account for limited hydrologic connectivity. They however provide a screening-level view useful for strategic planning purposes. Also note that the assessment considers surface flooding from seawater moving inland along the coast or up and out of the canals. Additional flooding impacts such as, back-flows from storm drains at high tides are not modeled for this study.

The assessment of tidal flooding focused on identifying assets that have greater potential impact to current high tide levels. Higher potential impact was considered for more critical assets (e.g., major medical facilities) or where more people could be affected (e.g., apartment buildings). Similar to the floodplain inundation assessment, the tidal flooding assessment considered how adaptive buildings are based on the year they were built and the Base Flood Elevation (BFE) requirement in place at the time they were built. Based on current tidal flooding levels, it is important to note that while fewer properties and roads may be in harm's way compared to the major flood inundation extents; however, these tidal flooding events happen more frequently (nearly three times per year, on average, but ranging between 0 and 9 times over the last 10 years). Greater consequences also may be associated with more persistent tidal flooding.

Summary of Key Findings: High Tide Flooding & Sea Level Rise



CRITICAL SERVICES & COMMUNITY FACILITIES

FIU Campus area South Central, Keystone, Sans Souci

Overland flooding from periodic high tides (i.e., a 2ft tide) currently impacts the northeastern corner of the city/FIU campus. Over the next 30 years, with a projected SLR of 2ft, several coastal properties such as schools and medical facilities will be impacted.



RESIDENTIAL & COMMERCIAL PROPERTY

Keystone, South Central, NE 135th St

With a foot of SLR, overland flooding from periodic high tides may impact about 12% of coastal residential properties, increasing to 42% for coastal properties and about 11% of inland properties along the canal in the next 30 years with projected SLR of 2 feet.



ROADS & MOBILITY

Keystone, Sans Souci, Between Memorial Hwy & I-95

Over the next 30 years, with a projected SLR of 2ft, both coastal and inland roads may become inaccessible.



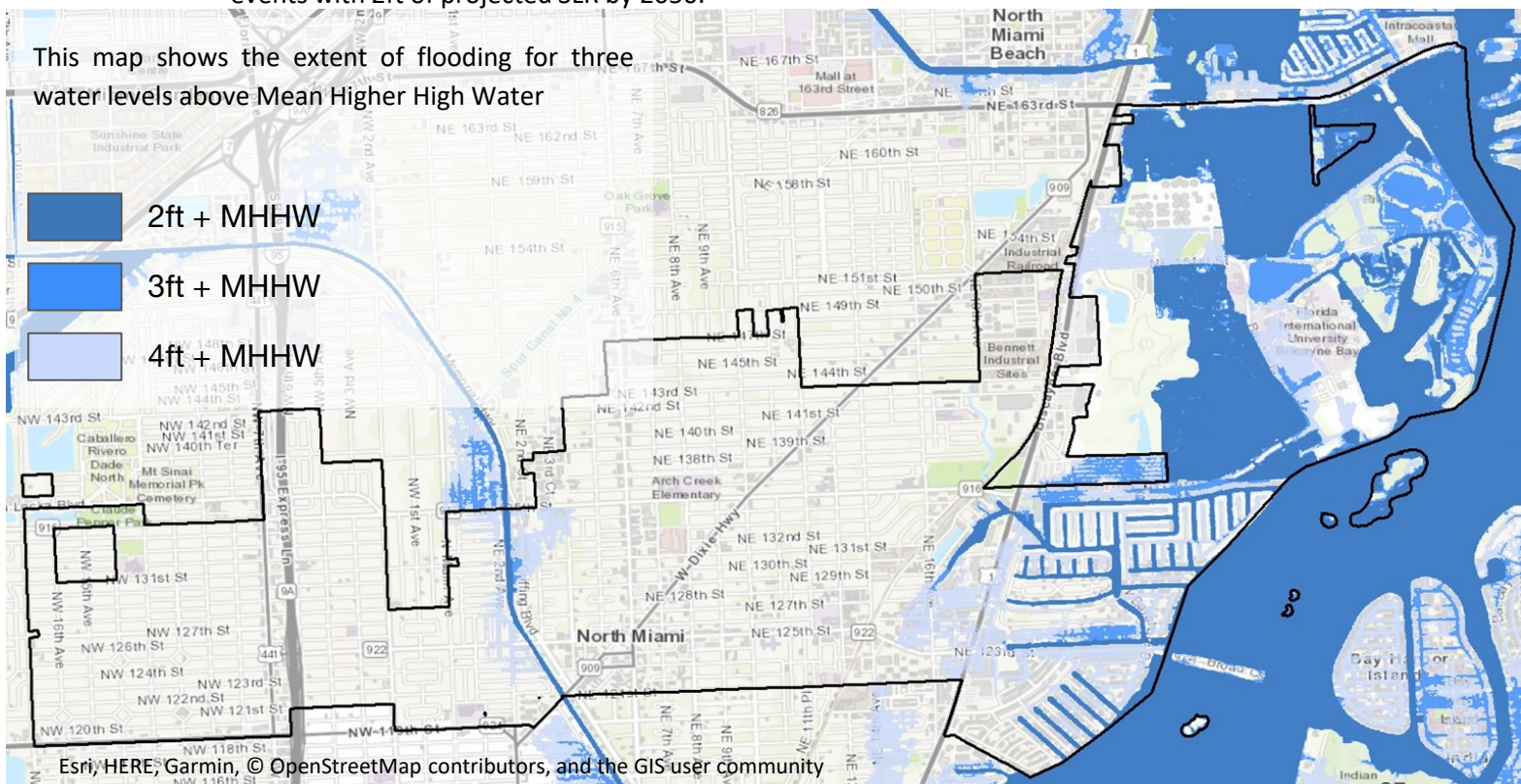
ECONOMIC FACTORS

South Central, Sans Souci, Keystone

The commercial corridor along Biscayne Blvd will see significant impacts during periodic tidal flooding events with 2ft of projected SLR by 2050.

This map shows the extent of flooding for three water levels above Mean Higher High Water

- 2ft + MHHW
- 3ft + MHHW
- 4ft + MHHW





High Tide Flooding & SLR Impacts on Critical Services & Community Facilities

FIU campus, South Central, Keystone, Sans Souci

Overland flooding from periodic high tides (i.e., a 2ft tide) currently impacts the northeastern corner of the city/FIU campus. Over the next 30 years, with a projected SLR of 2ft, there is a many critical facilities such as schools and medical facilities will be impacted by periodic high tide flooding. The table below shows the increase in vulnerabilities over time.

Theme and Asset	Asset Total	Tidal Flooding and SLR (vulnerability)		
		2 ft + MHWW	3 ft + MHWW	4 ft + MHWW
Critical Services & Community Facilities				
Critical Facilities & Govt-Owned	137	1 (1%)	2 (1%)	17 (12%)
Parks, Cultural, & Entertainment	53	NA	2 (4%)	7 (13%)



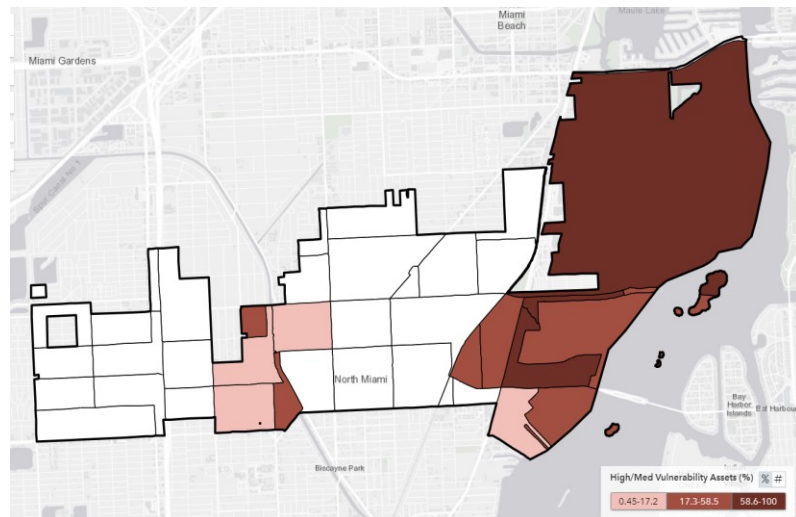
High Tide Flooding & SLR Impacts on Residential & Commercial Properties

Keystone, South Central, NE 135th St

With a foot of SLR, overland flooding from periodic high tides could impact about 12% of coastal residential properties, increasing to 42% for coastal properties and about 11% of inland properties along the canal in the next 30 years with projected SLR of 2 feet.

Note that while this assessment only takes into account direct above-ground flooding, high tides also result in storm drain backflows that can affect areas of the City that are not directly along the canal or the coast.

Residential Property vulnerable to 2050 high tide flooding with 2ft of SLR



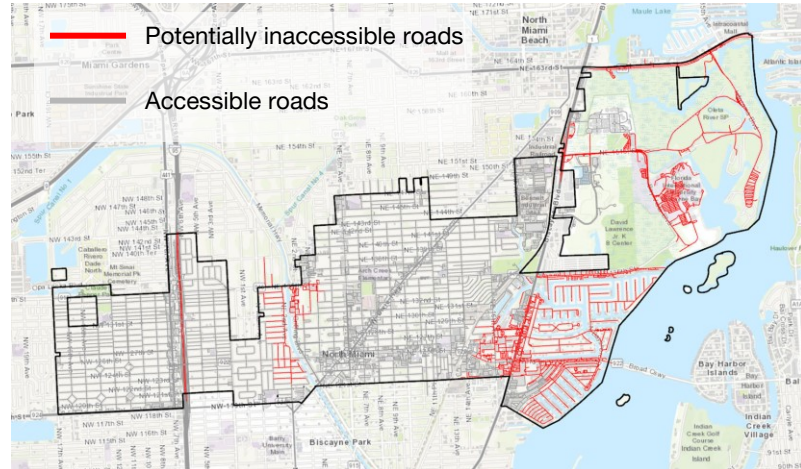


High Tide Flooding & Sea Level Rise Impacts on Roads & Mobility

Keystone, Sans Souci, Between Memorial Hwy & I-95

Over the next 30 years, with a projected SLR of 2ft, both coastal and inland roads may become inaccessible. With a foot of SLR, less than 1% of properties are inaccessible. Over the next 30 years, with a projected SLR of 2ft, this number increases to 13%. This includes coastal areas such as Keystone and Sans Souci, as well as inland areas around the canal, as seen in the map at right.

Potentially Inaccessible Roads

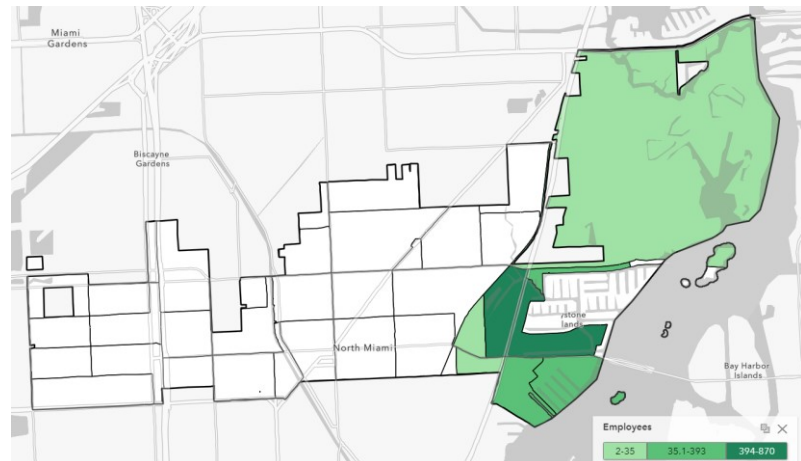


High Tide Flooding & Sea Level Rise Impacts on Economic Factors

South Central, Sans Souci, Keystone

The commercial corridor along Biscayne Blvd will see significant impacts during periodic tidal flooding events with 2ft of projected SLR by 2050. The map at right shows total employees affected by a projected SLR of 2ft. City-wide, about 29% of jobs in the City are associated with business locations highly vulnerable to this SLR scenario. These numbers are based on the number of employees at businesses where the properties have high or medium vulnerability and risk. These include only direct impact vulnerability; excluded are the amount of jobs that may be associated with indirect impacts, such as business interruption, inaccessibility, and other economic impacts.

Employees Affected by Tidal Flooding & SLR (+4ft MHHW)



Extreme Heat

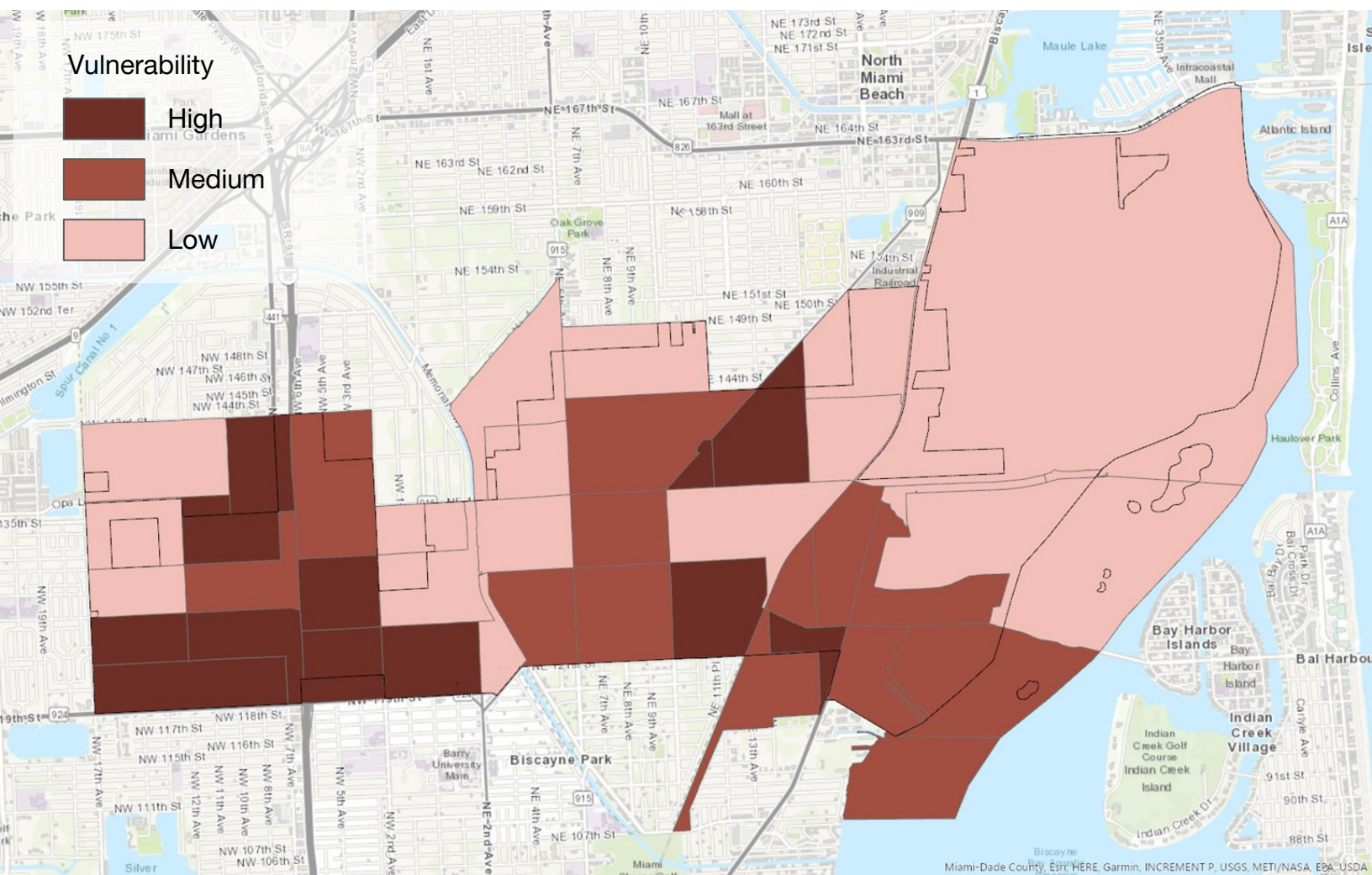
Summary of Findings

Highly vulnerable areas occur throughout the City. The southwest section of the City and areas along the highway through the center of the city are some of the most vulnerable areas, which are highlighted in dark red in the map below. These areas have relatively high developed land cover, high concentrations of heat-sensitive lower-income populations, and low tree canopy coverage.

Public Survey Responses:

Are there any particular locations in North Miami that you feel would benefit the community with additional shading with trees and canopies?

- West 441 corridor
- All of 135th street
- West of N. Miami Ave.
- The area around City Hall
- All bus stops
- Along or around NW 7th Ave and I-95



Extreme Heat

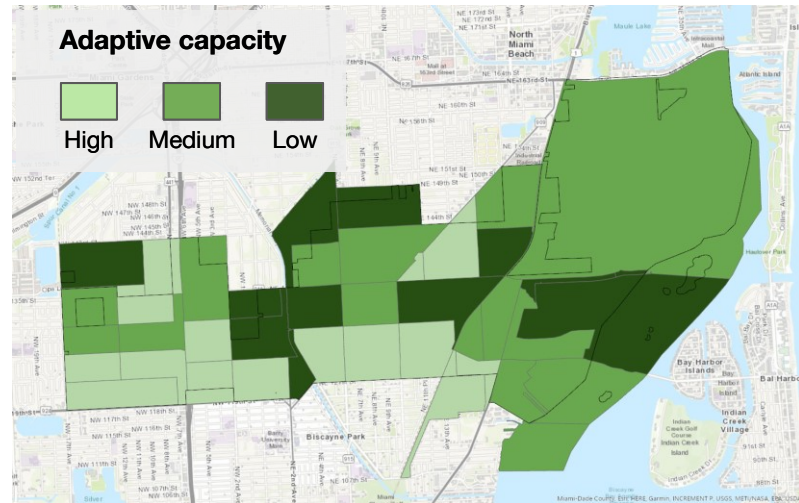
Summary of Findings

Areas of the City that have the highest vulnerability also have the lowest adaptive capacity. Assessing adaptive capacity in extreme heat is the combination of median household income and percent tree canopy cover. These are the areas of the city where the ability to cope with extreme heat may be most difficult, as a result of household or environmental capacity. In the map on the right, the block groups with the lowest adaptive capacity are in dark green. These areas have relatively low median household income and low tree canopy cover.

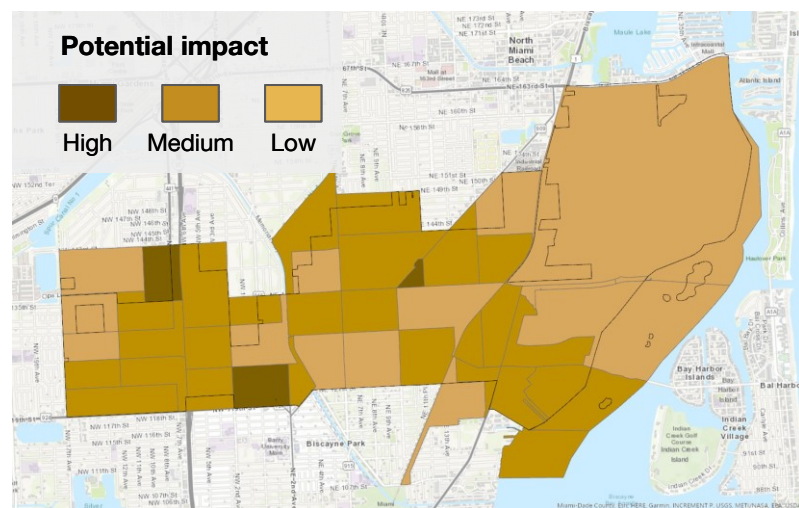
Potential Impact is a combination of sensitive age groups and percent impervious surfaces, with the result being high potential impact where both amounts of sensitive individuals and percent impervious surfaces are high. Areas with high potential impact are dark yellow on the map at right. These are areas where there are the largest number of households with members younger than 18 and older than 65 and the percent of impervious surfaces is very high, which is considered as areas that would be greatly impacted by extreme heat events.

The methodology for assessing Extreme Heat is detailed on the following page.

Extreme Heat Adaptive Capacity



Extreme Heat Potential Impact



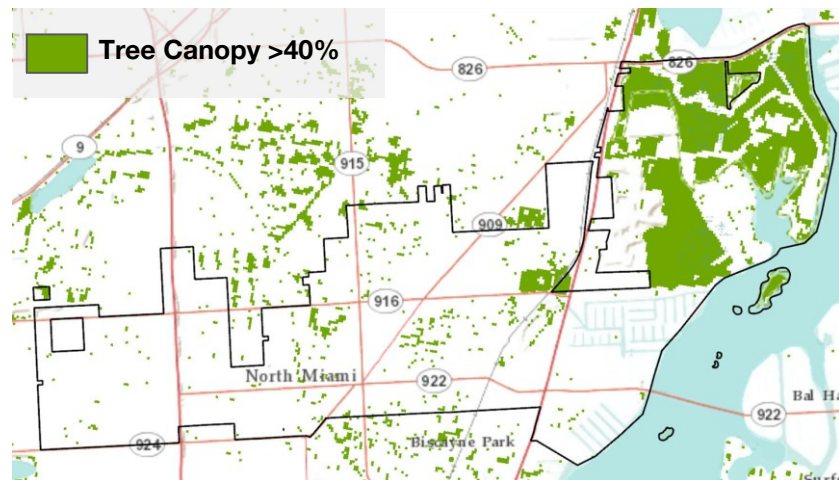
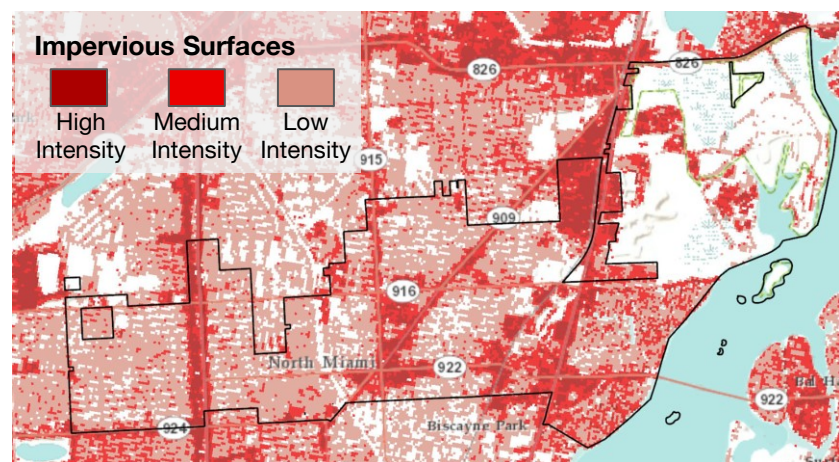
Extreme Heat Defined

How Extreme Heat Was Assessed

Using the urban heat island concept, the extreme heat assessment is conducted at the neighborhood scale to provide screening-level information about relative urban heat vulnerability.

For the purpose of this assessment, households with members over 65 years of age and younger than 18 years are recognized as populations that are physiologically more sensitive to heat events (i.e., 'sensitive individuals'). Relative heat vulnerability in a neighborhood (i.e., a block group) is calculated as a combination of 1) potential impact which considers how sensitive individuals may be potentially impacted by high percentages of impervious surface/developed land cover (map, top right) contributes to urban heat island effect and 2) adaptive capacity which considers the cooling effect of dense tree canopy (map, bottom right) and the median income as an indicator of ability to afford household cooling and medical services (if necessary).

Note that designations of high/medium/low adaptive capacity, potential impact, and vulnerability are calculated relative to the other areas of the City. As an example, a neighborhood may not have substantial tree canopy in general or absolute terms, but if it is higher compared to other neighborhoods in the city (i.e., in the top 25th percentile), then it will be assigned a 'High' adaptive capacity score.



The American Community Survey 5-year dataset (2018) was used to obtain information about sensitive individuals and median income for block groups within North Miami. The developed land cover data is derived from the the U.S. National Land Cover Dataset (NLCD; 2016). The tree canopy dataset is provided by the U.S. Forest Service (USFS) Geospatial Technology and Applications Center (GTAC).

Key Vulnerabilities Identified

The assessment highlighted the following Key Vulnerabilities to the people and assets of North Miami. This list provides findings that were discussed during the working group meetings, rather than an exhaustive summary of all climate-related vulnerabilities.

Widespread vulnerabilities from extreme flooding. This vulnerability to residential and commercial properties are indicated by two threat assessments, including storm surge (due to a direct hit from Category 3-5 event) and floodplain inundation (from 100- and 500-year flood events). This vulnerability is driven by a significant portion of the City being located in the floodplain, older construction in the regulatory floodplain, and construction outside the regulatory floodplain that has potential for flooding. Additionally, the potential for widespread road inaccessibility that could cause significant temporary disruptions for emergency services is a result of severe flooding. Worst-case surge from a Category 3 or higher storm could leave most of the City east of I-95 temporarily inaccessible, including several areas that would remain dry but could still be inaccessible to emergency response services.

As sea level continues to rise, so will the city's risk of high tide flooding. Over the next ten years, with a foot of sea level rise (SLR), overland flooding from periodic high tides (i.e., a 2 feet tide) may impact about 12% of coastal residential properties. This number rises to 42% for coastal properties and about 11% of inland properties along the canal in the next 30 years with projected SLR of 2 feet. Note that the assessment considers surface flooding from seawater moving inland along the coast or up and out of the canals. Additional flooding impacts are likely from back-flows from storm drains but is not modeled for this study. The commercial corridor along Biscayne Boulevard will also see significant impacts during periodic tidal flooding events with 2 feet of projected SLR by 2050. By 2050, most roads and properties in the Keystone and Sans Souci areas may be temporarily inaccessible several times a year during annual high tide events.

Critical facilities and community resources are vulnerable and could result in cascading impacts. The City Hall building is in the 100-year floodplain and is an older structure built before floodplains were mapped, making it highly vulnerable to a major flooding event. In addition, four out of five community centers are highly vulnerable to floodplain inundation and storm surge from a Category 3-5 hurricane.

Many non-city owned facilities that provide critical services to the community are highly vulnerable to major flooding. Almost all medical facilities are highly vulnerable to floodplain inundation and all but two are highly vulnerable to surge from a major storm (Category 3-5 event) during which many of the facilities are potentially exposed to flood depths of 3 feet or greater (near worst-case storm surge). Out of 28 school buildings, 25 are highly vulnerable to floodplain inundation, many of which were built before floodplains were mapped and are assumed to be built below the base flood elevation.

Extreme heat vulnerability is widespread throughout the City. This is both due to environmental factors of highly developed landscape and low tree canopy cover in most areas of the city combined with socioeconomically-driven low capacity of individuals and households to cope with heat-related impacts.

Section 4: Strategies & Actions for Building Resilience

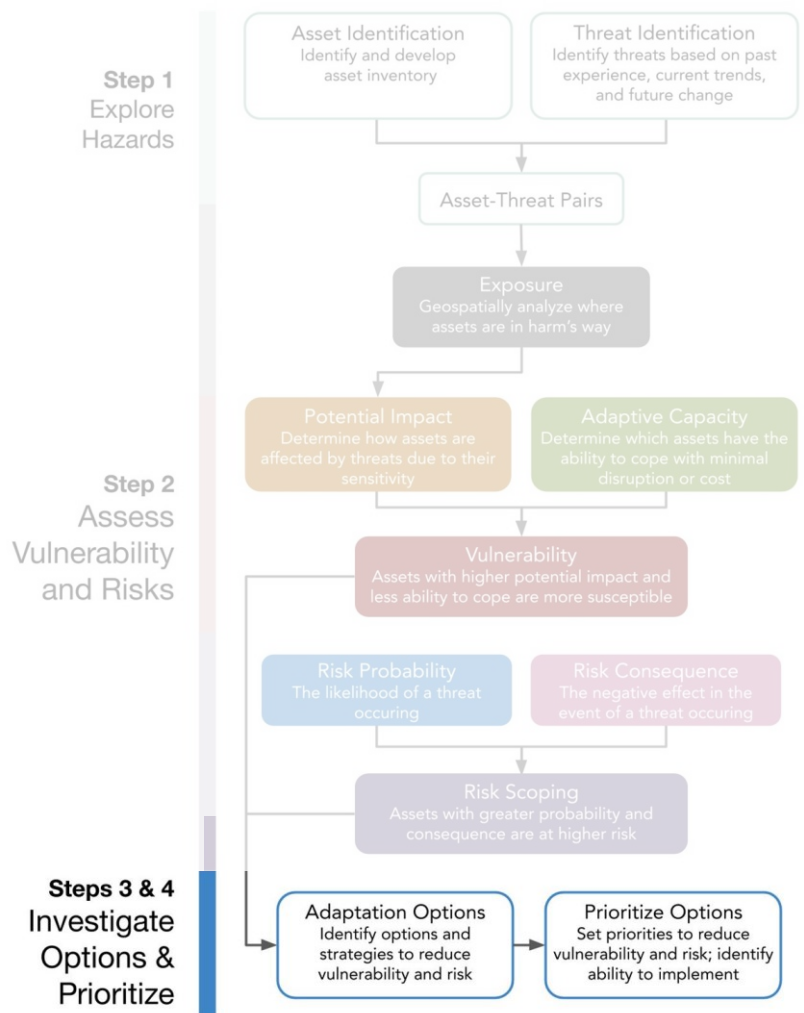
This section focuses on the process used by the project team to identifying potential adaptation strategies for three focus areas:

1. Vulnerability of residential and commercial properties to major flooding
2. Widespread vulnerability to extreme heat
3. Increasing tidal flooding risk

Identifying Options to Reduce Vulnerability and Risk

The assessment highlights how and where the community assets are vulnerable and at risk to a range of threats. However, it's important to keep in mind that the Steps to Resilience process is a solutions-oriented framework. In fact, the purpose of the vulnerability and risk assessment is to provide a foundation for the development and implementation of resilience strategies and, while recognizing issues the city faces, to also recognize opportunities. It is also important to recognize the process—from assessment of vulnerability and risk to the development of strategies and priorities—as an iterative one that can help guide the city towards building resilience.

Using information from the assessment, the project team identified strategies to address key vulnerabilities. Through 3 virtual workshops and a number of individual conversations, the project team consulted national and regional best practice, considered actions taken in other cities, and discussed options for three focus areas:



1) Vulnerability of Residential and Commercial Properties to Major Flooding Events

2) Sensitive Populations and Extreme Heat

3) Increasing Tidal Flooding Risk

An important consideration, and the next step, is to determine the ability to implement the strategies that have been identified. In the final workshop, the project team discussed four potential factors to evaluate the ability to implement strategies: staff capacity, political and leadership support, availability of financial resources, and public buy-in. A traffic-light approach can be used to evaluate the ability to implement strategies, where red indicates that there is a strong impediment, yellow indicates a partial or addressable impediment, and green indicates no concern for implementation. This exercise can inform the prioritization process by highlighting strategies that are most feasible to implement at a given point as well as illuminate the need to first remove barriers to implementation for strategies that are otherwise desirable.

Types of Adaptation & Resilience Actions

The ultimate goal is the development of options and strategies to build resilience. The following is a summary of the different types of actions that can be taken. In some cases, true resilience-building will require many different types of actions. The six types of actions used to categories options and strategies in this assessment are:



Infrastructure



Capacity Building



Land Use, Building
Codes & Standards



Public Outreach



Planning, Policy, &
Management



Funding & Financing

Infrastructure

Actions are either physical or green infrastructure and are some of the most commonly considered strategies for building resilience. Physical infrastructure actions are those that create new infrastructure or modify how it's built. Green infrastructure is focused on actions that use natural systems and processes for advancing adaptation.

Land Use, Building Codes & Standards

Actions around land use and building codes and standards include practice, planning, and policy related to land use, as well as building codes and standards. Land use practice action types include modifying or implementing new land use management practices. Actions related to land use planning are those that integrate climate into land use plans and planning processes. The final action type is building codes and standards. This is defined as actions to improve building codes, standards, and engineering for building physical infrastructure.

Planning, Policy, & Management

Strategies in this category are those not related to land use, but still fall into the categories of planning, policy, and management. Planning actions are those that integrate climate into existing planning processes or are climate-specific planning actions. Policy actions are focused on creating new or revising existing regulations and legislations. Operations and practice actions modify on-the-ground operations, management, and programs.

Capacity Building

Capacity building here is defined as actions and investments that grow both the City's internal as well community members' capacity to cope, adapt and thrive in a changing climate. Capacity building actions can take the form of external partnerships with other government, private or non-profit entities to share expertise and align resources; analysis and research investments, monitoring impacts as well as outcomes of taking action; provision of resources to community groups and individuals directly; building staff capacity to identify, assess and implement actions for adaptation and building resilience..

Public Outreach

Public Outreach strategies may be crucial to informing other types of strategies that could be implemented or should be prioritized, as well as public support for projects. These include both public communication and community engagement. Public communication actions aim to increase public awareness, as well as engage the public in climate decision making, while community engagement is considered to be two-way engagement of the public or community organizations in climate decision making.

Funding and Financing

Funding and financing strategies include external funding and financing. External funding includes obtaining funding from federal, state, or non-profit sources and can include funding from grants. Financing can also include loans that need to be repaid.

Focus Area 1: Vulnerability of Residential and Commercial Properties to Major Flooding Events

Almost two thirds of the city falls within the 100-year and 500-year floodplains mapped by FEMA. This extent also roughly resembles worst-case storm surge from Category 3-5 storms. In addition to the low-lying geography, widespread vulnerability to private and public assets is driven by older construction in the regulatory floodplain or construction outside the regulatory floodplain but within potential flooding extent. Additionally, extreme flooding event can also temporarily create widespread road inaccessibility east of I-95 and cause significant disruptions in access to emergency services.

Potential Adaptation Strategies

1. **Strategy: Require or incentivize resilient new development**

Some examples include:

1. Increase freeboard requirement to 2 feet for residential properties.
2. Adopt stricter floodplain building regulations for commercial and mixed-use properties.
3. Identify partnerships needed to develop guidelines for requiring and implementing Green Streets throughout the City of North Miami as a method of addressing stormwater runoff. A Green Streets stormwater management approach integrates vegetation, soil and engineering solutions to slow, filter and clean stormwater runoff from impervious surfaces.

1. **Strategy: Multi-pronged strategy to increase household and neighborhood-level emergency preparedness**

1. Partner with community organizations, faith-based groups, locally-owned small businesses to reach highly vulnerable individuals including non-English speaking households, low-income individuals, individuals with disability, etc.
2. Employ a variety of outreach materials and methods to engage and seek feedback from residents and meet them 'where they are';
3. Using this feedback provide targeted resources and support for increasing household-level preparedness.

1. **Strategy: Building community capacity to cope and recover faster**

1. Investigate the effectiveness of investing in a "resilience hub" for the North Miami community. A concept developed by the Urban Sustainability Directors Network, a resilience hub offers services and programs to community members by providing needed resources and fostering a sense of place and inclusiveness. In addition, the facility is designed to provide critical food, shelter and social services during and/or in the aftermath of a disaster. Working group discussions recognized that creating a resilience hub could be more financially and operationally feasible if located in a city-owned building outside of a vulnerable location. The development would require significant community involvement (e.g. nonprofits, schools, churches, etc.) in the planning process.
2. Identify and provide resources to small businesses for developing business continuity plans.
3. Seek funding (and expand existing programs) to provide energy upgrades to homes and apartments to offer resources such as air conditioning units to renters.

Focus Area 2: Sensitive Populations and Extreme Heat

Extreme heat vulnerability is widespread in North Miami. This both due to environmental factors of a highly developed landscape and low tree canopy cover in most areas of the city combined with socioeconomically-driven low capacity of individuals and households to cope with heat-related impacts.

Potential Adaptation Strategies

4. **Strategy: Establish long-term programs to reduce the urban heat island effect.**

1. Prioritize increasing tree canopy cover on City-owned land, especially in high-use areas such as bus shelters.
2. Identify partnership opportunities with developers, private landowners, the County and State, and NGOs/non-profit organizations to increase native tree canopy coverage in areas outside of City ownership.
3. Investigate building code updates to require cool/reflective roof materials. Create a program to retrofit existing residential and commercial structures. Standard or dark roofs can reach temperatures of 150°F or more in the summer sun. A cool roof under the same conditions could stay more than 50°F cooler, transferring less heat to the building below, resulting in cooler indoor temperatures and less demand for energy.

5. **Strategy: Increase community capacity to cope with extreme heat events.**

1. Work with local organizations, places of worship and regional partners to designate cooling centers within the City. Cooling Centers are locations that are air-conditioned or cooled that have been designated as a site to provide respite and safety during extreme heat (CDC reference). Cooling Centers can be a variety of property types and can even be set up outdoors in the form of spray parks, pools, and public parks. The assessment highlights areas where high urban heat potential co-occurs with relatively more vulnerable populations and this information can be a starting point for targeting this effort.
2. A Resilience Hub, discussed on previous page, could also be designed to serve as a cooling center.

Public Meeting Feedback:
Seek funding (and expand existing programs) to provide energy upgrades to homes and apartments to offer resources such as air conditioning units to renters.

One of the top two choices
for actions for

8 out of 14
participants

6. **Strategy: Education and awareness**

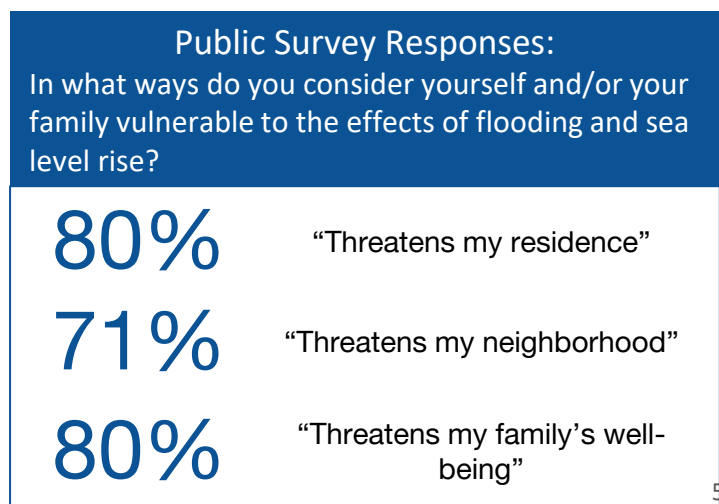
1. Develop a program to provide targeted heat advisory warnings to heat-sensitive populations. These can occur in coordination with the local National Weather Service office. As part of this program, also conduct educational outreach around avoiding heat exposure targeted towards older individuals, people with mobility restrictions, families with infants, houseless individuals, outdoor workers, etc.

Focus Area 3: Increasing Tidal Flooding Risk

Over the next ten years, with a foot of sea level rise, overland flooding from periodic high tides (i.e., a 2 foot tide) can impact about 12% of coastal residential properties in low-lying areas. This number will increase to 42% in the next 30 years with projected sea level rise of 2 feet. Additionally, over the next 30 years 11% of inland residential properties will be highly vulnerable.

Potential Adaptation Strategies

- 7. Strategy: A consistent strategy to reduce current vulnerabilities and avoiding adding new risk should be reflected through all strategic planning and investments made by the City**
 1. Incorporate Sea Level Rise in the upcoming Comprehensive Plan Update.
 2. Incorporate into comprehensive and economic development plan where it makes sense to encourage economic growth based on this assessment.
 3. Identify ways to preserve existing affordable housing and minimize displacement from areas that are unlikely to be directly affected by tidal flooding issues over the next 30 years. Seek opportunities to increase resilience of affordable housing that is vulnerable to tidal flooding currently or in the near future.
- 7. Strategy: Identify opportunities where data and information from the City's Assessment (CCVA) could be integrated in operational or strategic decisions**
 1. Identify ways to modify existing workflows for routine infrastructure maintenance and improvements so that opportunities to take into account SLR can be identified (in areas that will be affected over the next thirty years).
- 7. Strategy: Capacity Building through Monitoring and Research**
 1. Develop a citizen-science monitoring program, in partnership with stakeholders such as the FIU Sea Level Solutions Lab, that focuses on recurrent tidal flooding and sewer overflow issues that provides the public with a real-time method for reporting flooding issues. This program would provide highly localized information necessary to identify appropriate interventions while also increasing public understanding of tidal flooding issues.





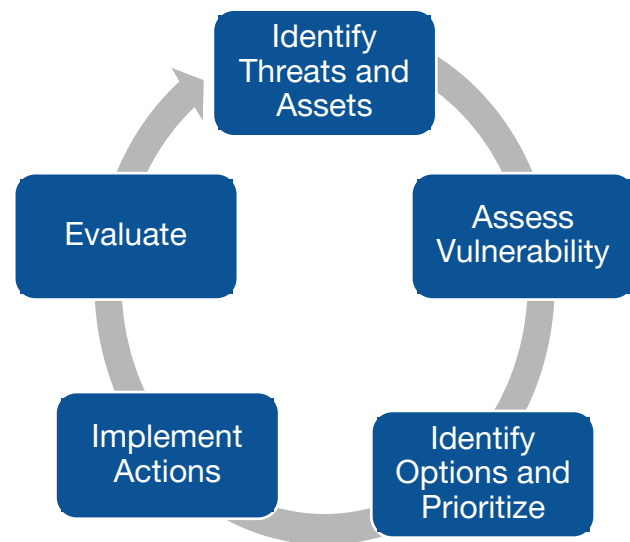
Section 5: Next Steps

The resources from this effort build on the great work and investments that the City has already made and seek to extend the City's capacity for assembling a portfolio of strategies that address near-term chronic issues while proactively addressing the challenges on the horizon. With a changing climate, having the capacity to refine and iterate on the assessment will provide Staff the efficiency and flexibility needed as the community grows, as this work is integrated with other planning efforts, and as new information becomes available in the future.

Beyond this report, a number of resources were developed that could be used to continue applying the systematic, decision-oriented framework that was followed in this project:

- Detailed spatial vulnerability assessments in an interactive and transparent tool that can be explored and used by all City departments
- Initial strategies and actions identified for key vulnerabilities from the assessment
- A set of worksheets that can aid in building insights from the quantitative assessment information and identify adaptation and resilience options based on those insights.
- A variety of maps, tabular summaries and GIS data at city-wide, neighborhoods and parcel scales.

Over the course of the 12 weeks there were 6 meetings total with several follow-ups in between with individual team members. Without the effort of the working group, the ambitious timeline for this assessment would not have been successful. Building resilience is an iterative process, for which the City now has renewed momentum, increased capacity, and action-oriented resources.



Section 6: Community Engagement



NORTH MIAMI
FLORIDA
Community Planning
and Development
SUSTAINABILITY
NorthMiamiFL.gov/CPD



As established in the Community Participation Plan for this project, the community engagement was sought through a variety of active and passive engagement methods throughout the duration of the project. This Section provides a summary report for:

1. Public Workshop introducing the CCVA project
2. Final Public Meeting
3. Public Survey on Adaptation Strategies

All remaining and supplemental documentation of community engagement including agenda and attendee lists is included in Appendix E.

A: Interactive Public Workshop Summary

As part of our Community Participation Plan for the NoMi CCVA, an Interactive Public Workshop was conducted and advertised throughout the City's website and newsletter, email blasts, and other outlets to inform the general public about the assessment and collect their feedback. Given COVID-19 restraints, all engagement strategies were adapted to virtual settings and were appropriately tailored to engage participants in a meaningful manner. To have consistent messaging around the project, as well as to provide educational content to members of the public, the City utilized their designated CCVA website to provide residents with educational flyers on a range of topics including climate adaptation and the City's climate threats.

A registration page was created for the Interactive Public Workshop with the option to submit questions prior. This would ensure that ample time is given not only during the event for individuals to ask questions, but also to give community members space and time to think about what questions they would like answered. Additionally, poll questions were included during the Workshop to continuously engage attendees and allow them to provide instantaneous feedback into how members of the public would like to be engaged in the future - in particular, what topics they would like to learn more about - and their primary concerns related to climate change impacts.

On March 12, 2021, there were 16 participants attending the Interactive Public Workshop and 6 poll questions were asked. The Workshop also allotted time for the public to provide commentary and have a one-on-one dialogue with City staff and the consultant team during the interactive panel discussion and the Q&A session. This intimate setting created a space for two-way discussion, where the public obtained key input on how the City is currently approaching the impacts and effects of a changing climate, what services they offer that residents rely heavily upon, and stay informed about how the City is committed to its efforts in prioritizing resilience even after the project is finalized. To find all materials pertaining to the Interactive Public Workshop please see Appendix E.

Interactive Public Workshop Social Promotion

Numerous avenues were taken to promote the Interactive Public Workshop, ranging from LinkedIn, Twitter, Facebook, as well as the City's website, newsfeed, and local TV Channel. Example advertisements are provided below.



NORTH MIAMI FLORIDA


REGISTER TODAY FOR THE:

North Miami Climate Change Vulnerability Assessment Public Workshop

Join North Miami's interactive workshop as we discuss the City's Climate Change Vulnerability Assessment study and learn how you can be part of the resilience efforts.

Date: Friday, Mar 12, 2021
Time: 1:00 PM

REGISTER



NORTH MIAMI FLORIDA

BE PART OF THE:

North Miami Climate Change Vulnerability Assessment Public Workshop

Join North Miami for an interactive workshop to discuss the City's Climate Change Vulnerability Assessment study and learn how you can be part of the resilience efforts.

Date: Friday, Mar 12, 2021
Time: 1:00 PM



NORTH MIAMI FLORIDA

JOIN US FOR THE:

North Miami Climate Change Vulnerability Assessment Public Workshop

Be part of North Miami's for an interactive workshop as we discuss the City's Climate Change Vulnerability Assessment study, and learn how you can be part of the resilience efforts.

Date: Friday, Mar 12, 2021
Time: 1:00 PM

Scan to Register Here:

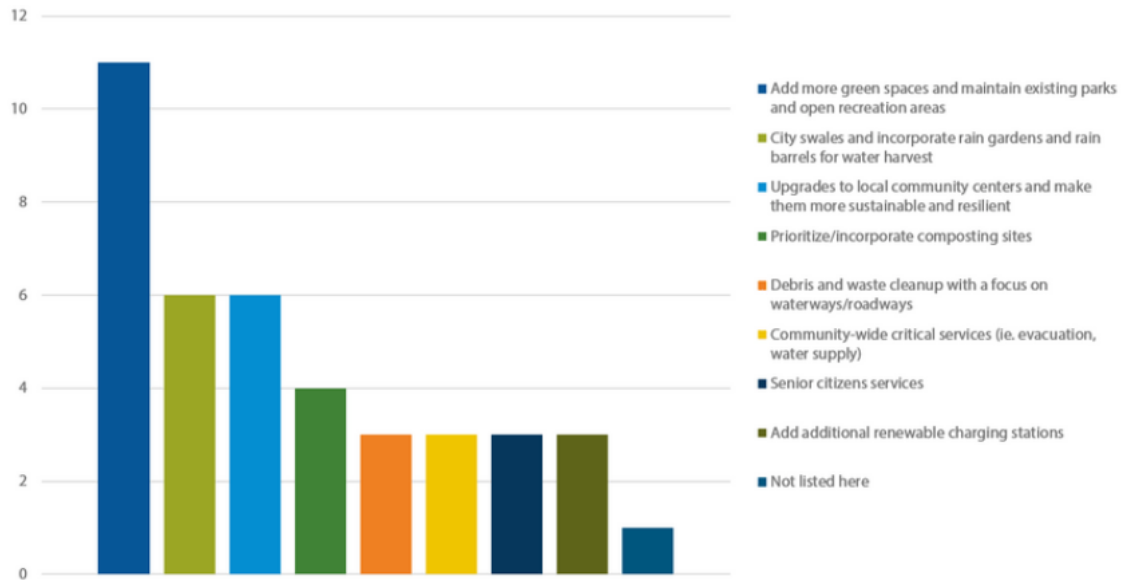


or Click Here to Register

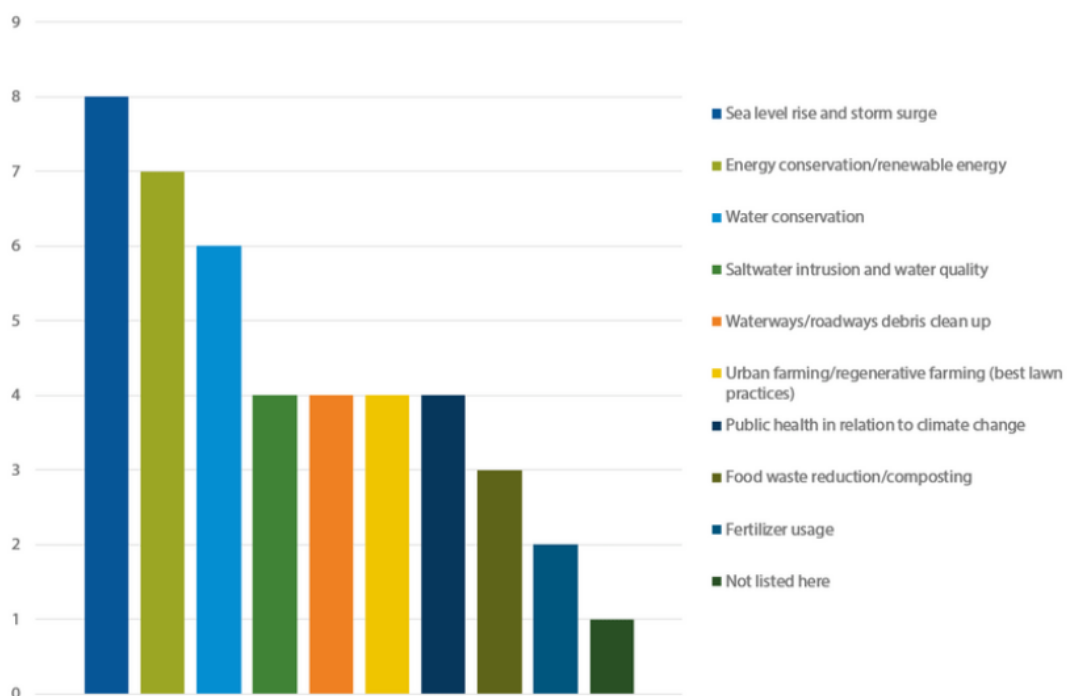
Interactive Public Workshop Poll Questions

During the Workshop, several polling questions were asked. Two of the questions are provided below as examples.

What type of services would you like the City to enhance? Please select your top three.



What types of information during public events would you like to learn more about? Please select the top three.



B: Public Meeting Summary

During the final stages of community engagement for this project, a Public Meeting was held that summarized the key findings from the vulnerability assessment and shared prioritized adaptation strategies. The Public Meeting highlighted how feedback from prior engagements was incorporated into the adaptation planning process. Live polling during the event further allowed for additional input on the public's top interests concerning adaptation strategies the City is considering as part of the Final Report.

The Public Meeting attendees spanned across members of the general public, institutional leaders from the City's local university, and Florida governmental officials. To embrace community member's responses, we showcased examples of survey results, specifically those gathered from the initial survey, and how certain mentioned locations or assets would be considered and integrated into the Final Report.

On April 1, 2021, there were 37 attendees participating in the Public Meeting. To further engage and comprehensively understand how the public feels towards certain adaptation actions, we asked two poll questions to gather their input, with the possibility for them to elaborate verbally or via chat if they had additional thoughts concerning adaptation strategies. To find all materials pertaining to the Public Meeting, please see Appendix E.

Miami-Dade County Mayor, Daniella Levine Cava, attended the Public Meeting and shared inspirational words of support acknowledging the proactive work of the City of North Miami. Mayor Cava's quote can be seen below.



Public Meeting Social Promotion

Numerous avenues were taken to promote the Public Meeting, ranging from LinkedIn, Twitter, Facebook, as well as the City's website, newsfeed, and local TV Channel. Examples of the advertisements are provided below.



NORTH MIAMI FLORIDA


PARTICIPATE IN THE:

North Miami Climate Change Vulnerability Assessment Final Public Meeting

Join North Miami for the Final Public Meeting to learn about the City's Climate Change Vulnerability Assessment study.

Date: Thursday, April 1st, 2021
Time: 5:30 PM

The poster features a vibrant, colorful illustration of diverse people and nature, including a soccer ball, a person in a wheelchair, and a large portrait of a woman.



NORTH MIAMI FLORIDA

PARTICIPATE IN THE:

North Miami Climate Change Vulnerability Assessment Public Meeting

Join North Miami for the Public Meeting to receive an overview of preliminary Climate Change Vulnerability Assessment findings.

Date: Thursday, April 1, 2021
Time: 5:30PM

The poster includes three small images: a colorful parrot, a wetland landscape with a yellow and black striped sign, and a person in a white shirt interacting with a digital display.



NORTH MIAMI FLORIDA

BE PART OF THE:

North Miami Climate Change Vulnerability Assessment Public Meeting

Join North Miami for the Public Meeting to receive an overview of preliminary Climate Change Vulnerability Assessment findings.

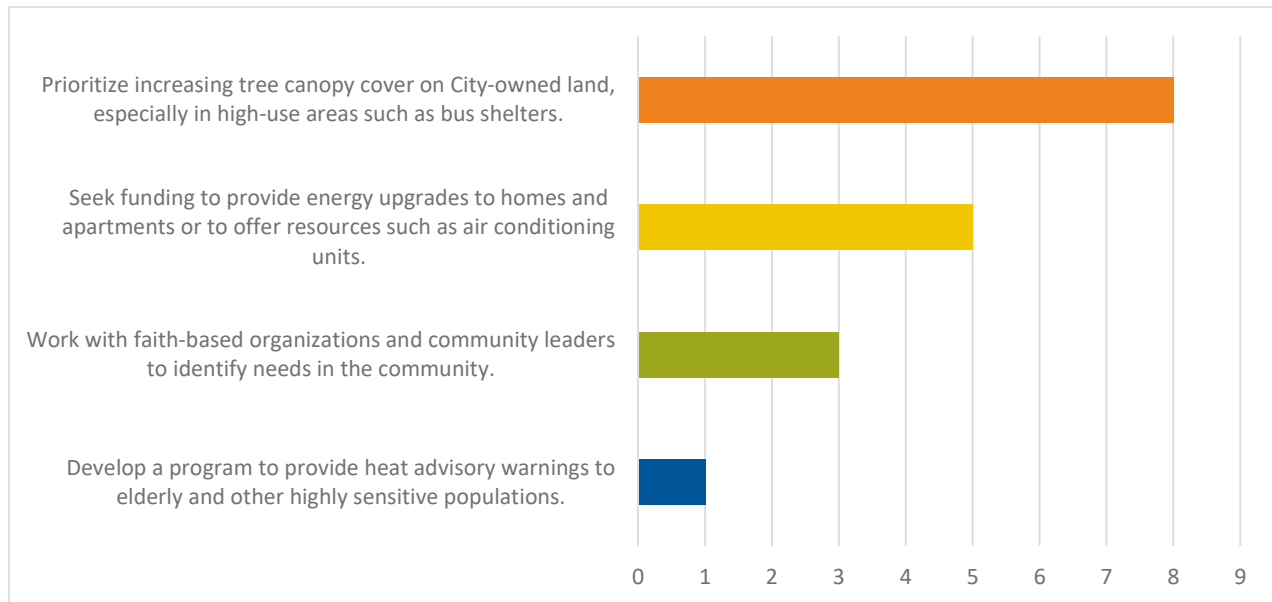
Date: Thursday, April 1, 2021
Time: 5:30 PM

The poster features a background image of a tree with a blue sky and a green diagonal stripe on the left side.

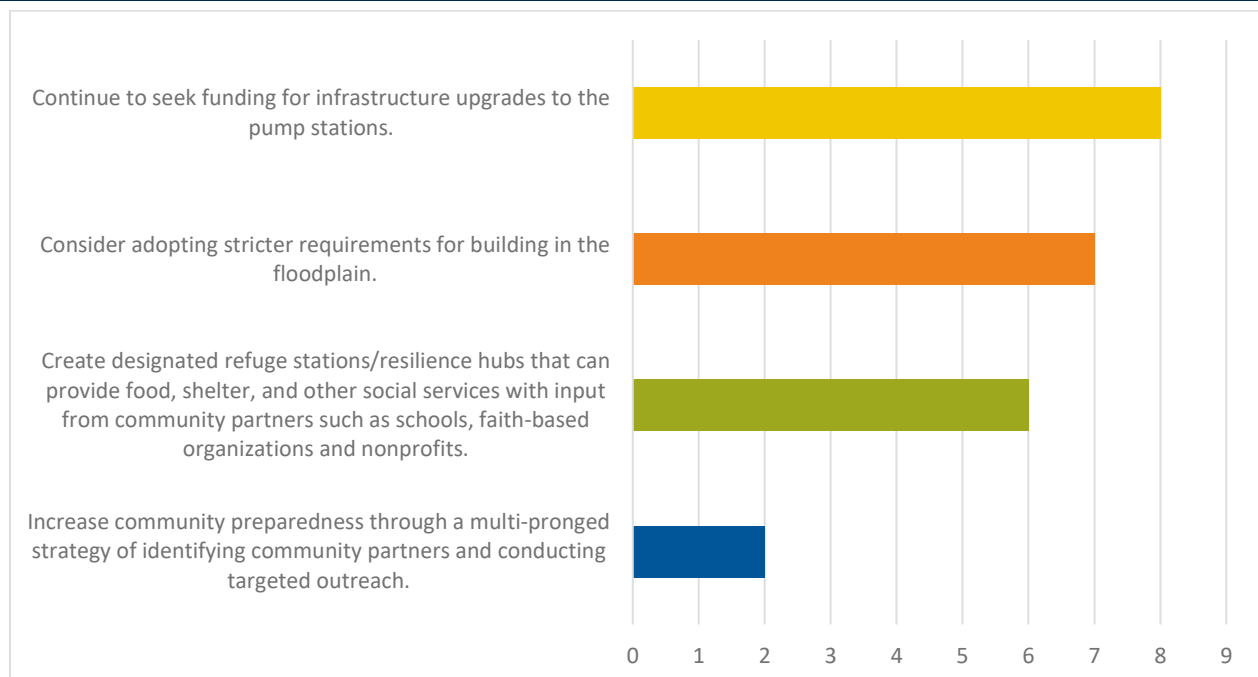
Public Meeting Poll Questions

During the Public Meeting, several polling questions were asked. Two of the questions are provided below as examples.

To combat the effects of extreme heat the City is considering several strategies. Please select two strategies you consider to be your highest priority.



To better prepare for potentially stronger and more frequent storms, please select the top two strategies you feel would have the greatest positive impact in NoMi.



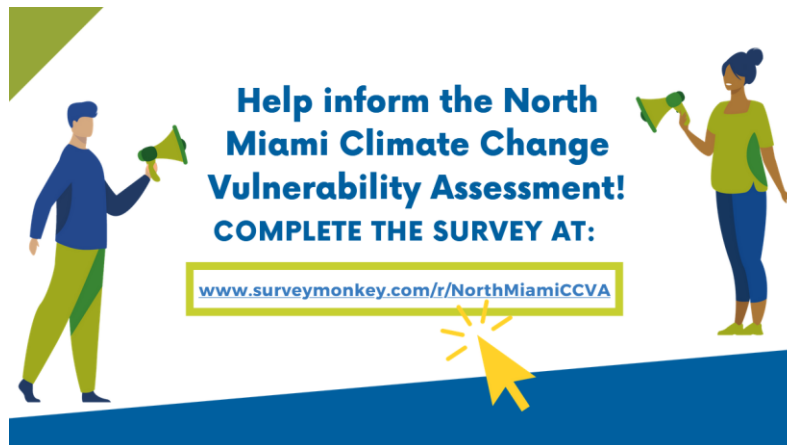
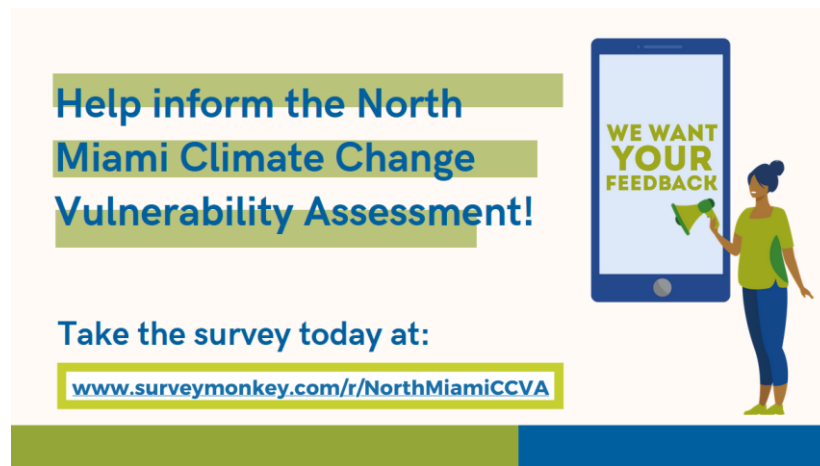
C: Second Survey Summary

As established in the Community Participation Plan, input on some aspects of the Final Report was sought through the Second Survey. Specifically, we asked the public for their feedback on potential adaptations strategies that were discussed by the working group and included in the Final Report. The Second Survey questions embodied a range of topics including where additional prioritization of public services is needed, the identification of opportunities for future public engagement, likelihood of potential citizen science participation and support, and how the City can continue to approach education and public awareness towards climate change, flooding, extreme heat, and more.

To advertise and promote the Second Survey, multiple avenues were taken so that the City may reach a broad range of groups within the City. The City advertised the Second Survey through a distribution of email blasts to homeowners, community groups, home associations, and local institutions. Additionally, social media accounts, including Twitter, LinkedIn, and Facebook, were also utilized to reach broader groups of people. To find the full list of questions and answers pertaining to the Second Survey, please see Appendix E.

Second Survey Social Promotion

Numerous avenues were taken to promote the Second Survey, ranging from LinkedIn, Twitter, Facebook, as well as the City's website and newsfeed. Examples are provided below.

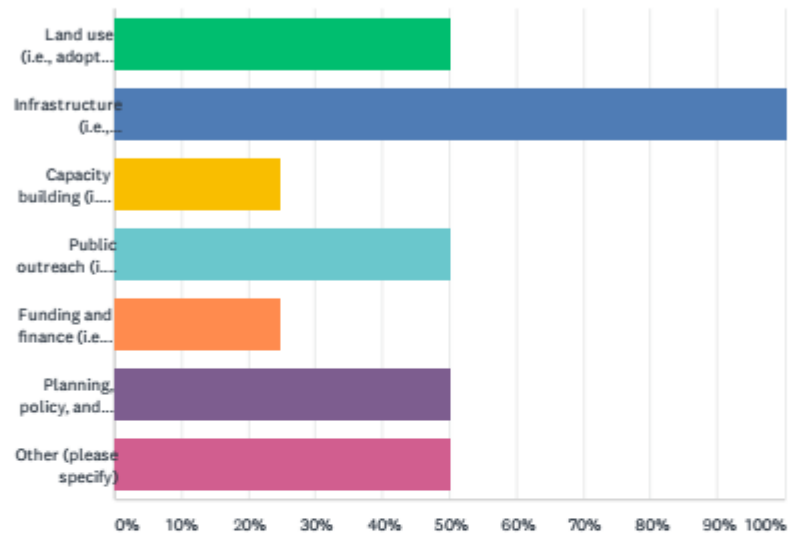


Second Survey Brief Results

North Miami Climate Change Vulnerability Assessment Survey

Q12 Which of the following types of adaptation strategies would you support the City in undertaking for building a more climate-resilient North Miami? Please select all that apply.

Answered: 4 Skipped: 1

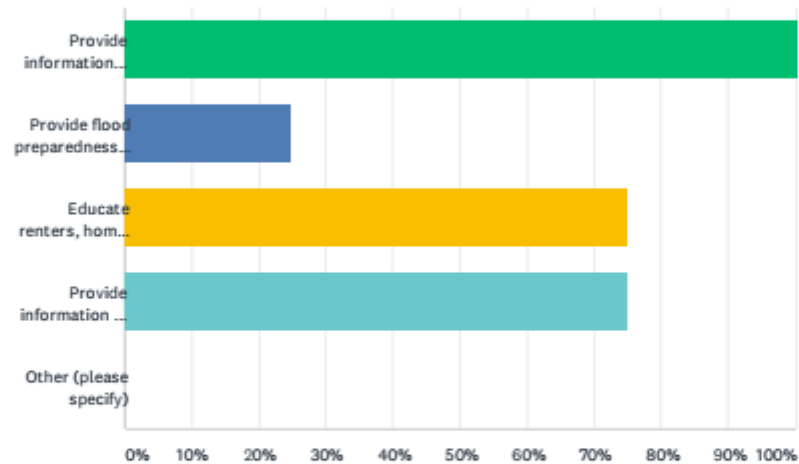


ANSWER CHOICES		RESPONSES	
Land use (i.e., adopting policies or ordinances that require more resilient land uses and building practices such as, stricter building codes and standards for new development)		50.00%	2
Infrastructure (i.e., updating, modifying or creating new infrastructure including nature-based solutions or green infrastructure such as swales and mangroves to reduce flooding and extreme heat impacts)		100.00%	4
Capacity building (i.e., increasing capacity of city staff as well as the community to respond to climate change through partnerships, trainings, resource sharing and research and monitoring activities)		25.00%	1
Public outreach (i.e., building awareness of climate risks as well as involving the public on decisions related to climate threats and adaptation)		50.00%	2
Funding and finance (i.e., finding sources of funding or financing for resilience investments)		25.00%	1
Planning, policy, and management (i.e., updating local plans and policies to reflect local climate risk and future planning)		50.00%	2
Other (please specify)		50.00%	2
Total Respondents: 4			

#	OTHER (PLEASE SPECIFY)	DATE
1	Using solar power is the best way to go.	3/26/2021 3:38 PM
2	incorporating local residents into creating a local food economy, and creating resiliency at the community level around access to fresh food even in times of emergency.	3/24/2021 8:02 PM

Q14 The City of North Miami can increase public awareness and educate the community on flood risks and flood adaptation measures for residences and businesses through the following activities. Select all options that would better support you and your neighborhood.

Answered: 4 Skipped: 1



ANSWER CHOICES		RESPONSES	
Provide information flood risk at the neighborhood level		100.00%	4
Provide flood preparedness information for businesses		25.00%	1
Educate renters, home buyers and real estate professionals about floodplains and increasing risk from sea level rise		75.00%	3
Provide information on grants/funds that assist homeowners and renters prepare and recover from flooding		75.00%	3
Other (please specify)		0.00%	0
Total Respondents: 4			

#	OTHER (PLEASE SPECIFY)	DATE
	There are no responses.	

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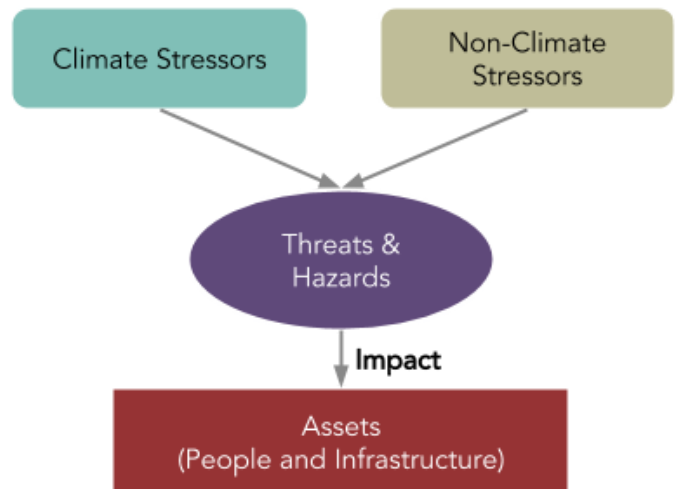
Appendix A: Analysis Technical Documentation

Process Overview

The U.S. Climate Resilience Toolkit defines *exposure* as “the presence of people, assets, and ecosystems in places where they could be adversely affected by hazards.” For purposes of this assessment, “exposure” specifically means that an asset (e.g., a structure, parcel, or roadway) is spatially coincident with a specific hazard (e.g., flooding). For example, a warehouse located within the 500-year floodplain is considered to be “exposed.”

Conceptually, the threats to which assets are exposed are affected by both climate and non-climate stressors (shown in the diagram above).

For purposes of this assessment, these threats are presented using pre-existing hazard models, and discussion of how those hazards may change over time is presented through narrative and supporting information rather than modification of the hazard models using a variety of stressor scenarios.



The assessment was conducted in four stages:

1. Asset data normalization and categorization;
2. Spatial relation of individual assets to each hazard layer;
3. Application of asset-scale vulnerability and risk rulesets; and
4. Aggregation of vulnerable and at-risk assets to census block groups.

Vulnerability and Risk Assessment

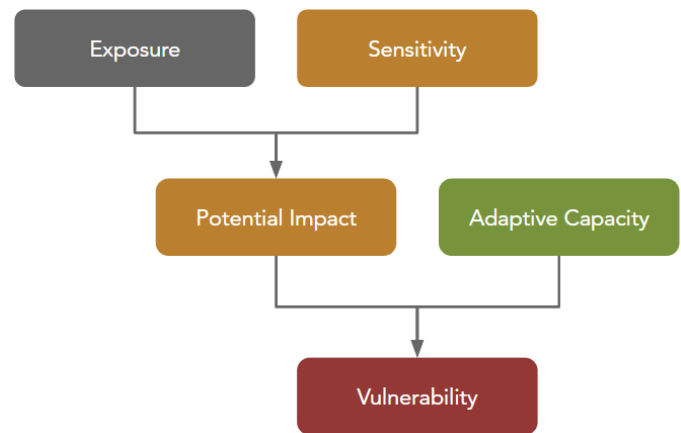
The vulnerability and risk assessment framework used multi-criteria decision analysis as well as spatial analysis in a data-driven pipeline.¹ This involved developing criteria, or rules, that were used to assign to assets specific ordinal classifications of *high*, *medium*, and *low* for each of the variables described below. The classifications were then combined using a matrix approach to determine levels of vulnerability, risk, and combined vulnerability and risk.²

Vulnerability

Vulnerability describes the susceptibility of exposed assets based on the two core concepts described above: (1) potential impact—the degree to which an asset is affected; and (2) adaptive capacity—the ability the asset has to cope with a potential impact.

Potential Impact

Potential impact is the degree to which an exposed asset (asset that is in harm's way) is potentially negatively affected by a climate-related threat. The level at which an exposed asset is negatively affected is also referred to as the asset's *sensitivity*. Assets that are not exposed have no potential impact; thus, they are not vulnerable, or at risk. Exposed assets were evaluated for levels of sensitivity, which were used in determining levels of potential impact.



Factors used to determine levels of potential impact were based on the asset's characteristics or on the level of impact due to service loss if the asset were to be affected.³ For example, a property with a building structure in a flood hazard area has a higher potential impact than does a property that does not have a building in a flood hazard area.

Adaptive Capacity

Adaptive capacity considers how an asset is able to cope with a threat event or impact. An asset with adaptive capacity is able to withstand an impact with minimal disruption or loss. Measures of adaptive capacity can include physical elements, conditions, or designs in place that help an asset absorb an impact. Exposed assets were evaluated for indicators of adaptive capacity and classified accordingly.

For example, a commercial building that has flood-proofed its foundation and raised its ground floor above flood levels has more adaptive capacity than a commercial building that has not done so. As another example, a park with facilities designed to withstand flood waters without damaging its infrastructure has adaptive capacity.

¹ Malczewski, Jacek, and Claus Rinner. *Multicriteria Decision Analysis in Geographic Information Science*. Springer-Verlag, 2015.

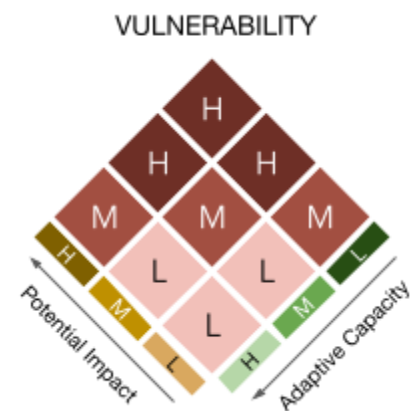
² EPA Office of Water, Climate Ready Estuaries. *Being Prepared for Climate Change: A Workbook for Developing Risk-Based Adaptation Plans*. U.S. Environmental Protection Agency, 2014.

[https://www.epa.gov/sites/production/files/2014-09/documents/being_prepared_workbook_508.pdf]

³ Glick, P., B. A. Stein, and N.A. Edelson, editors. *Scanning the Conservation Horizon: A Guide to Climate Change Vulnerability Assessment*. National Wildlife Federation, 2011.

[http://www.habitat.noaa.gov/pdf/scanning_the_conservation_horizon.pdf]

Levels of potential impact and adaptive capacity are then combined to inform vulnerability. Assets with low potential impact and high adaptive capacity are the least vulnerable. Assets with high potential impact and low adaptive capacity are the most vulnerable. For example, a business-related structure in the flood hazard zone has a “high” level of potential impact and, if it was built before 1973, it is classified as having “low” adaptive capacity. Together, they result in a “high” vulnerability classification.

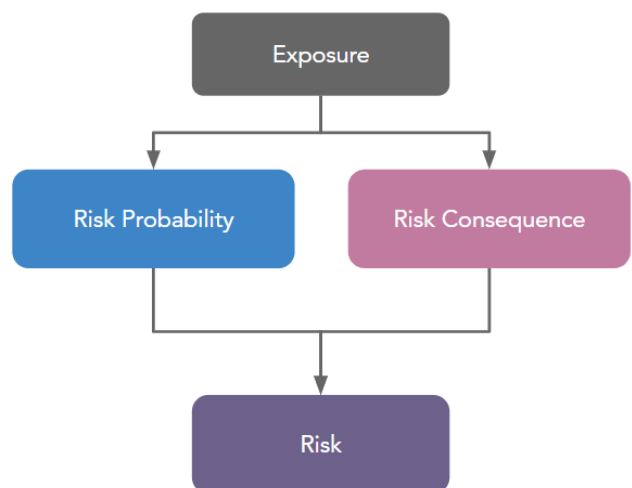


Risk Scoping

Just as potential impact and adaptive capacity combine to determine vulnerability, risk probability and risk consequence combine to give us an assessment of risk scoping.

Risk Probability

Probabilities were determined for each threat using annualized likelihoods of threat occurrence or relative levels based on known risk factors. For example, for FEMA Flooding, the 100-year and 500-year flood hazard zones were used to evaluate different probabilities of flooding for each asset.

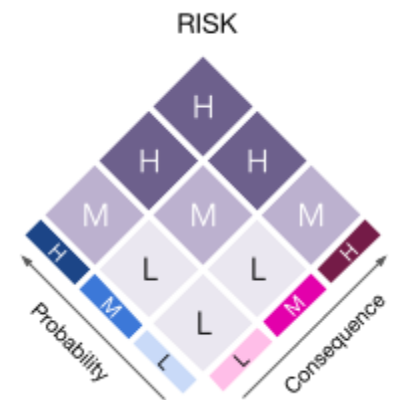


Risk Consequence

Risk consequence refers to negative outcomes or critical thresholds that indicate varying levels of significance if a threat were to occur. For example, assets with structures affected at various flood depths may have a greater negative consequence than assets with no affected structures.

Levels of risk probability and risk consequence are then combined to inform risk scoping. For example, a parcel with an exposed building in the 100-year inundation extent would have a high risk classification, while a parcel in the 500-year flood hazard zone would have a moderate risk classification.

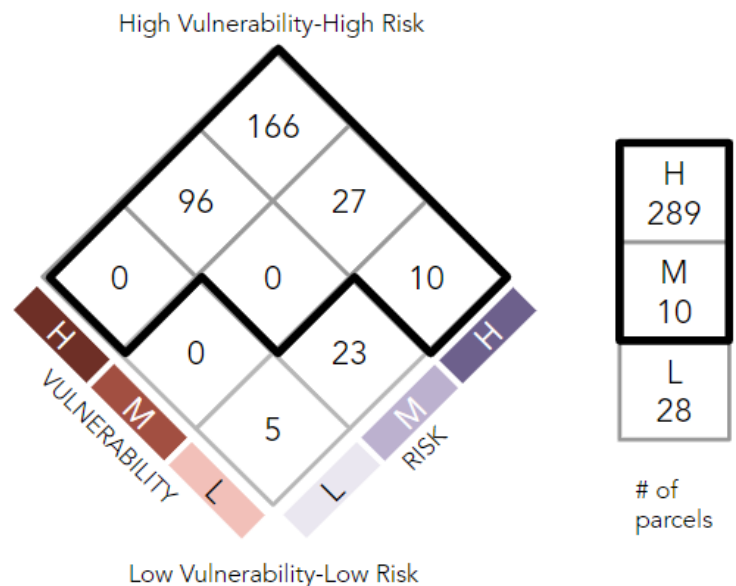
It is important to note that this step is referred to as risk scoping, as no loss estimates were quantified.



Combined Vulnerability and Risk

Vulnerability considers how an asset might be impacted and its ability to cope if a given threat event were to occur, and risk considers the probability of the threat occurring and the general consequence of the threat (without considering factors that make it susceptible). Combining these concepts allows decision makers to evaluate which assets are most susceptible and most likely to be impacted, and also to consider options according to different levels of risk threshold.

The matrix shown here features the combination of vulnerability and risk for Commercial Property and FEMA Flooding. High-vulnerability and high-risk parcels are in the top-most cell. Those that have low vulnerability and low risk are in the bottom-most cell.

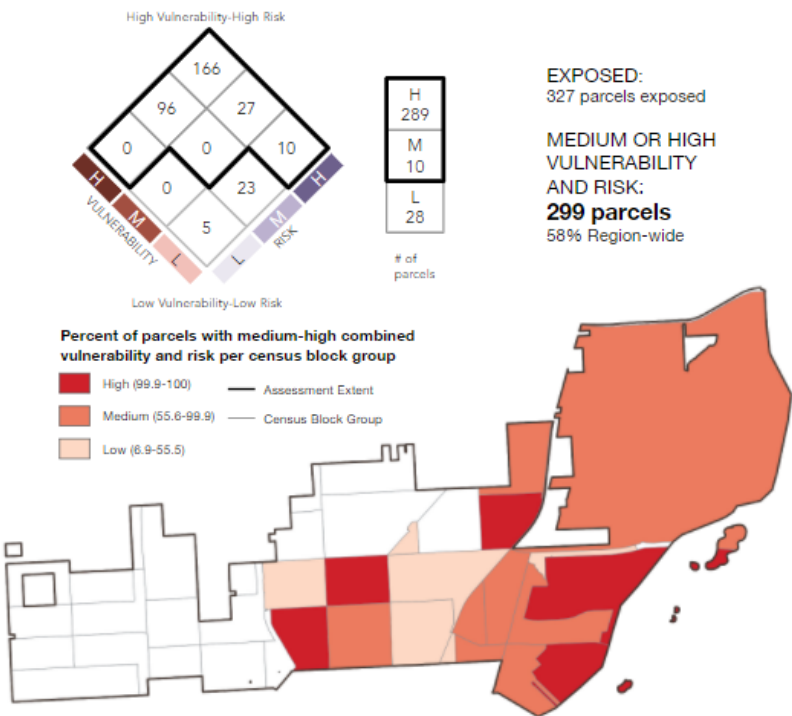


Aggregation of Vulnerability and Risk

In order to focus on the most vulnerable and risk assets, the assets with either medium or high combined vulnerability and risk are mapped at the aggregate scale. In the matrix and parcel-level map to the right, these are the cells or parcel with the two darkest shades of red.

Due to varying sizes of census block groups in the region, the *percent of assets with medium-high combined vulnerability and risk* map is used to provide a relative perspective of vulnerability within different areas in the City.

The table on the following page provides a high-level summary of the types of criteria used for each component of the vulnerability and risk assessment framework.



High-Level Summary of Assessment Ruleset Components

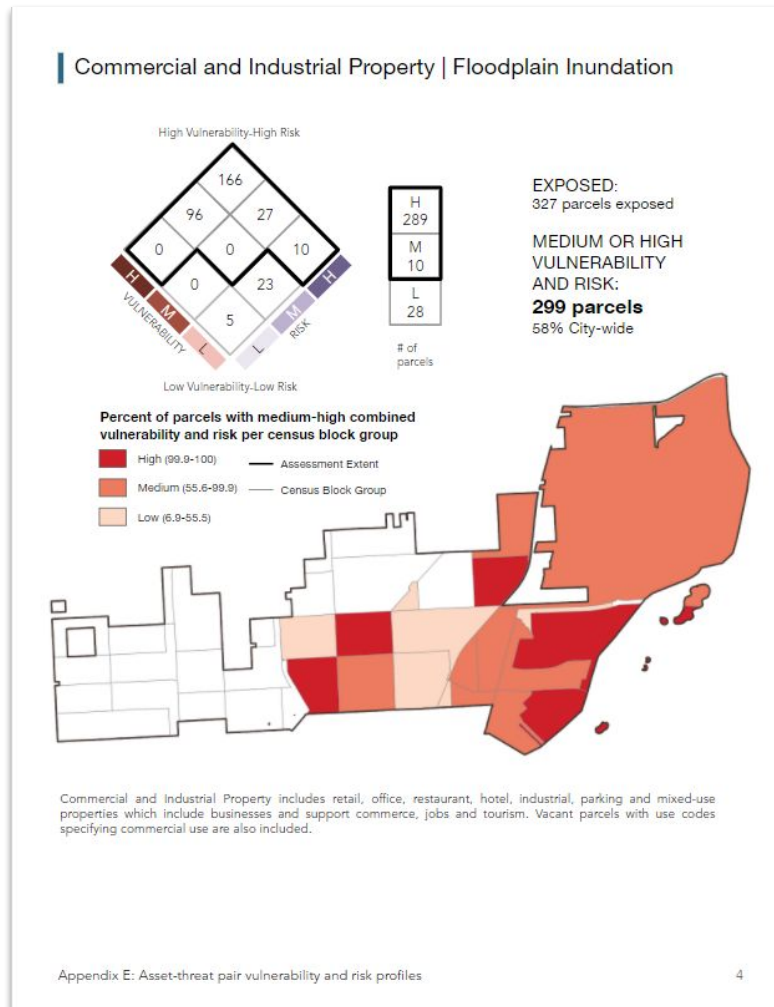
Hazard	Exposure	Vulnerability		Risk	
		Potential Impact	Adaptive Capacity	Probability	Consequence
Floodplain Inundation	Any FEMA flood zone (floodway, 100-yr, and 500-yr)	Criticality of asset based on type and use	Structural age using thresholds of 1973 and 2000	Levels of flood probability (100-yr, 500-yr)	N/A
Storm Surge (Cat 1-2)	Storm surge categories 1-2	Criticality of asset based on type and use	Structural age using thresholds of 1973 and 2000	Levels of Storm Category (1, 2)	Depth of flooding
Storm Surge (Cat 3-5)	Storm surge categories 3-5	Criticality of asset based on type and use	Structural age using thresholds of 1973 and 2000	Levels of Storm Category (3-5)	Depth of flooding
Tidal Flooding and SLR (2ft + MHHW)	Full flood extent	Criticality of asset based on type and use	Structural age using thresholds of 1973 and 2000	N/A	
Tidal Flooding and SLR (3ft + MHHW)	Full flood extent	Criticality of asset based on type and use	Structural age using thresholds of 1973 and 2000	N/A	
Tidal Flooding and SLR (4ft + MHHW)	Full flood extent	Criticality of asset based on type and use	Structural age using thresholds of 1973 and 2000	N/A	
Extreme Heat	All areas	Ages 65+ and less than 18 and percent developed land cover	Percent of tree canopy coverage and median household income	N/A	

Appendix B: Asset Threat Pair Vulnerability and Risk Profiles

Asset-threat profile guide

The spatially-distinct asset-threat pair vulnerability and risk assessments, or vulnerability assessments (where risk was not assessed), are presented in the following pages using consistent 1-page profiles. This guide below points out the key features of each profile.

Assessment overview / map



← **Asset-threat pair**

← **Exposure**
Number of assets
citywide in harm's way
for this threat.

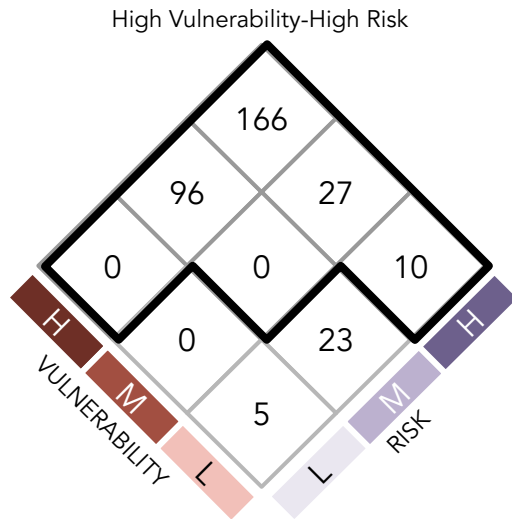
← **Count of assets
most affected**
Number of assets
citywide with medium
or high potential
impact/combined
vulnerability and risk.

Assets most affected in each census block group

The high and medium vulnerability and risk parcels are aggregated within each census block group to identify the most vulnerable neighborhoods in the assessment area.

Note that the legend ranges are *per census block group*, which will vary from the "medium or high vulnerability and risk" total in the upper right.

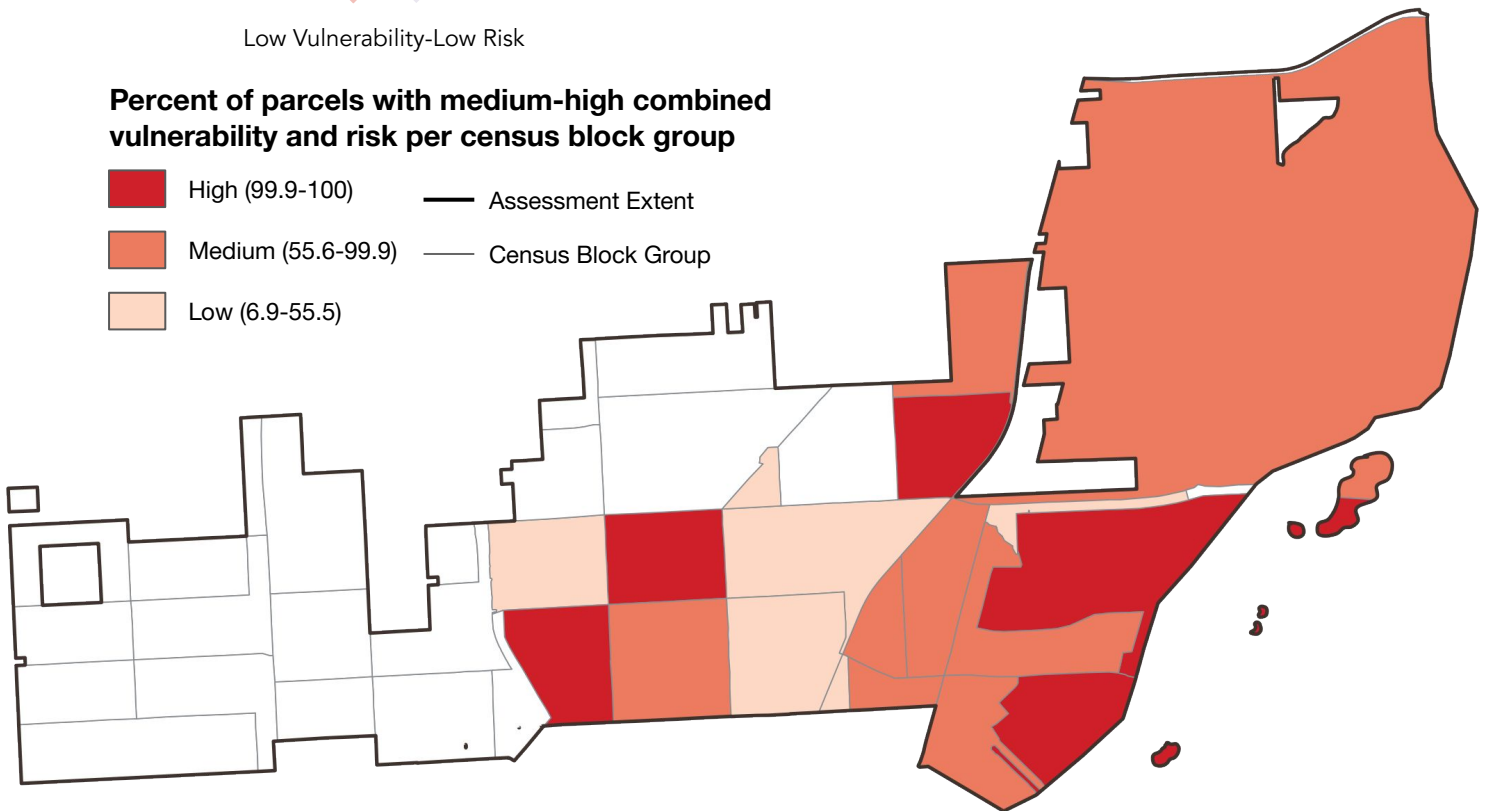
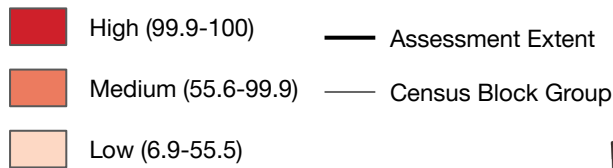
Commercial and Industrial Property | Floodplain Inundation



EXPOSED:
327 parcels exposed

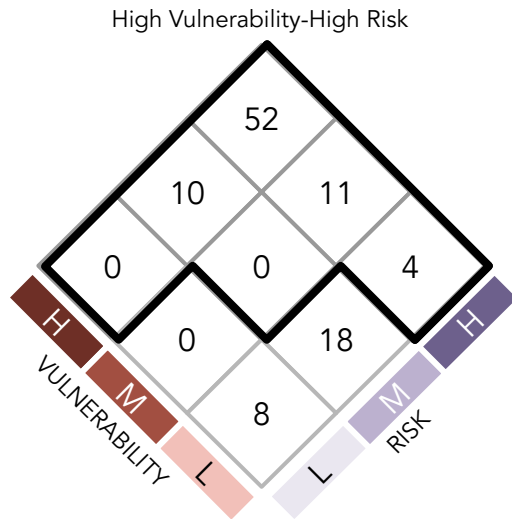
MEDIUM OR HIGH VULNERABILITY AND RISK:
299 parcels
58% City-wide

Percent of parcels with medium-high combined vulnerability and risk per census block group



Commercial and Industrial Property includes retail, office, restaurant, hotel, industrial, parking and mixed-use properties which include businesses and support commerce, jobs and tourism. Vacant parcels with use codes specifying commercial use are also included.

Critical Facilities & Government-Owned Property | Floodplain Inundation



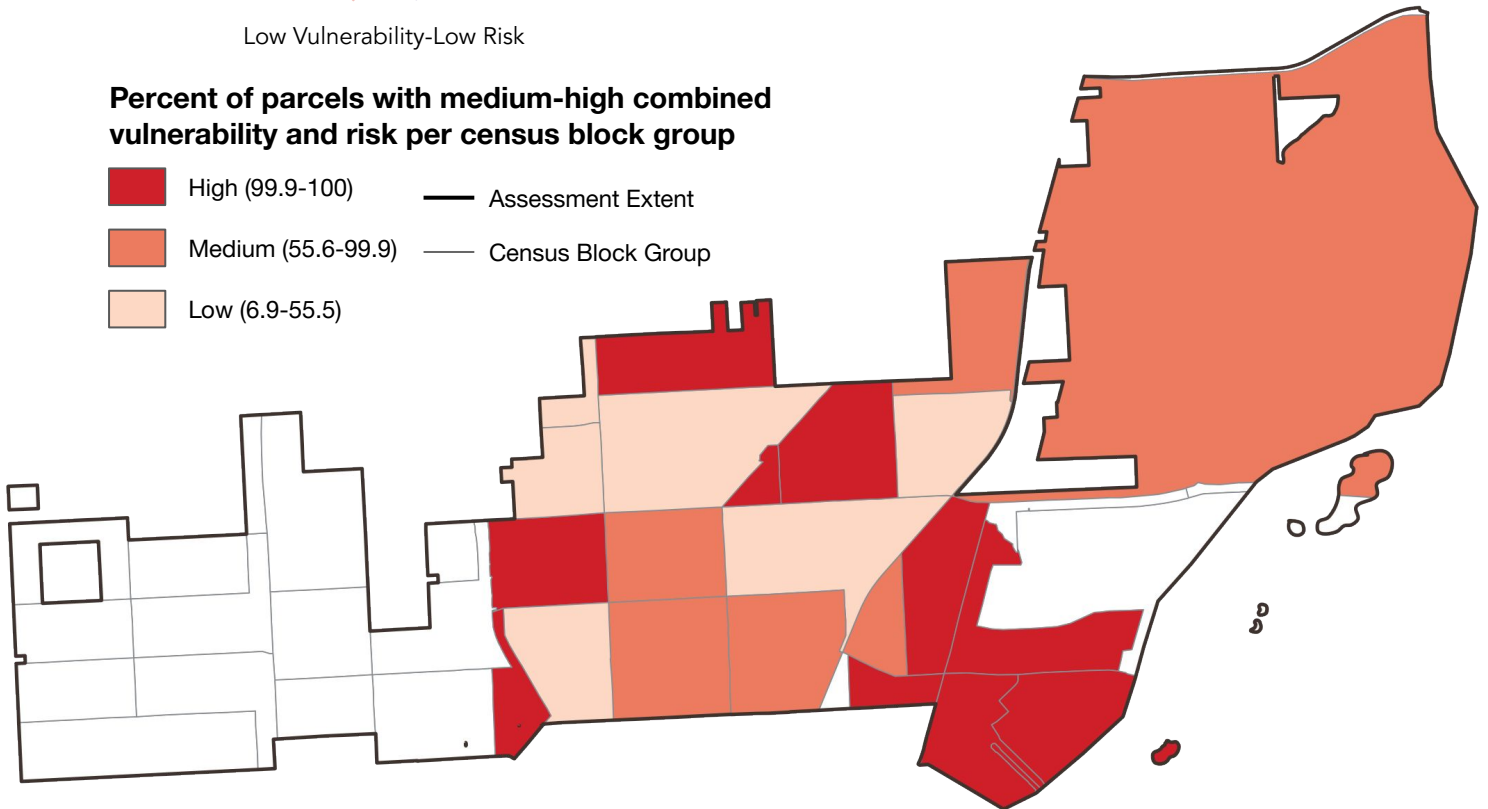
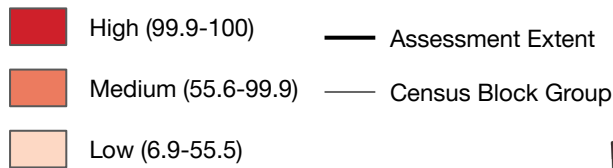
H
73
M
4
L
26

of parcels

EXPOSED:
103 parcels exposed

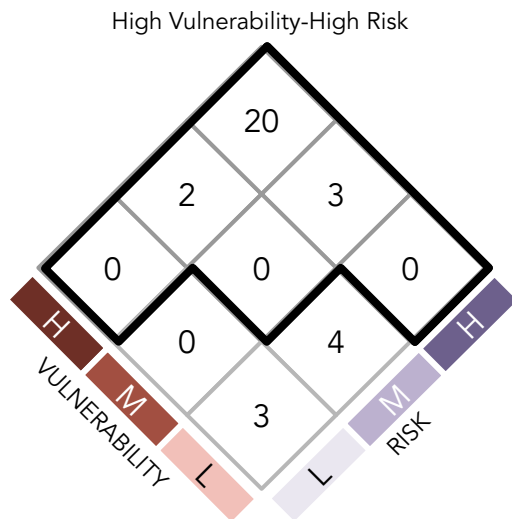
MEDIUM OR HIGH VULNERABILITY AND RISK:
77 parcels
56% City-wide

Percent of parcels with medium-high combined vulnerability and risk per census block group



Critical facilities and government-owned property includes city-owned or private facilities that provide critical services to the people of North Miami, as well as other government-owned properties within the city boundaries. The category includes medical facilities, schools, food pantries and stores accepting snap benefits, police and fire stations, utility facilities, and City Hall. Also included are all other properties listed as owned by the federal, state or city government, except parks and community centers.

Parks, Cultural, & Entertainment Property | Floodplain Inundation



H
25
M
0
L
7

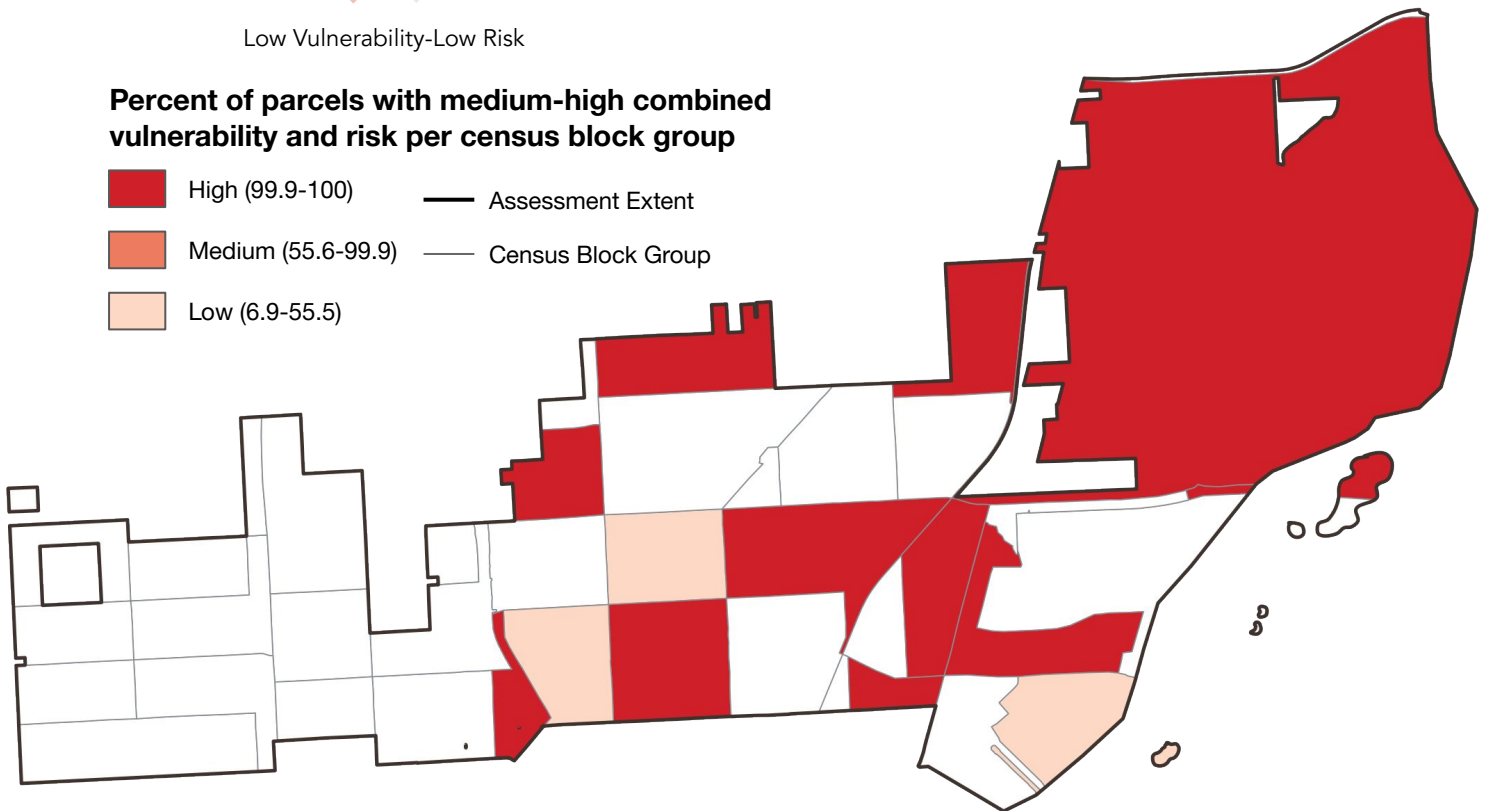
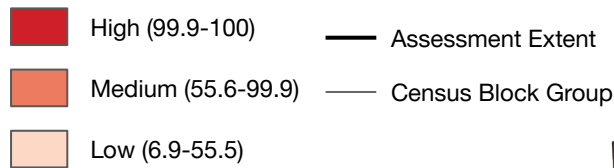
of
parcels

EXPOSED:
32 parcels exposed

MEDIUM OR HIGH
VULNERABILITY
AND RISK:
25 parcels
47% City-wide

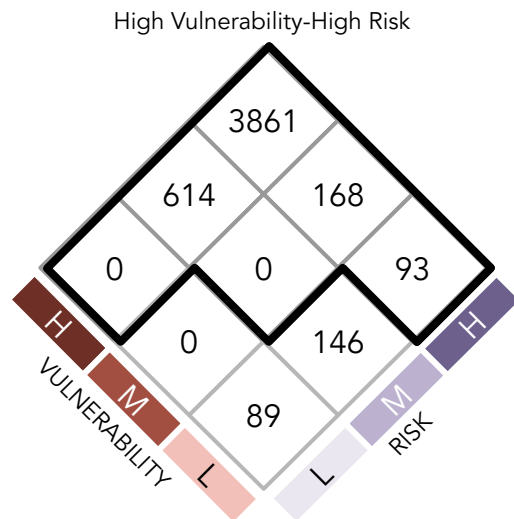
Low Vulnerability-Low Risk

Percent of parcels with medium-high combined vulnerability and risk per census block group



Parks, cultural, and entertainment property includes places of worship, community centers, parks, museums, libraries as well as commercial, private, or exempt properties used for community gatherings and entertainment.

Residential Property | Floodplain Inundation



H
4643
M
93
L
235

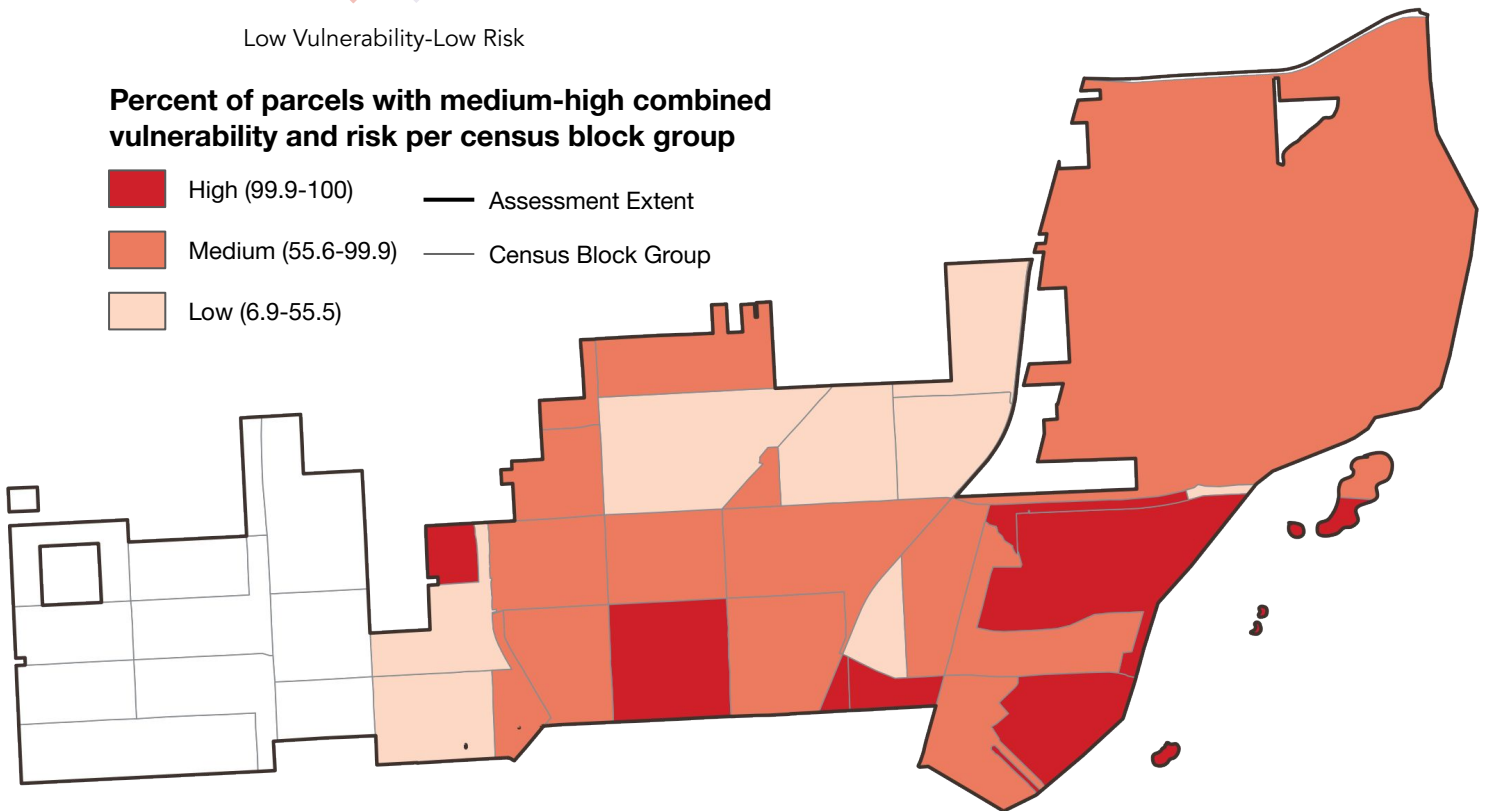
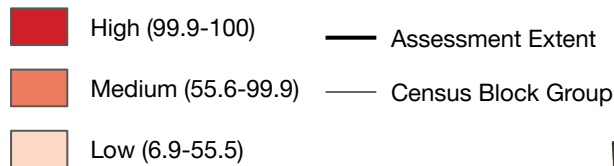
of
parcels

EXPOSED:
4,971 parcels exposed

**MEDIUM OR HIGH
VULNERABILITY
AND RISK:**
4,736 parcels
49% City-wide

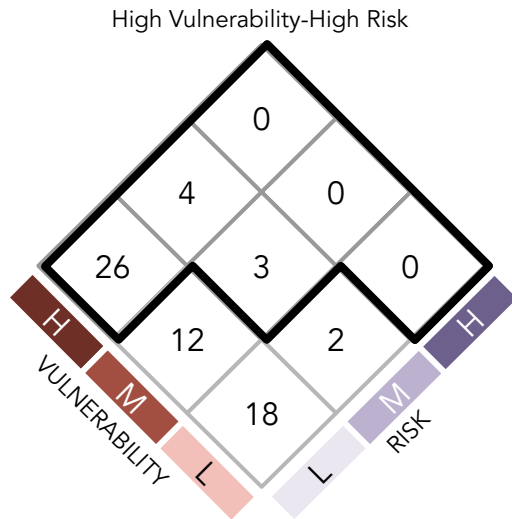
Low Vulnerability-Low Risk

**Percent of parcels with medium-high combined
vulnerability and risk per census block group**



Residential property includes properties where people live or shelter. It includes single and multifamily houses, condominiums, mobile homes, group homes, residential medical facilities and retirement homes. Vacant parcels with use codes specifying residential use are also included.

Commercial and Industrial Property | Storm Surge (Cat 1-2)



H
4
M
29
L
32

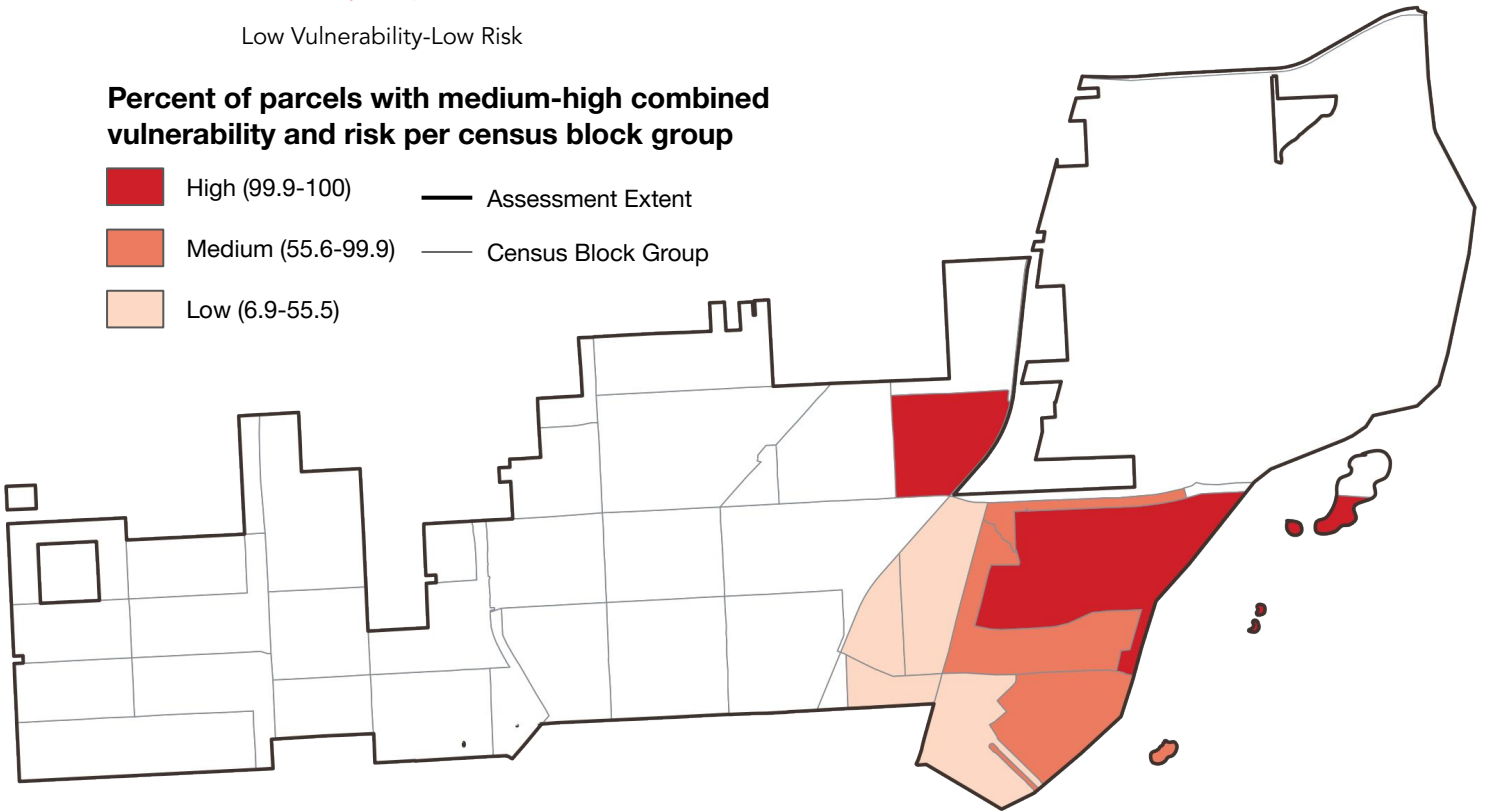
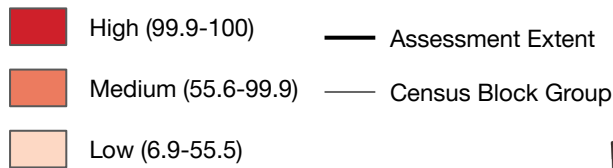
of
parcels

EXPOSED:
65 parcels exposed

**MEDIUM OR HIGH
VULNERABILITY
AND RISK:**
33 parcels
6% City-wide

Low Vulnerability-Low Risk

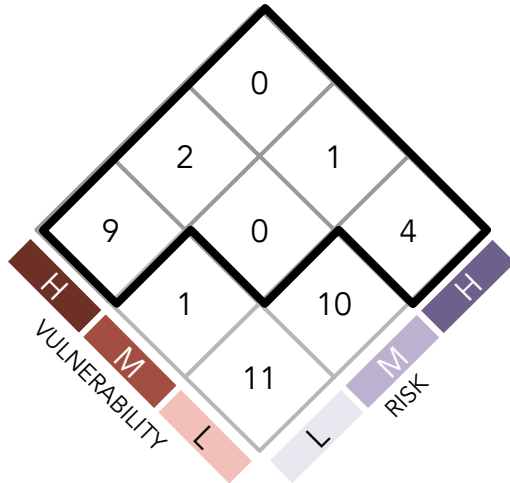
**Percent of parcels with medium-high combined
vulnerability and risk per census block group**



Commercial and Industrial Property includes retail, office, restaurant, hotel, industrial, parking and mixed-use properties which include businesses and support commerce, jobs and tourism. Vacant parcels with use codes specifying commercial use are also included.

Critical Facilities & Government-Owned Property | Storm Surge (Cat 1-2)

High Vulnerability-High Risk



H
3
M
13
L
22

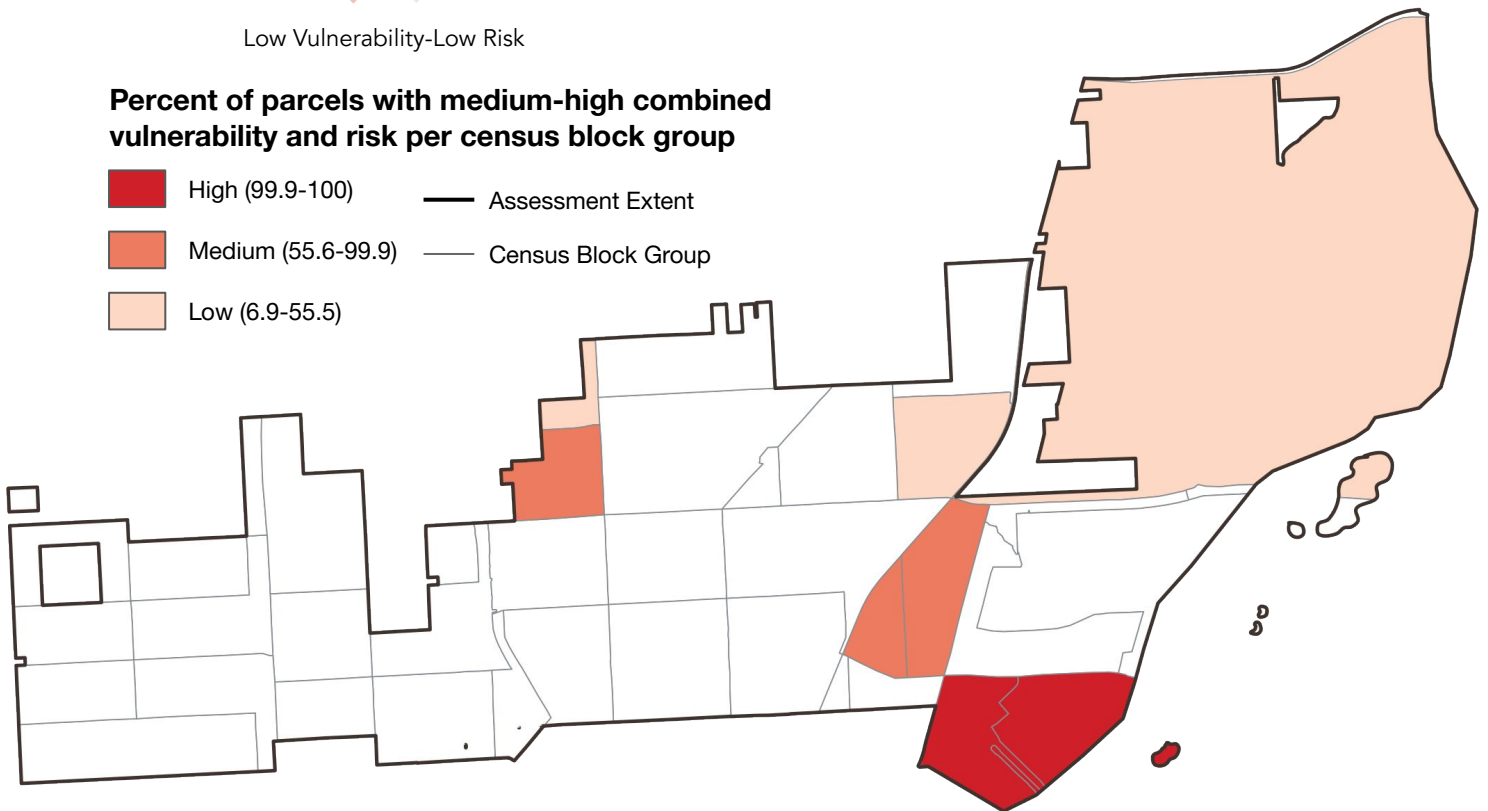
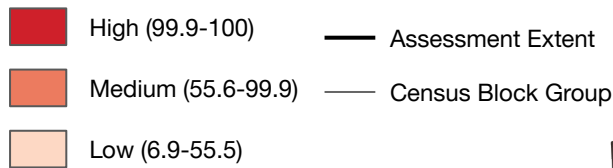
of parcels

EXPOSED:
38 parcels exposed

MEDIUM OR HIGH VULNERABILITY AND RISK:
16 parcels
12% City-wide

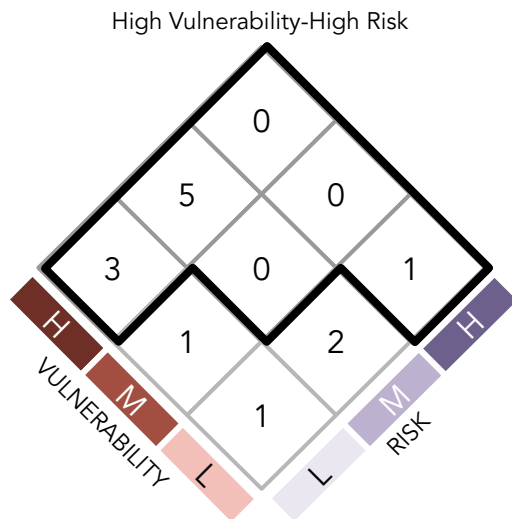
Low Vulnerability-Low Risk

Percent of parcels with medium-high combined vulnerability and risk per census block group



Critical facilities and government-owned property includes city-owned or private facilities that provide critical services to the people of North Miami, as well as other government-owned properties within the city boundaries. The category includes medical facilities, schools, food pantries and stores accepting snap benefits, police and fire stations, utility facilities, and City Hall. Also included are all other properties listed as owned by the federal, state or city government, except parks and community centers.

Parks, Cultural, & Entertainment Property | Storm Surge (Cat 1-2)



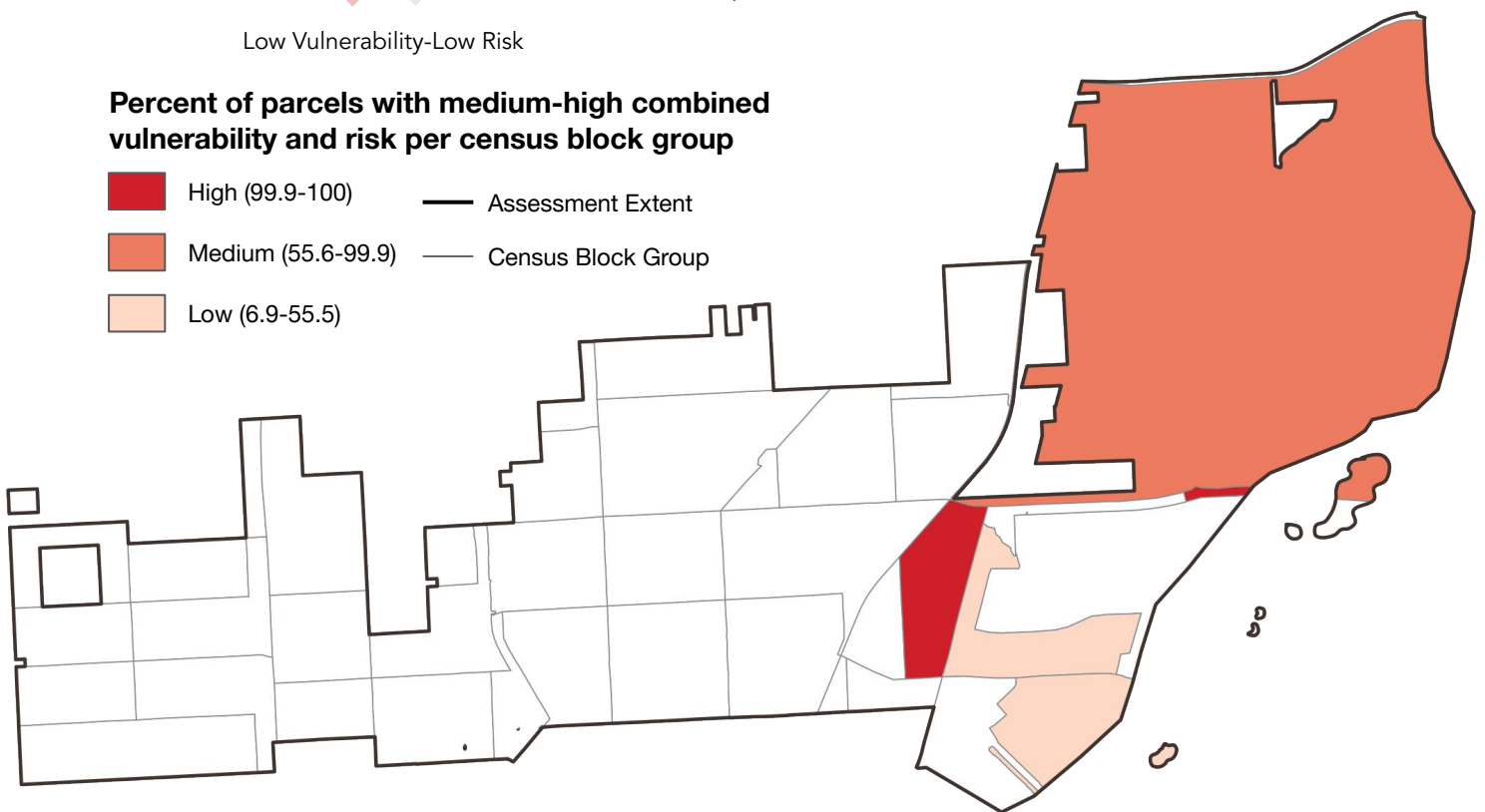
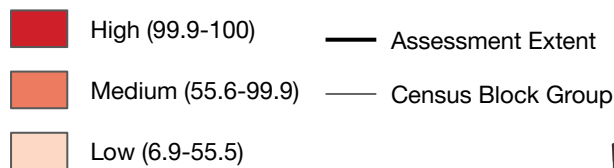
H
5
M
4
L
4

of parcels

EXPOSED:
13 parcels exposed

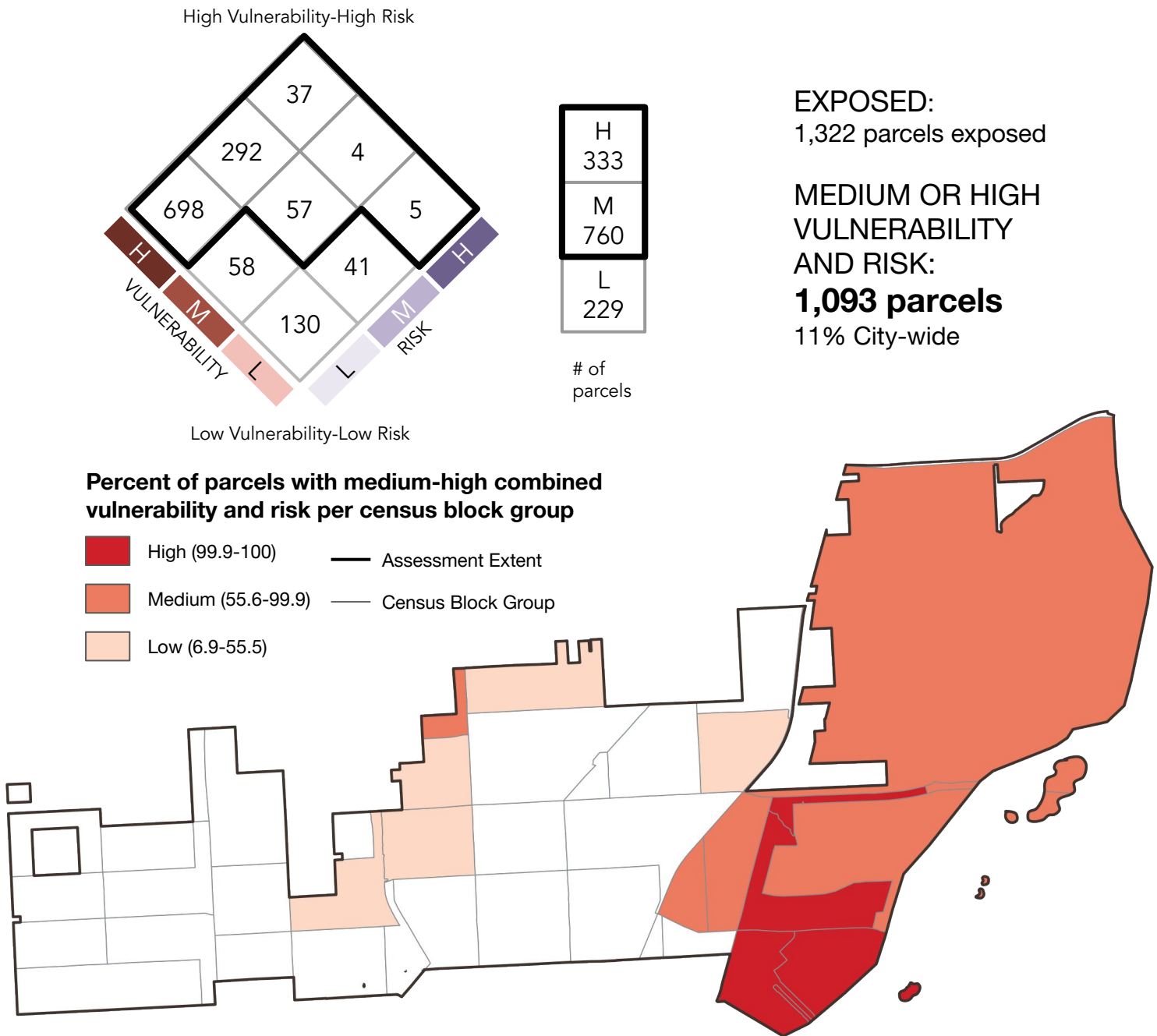
MEDIUM OR HIGH VULNERABILITY AND RISK:
9 parcels
17% City-wide

Percent of parcels with medium-high combined vulnerability and risk per census block group



Parks, cultural, and entertainment property includes places of worship, community centers, parks, museums, libraries as well as commercial, private, or exempt properties used for community gatherings and entertainment.

Residential Property | Storm Surge (Cat 1-2)

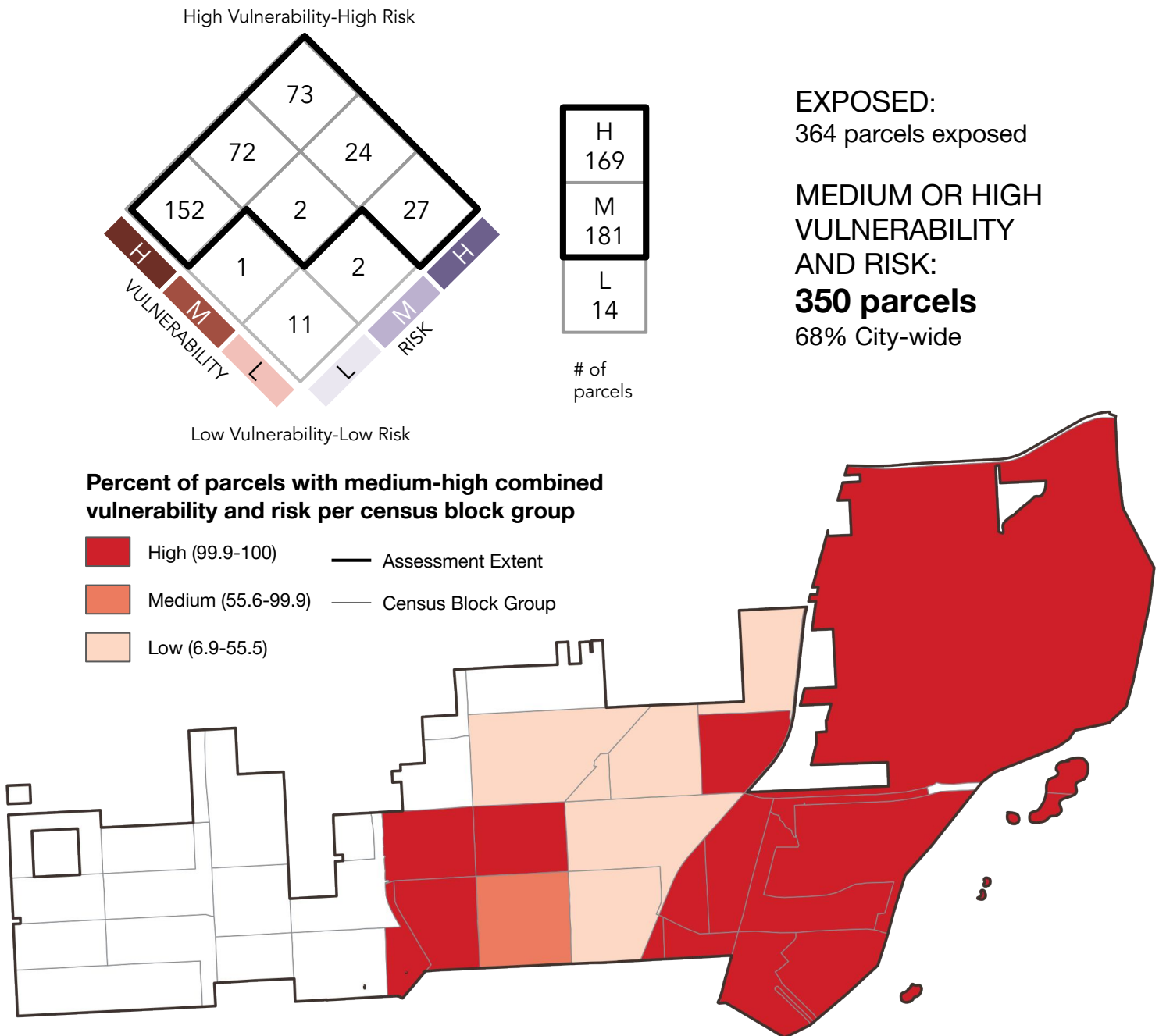


EXPOSED:
1,322 parcels exposed

**MEDIUM OR HIGH
VULNERABILITY
AND RISK:**
1,093 parcels
11% City-wide

Residential property includes properties where people live or shelter. It includes single and multifamily houses, condominiums, mobile homes, group homes, residential medical facilities and retirement homes. Vacant parcels with use codes specifying residential use are also included.

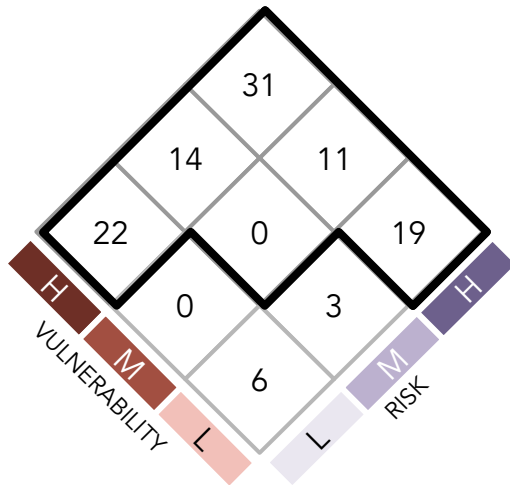
Commercial and Industrial Property | Storm Surge (Cat 3-5)



Commercial and Industrial Property includes retail, office, restaurant, hotel, industrial, parking and mixed-use properties which include businesses and support commerce, jobs and tourism. Vacant parcels with use codes specifying commercial use are also included.

Critical Facilities & Government-Owned Property | Storm Surge (Cat 3-5)

High Vulnerability-High Risk



H
56
M
41
L
9

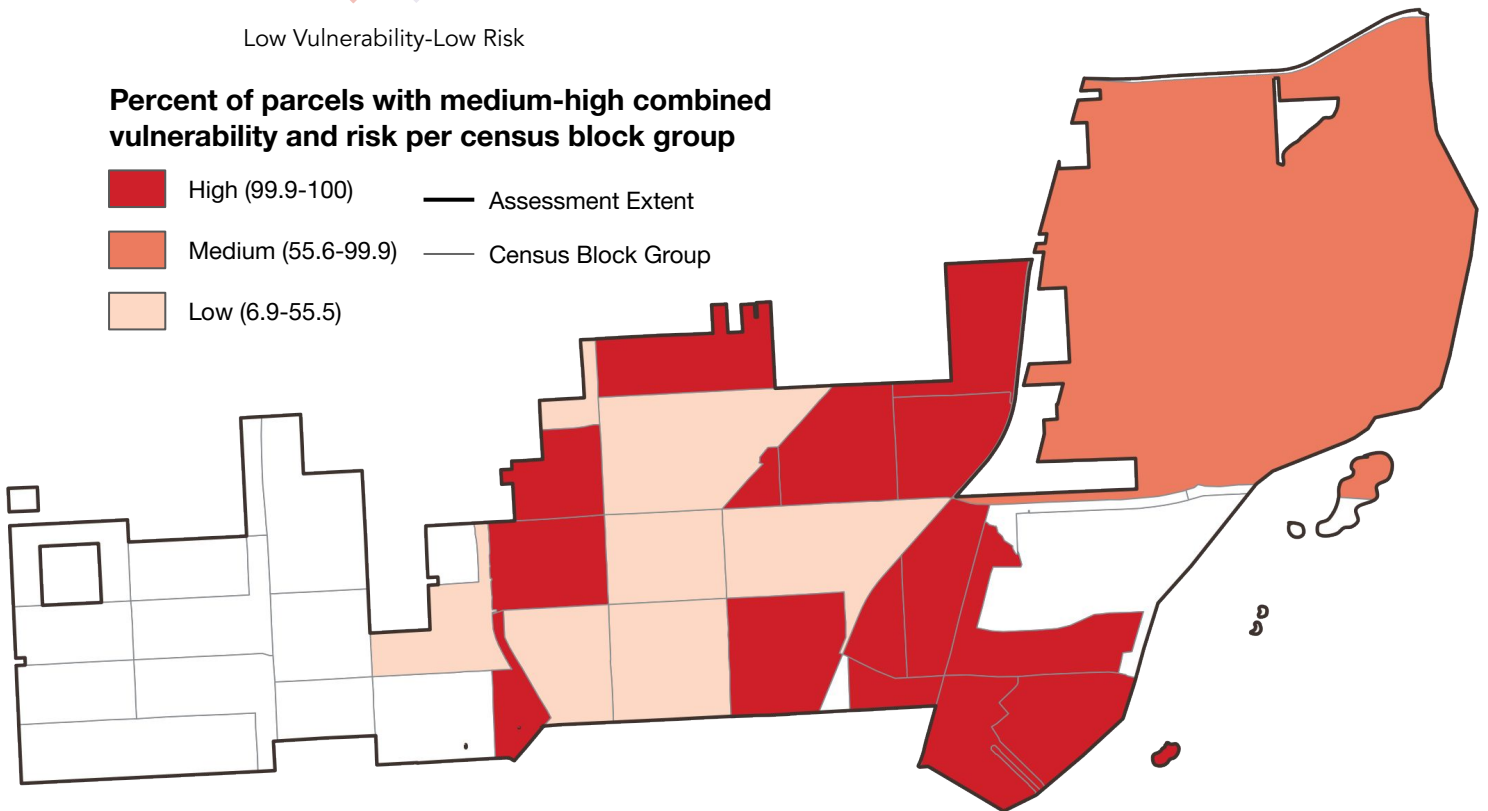
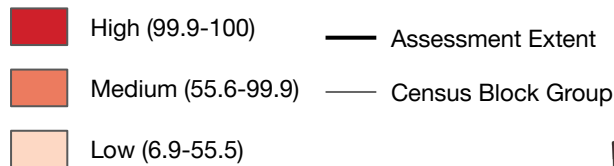
of parcels

EXPOSED:
106 parcels exposed

MEDIUM OR HIGH VULNERABILITY AND RISK:
97 parcels
71% City-wide

Low Vulnerability-Low Risk

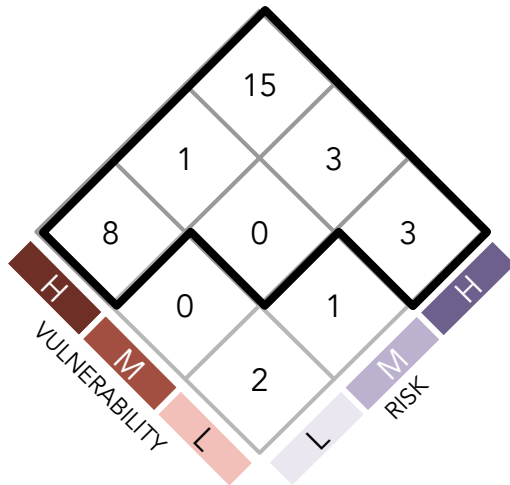
Percent of parcels with medium-high combined vulnerability and risk per census block group



Critical facilities and government-owned property includes city-owned or private facilities that provide critical services to the people of North Miami, as well as other government-owned properties within the city boundaries. The category includes medical facilities, schools, food pantries and stores accepting snap benefits, police and fire stations, utility facilities, and City Hall. Also included are all other properties listed as owned by the federal, state or city government, except parks and community centers.

Parks, Cultural, & Entertainment Property & Storm Surge (Major Storms, Cat 3-5)

High Vulnerability-High Risk



H
19
M
11
L
3

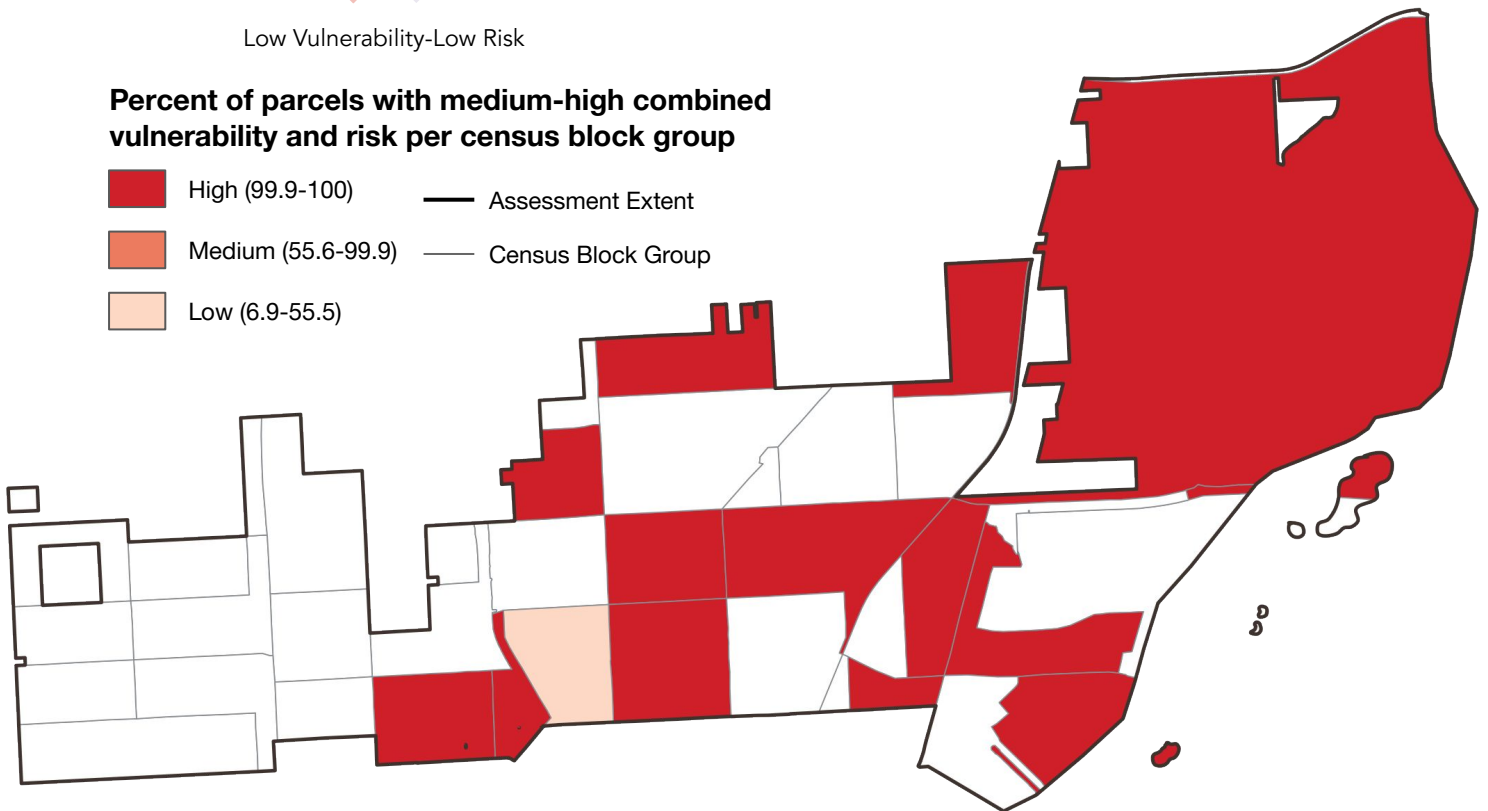
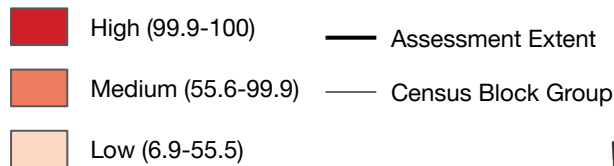
of
parcels

EXPOSED:
33 parcels exposed

**MEDIUM OR HIGH
VULNERABILITY
AND RISK:**
30 parcels
57% City-wide

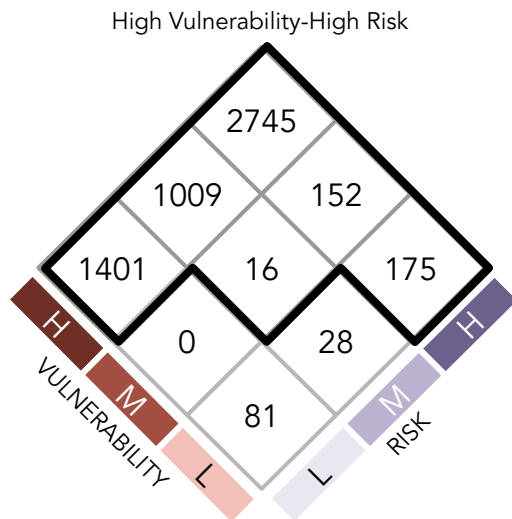
Low Vulnerability-Low Risk

**Percent of parcels with medium-high combined
vulnerability and risk per census block group**



Parks, cultural, and entertainment property includes places of worship, community centers, parks, museums, libraries as well as commercial, private, or exempt properties used for community gatherings and entertainment.

Residential Property | Storm Surge (Cat 3-5)



H
3906
M
1592
L
109

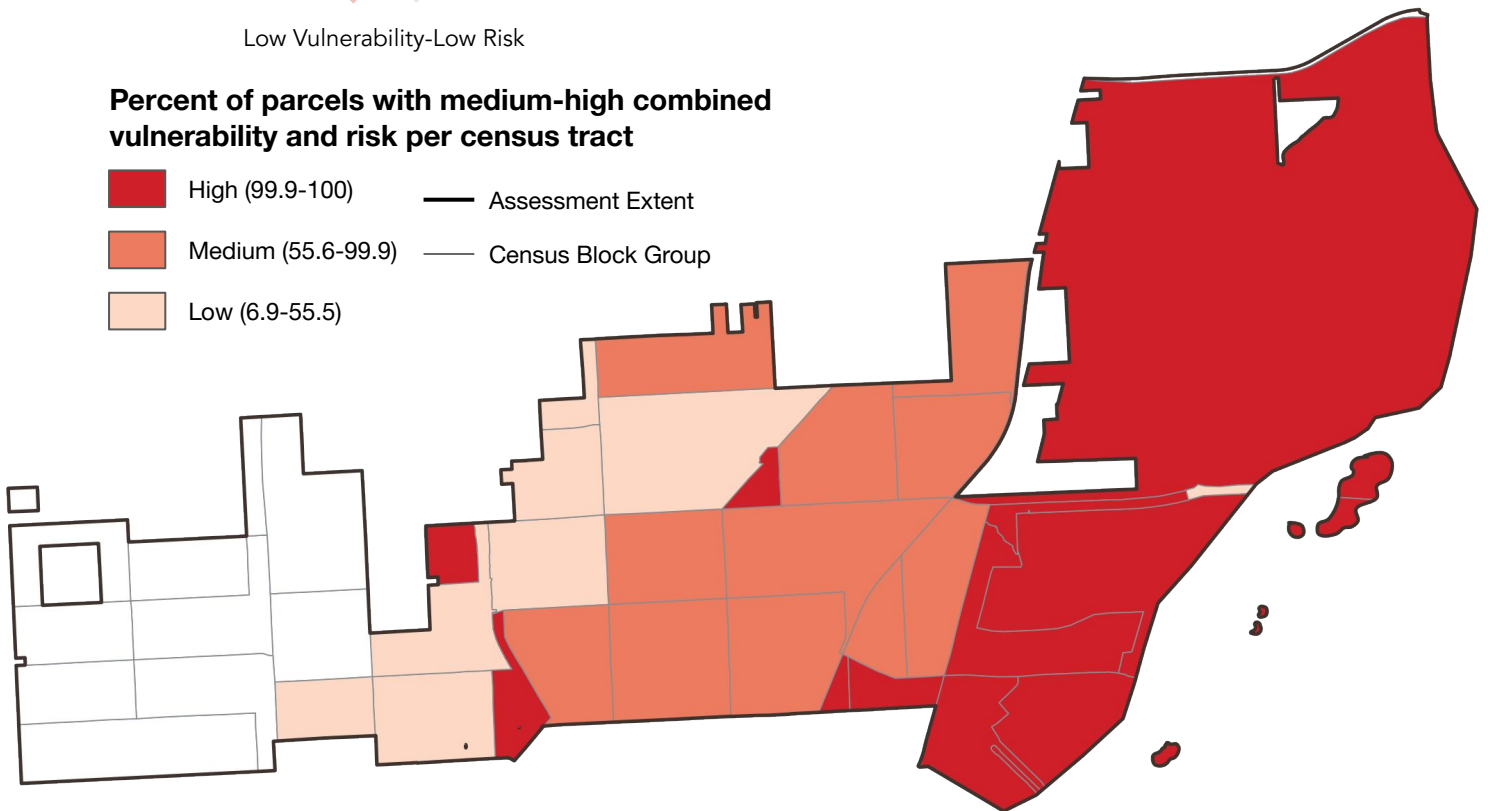
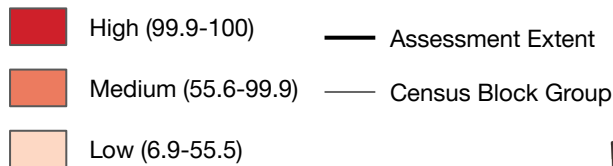
of
parcels

EXPOSED:
5,607 parcels exposed

**MEDIUM OR HIGH
VULNERABILITY
AND RISK:**
5,498 parcels
58% City-wide

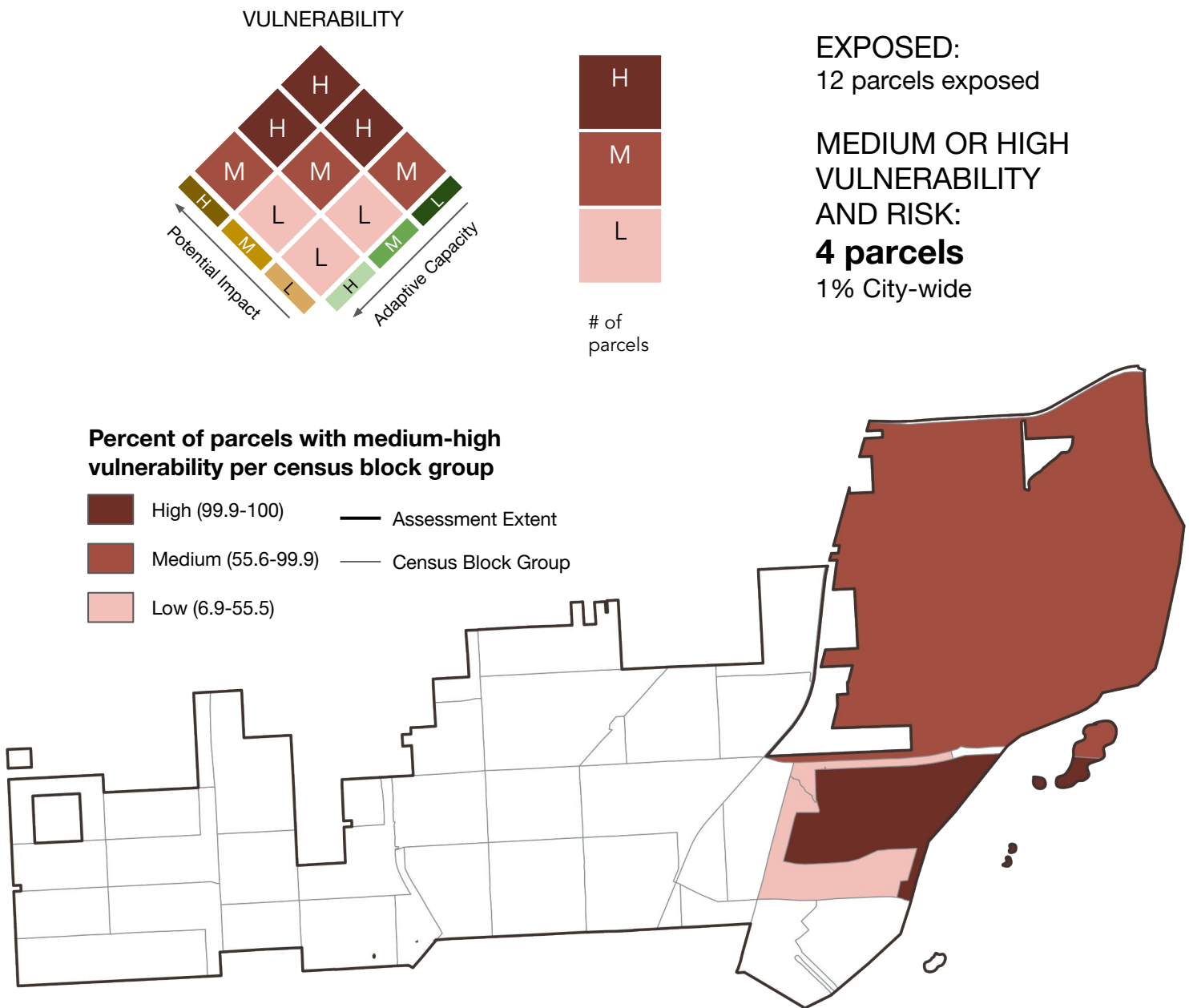
Low Vulnerability-Low Risk

**Percent of parcels with medium-high combined
vulnerability and risk per census tract**



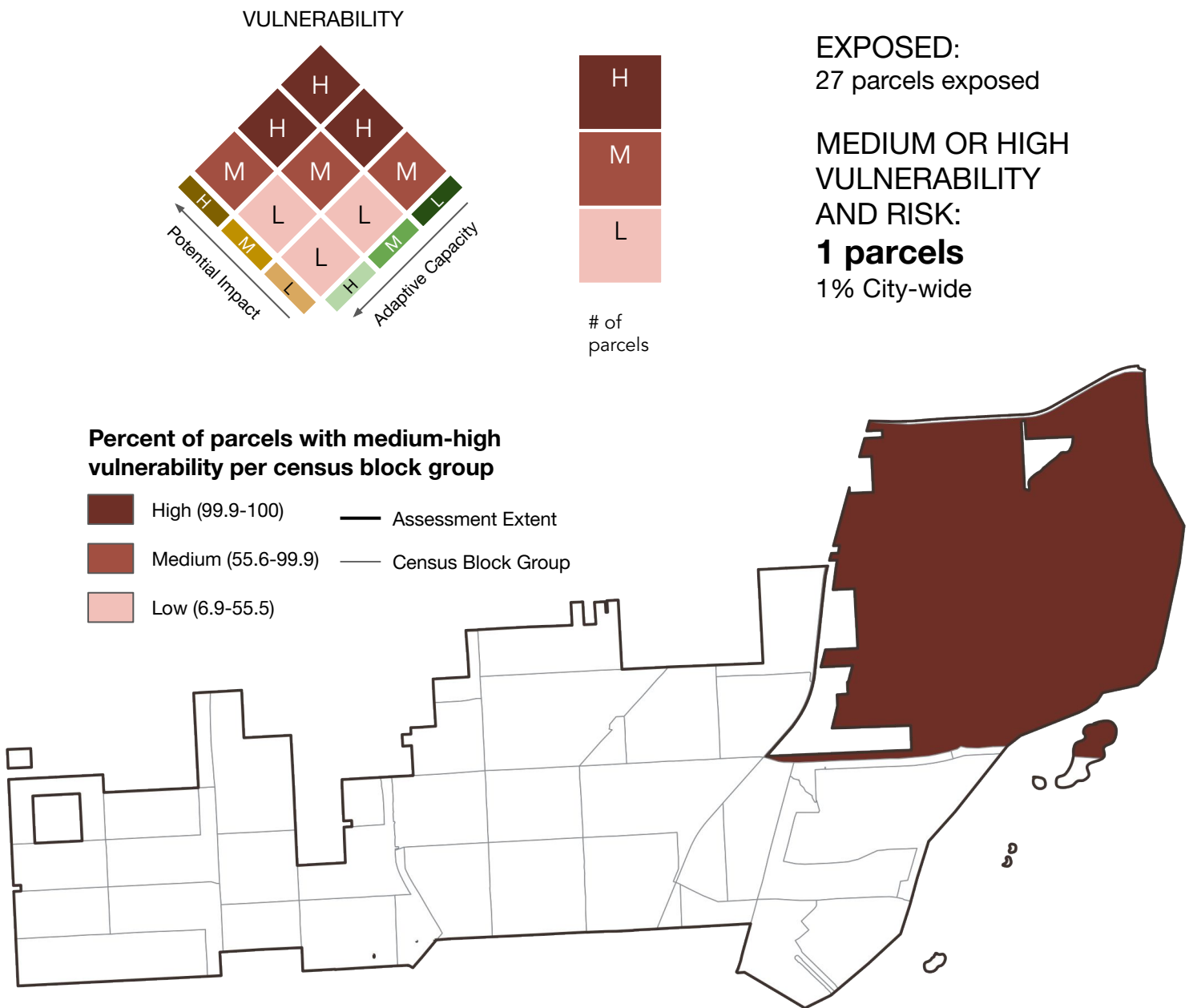
Residential property includes properties where people live or shelter. It includes single and multifamily houses, condominiums, mobile homes, group homes, residential medical facilities and retirement homes. Vacant parcels with use codes specifying residential use are also included.

Commercial and Industrial Property | Tidal Flooding & SLR (2ft water level + MHHW)



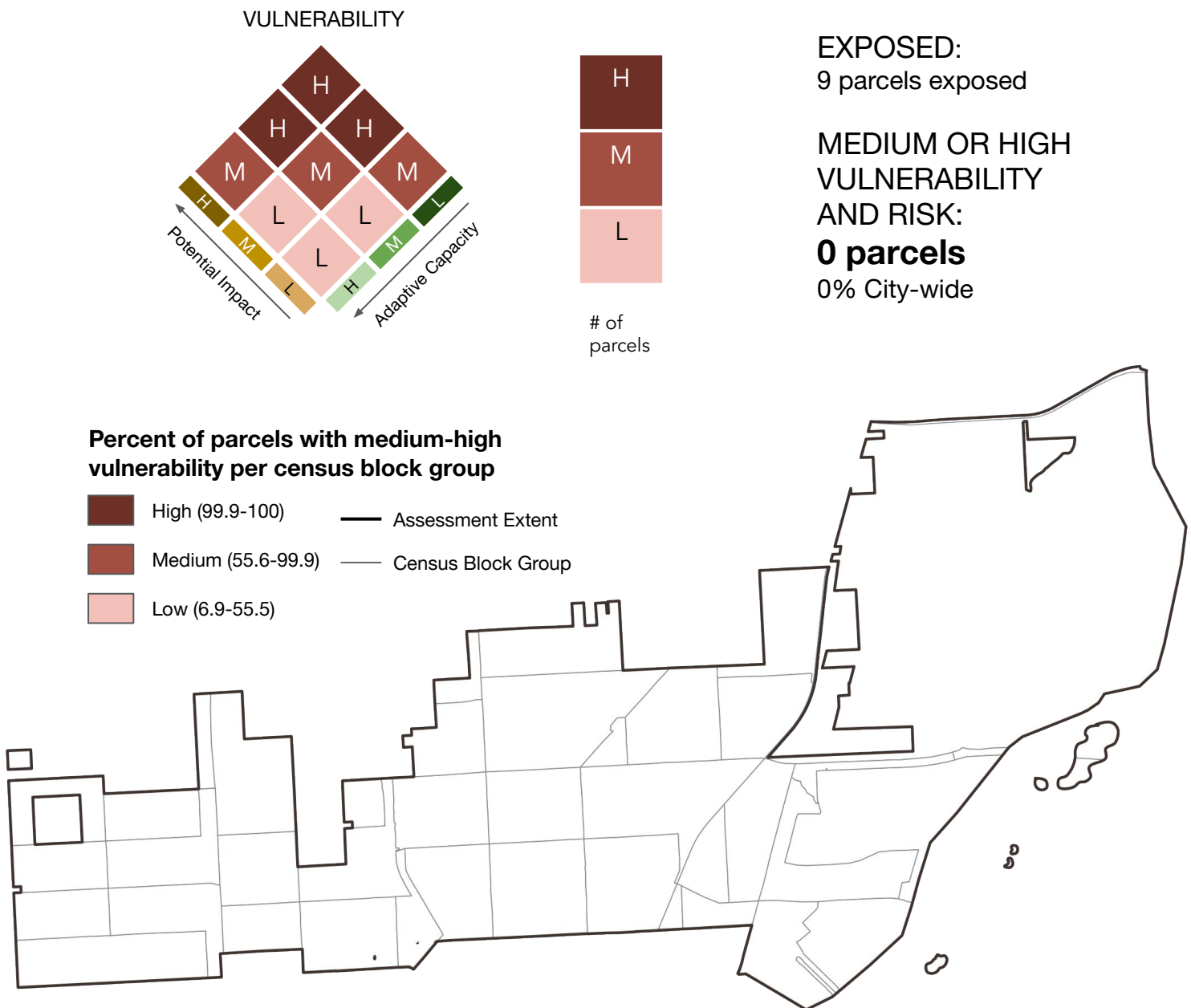
Commercial and Industrial Property includes retail, office, restaurant, hotel, industrial, parking and mixed-use properties which include businesses and support commerce, jobs and tourism. Vacant parcels with use codes specifying commercial use are also included.

Critical Facilities & Government-Owned Property | Tidal Flooding & SLR (2ft water level + MHHW)



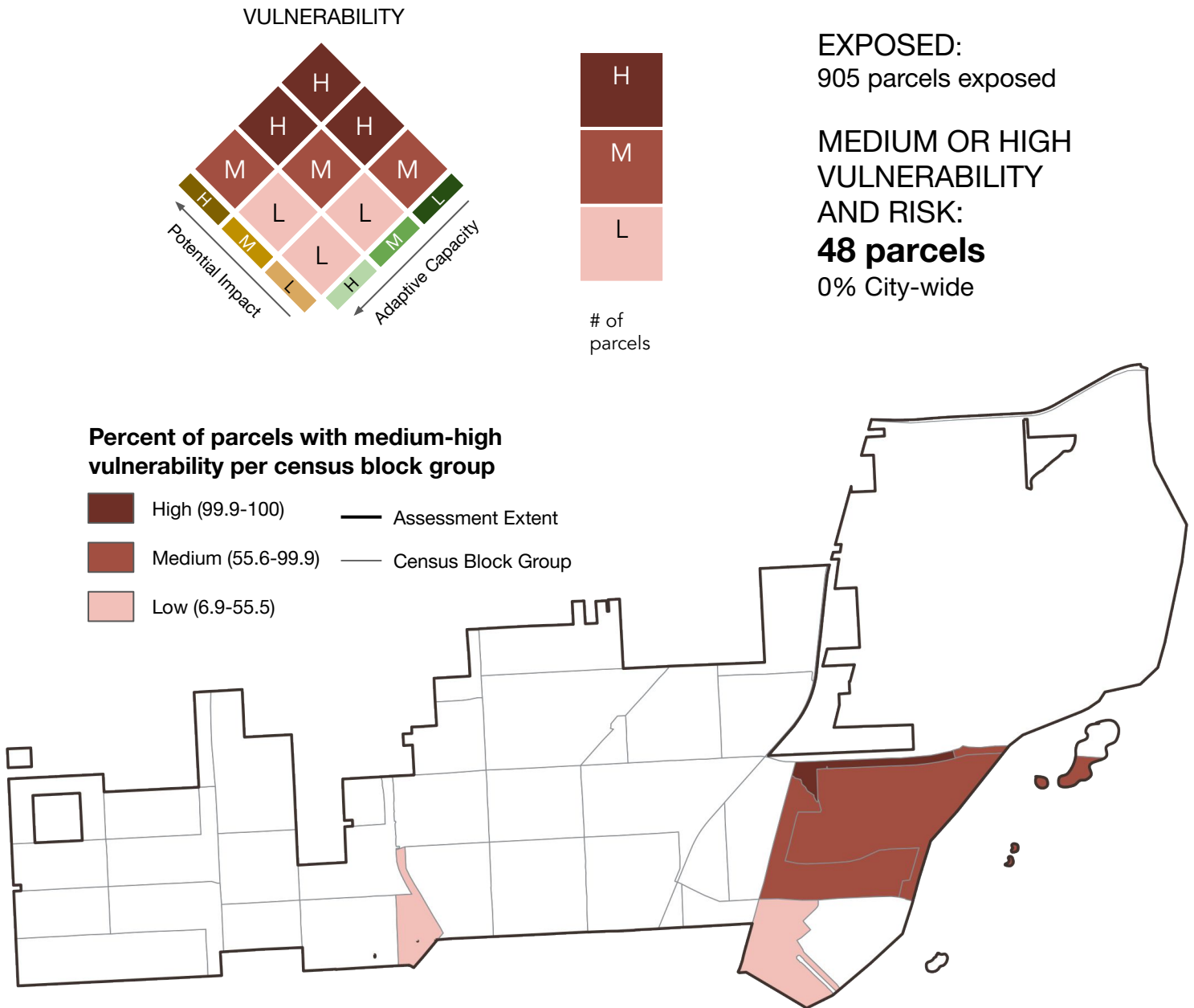
Critical facilities and government-owned property includes city-owned or private facilities that provide critical services to the people of North Miami, as well as other government-owned properties within the city boundaries. The category includes medical facilities, schools, food pantries and stores accepting snap benefits, police and fire stations, utility facilities, and City Hall. Also included are all other properties listed as owned by the federal, state or city government, except parks and community centers.

Parks, Cultural, & Entertainment Property | Tidal Flooding & SLR (2ft water level + MHHW)



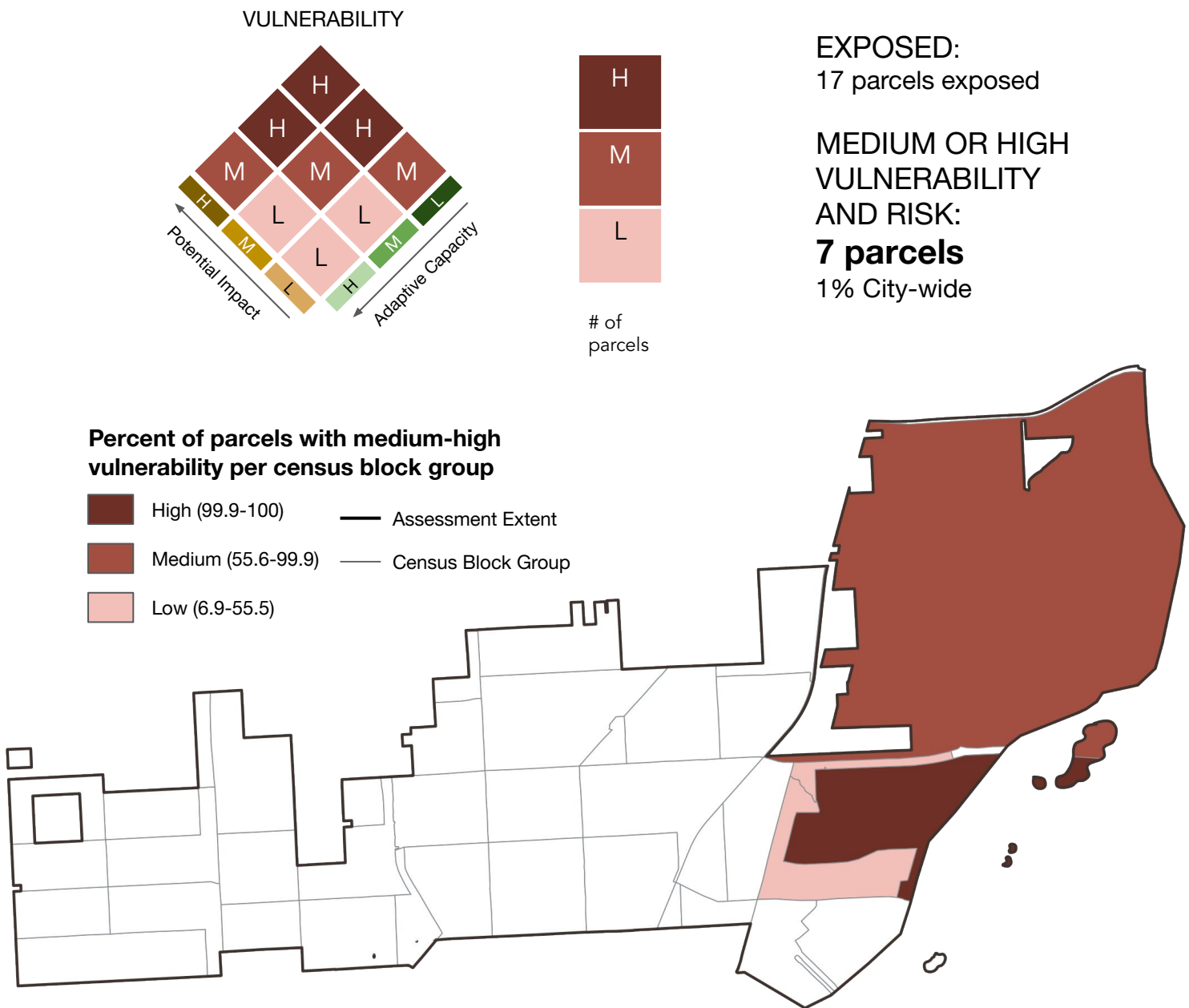
Parks, cultural, and entertainment property includes places of worship, community centers, parks, museums, libraries as well as commercial, private, or exempt properties used for community gatherings and entertainment.

Residential Property | Tidal Flooding & SLR (2ft water level + MHHW)



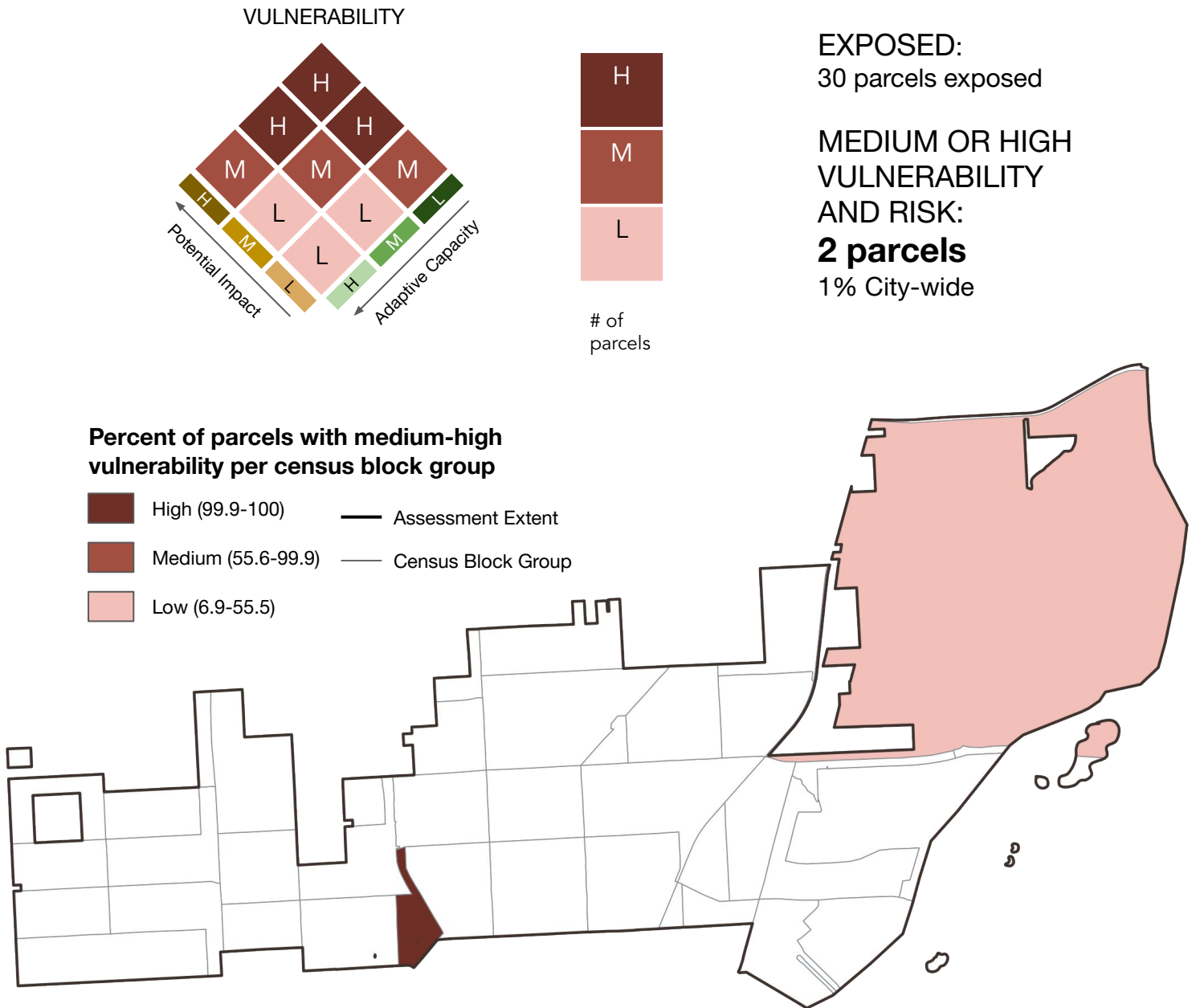
Residential property includes properties where people live or shelter. It includes single and multifamily houses, condominiums, mobile homes, group homes, residential medical facilities and retirement homes. Vacant parcels with use codes specifying residential use are also included.

Commercial and Industrial Property | Tidal Flooding & SLR (3ft water level + MHHW)



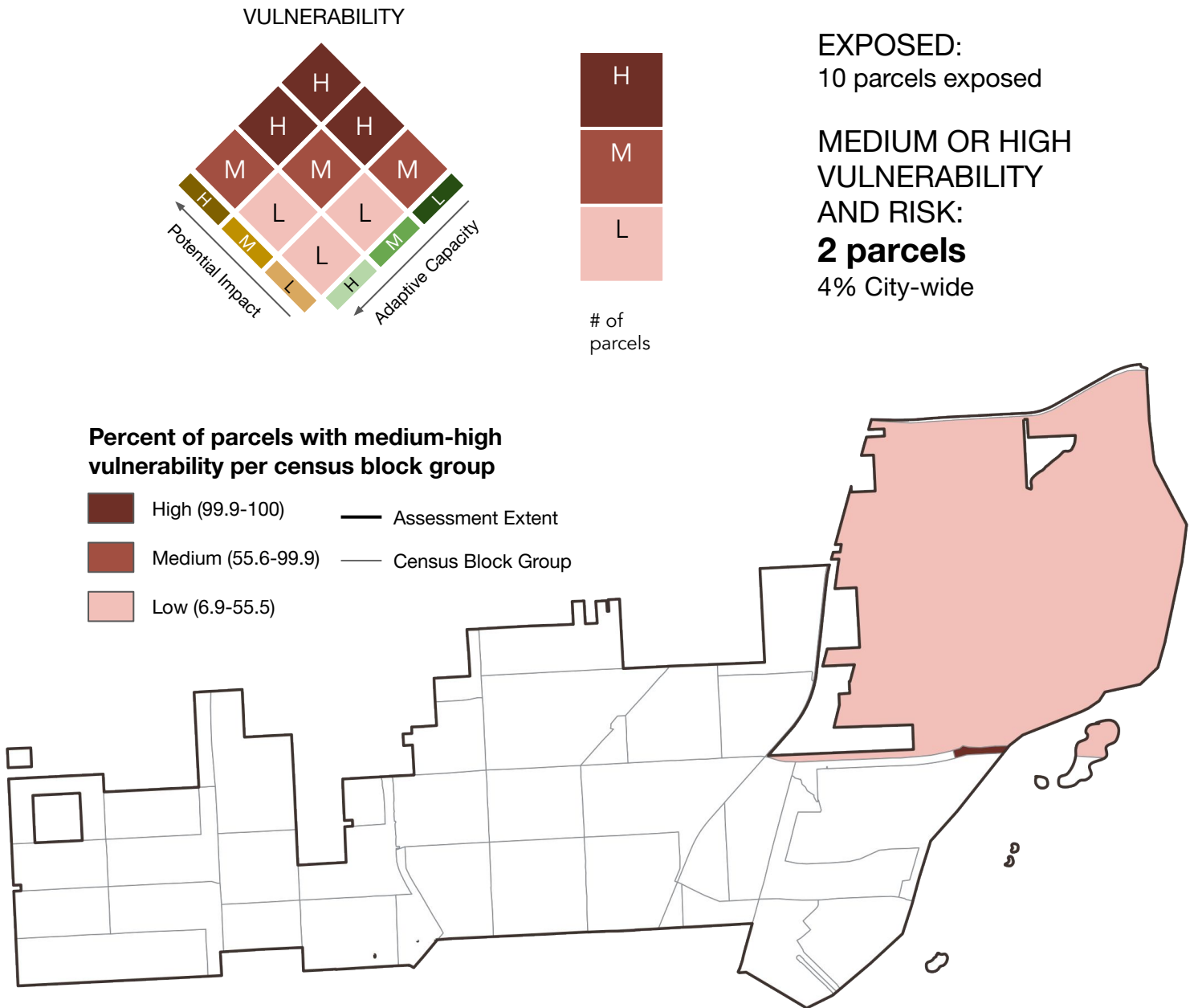
Commercial and Industrial Property includes retail, office, restaurant, hotel, industrial, parking and mixed-use properties which include businesses and support commerce, jobs and tourism. Vacant parcels with use codes specifying commercial use are also included.

Critical Facilities & Government-Owned Property | Tidal Flooding & SLR (3ft water level + MHHW)



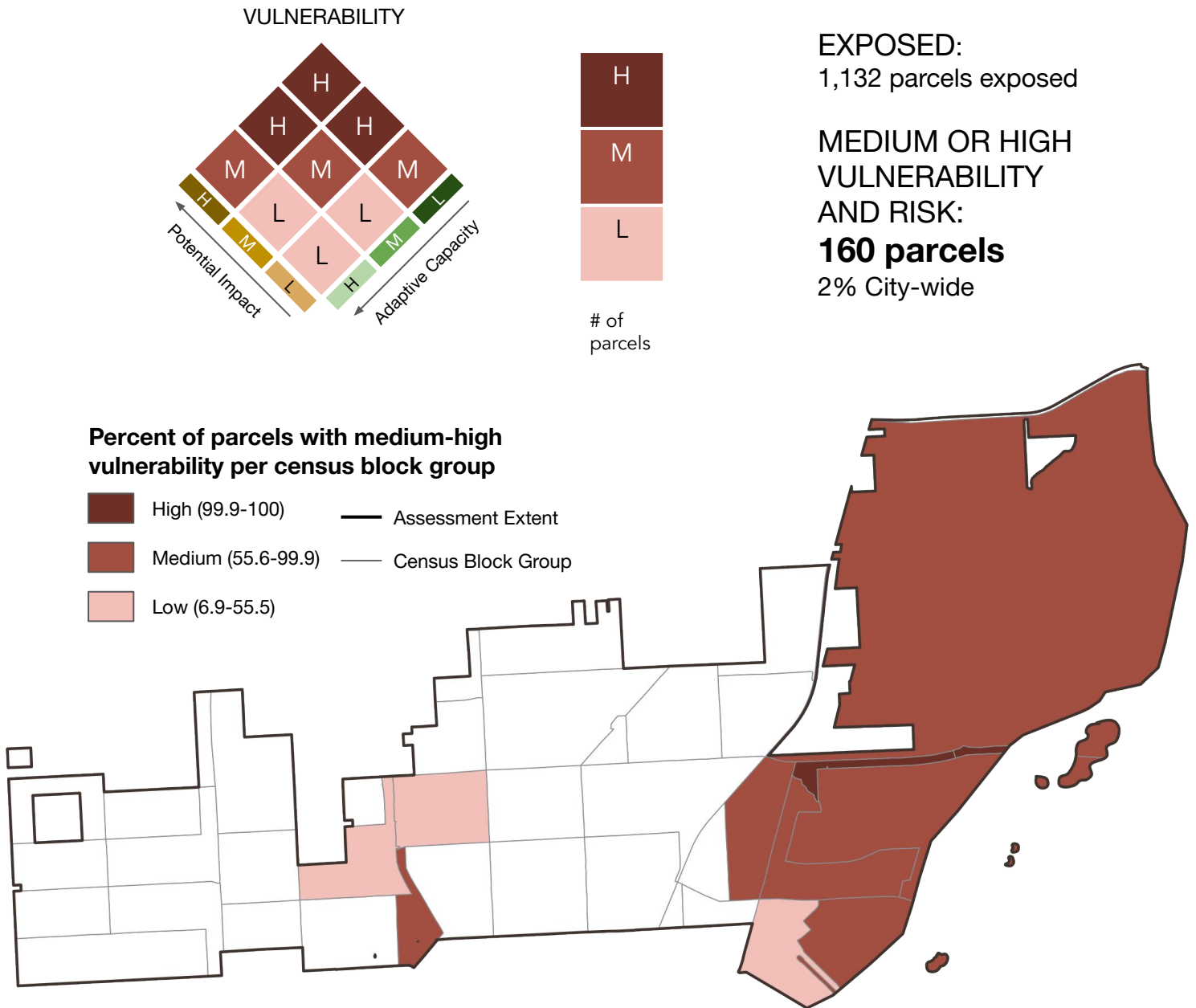
Critical facilities and government-owned property includes city-owned or private facilities that provide critical services to the people of North Miami, as well as other government-owned properties within the city boundaries. The category includes medical facilities, schools, food pantries and stores accepting snap benefits, police and fire stations, utility facilities, and City Hall. Also included are all other properties listed as owned by the federal, state or city government, except parks and community centers.

Parks, Cultural, & Entertainment Property | Tidal Flooding & SLR (3ft water level + MHHW)



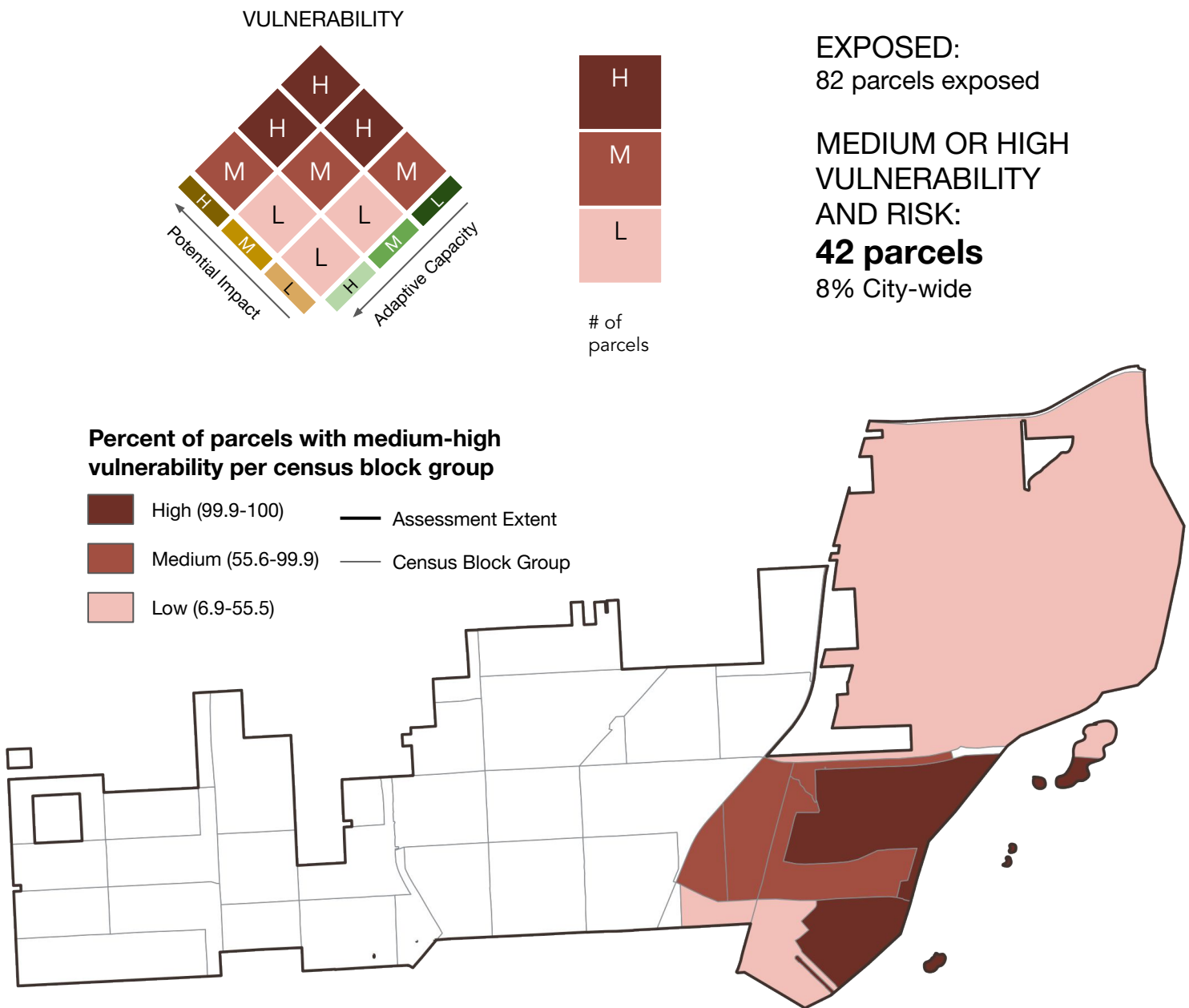
Parks, cultural, and entertainment property includes places of worship, community centers, parks, museums, libraries as well as commercial, private, or exempt properties used for community gatherings and entertainment.

Residential Property | Tidal Flooding & SLR (3ft water level + MHHW)



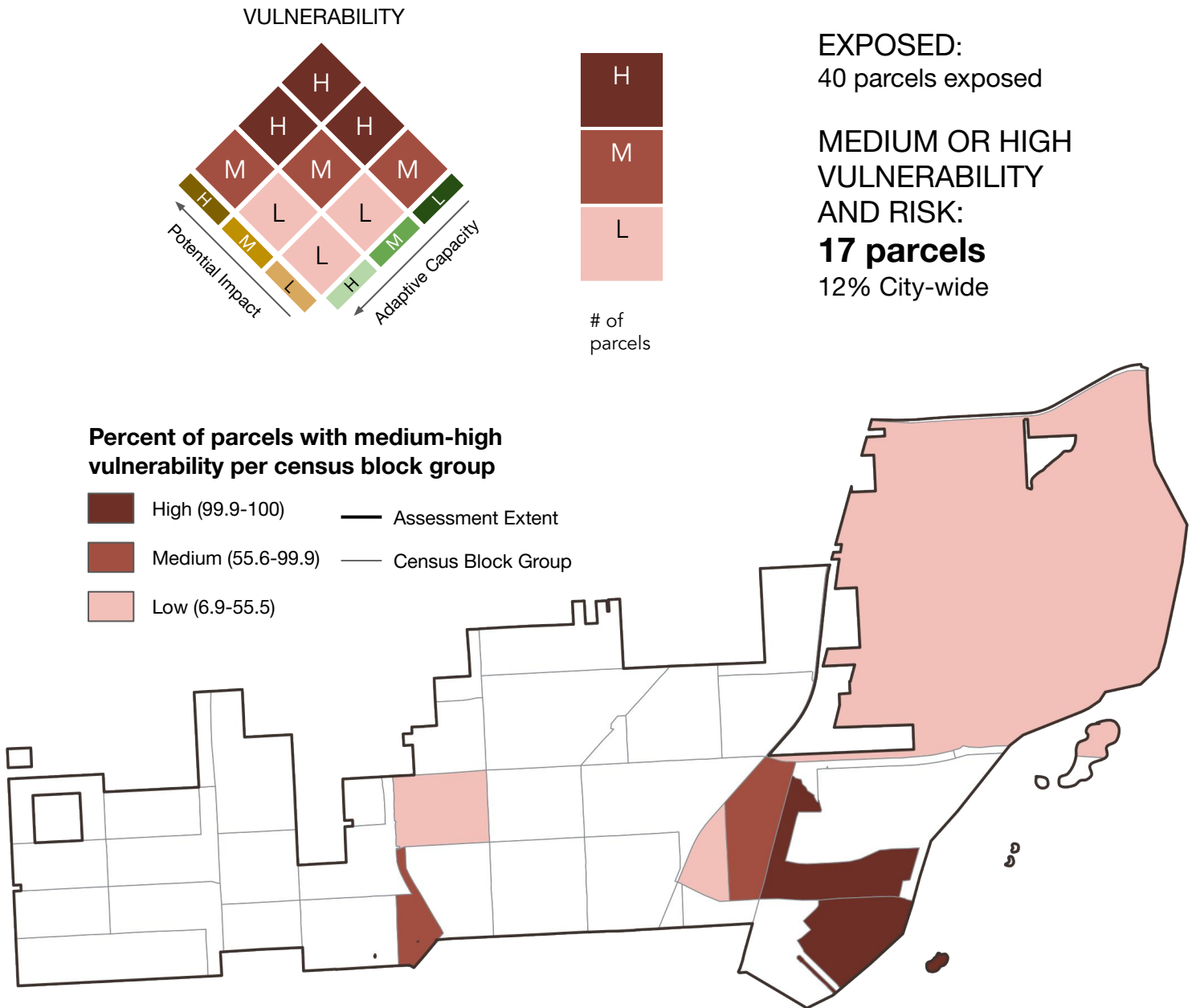
Residential property includes properties where people live or shelter. It includes single and multifamily houses, condominiums, mobile homes, group homes, residential medical facilities and retirement homes. Vacant parcels with use codes specifying residential use are also included.

Commercial and Industrial Property | Tidal Flooding & SLR (4ft water level + MHHW)



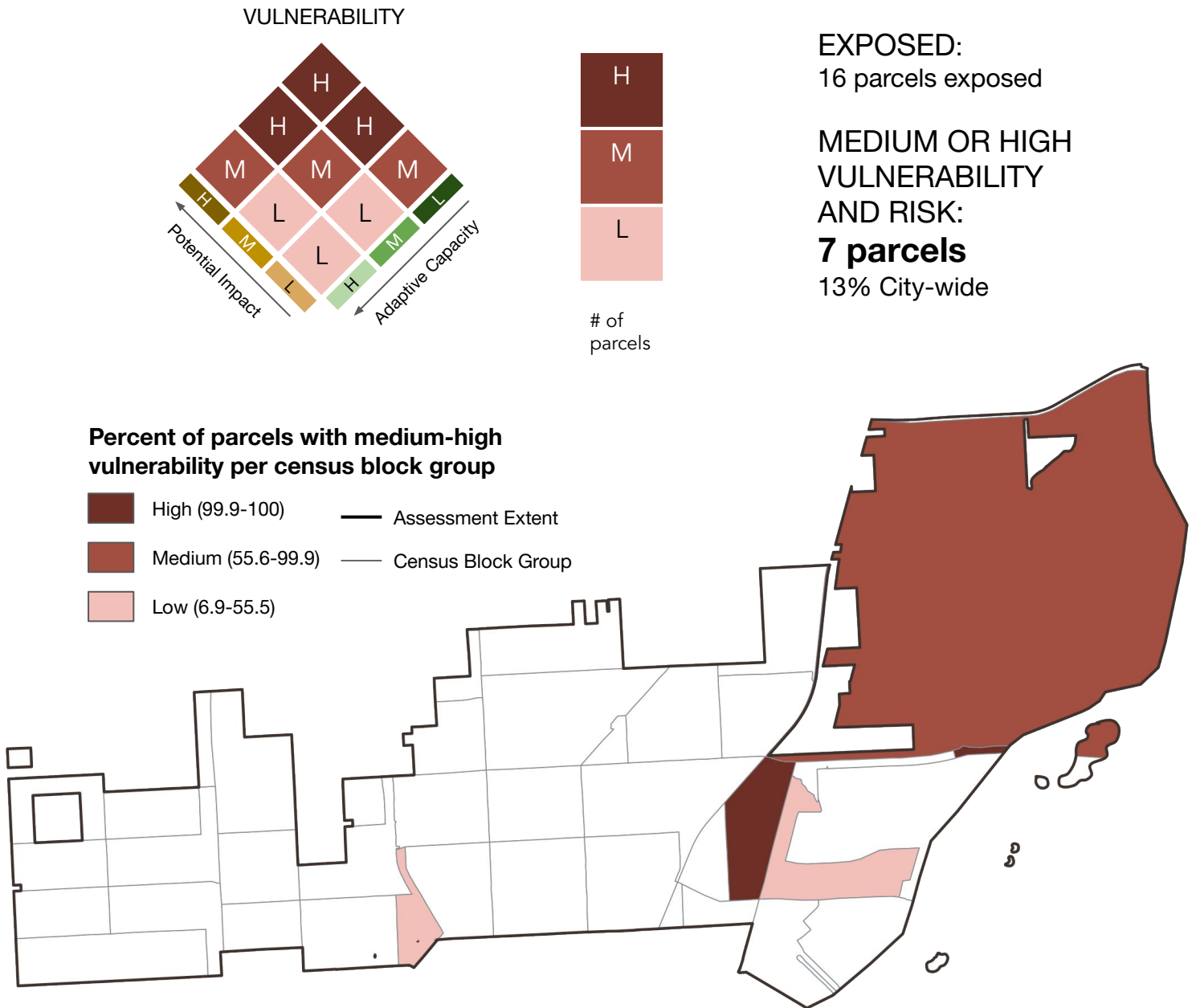
Commercial and Industrial Property includes retail, office, restaurant, hotel, industrial, parking and mixed-use properties which include businesses and support commerce, jobs and tourism. Vacant parcels with use codes specifying commercial use are also included.

Critical Facilities & Government-Owned Property | Tidal Flooding & SLR (4ft water level + MHHW)



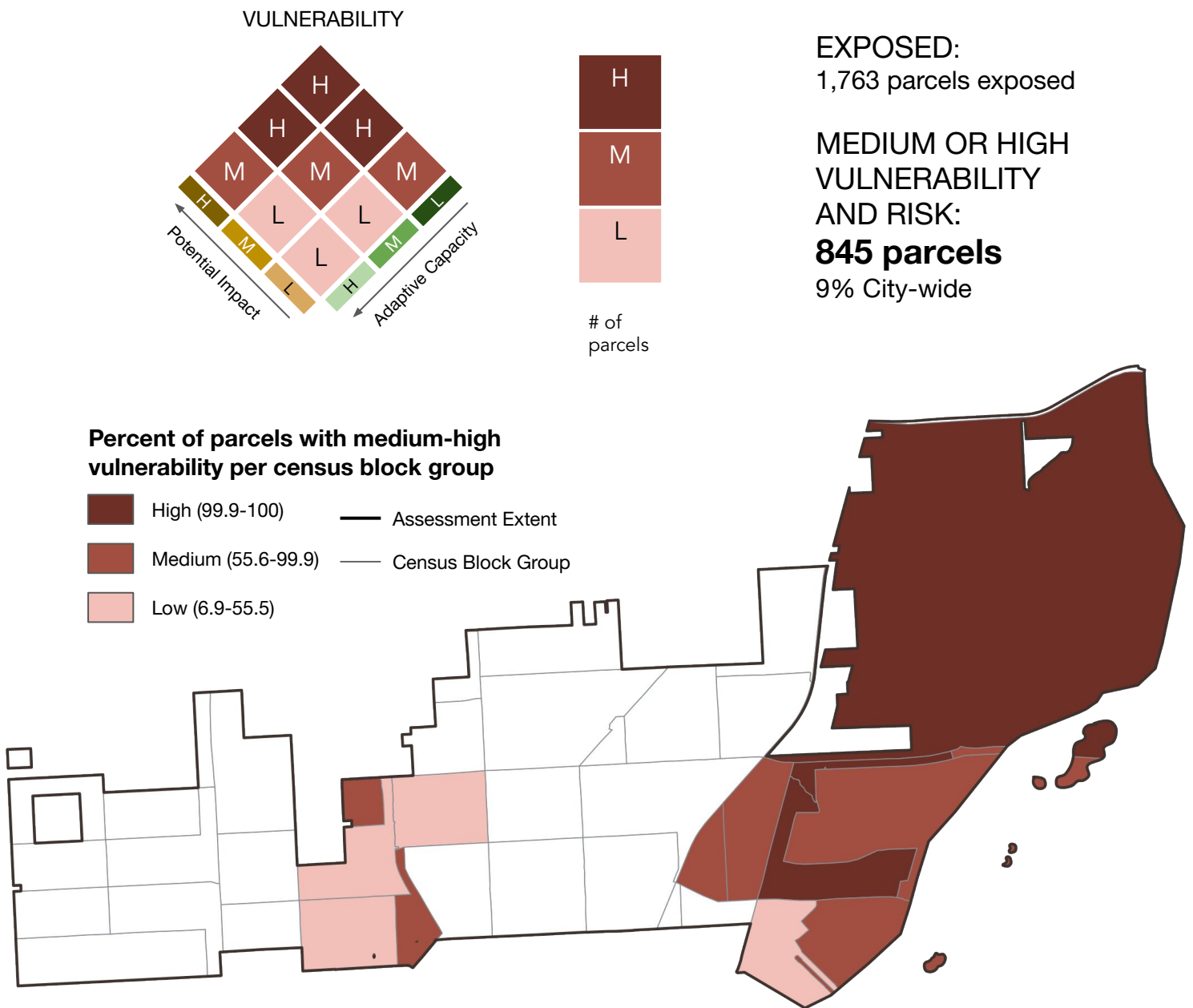
Critical facilities and government-owned property includes city-owned or private facilities that provide critical services to the people of North Miami, as well as other government-owned properties within the city boundaries. The category includes medical facilities, schools, food pantries and stores accepting snap benefits, police and fire stations, utility facilities, and City Hall. Also included are all other properties listed as owned by the federal, state or city government, except parks and community centers.

Parks, Cultural, & Entertainment Property | Tidal Flooding & SLR (4ft water level + MHHW)



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Residential Property | Tidal Flooding & SLR (4ft water level + MHHW)



Residential property includes properties where people live or shelter. It includes single and multifamily houses, condominiums, mobile homes, group homes, residential medical facilities and retirement homes. Vacant parcels with use codes specifying residential use are also included.

Appendix C: Adaptation Strategies

This appendix provides

- A list of adaptation strategies and actions discussed by the Team for the three focus areas.
- A curated list of resources for the City to continue identifying, refining, and implementing adaptation action.

Potential Strategies and Actions

While Section 5 of the main report also includes these strategies and actions, they are provided here in an easy-to-reference format organized by threat and action types. as identified by factors determined in consultation with City staff. Curated resources for the City to continue identifying, refining and implementing adaptation actions. prioritized list of adaptation strategies for the focus areas organized by asset and action types.

This table also includes a preliminary and high-level cost estimate (as specified in the scope of work approved by the City of North Miami) that takes into account the monetary cost of implementing the action proposed as well as the staff time. The categories of high, medium, low does not take into account the cost of implementing the ultimate goal of the action, but rather just the specific stage mentioned here (e.g., cost estimate for Action 1.3 only includes the staff time required to “identify partnerships” and the additional substantial time and potentially monetary resources that may be required to execute the eventual goal of developing design guidelines).

ID	Strategy/Action	Type	Threat	Cost Estimate
1	Strategy: Require or incentivize new development		Major Flooding	Medium
1.1	Increase freeboard requirements to 2 feet for residential properties.	Land Use, Building Codes, and Engineering Standards	Major Flooding	Medium
1.2	Adopt stricter floodplain building regulations for commercial and mixed-use properties	Land Use, Building Codes, and Engineering Standards	Major Flooding	Medium
1.3	Identify partnerships needed to develop guidelines for requiring and implementing green streets throughout the City of North Miami as a method of addressing stormwater runoff. A green streets stormwater management approach integrates vegetation, soil and engineering solutions to slow, filter, and clean stormwater runoff from impervious surfaces.	Capacity Building	Major Flooding	Low
2	Strategy: Multi-pronged strategy to increase household and neighborhood-level emergency preparedness		Major Flooding	Low
2.1	Partner with community organizations, faith-based groups, locally-owned small businesses to reach highly vulnerable individuals including non-English speaking households, low-income individuals, individuals with disability, etc.	Public Outreach: Community Engagement	Major Flooding	Low

ID	Strategy/Action	Type	Threat	Cost Estimate
2.2	Employ a variety of outreach materials and methods to engage and seek feedback from residents and meet them 'where they are'	Public Outreach: Community Engagement	Major Flooding	Low
2.3	Using this feedback to provide targeted resources and support for increasing household-level preparedness.	Capacity Building: Community Resources	Major Flooding	Low
3	Strategy: Building community capacity to cope and recover faster		Major Flooding	Low
3.1	Investigate the effectiveness of investing in a "resilience hub" for the North Miami community. A concept developed by the Urban Sustainability Directors Network, a resilience hub offers services and programs to community members by providing needed resources and fostering a sense of place and inclusiveness. In addition, the facility is designed to provide critical food, shelter and social services during and/or in the aftermath of a disaster. Working group discussions recognized that creating a resilience hub could be more financially and operationally feasible if located in a city-owned building outside of a vulnerable location. The development would require significant community involvement (e.g. nonprofits, schools, churches, etc.) in the planning process.	Capacity Building: Community Resources	Major Flooding	Medium
3.2	Identify and provide guidance to small businesses for developing business continuity plans.	Capacity Building: Community Resources	Major Flooding	Low
4	Strategy: Establish long-term programs to reduce the urban heat island effect		Extreme Heat	Low
4.1	Prioritize increasing tree canopy cover on City-owned land, especially in high-use areas such as bus shelters.	Green Infrastructure	Extreme Heat	Low
4.2	Identify partnership opportunities with developers, private landowners, the County and State, and NGOs/non-profit organizations to increase native tree canopy coverage in areas outside of City ownership.	Capacity Building	Extreme Heat	Low

ID	Strategy/Action	Type	Threat	Cost Estimate
4.3	Investigate building code updates to require cool/reflective roof materials. Create a program to retrofit existing residential and commercial structures. Standard or dark roofs can reach temperatures of 150°F or more in the summer sun. A cool roof under the same conditions could stay more than 50°F cooler, transferring less heat to the building below, resulting in cooler indoor temperatures and less demand for energy.	Land Use, Building Codes, and Engineering Standards	Extreme Heat	Medium
5	Strategy: Increase community capacity to cope with extreme heat events		Extreme Heat	Medium
5.1	Work with local organizations, places of worship and regional partners to designate cooling centers within the City. Cooling Centers are locations that are air-conditioned or cooled that have been designated as a site to provide respite and safety during extreme heat (CDC reference). Cooling Centers can be a variety of property types and can even be set up outdoors in the form of spray parks, pools, and public parks. The assessment highlights areas where high urban heat potential co-occurs with relatively more vulnerable populations and this information can be a starting point for targeting this effort.	Capacity Building	Extreme Heat	Medium
5.2	Resilience hubs could be designated to serve as cooling centers.	Capacity Building	Extreme Heat	High
5.3	Seek funding (and expand existing programs) to provide energy upgrades to homes and apartments to offer resources such as air conditioning units to renters.	Funding and Finance	Extreme Heat	Low
6	Strategy: Education and Awareness		Extreme Heat	Medium
6.1	Develop a program to provide targeted heat advisory warnings to heat-sensitive populations. These can occur in coordination with the local National Weather Service office. As part of this program, also conduct educational outreach around avoiding heat exposure targeted towards older individuals, people with mobility restrictions, families with infants, houseless individuals, outdoor workers, etc.	Capacity Building; Public Outreach	Extreme Heat	Medium

ID	Strategy/Action	Type	Threat	Cost Estimate
7	Strategy: A consistent strategy to reduce current vulnerabilities and avoiding adding new risk should be reflected through all strategic planning and investments made by the City		Tidal Flooding	Low
7.1	Incorporate Sea Level Rise in the upcoming Comprehensive Plan Update.	Planning, Policy, and Management	Tidal Flooding	Low
7.2	Incorporate into comprehensive and economic development plans where it makes sense to encourage economic growth based on this assessment.	Planning, Policy, and Management	Tidal Flooding	Low
7.3	Identify ways to preserve existing affordable housing and minimize displacement from areas that are unlikely to be directly affected by tidal flooding issues over the next 30 years. Seek opportunities to increase resilience of affordable housing that is vulnerable to tidal flooding currently or in the near future.	Planning, Policy, and Management	Tidal Flooding	High
8	Strategy: Identify opportunities where data and information from the City's Assessment (CCVA) could be integrated in operational or management decisions		Tidal Flooding	Low
8.1	Identify ways to modify existing workflows for routine infrastructure improvements so that opportunities to take into account SLR can be identified whenever relevant.	Planning, Policy, and Management	Tidal Flooding	Low
8.2	Consider opportunities for alignment with the assessment and considering resilience in the areas of Capital Improvement Plan (CIP) project planning and prioritization, maintenance activities, and planning activities (including the City's Comprehensive Plan).	Planning, Policy, and Management	Tidal Flooding	Low
9	Strategy: Capacity Building through monitoring and research		Tidal Flooding	Medium
9.1	Develop a citizen-science monitoring program, in partnership with stakeholders such as the FIU Sea Level Solutions Lab, that focuses on recurrent tidal flooding and sewer overflow issues that provides the public with a real-time method for reporting flooding issues. This program would provide highly localized information necessary to identify appropriate interventions while also increasing public understanding of tidal flooding issues.	Capacity Building; Public Outreach	Tidal Flooding	Medium

ID	Strategy/Action	Type	Threat	Cost Estimate
Other strategies discussed during the course of the project or are otherwise potentially relevant				
10	Continue to seek additional sources of funding for pump station upgrades. Consider the need for a pump station vulnerability assessment that could help prioritize future funding. As pump station infrastructure is upgraded, identify the co-benefit opportunities by going beyond the minimum required standards. E.g., use solar for back-up power, make the landscaping on the entire parcel highly permeable, improve aesthetic appearance, etc.	Funding and Finance	All Flooding	Medium
11	Provide information on flood risk at the neighborhood level.	Infrastructure	All Flooding	Low
12	Prioritize opportunities for green infrastructure that can help address both near and long-term vulnerabilities	Infrastructure	All Flooding	Medium
13	Building on the success of the Good Neighbor Stormwater Park and using the plan created in the process, identify and seek funding for converting more repetitive loss properties in to public spaces that also address stormwater issues and urban heat island effect.	Funding and Finance	All Flooding	Medium

Resources for Identifying Additional Strategies

Resource	Source	Link
Type: Local Adaptation Plans		
Adaptation Clearinghouse	Georgetown Climate Center	https://www.georgetownclimate.org/adaptation/index.html
Type: Adaptation Case Studies		
Adaptation Clearinghouse	Georgetown Climate Center	https://www.adaptationclearinghouse.org/
Climate Adaptation Knowledge Exchange	EcoAdapt	https://www.cakex.org/resources/type/project
Type: Land Use and Building Codes		
Smart Growth Fixes for Climate Adaptation and Resilience	U.S. EPA	https://www.epa.gov/smartgrowth/smart-growth-fixes-climate-adaptation-and-resilience
Type: Resilience		
HUD Community Resilience Toolkit	U.S. Dept. of Housing and Urban Development	https://files.hudexchange.info/resources/documents/HUD-Community-Resilient-Toolkit.pdf
Type: Equity		
Water Rising: Equitable Approach to Urban Flooding	U.S. Water Alliance	http://uswateralliance.org/sites/uswateralliance.org/files/publications/Final_USWA_Water%20Rising.pdf
Opportunities for Equitable Adaptation in Cities	Georgetown Climate Center	https://www.georgetownclimate.org/files/report/GCC-Opportunities for Equitable Adaptation in Cities on-Feb 2017.pdf
Social Equity and Climate Change: A discussion page about community resilience	American Planning Association	https://www.washington-apa.org/assets/docs/2015/Ten_Big_Ideas/October_Revisions/social_equity_11.9.pdf

Appendix B: Funding Sources

Grant Identification Sites	
Organization	URL
American Flood Coalition	https://floodcoalition.org/fundingfinder/#programdetails
US Climate Resilience Toolkit	https://toolkit.climate.gov/content/funding-opportunities
Adaptation Clearinghouse	https://www.adaptationclearinghouse.org/search/?type%5B%5D=&keyword_a=t&q=funding
Grants.gov	https://www.grants.gov/
Florida League of Cities	https://www.floridaleagueofcities.com
Indian River County	https://www.ircgov.com/search.html?cx=008058945305766018525%3Aqmnk3b9y1e4&ie=UTF-8&q=federal+funding+sources+for+flood+mitigation&sa=

Opportunities		
Organization	Program	URL
Federal Emergency Management Agency (FEMA)	Building Resilient Infrastructure and Communities (BRIC) Grant	https://www.fema.gov/grants/mitigation/pre-disaster
	Flood Mitigation Assistance (FMA) Grant Program	
US Department of Housing and Urban Development	CDBG- DR (Disaster Recovery)	https://www.hudexchange.info/programs/cdbg-dr/
	CDBG-MIT (Hazard Mitigation)	https://www.hudexchange.info/programs/cdbg-mit/
	CDBG Section 108 Loan Guarantee Program	https://www.hudexchange.info/programs/section-108/
US Environmental Protection Agency Water and Resilience Programs	Climate Change Adaptation Resource Center (ARC-X)	https://www.epa.gov/arc-x/our-climate-adaptation-search

		https://www.epa.gov/arc-x/federal-funding-and-technical-assistance-climate-adaptation
	State Clean Water Revolving Fund (SRF)	
	Brownfields Revolving Fund	
	Environmental Justice Small Grants Program	
	Five Star and Urban Waters Restoration Grant	
	Section 319 NPS Program	
National Fish and Wildlife Foundation	National Coastal Resilience fund	https://www.nfwf.org/apply-grant/application-information
	Resilience Communities Program	
Florida State Funding and Financing Sources	Florida Dept of Environmental Protection	https://www.floridadisaster.org/dem/mitigation/hazard-mitigation-grant-program/
	Florida Division of Emergency Management Flood Mitigation Assistance Grant Program	
	Florida Resilient Coastlines Program (DEP)	
	Coastal Partnership Initiative Grant Program	
	State Agency and Water Management District Grant Program	
	Beaches Funding Grant	
Technical and Funding Assistance Programs	Florida Resilient Cities Program University of Florida College of Design, Construction and Planning	https://dcp.ufl.edu/frc/
	Florida League of Cities Grant Guidance	https://www.floridaleagueofcities.com/grants-funding-opportunities

Other Financing Mechanisms		
Category	Type	Description
Bonds and Loans	Municipal	Environmental Impact Bonds and General Obligation Bonds for Flood control infrastructure
	Infrastructure	EPA Water and Wastewater Revolving Financing Programs and CDBG Section 108 Loan Program
	District Level Flood Mitigation	District level business improvement and flood protection program fees
	Individual Property Savings	CRS Rating Improvement Flood Insurance reductions

Appendix E: Community Engagement Documentation

Educational Content Flyers

Public Workshop Agenda and Attendee List

Public Workshop PowerPoint Presentation Slides

Public Workshop Full Poll Results

Public Meeting Agenda and Attendee List

Public Meeting PowerPoint Presentation Slides

Public Meeting Full Poll Results

Second Survey Full Results

Educational Content Flyers

What is a Climate Change Vulnerability Assessment?

A vulnerability assessment is a structured process that identifies ways in which a community is susceptible to harm from climate threats. North Miami's Climate Change Vulnerability Assessment (CCVA) utilizes science-driven data about climate threats from multiple sources, including the National Oceanic Atmospheric Administration (NOAA) and the Federal Emergency Management Agency (FEMA). This scientific data is combined with information about the North Miami's people, assets, and businesses to understand current and future challenges to long-term operability of the City. The CCVA provides the basis for the City to begin identifying strategies to build resilience and adapt to a changing climate.

How is Risk Determined?

Once the vulnerability is understood for each asset, the next step is to determine risk. Risk entails calculating the probability of an event and how at risk an asset is to a particular threat, in conjunction with the associated consequences of that event or hazard.

What is Adaptation and Adaptive Capacity?

Climate adaptation entails modifying an asset to be able to withstand current or future environmental conditions and be resilient against climate threats. Any adaptation action taken is appropriately tailored to each asset. Ranging from hardening an asset to relocating it, numerous efforts may be taken to protect an asset for the long-term. An asset's adaptive capacity measures the extent to which an asset is able to change to reduce the risk of a threat.

Asset Example:

Two businesses, Business A and Business B, are on the same road. Business A has a park next to it and Business B sits right in the middle of a busy street. During a heavy rainstorm, Business A does not experience as severe of flooding as Business B because the park provides a place for water to run off to. Whereas, Business B is surrounded by impermeable concrete surfaces where water does not soak into the ground. Thus, Business A & B have the same exposure, but differ in vulnerability and risk.



Community Assets Types:



AN INTRODUCTION TO NORTH MIAMI'S CLIMATE THREATS

As part of North Miami's Climate Change Vulnerability Assessment (CCVA), the study selected the five climate threats that either have impacted or may impact the City's long-term operability. The CCVA study takes into consideration several metrics and utilizes science-driven data from multiple sources, including the Federal Emergency Management Agency (FEMA) and the National Ocean Atmospheric Administration (NOAA), to understand the City's current and future challenges, as well as identify sensible opportunities for building resilience and adapting to climate change. The information below contains details about the five chosen climate threats for NoMi's CCVA study.



Rainfall-Induced Flooding

Flooding associated with rain events, such as thunderstorms, tropical systems, and cold fronts. Changes in rainfall patterns can cause downpours of rain in short periods of time which may create flooding hotspots in heavily developed areas with impervious surfaces. The frequency and intensity of these rainstorm events disrupt stormwater systems, mobility, viability and more.



Storm Surge

Hurricanes are inherently a part of every South Florida community. Storm surge is the abnormal rise in tide generated by a severe tropical storm or hurricane. Strong winds over the ocean drive water onshore which can lead to extensive property loss, damage coastal habitats and beaches and undermine the foundation of critical infrastructure like roads and utilities. Rising sea levels combined with the potential for stronger and more frequent storms in the future may cause flooding in areas that previously would not have experienced it.



Extreme Heat and the Urban Heat Island Effect

Florida's tropical climate, in conjunction with largely populated and developed areas, exacerbates the problem of extreme heat. Known as the Urban Heat Island Effect, this occurs when a metropolitan area experiences warmer temperatures than its surrounding environment due to the urban area's ability to excessively trap and absorb heat.



Tidal Flooding and Sea Level Rise

Height of a daily tide varies seasonally and from year-to-year depending on relative position of the earth, sun and the moon, and ocean and wind currents. Seasonal high tides can cause sunny day flooding. As sea levels rise, so too do tides, exacerbating flooding in low-lying coastal areas. Future sea level projections indicate 1-3 ft of sea level rise within the next few decades which will continue to increase the severity and frequency of future tidal flooding. Due to South Florida's porous topography, rising sea levels will also affect water and stormwater infrastructure in the City.

Swales 101

A critical and often overlooked nature-based form of stormwater infrastructure are swales. These long, narrow stretches of gently sloping grass, normally located alongside roads, sidewalks, or in front of properties, serve numerous purposes and are integral to communities like NoMi that experience rain events almost all year round. Swales are instrumental in managing stormwater and reducing the impacts of flooding. Their flexibility to fit a variety of landscapes, in concert with relatively low maintenance needs, makes swales increasingly feasible for all to implement and reap the benefits.

Why should swales be protected?

Swales function as an essential form of stormwater management and should be protected because they assist with reducing the effects of flooding and help treat runoff allowing less pollution to flow into canals and the Biscayne Bay. It is up to every single one of us to be an advocate for the protection of swales and educate our neighbors and friends on the pivotal roles they play.

Benefits of swales

- Swales provide a natural way for stormwater to collect away from roads and property in a controlled manner that slows down the movement of water.
- The soil within swales helps trap pollutants associated with runoff and acts as a barrier for pollution that would otherwise flow into our bodies of water and pollute potable water.
- These open drainage systems do not just reduce the magnitude of flooding, but also serve as a form of beautifying open spaces and creating an aesthetically pleasing environment.

How should they be maintained?

- Please do not park on them! The weight of cars compacts the soil reducing the effectiveness of their pollution reduction.
- Mow them periodically, if overgrown.
- Clear out any debris or trash as it appears.
- Aerate the soil every few months. We can poke holes in the soil to allow for soil aeration and therefore better water retention.
- Reduce our fertilizer and pesticide usage when possible.

Who should maintain swales?

- The responsibilities pertaining to swale maintenance applies to all, including the City and homeowners themselves. Actively doing your part, and working alongside the City in helping to maintain healthy swales will ensure that North Miami stays beautiful, healthy, and thriving for the years to come.



When it rains, water moves down the swale and is being absorbed along the way as it travels to the bottom.

Public Workshop Agenda and Attendee List



Agenda

North Miami Climate Change Vulnerability Assessment Interactive Public Workshop

Friday, March 12th 2021
1:00-2:30PM
Virtual Meeting via Zoom

1. Welcome Remarks and Introductions

- a. Amanda Murray – City of North Miami Sustainability Administrator

2. Environmental Education Climate Change & Sea Level Rise 101

- a. Lea Mayer, Senior Marketing & Outreach Associate at Brizaga
 - What is Climate Change & Sea Level Rise?
 - Florida Geology & Contributing Factors
 - North Miami's Commitment to Resilience

3. North Miami Resources, City Staff Introduction & Panel Discussion

- a. John Quintero – City of North Miami Civil Engineer
- b. Carlos Garcia – City of North Miami Stormwater Superintendent
- c. Angelo M. Brinson, II – City of North Miami Commander, Emergency Manager
- d. Fransisco Medranda – City of North Miami Senior Management Analyst
- e. John Lorfis - City of North Miami Assistant Code Compliance Sanitation Director
 - How Does Each Department Help Build NoMi's Resilience?

4. Continuing Community Engagement

- a. Lea Mayer, Senior Marketing & Outreach Associate at Brizaga

5. Q&A

City of North Miami Climate Change Vulnerability Assessment –
Interactive Public Workshop Attendee List

	First Name	Last
1	Alex	Harris
2	Niall	Macaulay
3	Bill	Demshok
4	Harold	Clayton
5	Julieta	Rodrigo
6	Elizabeth	Rushing
7	Russell	Corbett
8	Sandra	Goimbert
9	Susan	Fink
10	Francoise	Cham
11	Nadia	Seeteram
12	Diana	Perez
13	Pedro	Desiral
14	Barbara	McAdam
15	Kefira	Baron
16	Sara	Mcdevitt

Public Workshop PowerPoint Presentation Slides



NEMAC+FernLeaf

March 12th, 2020

North Miami Interactive Public Workshop

Join us today to learn how the City approaches the impacts of a changing climate and how the City is invested in their resilient future!

Workshop Objectives

1

**Introduction to the Climate Change
Vulnerability Assessment**

2

**Environmental Education Climate
Change & Sea Level Rise 101**

3

**North Miami Resources – City Staff
Introduction & Panel Discussion**

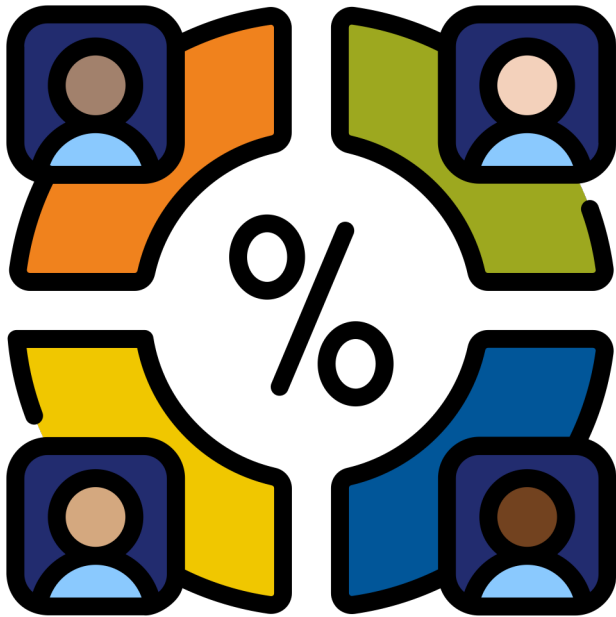
4

Continuing Community Engagement

5

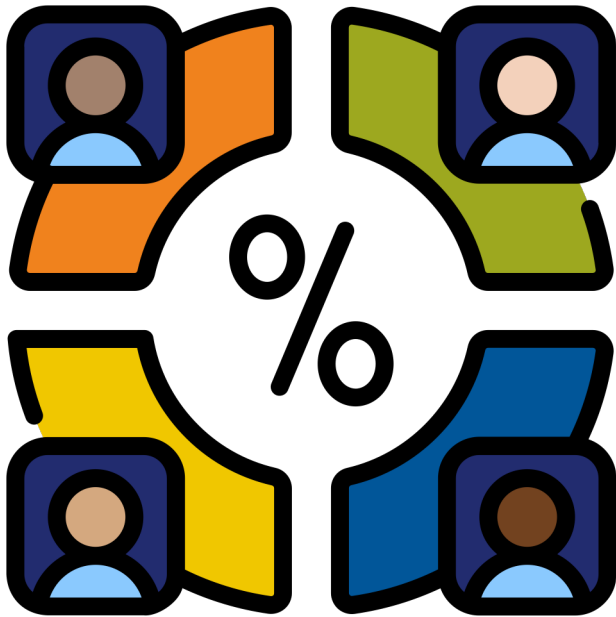
Questions & Answers

Poll Question



**What show did you most enjoy
binge-watching recently?**

Poll Question



I am (a): _____
Please select all that apply.

Definitions for Today

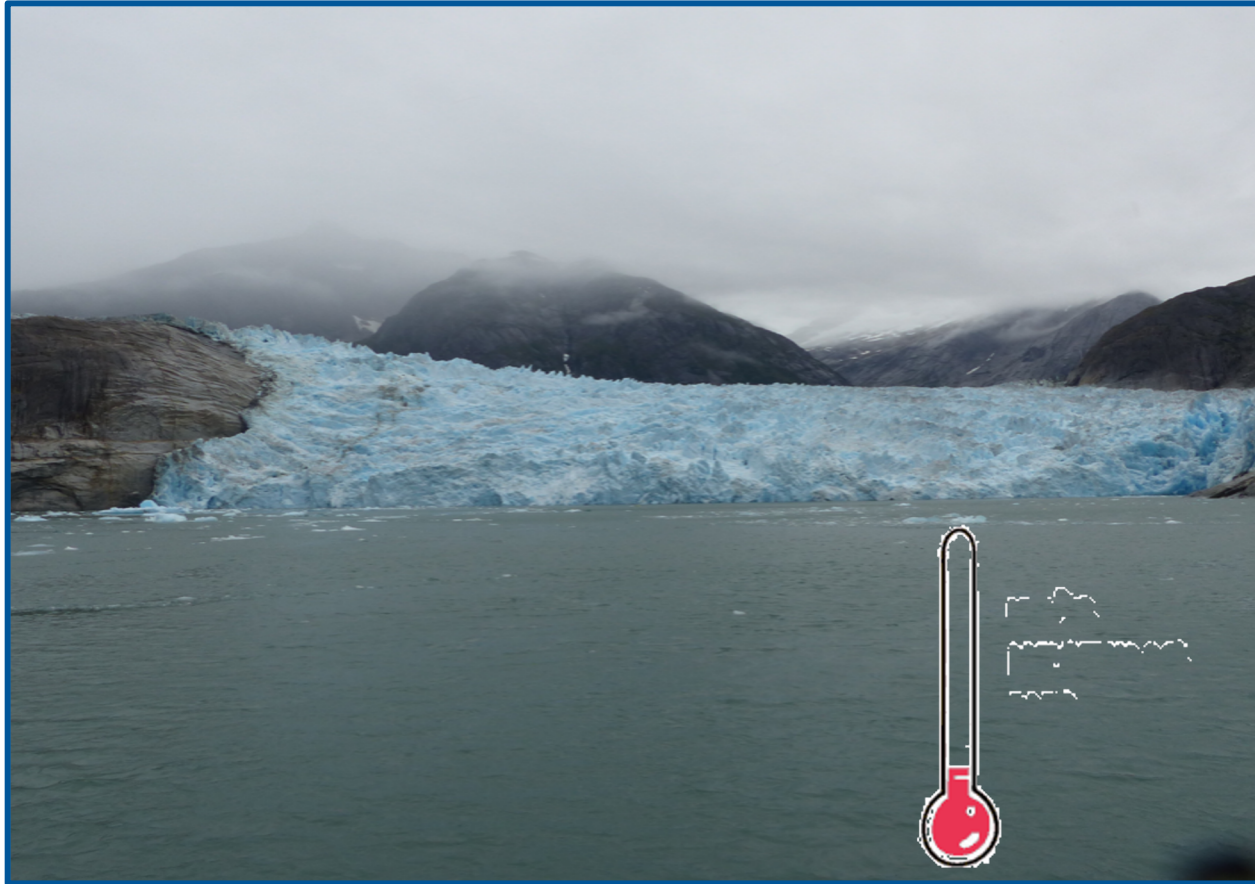
- Resilience - The ability to prosper through adversity.
- Climate Gentrification - The process of wealthier populations moving to areas with lower climate exposure that were previously occupied by lower socioeconomic communities that are now being displaced.
- Swales - Long, shallow, and linear vegetated channels, alongside roads or property boundaries, that store or convey water runoff and naturally remove pollutants.
- EcoBins - High-tech recycling bins with solar panels, LED lighting, and space for advertising.

What is Climate Change?

- Climate change is literally that – the global change of normal climate patterns that affect all living things and nature as we know it.
- The Greenhouse Gas Effect.
- Glacier ice begins to melt, and warmer water expands therefore causing sea levels to rise.
- Extreme heat occurs, but also extreme droughts, heavier rains, and more dramatic changes, all leading to extreme weather patterns.



What Causes Sea Levels to Rise?



As temperatures continue to warm, ice on land will melt inputting cold freshwater into the oceans.

As temperatures continue to warm, existing ocean waters will increase in volume due to thermal expansion.

Florida's Geology and Climate Risk Contributing Factors



- Limestone geology
- Florida's elevation is mostly entirely at sea level



Pavement traps and absorbs heat. It also contributes to flooding.

This contributes to the Urban Heat Island Effect.

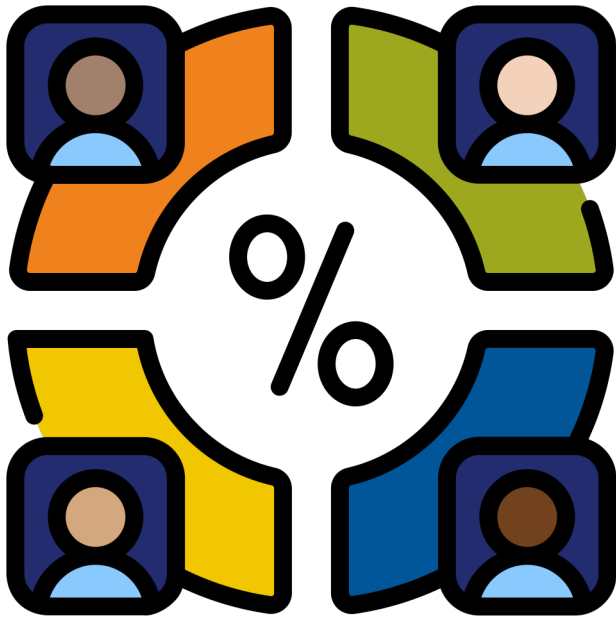


Our topography also lends itself to street flooding.



Sunny day flooding or "King Tides" is another issue we face.

Poll Question



What are your top three concerns in relation to climate change impacts?

North Miami's Commitment to Resilience

Good Neighbor Stormwater Park



Partnership with Waste Pro



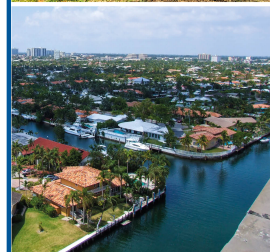
Citizens Guide to Sustainability and Resiliency



Resilient NoMi
Plan . Protect . Preserve

Citizens Guide to Sustainability and Resiliency

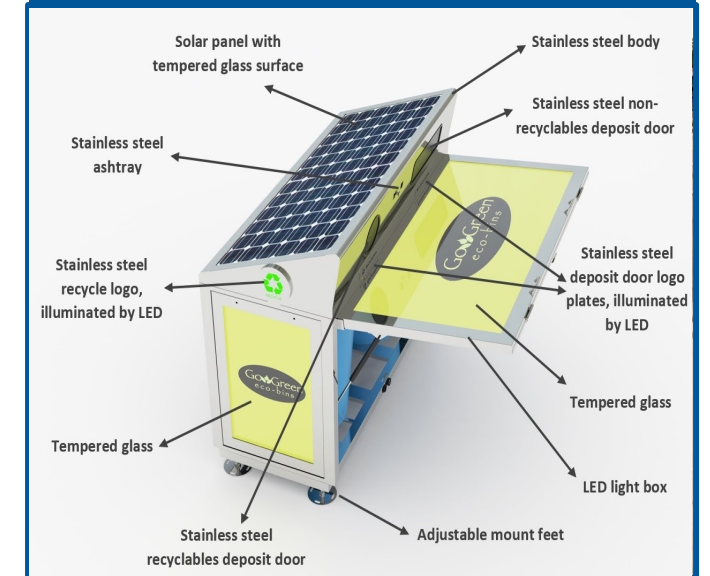
for residents, businesses, and visitors of the City of North Miami



NORTH MIAMI
FLORIDA

NorthMiamiFL.gov
Instagram YouTube Facebook Twitter

Renewable EcoBins



And of course, the Climate Change Vulnerability Assessment!

Climate Change Vulnerability Assessment

Resilience is the ability of a community, business, school, family, or individual to **withstand** an adverse event, **recover** from and **respond** to it, and **thrive**.

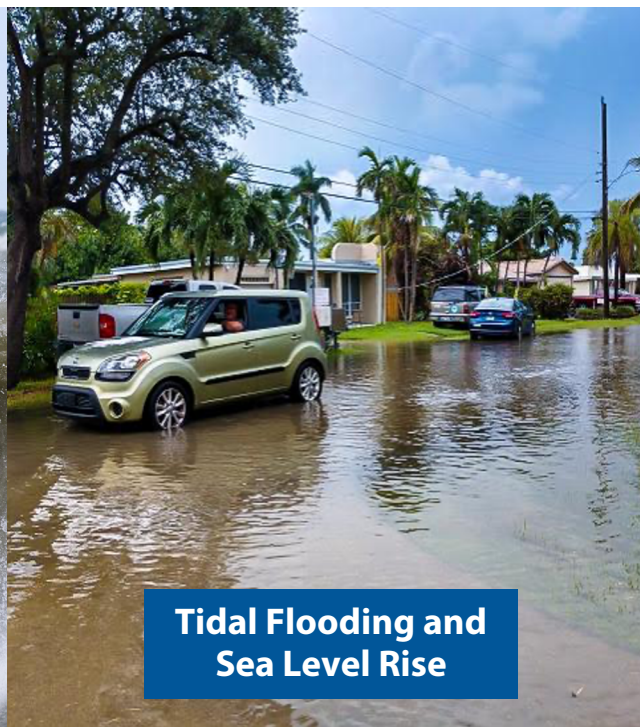
- The purpose of the assessment is to develop a **resource to inform strategies and actions** that to build community resilience and adapt to climate change.
- Uses a systematic framework to understand climate vulnerability and risk.
- Is solutions-oriented and informs targeted use of limited resources.
- Is a multi-department collaborative effort.
- Focuses on developing a process that the City can continue to iterate on.

Climate Threats

- The assessment uses publicly available data produced by federal agencies such as, National Oceanic and Atmospheric Administration (NOAA) and Federal Emergency Management Agency (FEMA).



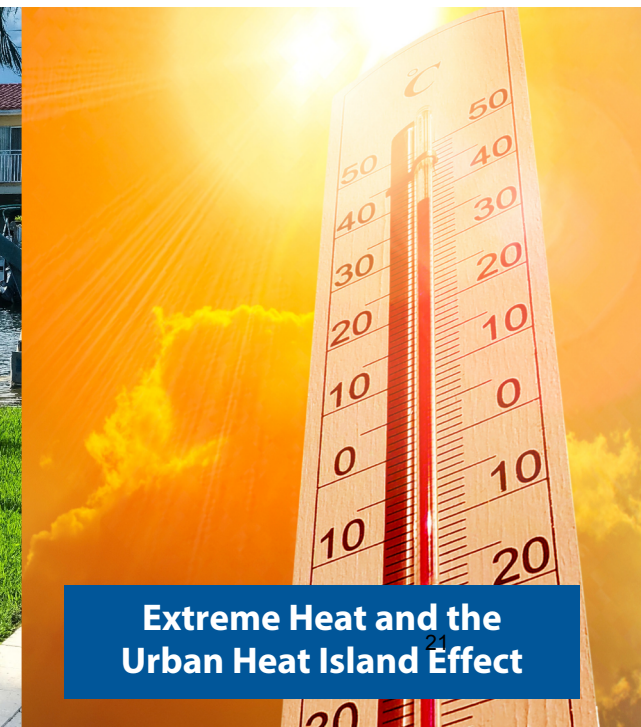
Storm Surge



**Tidal Flooding and
Sea Level Rise**



**Rainfall-Induced
Flooding**



**Extreme Heat and the
Urban Heat Island Effect**

Community Assets



Created by parkjeun
from Noun Project

PROPERTY AND PUBLIC SERVICES

Residential

Commercial & Industrial

Critical Facilities and Government-Owned Properties

Cultural Properties, Parks and Community Centers



Created by Adrien Coquet
from Noun Project

ECONOMIC FACTORS

Sales volume

Jobs



Created by Bakunetsu Kaito
from Noun Project

ROADS & MOBILITY

Major and minor road systems

Access to critical services



Created by Anastasia Latysheva
from Noun Project

PEOPLE AND SOCIOECONOMICS

Sensitive Individuals

Social Vulnerability

Both residences are in harm's way, but with different vulnerability



Types of Action

Land Use

Infrastructure

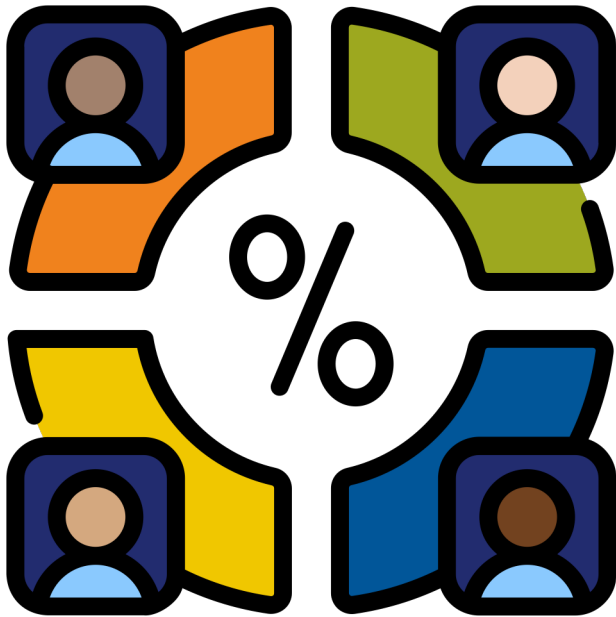
Capacity
Building

Public Outreach

Funding and
Finance

Planning, Policy
and
Management

Poll Question



**What type of services would you like the City to enhance?
Please select your top three.**

North Miami City Staff Panel Discussion



Department of Public Works

John Quintero – Civil Engineer
Carlos Garcia – Stormwater Superintendent

Emergency Management Division

Angelo M. Brinson, II - Commander,
Emergency Manager

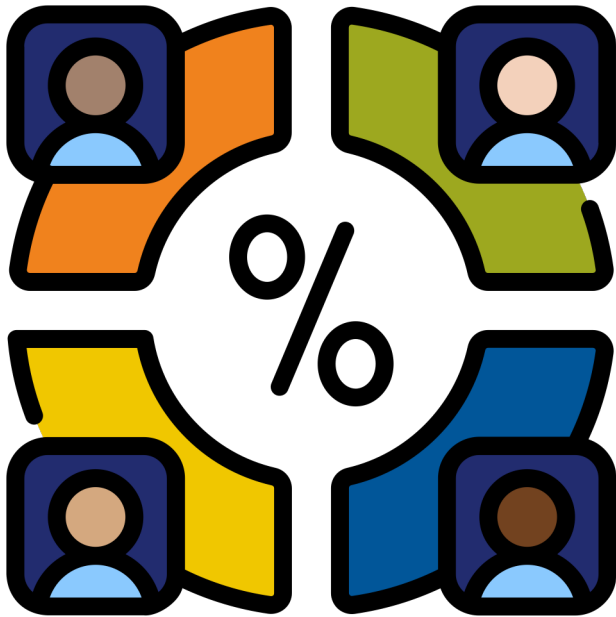
Keep North Miami Beautiful

Fransisco Medranda - Senior Management
Analyst

Clean Team and Waste/Recycling

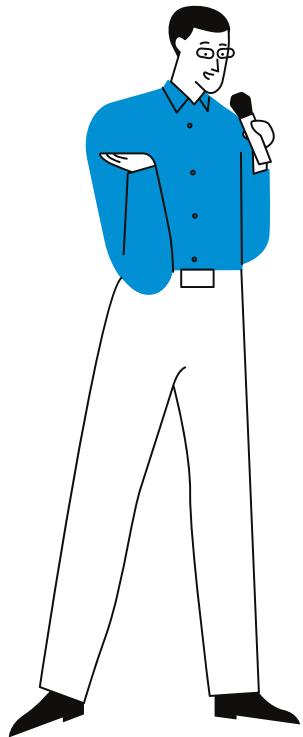
John Lorfis - Assistant Code Compliance
Sanitation Director

Poll Question



What types of information during public events would you like to learn more about? Please select the top three.

Stay engaged with North Miami!



Check out the City's landing site for upcoming engagement events for the CCVA project!



I'm looking for...



GOVERNMENT

DEPARTMENTS

RESIDENT SERVICES

DOING BUSINESS

ONLINE SERVICES

Climate Change Vulnerability Assessment

Policies

Programs

Projects

Resources

Green Business Rehabilitation Grant Program

[Home](#) › [Departments](#) › [Community Planning & Development](#) › [Sustainability](#) › Climate Change Vulnerability Assessment

▼ A A▲

Climate Change Vulnerability Assessment

In September 2020, the City of North Miami was awarded a grant from the Florida Resilient Coastlines Program (FRCP), the Department of Environmental Protection (DEP), and the Office of Resilience and Coastal Protection (RCP) to understand the City's vulnerabilities as it pertains to climate change. The grant is funding a Climate Change Vulnerability Assessment (CCVA) to assist the City in identifying vulnerable assets, communities, and places, as well as to develop viable opportunities for climate adaptation.

The project timeline consists of several opportunities for community engagement. Currently, the project team has an active survey that is available [here](#). This is just one method to engagement. Nearing the end of the project, a final public hearing will be held to disseminate the study's findings and inform NoMi residents on potential adaptation strategies. If you would like to stay updated on NoMi's CCVA project, please consciously check our website, social media channels, and more to stay engaged with us!

Project Timeline

- **Survey 1:** February 9 to March 7, 2021
- **Interactive Public Workshop:** March 12, 2021
[Registration Required](#)
- **Survey 2:** March 15 to 26, 2021
- **Public Hearing:** April 1, 2021



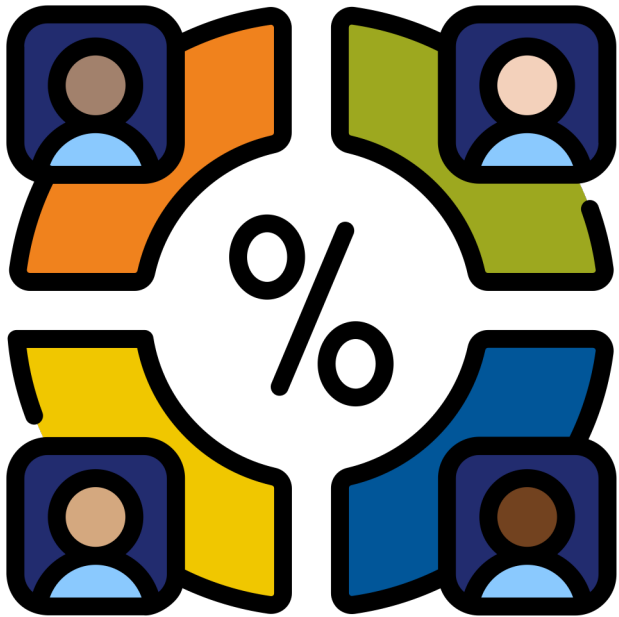
Take the Survey



Rainfall-Induced Flooding

Flooding associated with rain events, such as thunderstorms, tropical systems, and cold fronts. Changes in rainfall patterns can cause downpours of rain in short periods of time which may create flooding hotspots in heavily developed areas with impervious

Poll Question



What is your preferred type of engagement that you would like the City to use to communicate with community members?



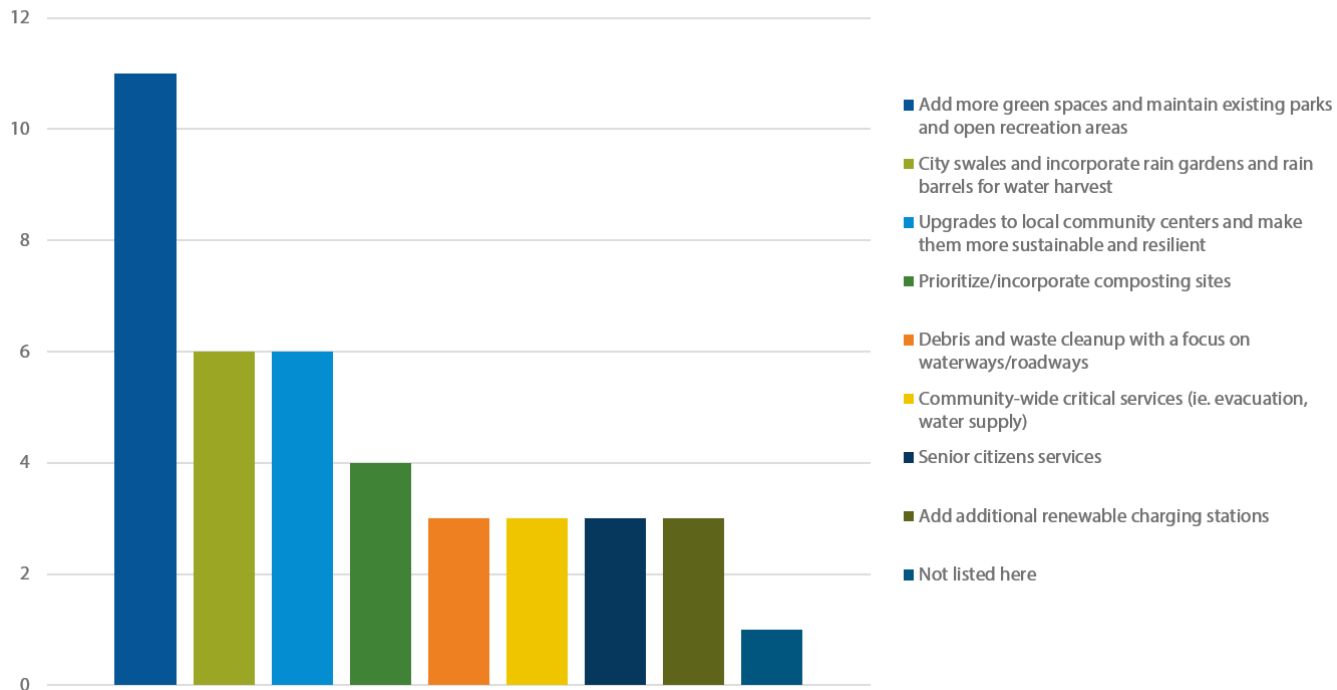
Q&A

Public Workshop Full Poll Results

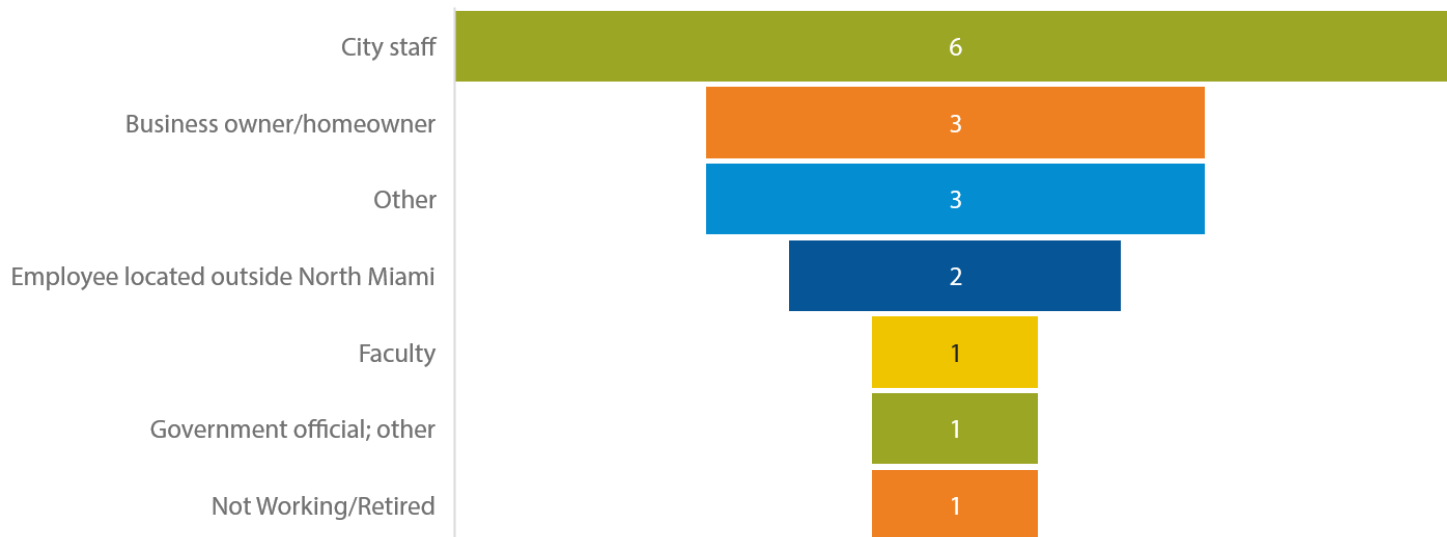
POLL QUESTIONS

HIGHLIGHTS FROM THE INTERACTIVE PUBLIC WORKSHOP

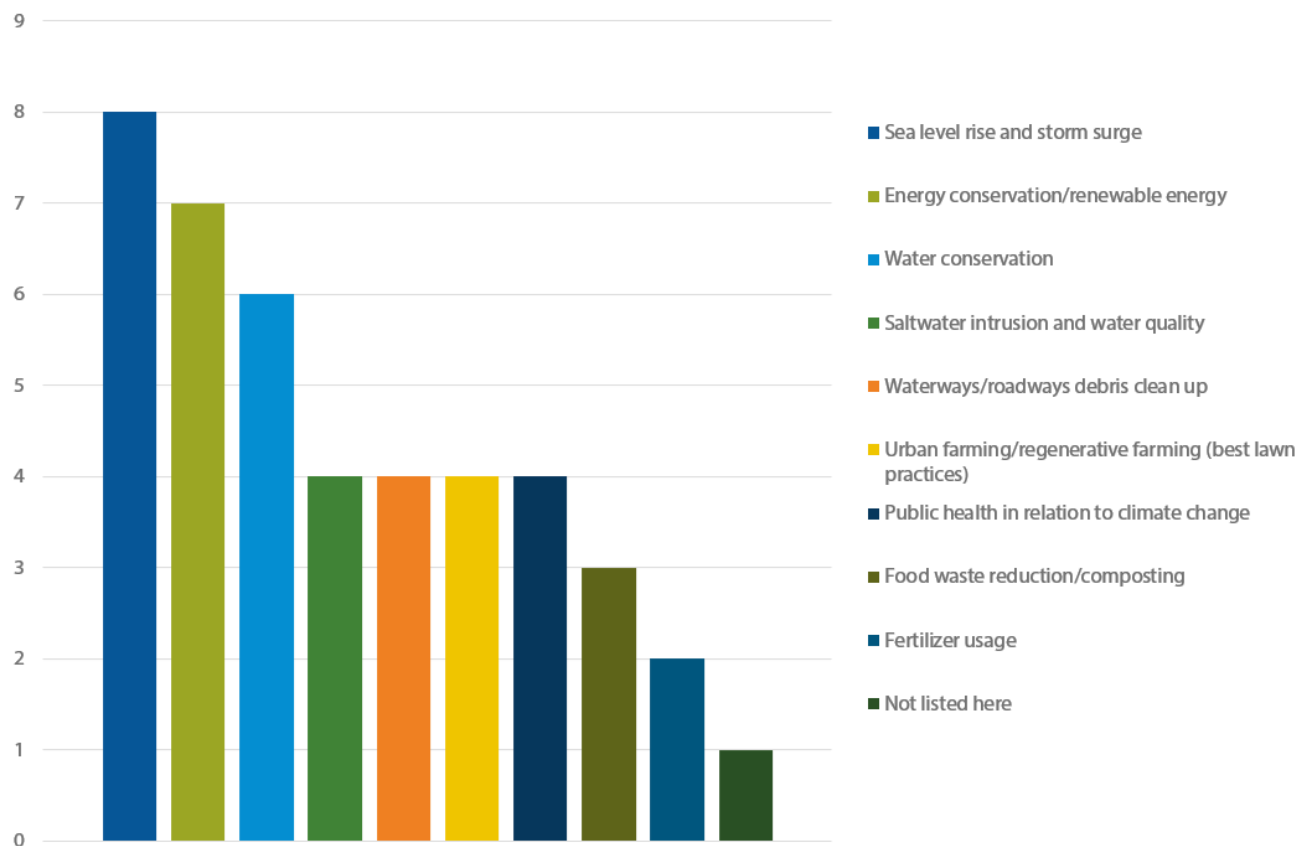
What type of services would you like the City to enhance? Please select your top three.



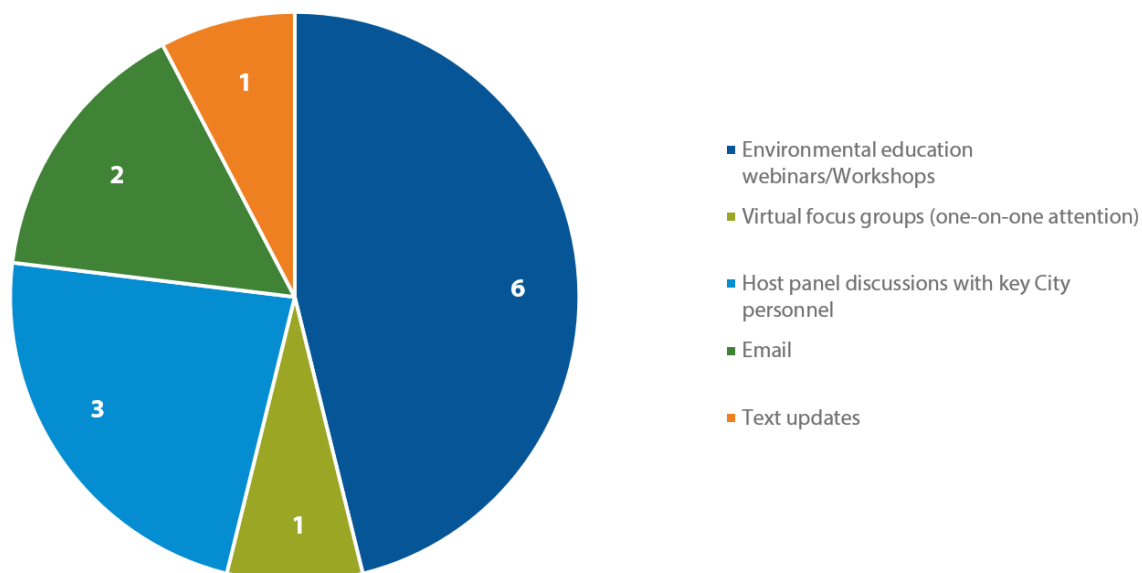
I am (a): Please select all that apply.



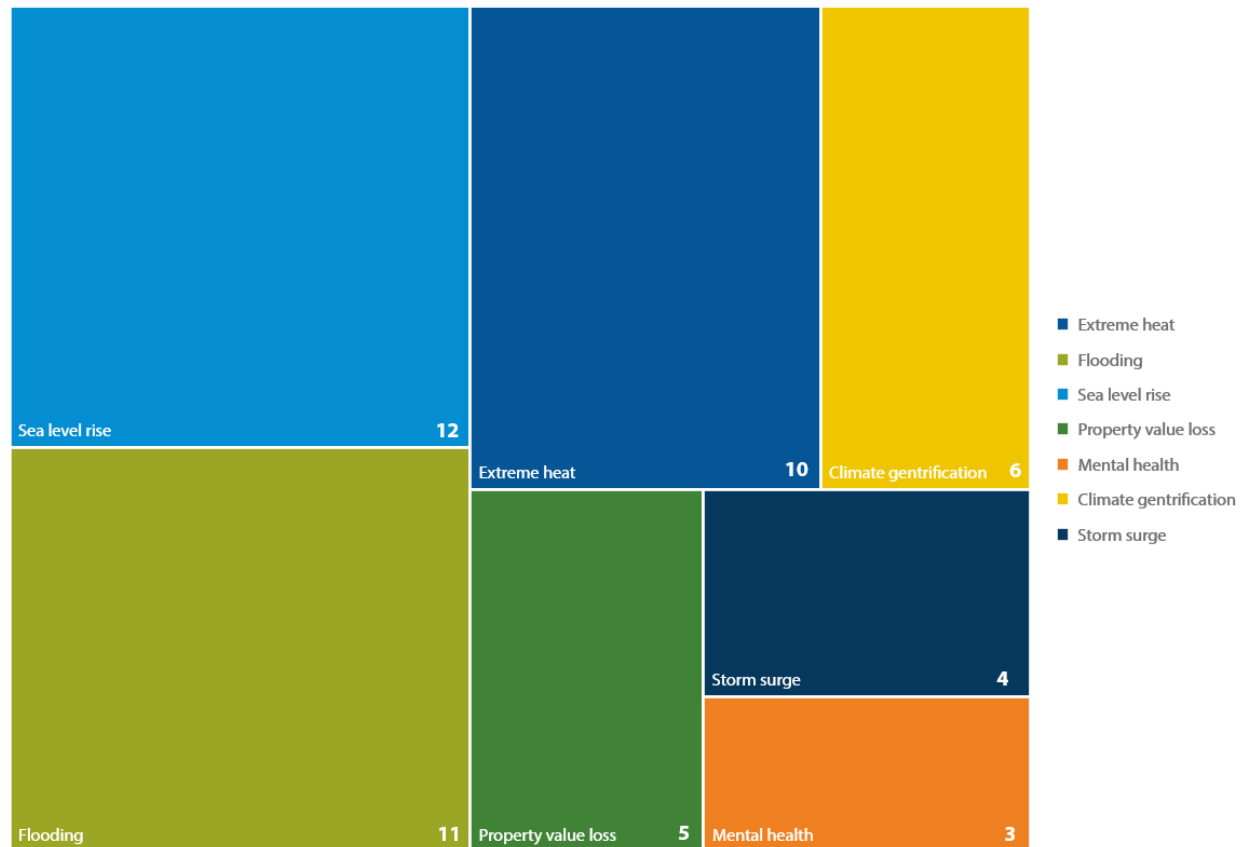
What types of information during public events would you like to learn more about? Please select the top three.



What is your preferred type of engagement that you would like the City to use?



What are your top three concerns in relation to climate change impacts?



Public Meeting Agenda and Attendee List



NEMAC+FernLeaf

Agenda

North Miami Climate Change Vulnerability Assessment Public Meeting

Thursday, April 1st 2021
5:00-6:00PM
Virtual Meeting via Zoom

1. Welcome Remarks and Introductions

- a. Amanda Murray – City of North Miami Sustainability Administrator
- b. Therese Therilus, Esq. – City of North Miami Manager
- c. Daniella Levine Cava – Miami-Dade County Mayor

2. Public Engagement Update

- a. Lea Mayer, Senior Marketing & Outreach Associate at Brizaga
 - Previous Engagement Outcomes
 - Examples Results from Initial Survey

3. Purpose & Scope of Study, Methodology and Examples of Key Findings

- a. Aashka Patel, Resilience Specialist at NEMAC+FernLeaf
 - NoMi Climate Change Vulnerability Assessment Scope
 - Climate Threats Assessed
 - Assessment Methodology
 - Example Assessment Considerations
 - Types of Actions
 - Assessment Findings and Potential Strategies
 - Building Resilience

4. Q&A

City of North Miami Climate Change Vulnerability Assessment –
Public Meeting Attendee List

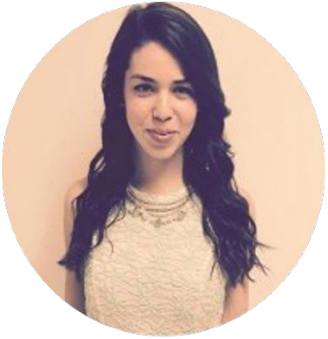
	First Name	Last
1	Olga	Gonzalez
2	Alex	Harris
3	Howard	Tonkin
4	Jayantha	Obeysekera
5	Nichole	Hefty
6	Melonie	Burke
7	Sara	Pezeshk
8	Stanley	Merantus
9	Bianca	Constant
10	Amir	Khoddamzadeh
11	Angelo	Brinson
12	Frank	Zuloaga
13	Michael	Sukop
14	Rachel	Goldberg
15	Tanjim	Hossain
16	Armando	Soto
17	Max	Siegler
18	Sarah	Mahan
19	Christian	Kamrath
20	Naomi	Siegler
21	Daniel	Kokiel
22	Jessica	Wolland
23	Veronica	Guzman
24	Kassandra	Timothe
25	Jennifer	Warren
26	Yoni	Goldberg
27	Evan A	Shields
28	Sandra	St Hilaire
29	Todd	Crowl
30	Ida	Kabak
31	Debbie	Love
32	Stephanie	Zenon
33	Deerick	Cook
34	Marline	Monestime
35	Rochelle	Lewis
36	Chuks	Okereke
37	Jeff	Geimer

Public Meeting PowerPoint Presentation Slides

North Miami Climate Change Vulnerability Assessment Public Meeting

Join us today to learn about the
Climate Change Vulnerability
Assessment approach and findings.

Meeting Objectives & Introductions



Amanda Murray,
City of North Miami
Sustainability Administrator



Theresa Therilus, Esq.,
City of North Miami Manager



Daniella Levine Cava,
Miami-Dade County Mayor



Lea Mayer,
Senior Marketing & Outreach Associate
at Brizaga



Aashka Patel,
Resilience Specialist
at NEMAC+FernLeaf

1

Welcome & Introductions

2

Community Engagement
Update

3

Purpose & Scope of Study

4

Methodology

5

Examples of Key Findings

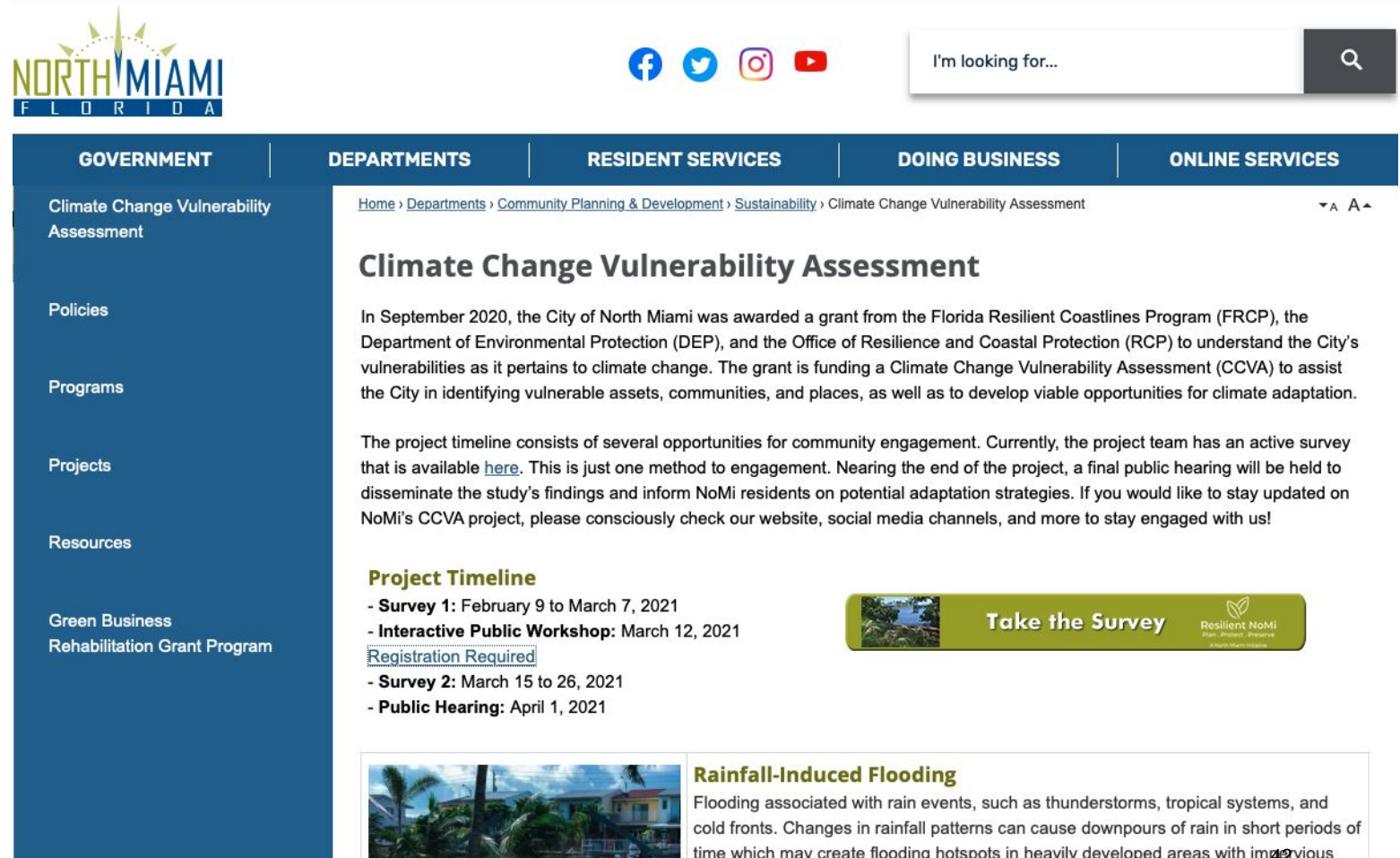
6

Q&A

NoMi CCVA Community Engagement

- Previous Community Engagement Strategies
- Brief Results on the Initial Survey
- Stay Engaged - Take the Second Survey Available Now!

Use the QR code to checkout NoMi's CCVA website.



The screenshot shows the North Miami Florida website. The header includes the city logo, social media icons for Facebook, Twitter, Instagram, and YouTube, and a search bar with the text "I'm looking for...". The navigation menu has five main categories: GOVERNMENT, DEPARTMENTS, RESIDENT SERVICES, DOING BUSINESS, and ONLINE SERVICES. Under GOVERNMENT, there is a link to "Climate Change Vulnerability Assessment". The main content area is titled "Climate Change Vulnerability Assessment" and includes a breadcrumb trail: Home > Departments > Community Planning & Development > Sustainability > Climate Change Vulnerability Assessment. The text describes the project, its timeline, and the importance of community engagement. A "Project Timeline" section lists key dates: Survey 1 (February 9 to March 7, 2021), Interactive Public Workshop (March 12, 2021), Survey 2 (March 15 to 26, 2021), and Public Hearing (April 1, 2021). A "Take the Survey" button is prominently displayed. A "Rainfall-Induced Flooding" section is also visible at the bottom.

GOVERNMENT

- Climate Change Vulnerability Assessment
- Policies
- Programs
- Projects
- Resources
- Green Business Rehabilitation Grant Program

DEPARTMENTS

RESIDENT SERVICES

DOING BUSINESS

ONLINE SERVICES

Home > Departments > Community Planning & Development > Sustainability > Climate Change Vulnerability Assessment

Climate Change Vulnerability Assessment

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Take the Survey

Rainfall-Induced Flooding

Flooding associated with rain events, such as thunderstorms, tropical systems, and cold fronts. Changes in rainfall patterns can cause downpours of rain in short periods of time which may create flooding hotspots in heavily developed areas with impenetrable

NoMi CCVA Initial Survey Results

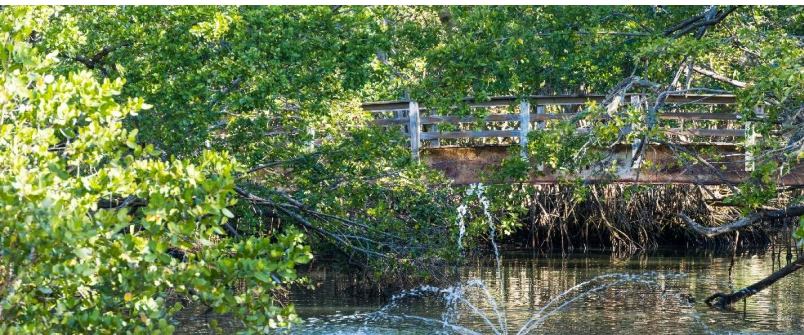
Are there any additional key places (e.g., certain businesses, cultural institutions, service organizations) or services in your neighborhood would you like to see strengthened?

- **Public transportation**
- **Communal spaces (MOCA)**
- **Senior Services**
- **Oleta River State Park**
- **Green Spaces/Parks**
- **NW 7th Ave**

What services or places (e.g., community centers, emergency services, organizations) have you found to be most critical to you and your community during, or in the aftermath of, major flooding events? (e.g. Such as after a hurricane)

- **Sources of Water Supply**
- **Emergency Services**
- **Assistance in Cleaning Debris after event**
- **Distributions of Sandbags**
- **Trash Pick-Up**
- **Trimming Trees**

We want your feedback! Use the QR code to provide input on the second survey today.



Objectives

- Purpose and scope of the assessment
- Methodology
- Examples of key findings
- Q&A

NoMi Climate Change Vulnerability Assessment (CCVA)

The purpose of the assessment is to develop a foundational **resource to inform strategies and actions** to build community resilience and adapt to climate change

- Use a systematic framework to understand climate vulnerability and risk
- Multi-departmental collaborative effort
- Focus on building momentum and developing a process for iteration



U.S. Climate
Resilience Toolkit
toolkit.climate.gov

1 Explore Hazards

2 Assess Vulnerability & Risk

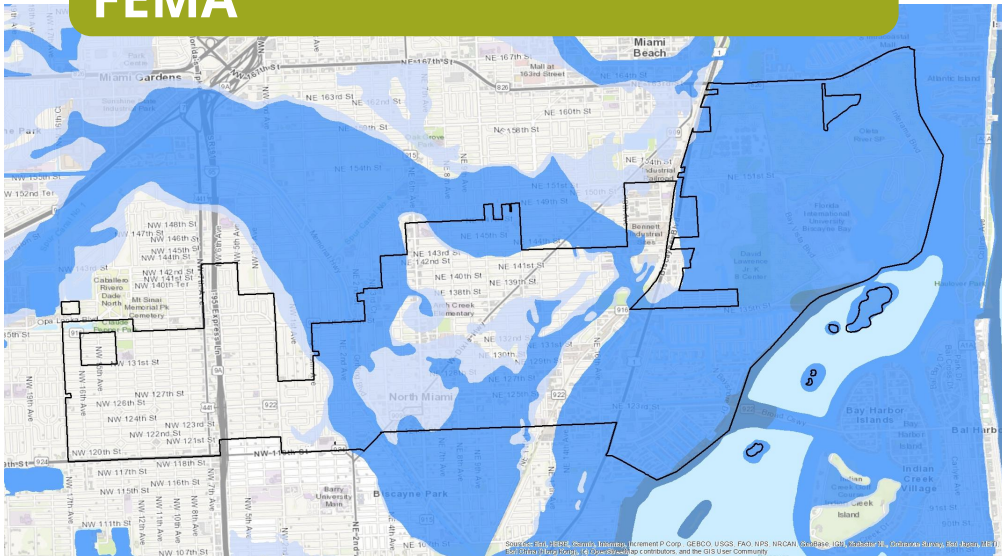
3 Investigate Options

4 Prioritize & Plan

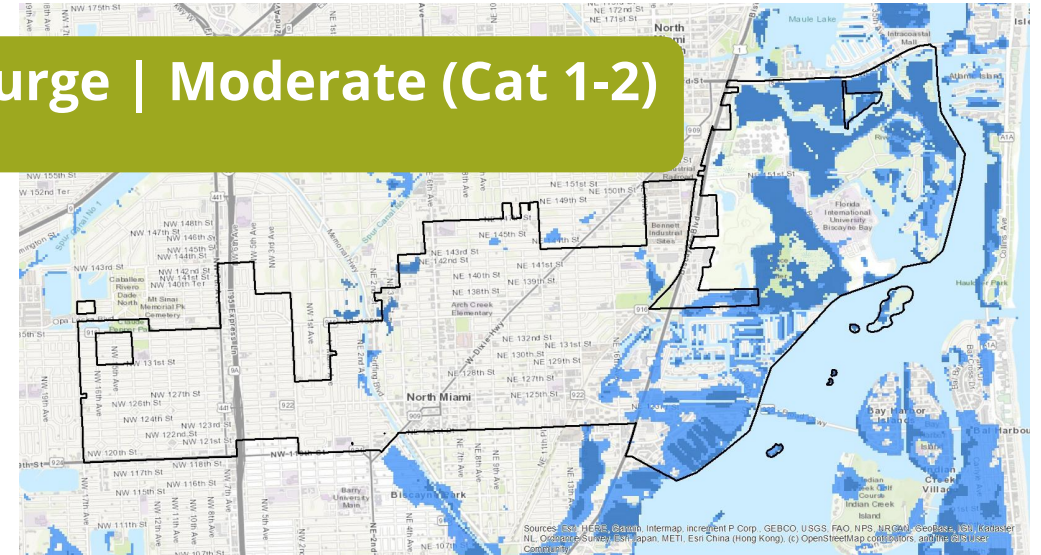
5 Take Action

Climate Threats Assessed: Extreme Flooding Events

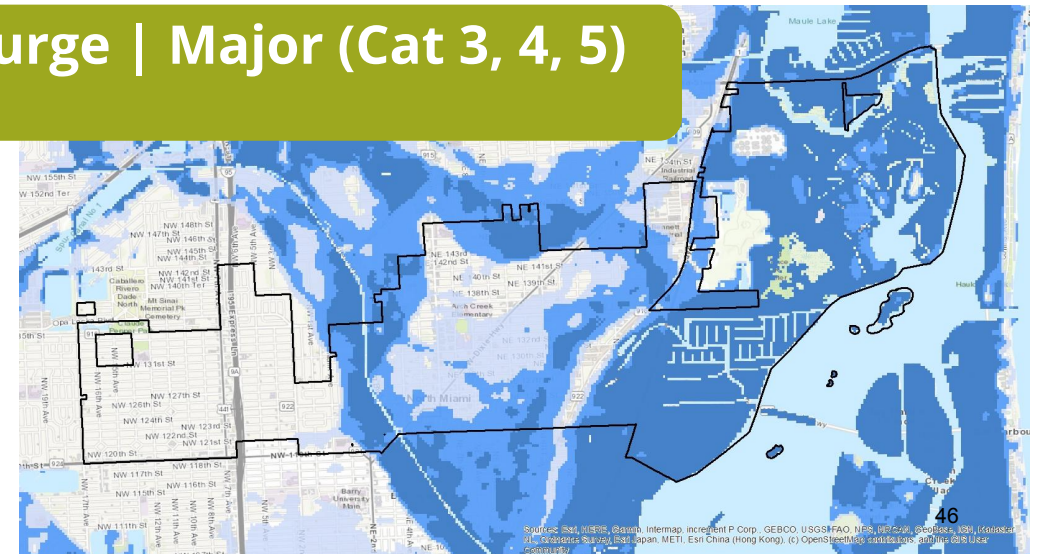
Floodplain Inundation FEMA



Storm Surge | Moderate (Cat 1-2) NOAA



Storm Surge | Major (Cat 3, 4, 5) NOAA

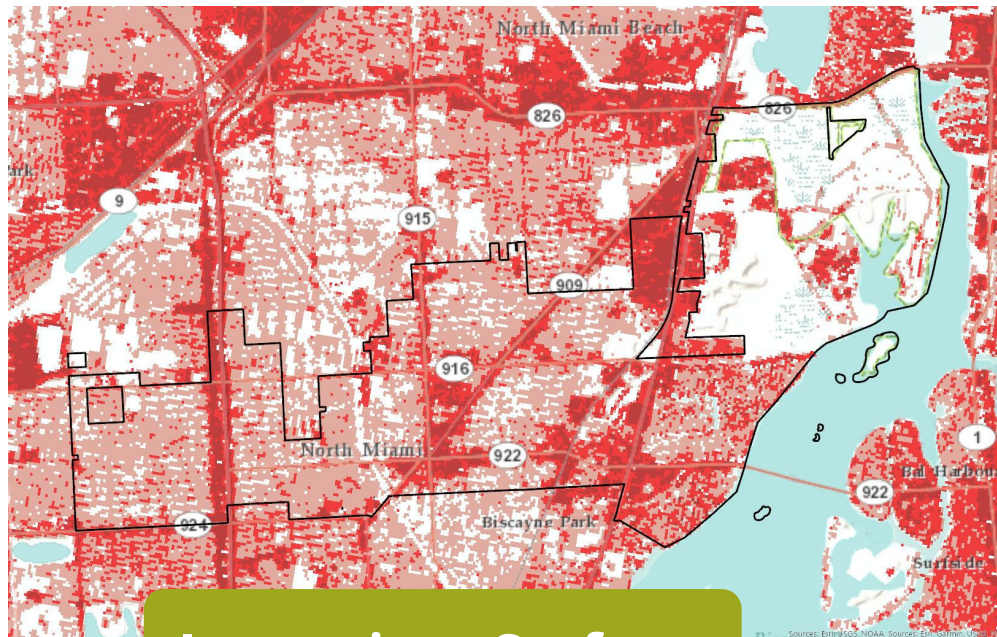


Climate Threats Assessed: Tidal Flooding & Sea Level Rise

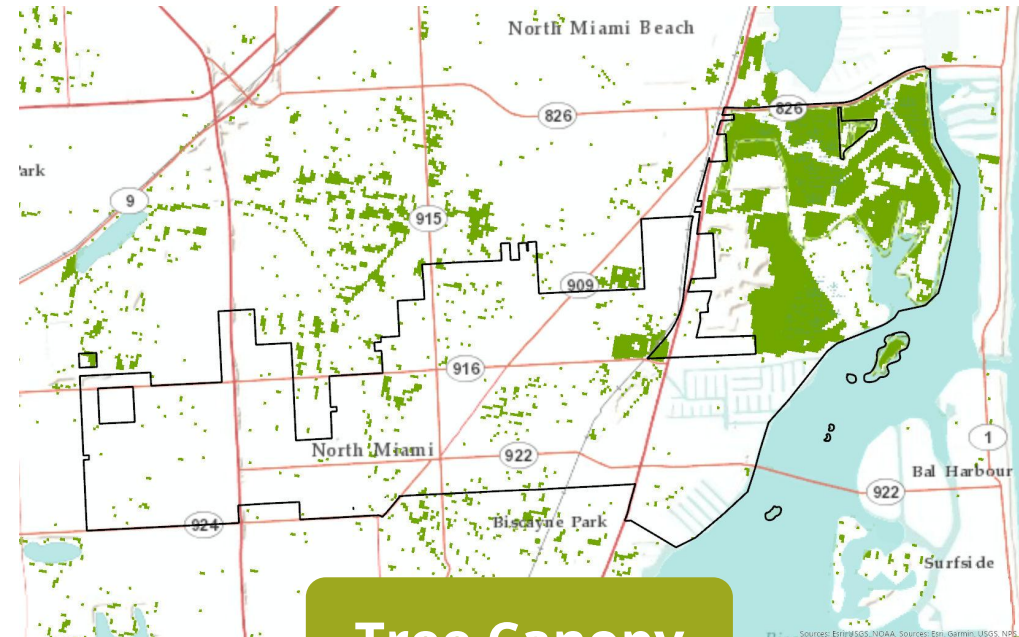


Extreme Heat & Public Health

- Households with members over 65 years of age and younger than 18
- High percentages of impervious surfaces/developed land cover
- Areas with greater than 40% tree canopy cover
- Median household income



Impervious Surfaces



Tree Canopy

Community Assets



Property & Public Services

Residential
Commercial & Industrial
Government-Owned
Critical Facilities (schools & public safety)
Parks & Cultural (community centers & religious)
Historic



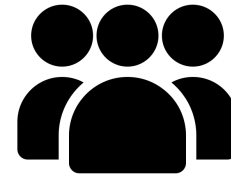
Economic Factors

Sales volume
Jobs



Roads & Mobility

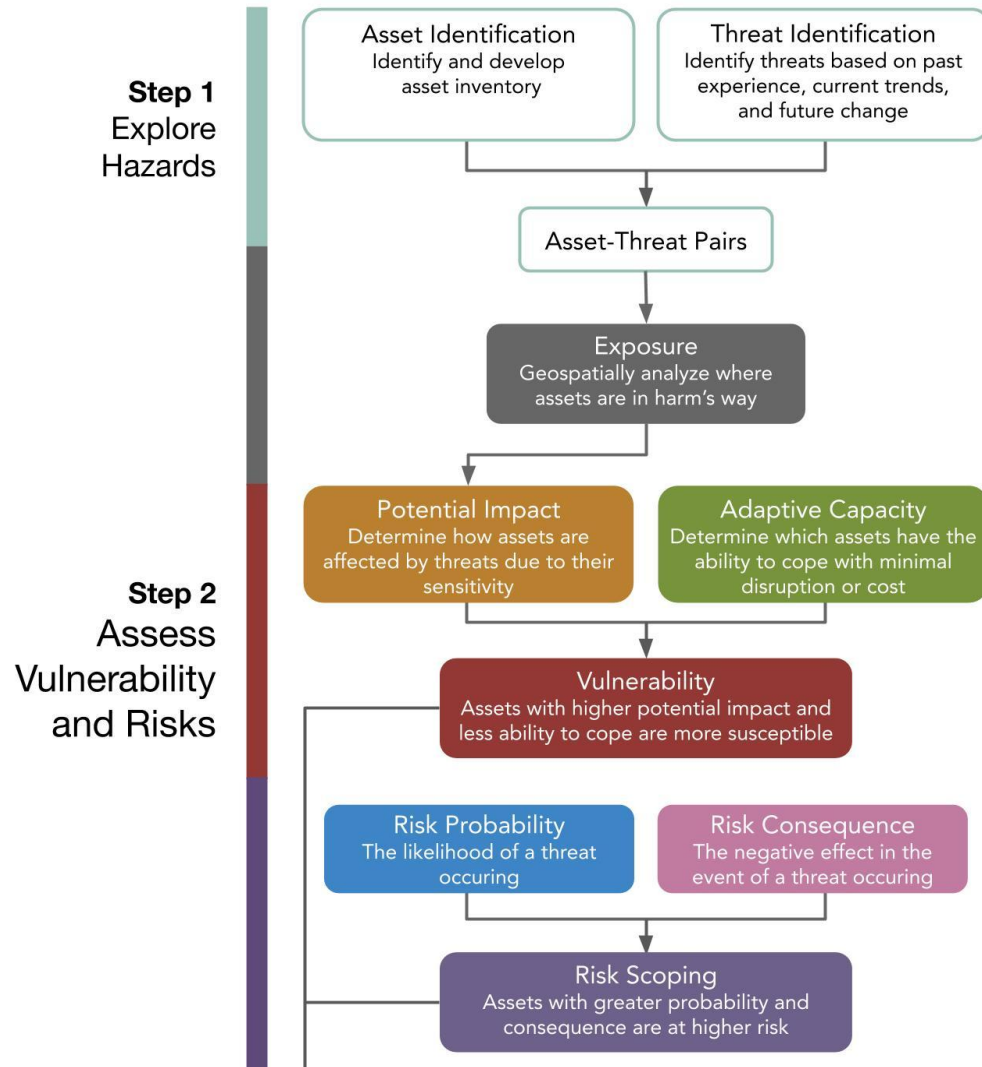
Major and minor road systems
Access to critical services



People & Socioeconomics

Heat-Sensitive populations
Indicators like socioeconomic status, household composition and disability, minority status and language, and housing type and transportation access

Assessment Methodology



Vulnerability: susceptibility based on sensitivity/potential impact and adaptive capacity

Risk Scoping: the probability and negative consequence of threats

Same Exposure, Different Vulnerability



Example Assessment Considerations

City-specific factors are used to define what makes city assets highly vulnerable and at risk to flooding

Example assessment criteria:

- ✓ Use or type of property and buildings in the floodplain
 - e.g. single family vs multi-family
- ✓ Year built and Base Flood Elevation (BFE) requirements
 - Indicator of ability to cope with flood inundation
- ✓ Likelihood of flooding
 - e.g. 100-yr vs 500-yr flood risk
- ✓ Potential depth of flood inundation
 - Potential depth above ground

Types of Actions



Infrastructure



Capacity Building



Land Use, Building
Codes & Standards



Public Outreach



Planning, Policy, &
Management



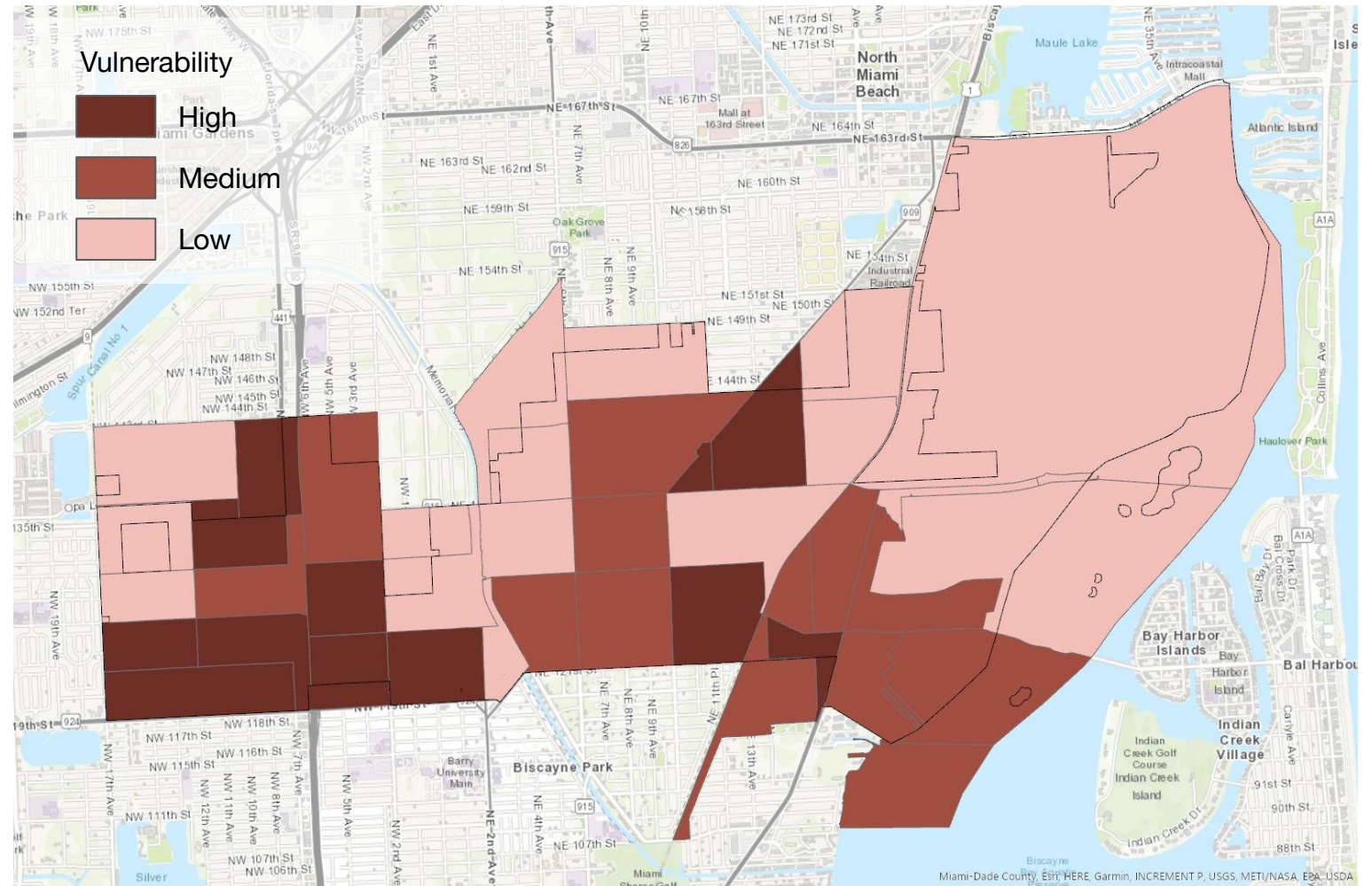
Funding & Financing

Assessment Findings

Extreme Heat





The most vulnerable areas in the city (darkest red) have:

- Sensitive populations (households with members 65+ or under 18)
- High levels of developed land cover
- Low tree canopy coverage
- High socioeconomic stress



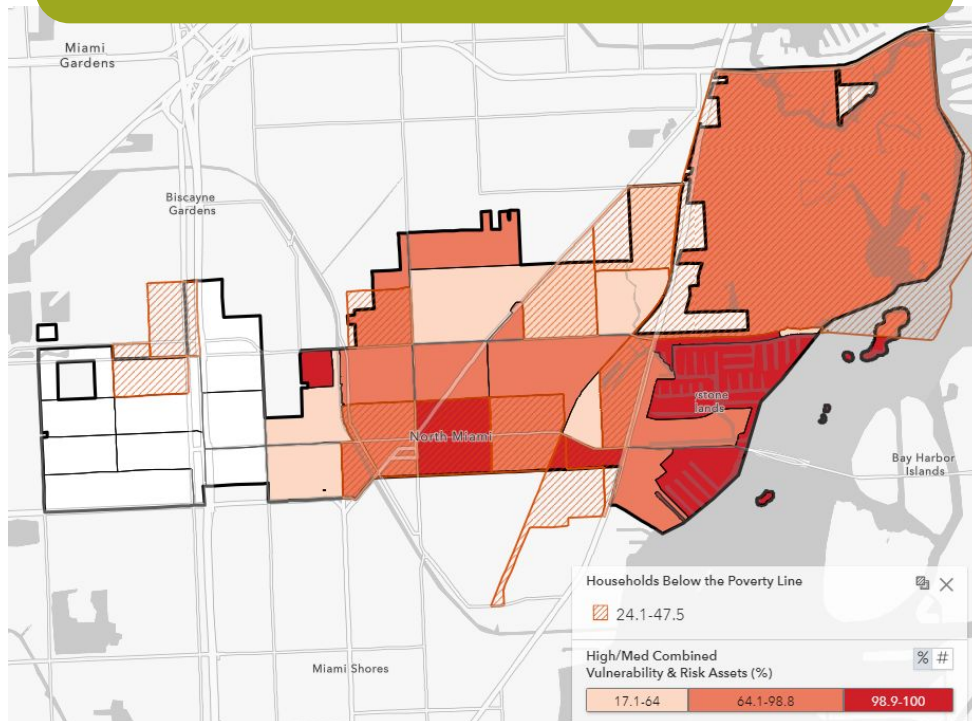
Potential Strategies

Example strategies and actions:

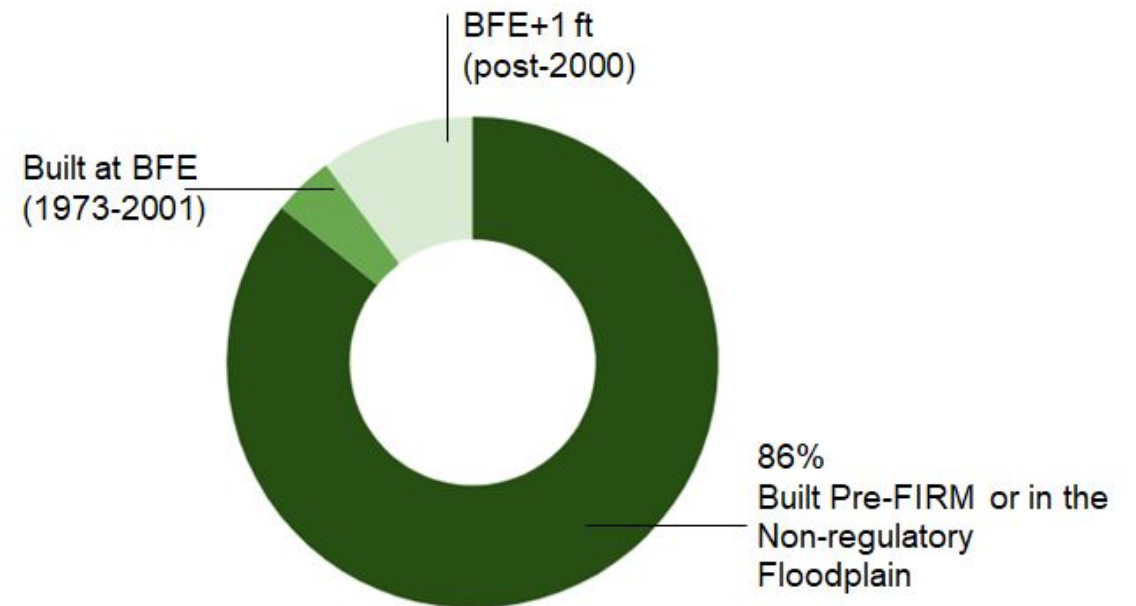
 Land Use, Building Codes & Standards	Identify and prioritize opportunities to increase tree canopy cover on City-owned land, especially in high-use areas such as bus shelter locations
 Capacity Building	Identify and reach out to partners for opportunities to increase tree canopy cover in areas outside of City ownership
 Funding & Financing	Seek funding to increase access to cooling, such as for energy upgrades for homes and apartments, providing air conditioning units, and access to other sources of cooling
 Public Outreach	<p>Provide heat advisory warnings to elderly people and other sensitive populations</p> <p>Work with community leaders and faith-based organizations to identify needs in the community</p>

Widespread Vulnerability to Residential and Commercial Properties

Residential Property | Floodplain Inundation & % of Households Below the Poverty Line






Adaptive Capacity (Year Built and BFE requirements)



Potential Strategies

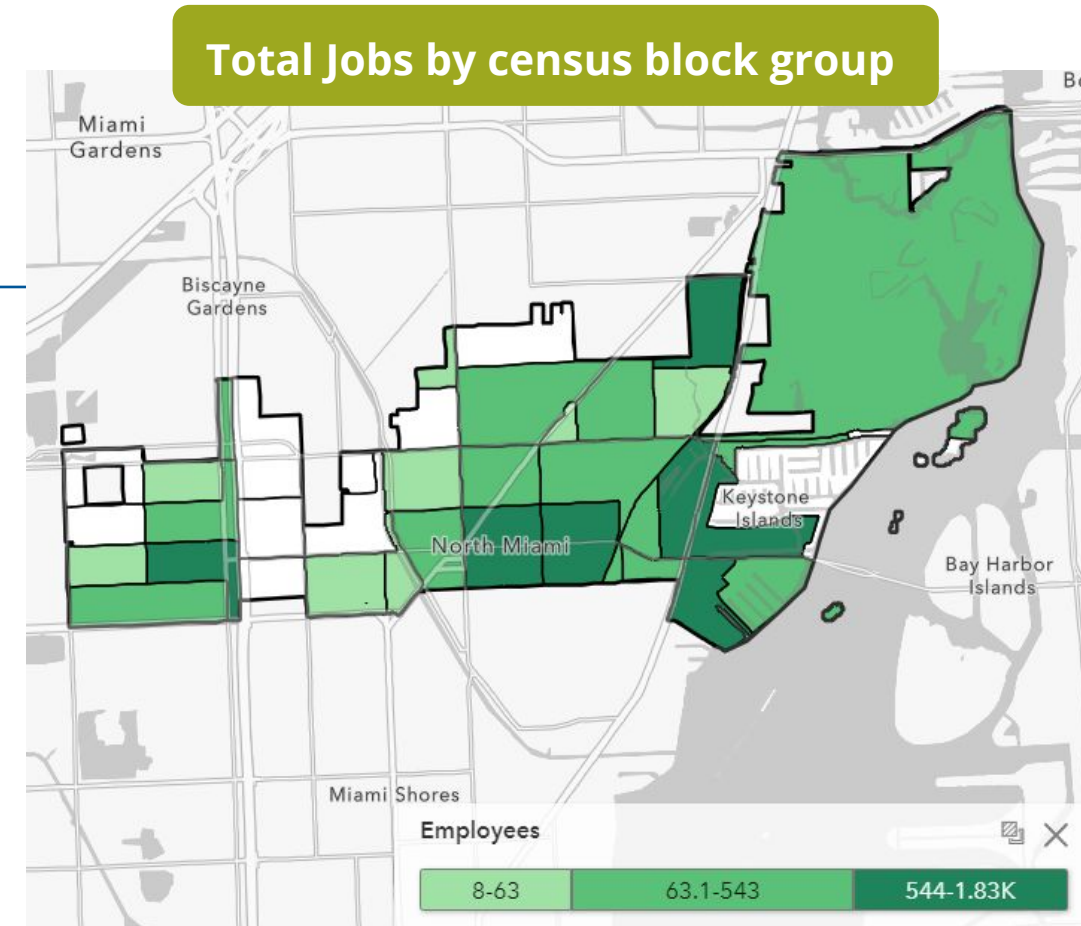
Example strategies and actions

 Capacity Building	<p>Create designated refuge stations or resilience hubs that can provide food, shelter, and other resources. Identify with input from community partners such as schools, churches, and other non-profits (multi-threat benefit)</p> <p>Increase community preparedness through a multi-pronged strategy: 1. partner with community organizations; 2. identify highly vulnerable households and neighborhoods; 3. disseminate targeted information and provide resources to increase household-level preparedness</p>
 Planning, Policy, & Management	<p>Consider increasing floodplain development requirements</p> <p>Identify alternative road access and evacuation routes and increase community awareness (as part of community preparedness strategy)</p>
 Funding & Financing  Infrastructure	<p>Continue to seek additional sources of funding for pump station upgrades. Identify opportunities and funding to make improvements beyond minimum standards that provide co-benefits</p>

Places of employment are also vulnerable to flooding

	Floodplain Inundation	Storm Surge (Cat 1-2)	Storm Surge (Cat 3-5)
Jobs (employees at vulnerable business locations)	91% (15,059)	18% (3,037)	98% (16,125)
Sales Volume (sales at vulnerable business locations)	\$2.3B (89%)	\$517M (20%)	\$2.5B (97%)

Numbers and percentages in the table above are those associated with medium to high vulnerability and risk inside City limits.



Increasing Vulnerability to Tidal Flooding due to SLR

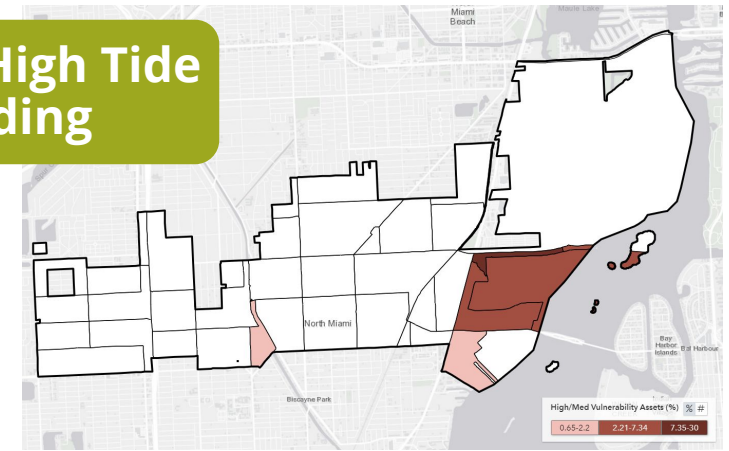
Next 10 years (1ft SLR):

- 12% of the residential properties along coastal area are highly vulnerable
- Potential for inaccessible roads and properties (7% of all properties City-wide)

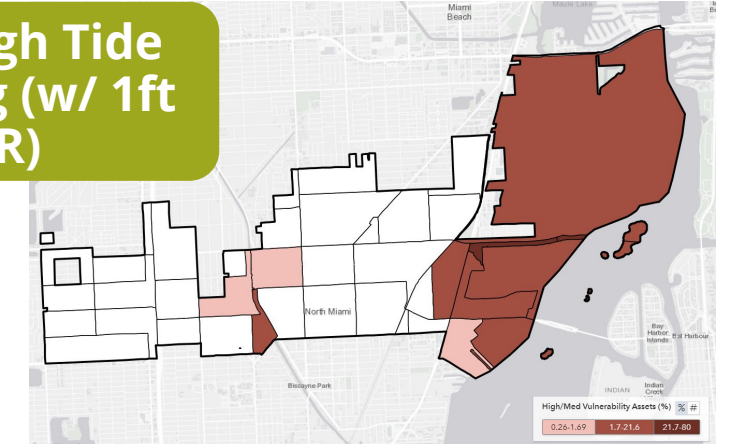
Next 30 years (2ft SLR):

- 42% of residential properties along coastal area are highly vulnerable
- 11% of inland residential properties are highly vulnerable
- Increased potential for inaccessible roads and properties (18% of all properties City-wide)
- Key commercial corridors are vulnerable

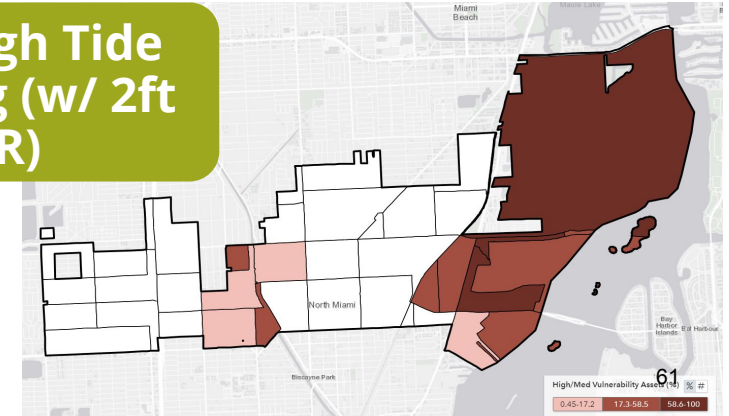
Current High Tide Flooding



2030 High Tide Flooding (w/ 1ft SLR)



2050 High Tide Flooding (w/ 2ft SLR)

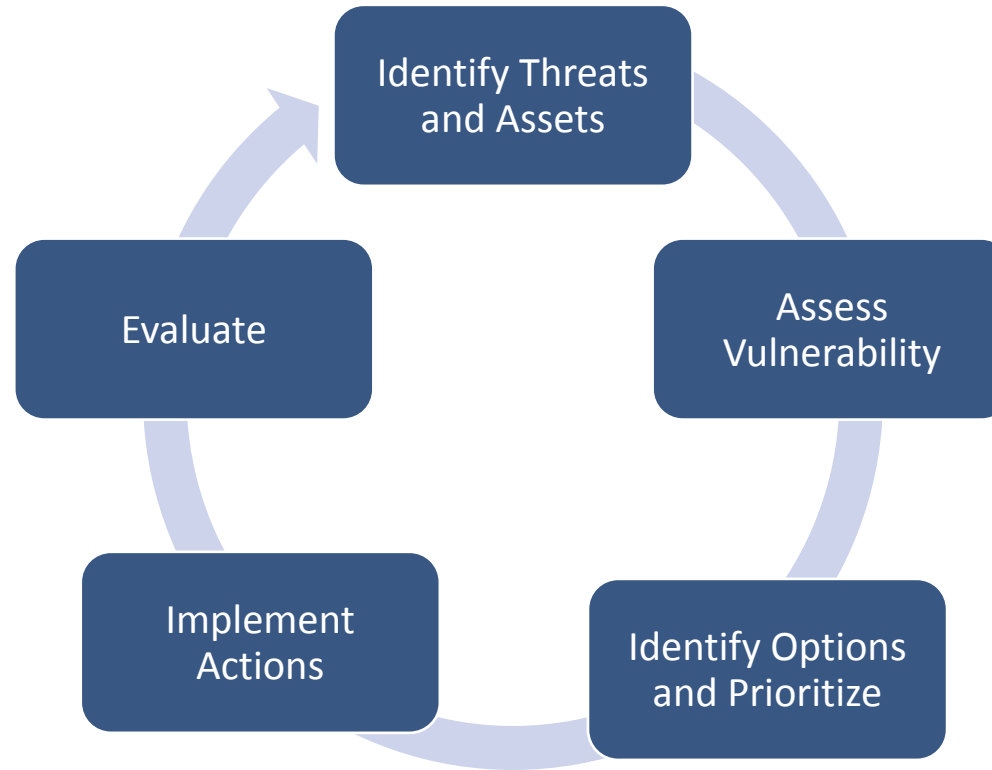


Potential Strategies

Example strategies and actions

 Planning, Policy, & Management	<p>Use vulnerability assessment information to incorporate SLR considerations in the upcoming Comprehensive Plan Update</p> <p>Identify ways to preserve existing affordable housing and increase their resilience and minimize displacement</p>
 Infrastructure	<p>Identify and prioritize opportunities for green infrastructure that can help address both near and long-term vulnerabilities</p>
 Land Use, Building Codes & Standards	<p>Green Streets design standards: explore partnerships with FDOT and County; consider incentivizing for new construction</p>
 Capacity Building	

Building resilience is an iterative process!



Question

To combat the effects of extreme heat the City is considering several strategies. Please select two strategies you consider to be your highest priority.

Question

To better prepare for potentially stronger and more frequent storms, please select the top two strategies you feel would have the greatest positive impact in NoMi.



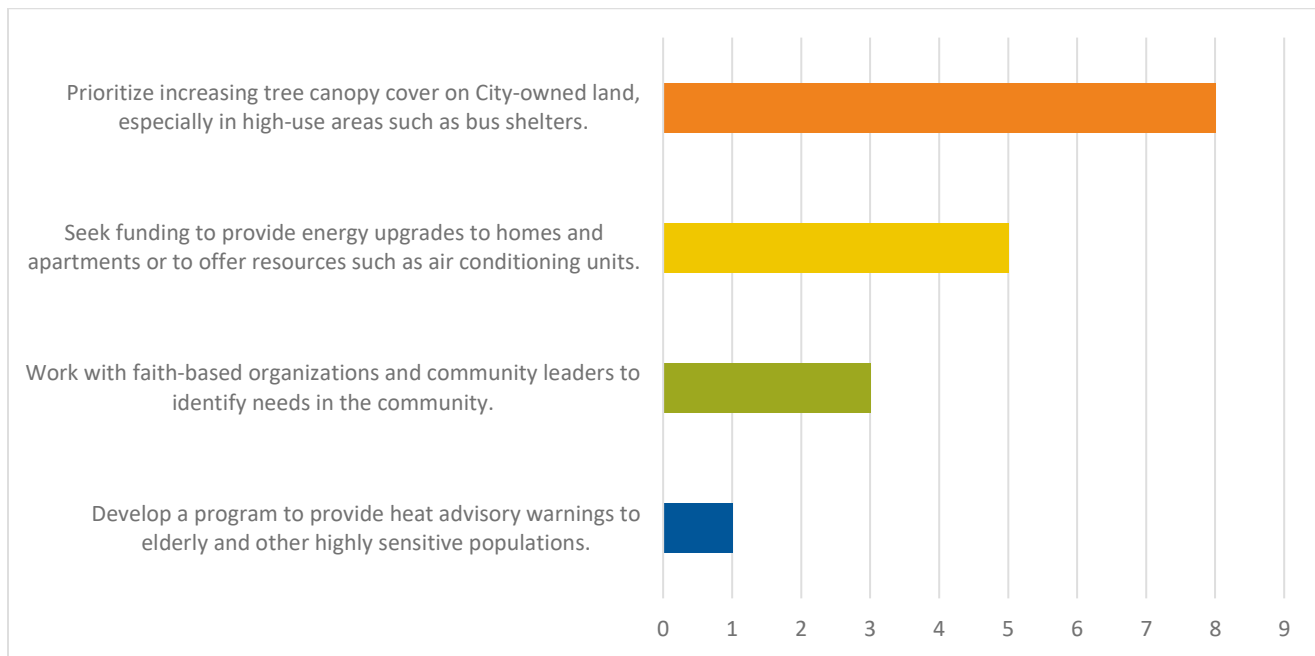
Thank you!

Aashka Patel
apatel@fernleafinteractive.com

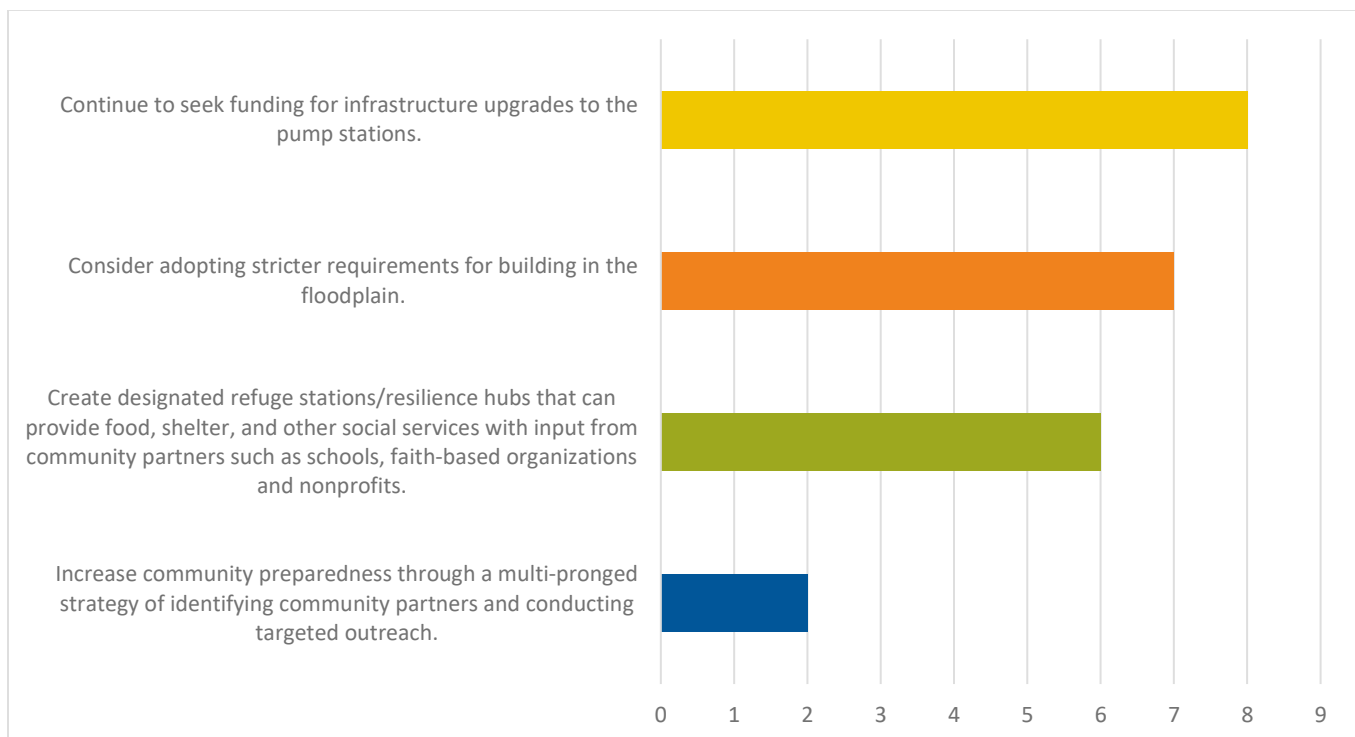
Public Meeting Full Poll Results

Public Meeting Poll Questions

To combat the effects of extreme heat the City is considering several strategies. Please select two strategies you consider to be your highest priority.



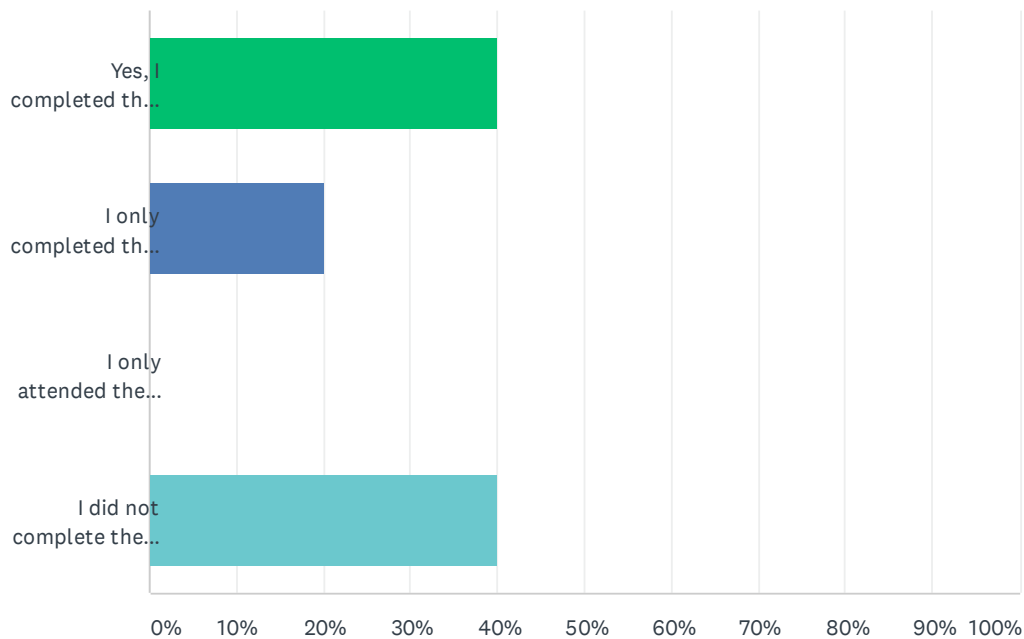
To better prepare for potentially stronger and more frequent storms, please select the top two strategies you feel would have the greatest positive impact in NoMi.



Second Survey Full Results

Q1 Did you complete the first North Miami Climate Change Vulnerability Assessment survey and attend the public workshop in March? (check one)

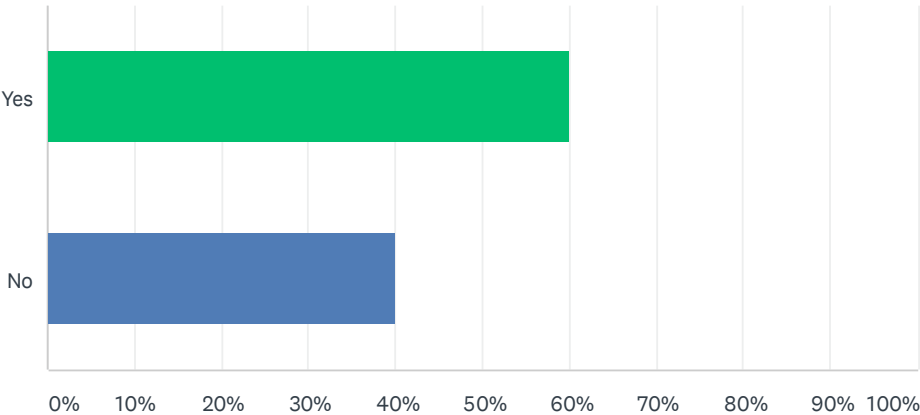
Answered: 5 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes, I completed the first survey and attended the public workshop	40.00%	2
I only completed the first survey	20.00%	1
I only attended the public workshop	0.00%	0
I did not complete the first survey, nor did I participate in the workshop	40.00%	2
TOTAL		5

Q2 Do you live in the City of North Miami?

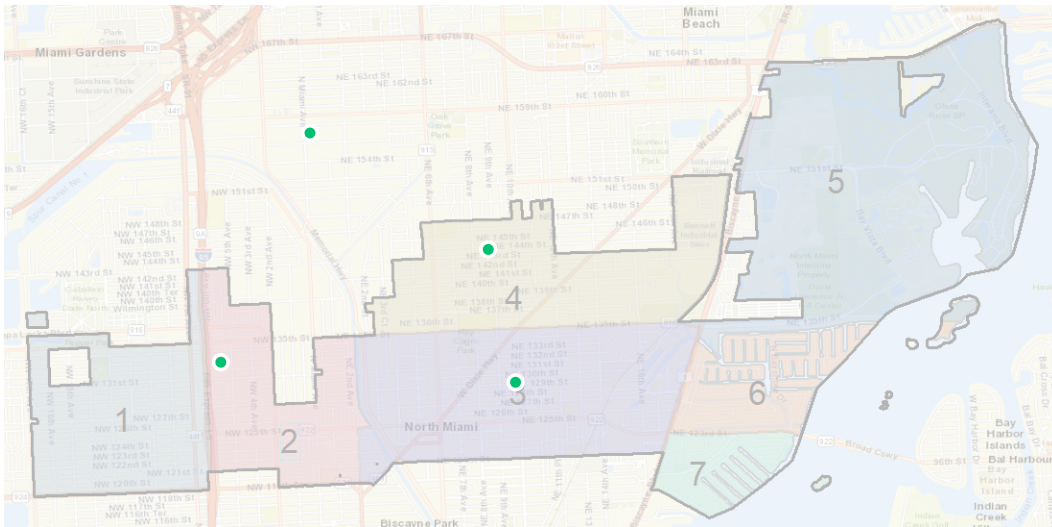
Answered: 5 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	60.00%	3
No	40.00%	2
TOTAL		5

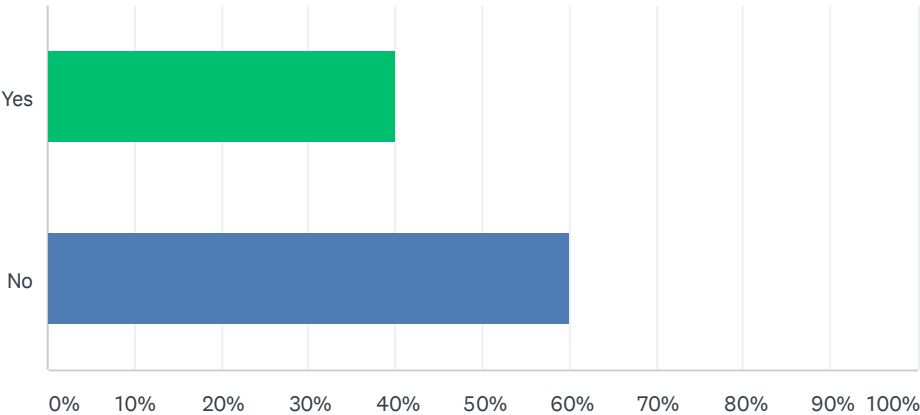
Q3 What neighborhood or zone do you live in the City of North Miami?

Answered: 4 Skipped: 1



Q4 Do you work in the City of North Miami?

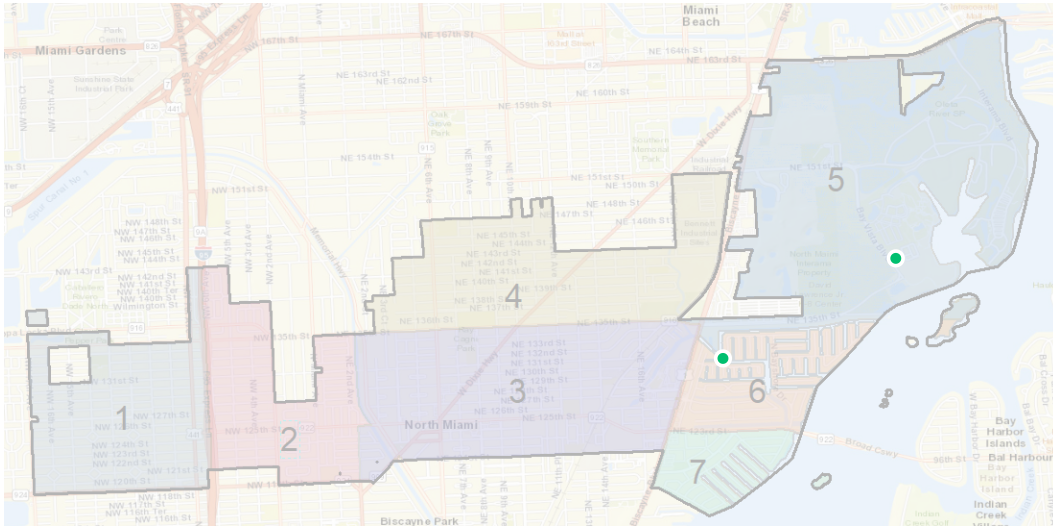
Answered: 5 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	40.00%	2
No	60.00%	3
TOTAL		5

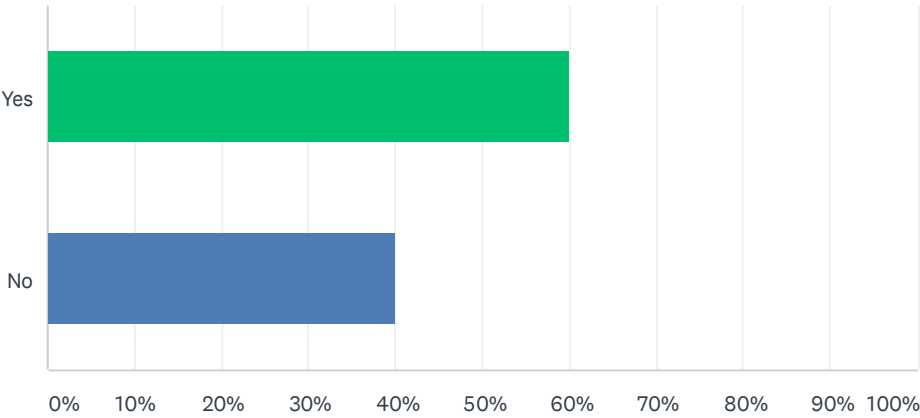
Q5 What neighborhood or zone do you work in the City of North Miami?

Answered: 2 Skipped: 3



Q6 Do you own property in North Miami?

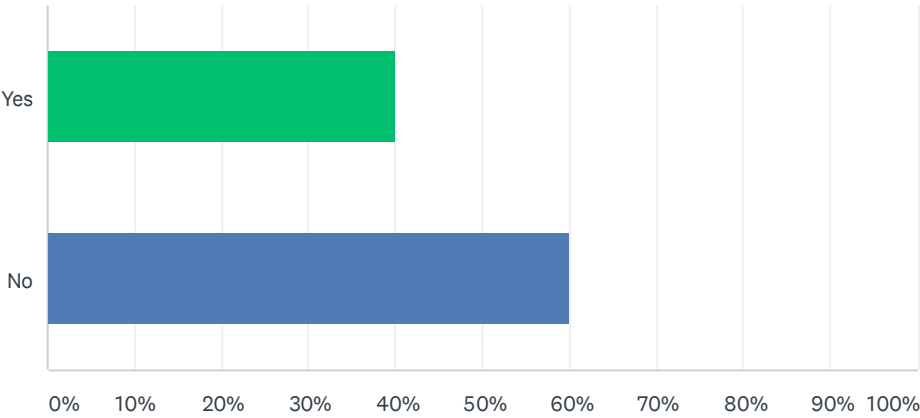
Answered: 5 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	60.00%	3
No	40.00%	2
TOTAL		5

Q7 Do you own a business in North Miami?

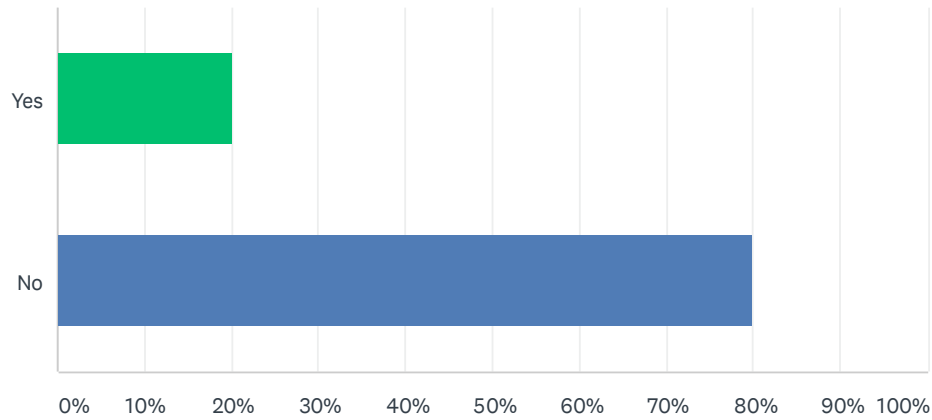
Answered: 5 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	40.00%	2
No	60.00%	3
TOTAL		5

Q8 Do you attend a university/college in North Miami?

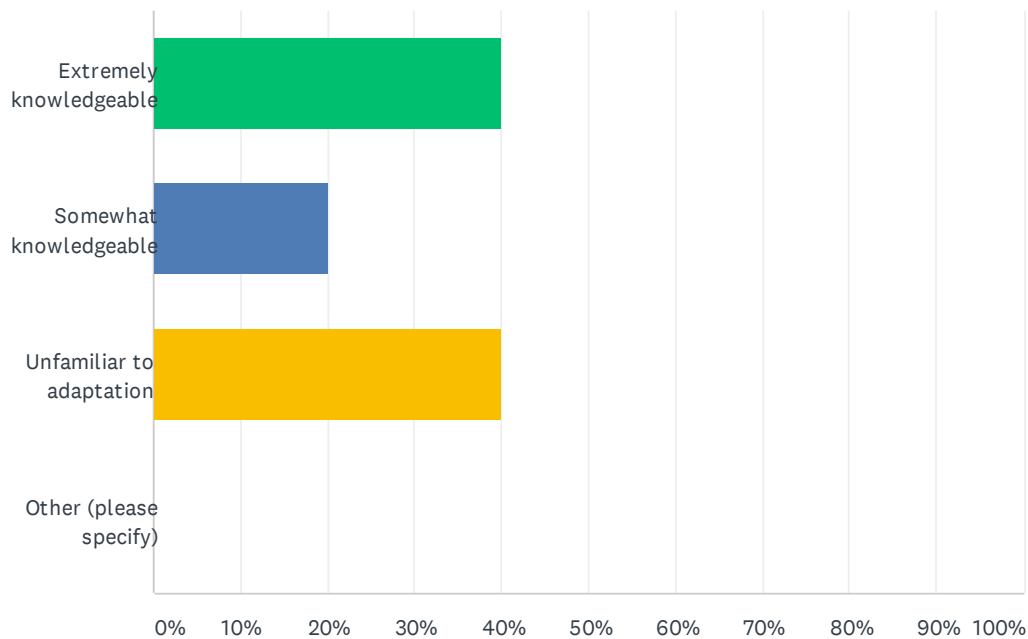
Answered: 5 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	20.00%	1
No	80.00%	4
TOTAL		5

Q9 What would you consider to be your knowledge level of adaptation actions that can be taken to address climate change risks?

Answered: 5 Skipped: 0

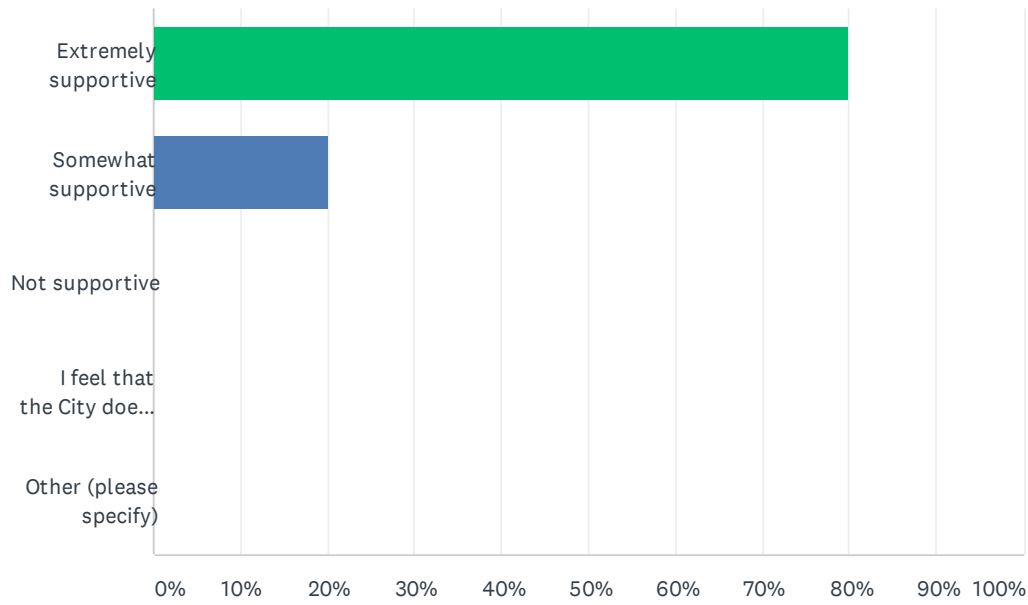


ANSWER CHOICES	RESPONSES	
Extremely knowledgeable	40.00%	2
Somewhat knowledgeable	20.00%	1
Unfamiliar to adaptation	40.00%	2
Other (please specify)	0.00%	0
TOTAL		5

#	OTHER (PLEASE SPECIFY)	DATE
	There are no responses.	

Q10 How supportive would you be of the City incorporating a variety of adaptation solutions, ranging in time, budget, and location, with the goal of protecting and preserving the community's all-encompassing assets? (i.e., parks, critical services and infrastructure)

Answered: 5 Skipped: 0

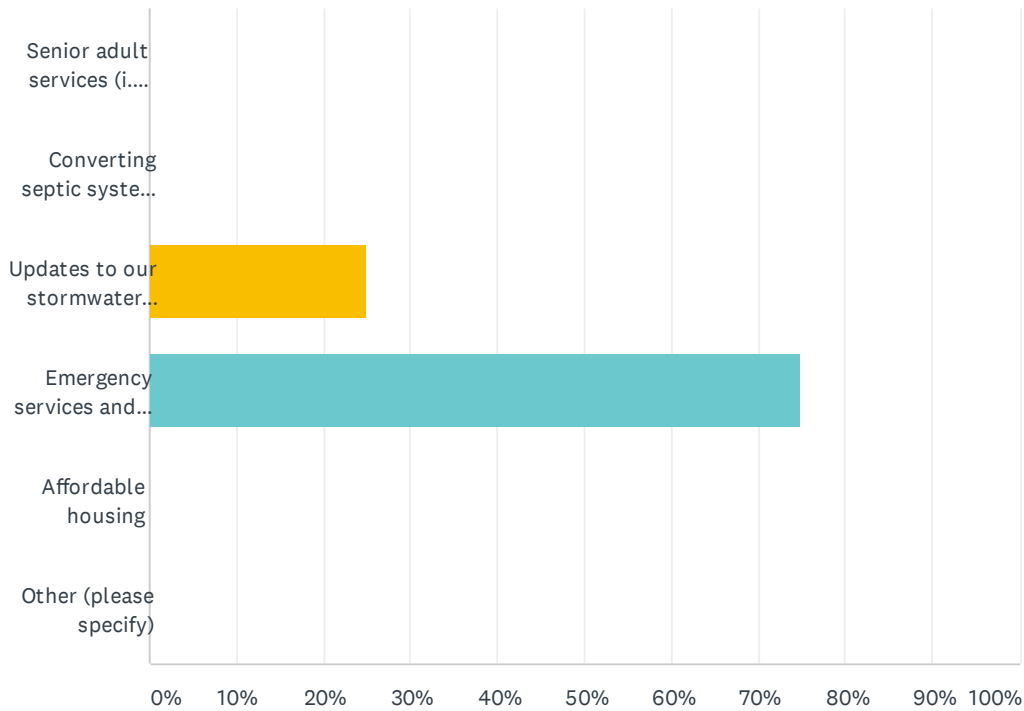


ANSWER CHOICES	RESPONSES	
Extremely supportive	80.00%	4
Somewhat supportive	20.00%	1
Not supportive	0.00%	0
I feel that the City does not need to adapt to climate change	0.00%	0
Other (please specify)	0.00%	0
TOTAL		5

#	OTHER (PLEASE SPECIFY)	DATE
	There are no responses.	

Q11 Maintaining City services during and in the aftermath of extreme events is an important goal of the City. Please indicate which City services rank highest in needing additional prioritization. (Please select your top three).

Answered: 4 Skipped: 1

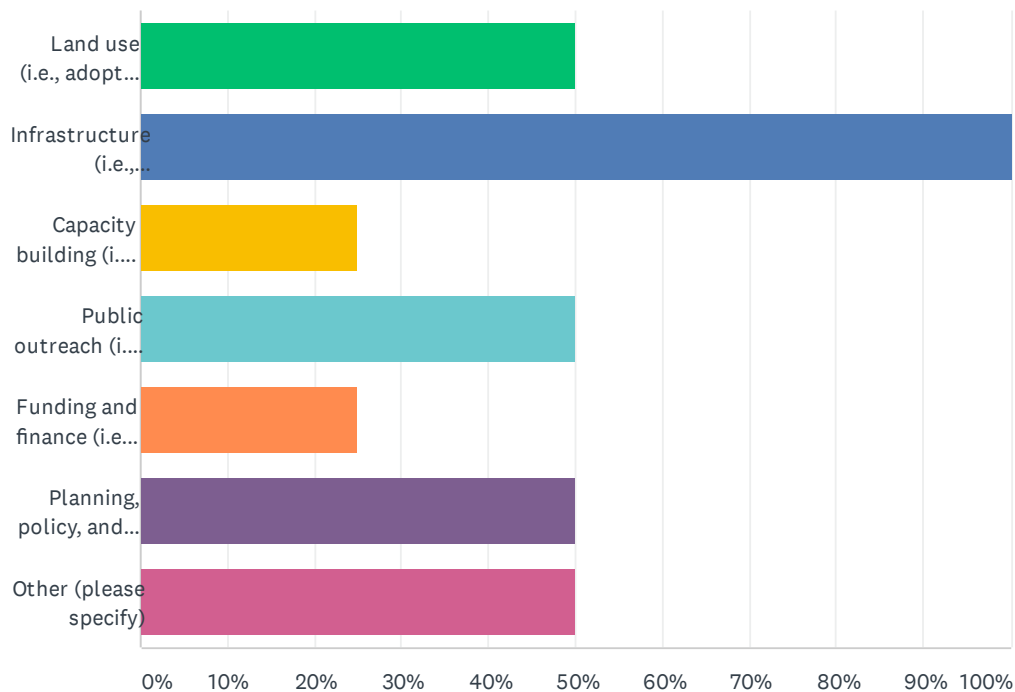


ANSWER CHOICES	RESPONSES	
Senior adult services (i.e., transportation, home delivered meals)	0.00%	0
Converting septic systems to sewer connections	0.00%	0
Updates to our stormwater system	25.00%	1
Emergency services and utilities	75.00%	3
Affordable housing	0.00%	0
Other (please specify)	0.00%	0
TOTAL		4

#	OTHER (PLEASE SPECIFY)	DATE
	There are no responses.	

Q12 Which of the following types of adaptation strategies would you support the City in undertaking for building a more climate-resilient North Miami? Please select all that apply.

Answered: 4 Skipped: 1

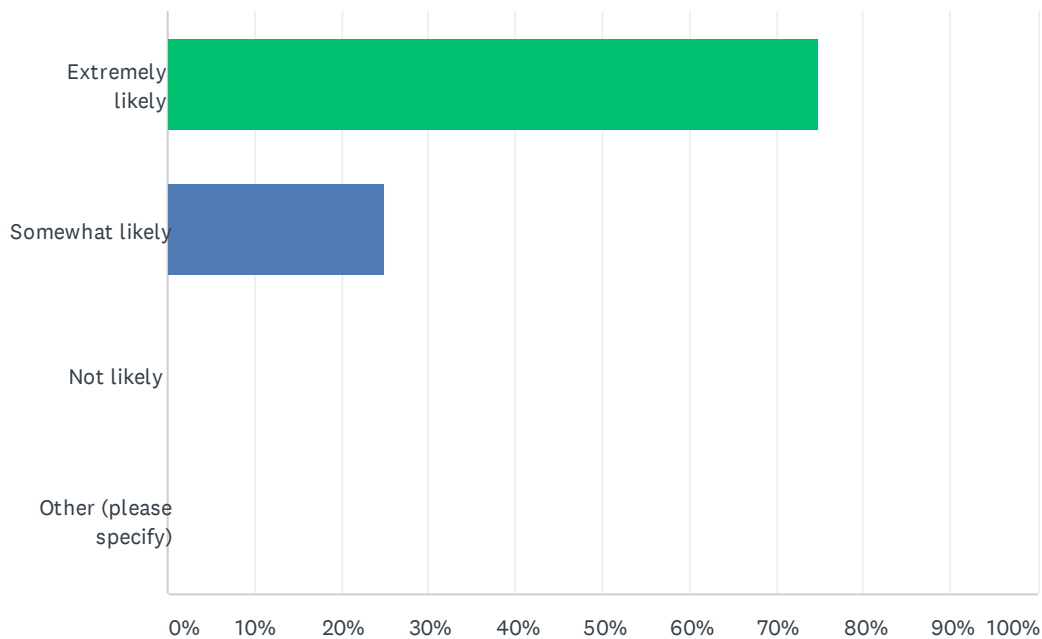


ANSWER CHOICES		RESPONSES	
Land use (i.e., adopting policies or ordinances that require more resilient land uses and building practices such as, stricter building codes and standards for new development)		50.00%	2
Infrastructure (i.e., updating, modifying or creating new infrastructure including nature-based solutions or green infrastructure such as swales and mangroves to reduce flooding and extreme heat impacts)		100.00%	4
Capacity building (i.e., increasing capacity of city staff as well as the community to respond to climate change through partnerships, trainings, resource sharing and research and monitoring activities)		25.00%	1
Public outreach (i.e., building awareness of climate risks as well as involving the public on decisions related to climate threats and adaptation)		50.00%	2
Funding and finance (i.e., finding sources of funding or financing for resilience investments)		25.00%	1
Planning, policy, and management (i.e., updating local plans and policies to reflect local climate risk and future planning)		50.00%	2
Other (please specify)		50.00%	2
Total Respondents: 4			

#	OTHER (PLEASE SPECIFY)	DATE
1	Using solar power is the best way to go.	3/26/2021 3:38 PM
2	incorporating local residents into creating a local food economy, and creating resiliency at the community level around access to fresh food even in times of emergency.	3/24/2021 8:02 PM

Q13 Frequent flooding in low-lying areas in North Miami can be tidally influenced (including, through backflow from storm drains), rainfall-driven or both. A proposed action to better understand these highly localized mechanisms of flooding is to establish a citizen-science technology for residents to document the time and source of flooding. How likely are you to use a phone-based application to document flooding in real-time in your neighborhood?

Answered: 4 Skipped: 1

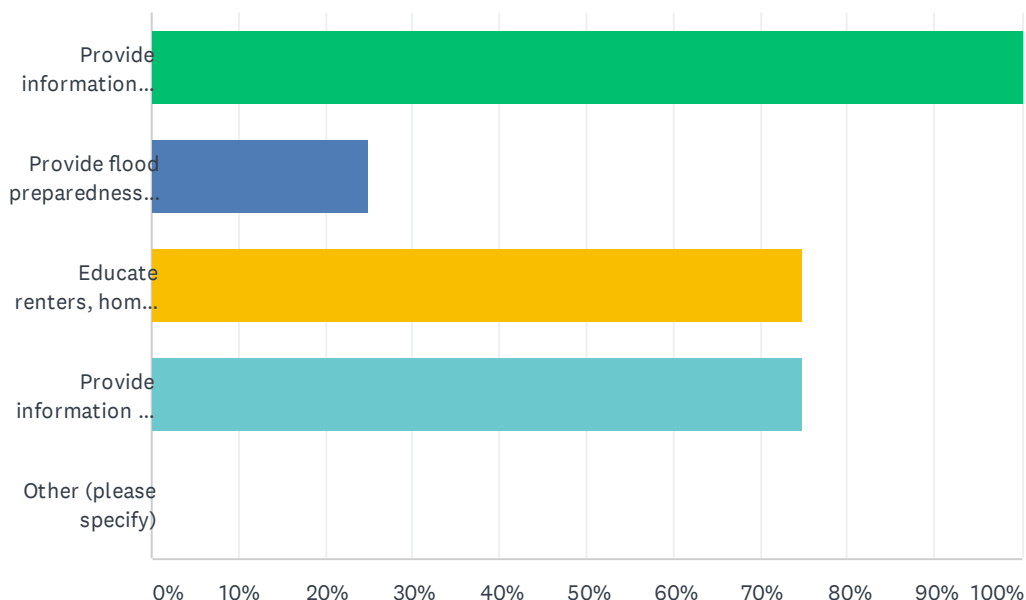


ANSWER CHOICES	RESPONSES	
Extremely likely	75.00%	3
Somewhat likely	25.00%	1
Not likely	0.00%	0
Other (please specify)	0.00%	0
TOTAL		4

#	OTHER (PLEASE SPECIFY)	DATE
	There are no responses.	

Q14 The City of North Miami can increase public awareness and educate the community on flood risks and flood adaptation measures for residences and businesses through the following activities. Select all options that would better support you and your neighborhood.

Answered: 4 Skipped: 1

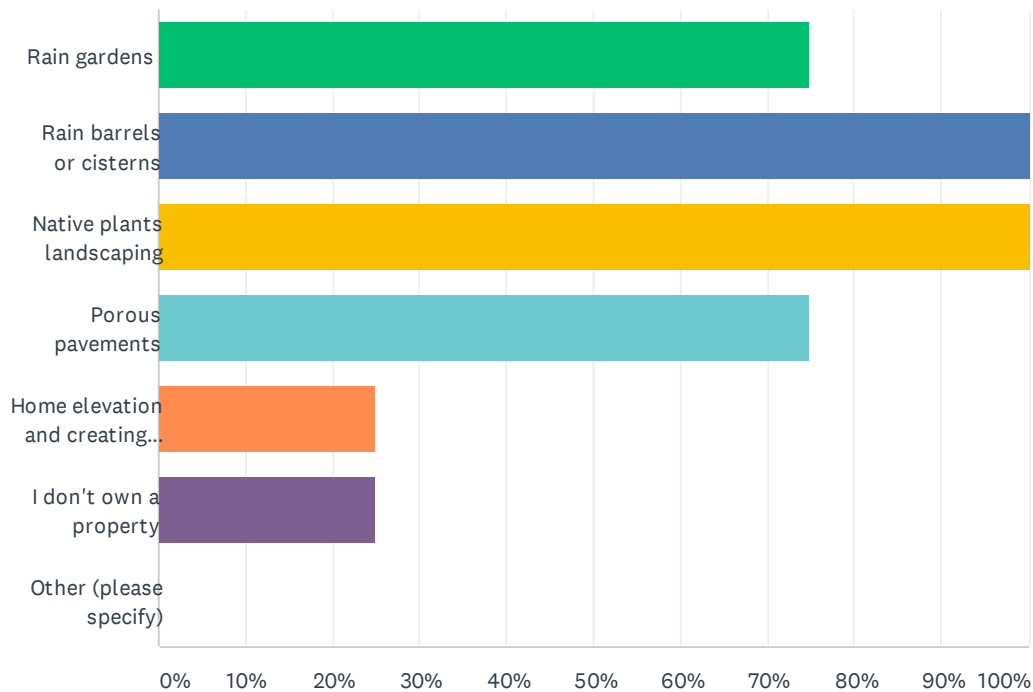


ANSWER CHOICES	RESPONSES	
Provide information flood risk at the neighborhood level	100.00%	4
Provide flood preparedness information for businesses	25.00%	1
Educate renters, home buyers and real estate professionals about floodplains and increasing risk from sea level rise	75.00%	3
Provide information on grants/funds that assist homeowners and renters prepare and recover from flooding	75.00%	3
Other (please specify)	0.00%	0
Total Respondents: 4		

#	OTHER (PLEASE SPECIFY)	DATE
	There are no responses.	

Q15 The assessment findings indicate that inland properties located in low-lying areas may experience worsening flooding in the next coming decades. If you own a property, which of the following green infrastructure strategies are you most likely to incorporate on your own property to help mitigate flooding? Please check all that apply.

Answered: 4 Skipped: 1



ANSWER CHOICES	RESPONSES	
Rain gardens	75.00%	3
Rain barrels or cisterns	100.00%	4
Native plants landscaping	100.00%	4
Porous pavements	75.00%	3
Home elevation and creating more green space under the home	25.00%	1
I don't own a property	25.00%	1
Other (please specify)	0.00%	0
Total Respondents: 4		

#	OTHER (PLEASE SPECIFY)	DATE
	There are no responses.	

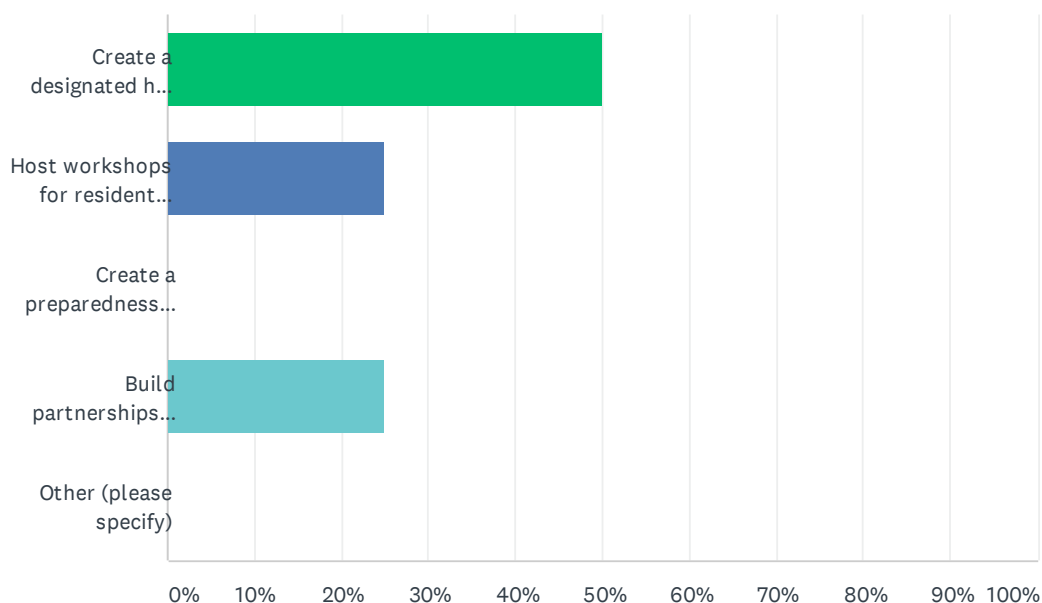
Q16 Are there specific policies that you would like to see modified to increase climate resilience?

Answered: 4 Skipped: 1

#	RESPONSES	DATE
1	nature based solution to protect our shorelines	4/1/2021 7:41 PM
2	Yes	3/26/2021 3:38 PM
3	Id like to see an incentivizing program from the city, towards absent land owners who own vacant lots. The city can create a program to temporarily lower their land tax rates if the land owners work with local farmers, gardeners, landscapers, to create a business around food or climate resiliency on that vacant lot.	3/24/2021 8:02 PM
4	A better draining system in the city that doesn't flood our homes.	3/18/2021 11:33 AM

Q17 The City wants your input in determining how to help increase household-level emergency preparedness for extreme events such as hurricanes. Please select your top adaptation action:

Answered: 4 Skipped: 1

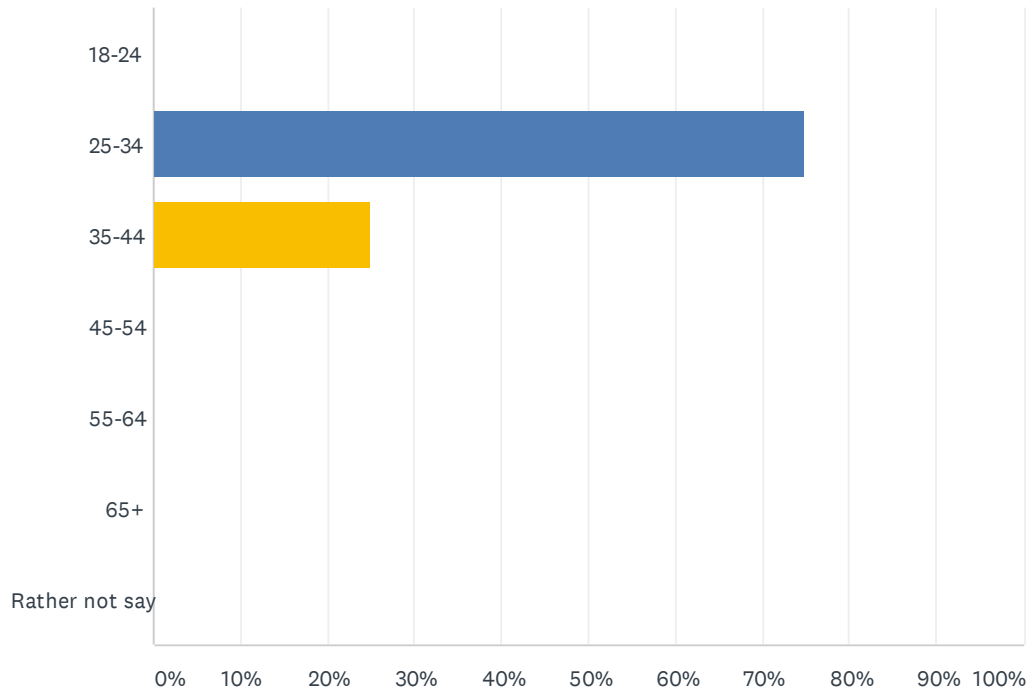


ANSWER CHOICES	RESPONSES	
Create a designated hub (e.g., a community center) that provides food, shelter, and other critical services during and after an extreme event.	50.00%	2
Host workshops for residents to build and take-home emergency preparedness kits.	25.00%	1
Create a preparedness strategy to educate the public on alternative access and evacuations routes.	0.00%	0
Build partnerships with community leaders and faith-based organizations to ensure that disaster preparedness information and resources are provided to vulnerable individuals and households (such as non-English speakers, elderly individuals or those with limited mobility, individuals dependent on public transportation).	25.00%	1
Other (please specify)	0.00%	0
TOTAL		4

#	OTHER (PLEASE SPECIFY)	DATE
	There are no responses.	

Q18 In what age group do you fall under?

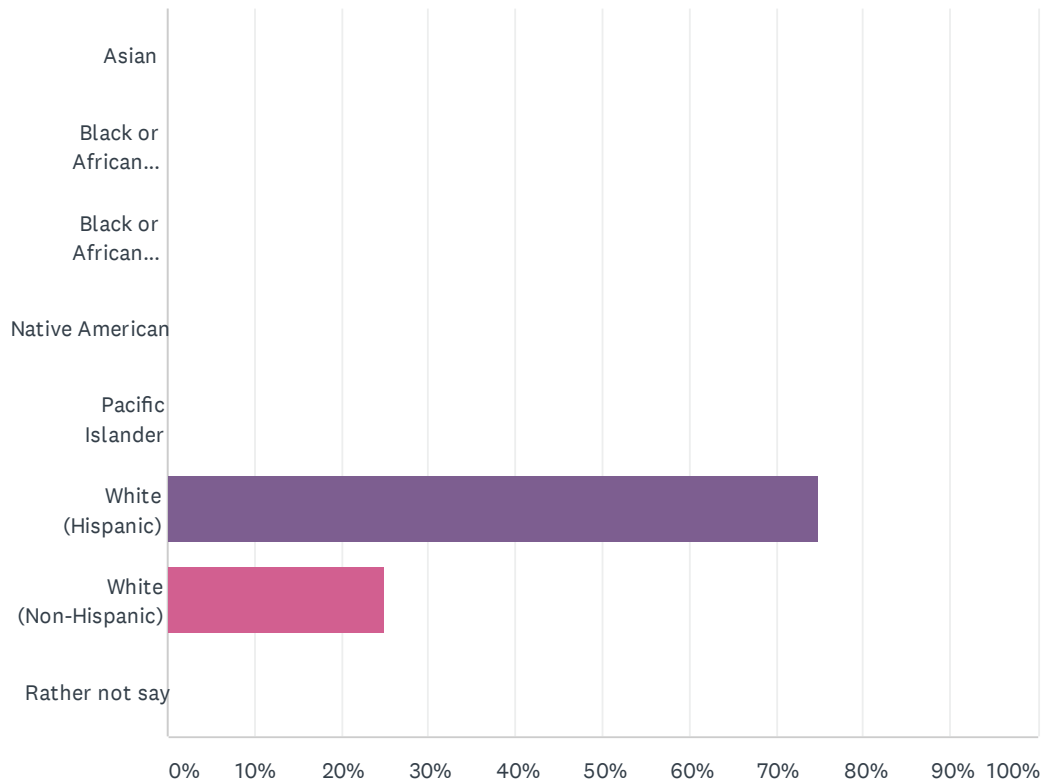
Answered: 4 Skipped: 1



ANSWER CHOICES	RESPONSES	
18-24	0.00%	0
25-34	75.00%	3
35-44	25.00%	1
45-54	0.00%	0
55-64	0.00%	0
65+	0.00%	0
Rather not say	0.00%	0
TOTAL		4

Q19 Which of the following categories describe you? Select all that apply to you:

Answered: 4 Skipped: 1



ANSWER CHOICES	RESPONSES	
Asian	0.00%	0
Black or African American (Hispanic)	0.00%	0
Black or African American (Non-Hispanic)	0.00%	0
Native American	0.00%	0
Pacific Islander	0.00%	0
White (Hispanic)	75.00%	3
White (Non-Hispanic)	25.00%	1
Rather not say	0.00%	0
Total Respondents: 4		

Appendix F: GIS Layers Provided to the City

The assessment output is available in an interactive, transparent format to the City of North Miami through the AccelAdapt tool at the web address 'northmiami.acceladapt.com'.

In addition all the assessment input and output data is also provided to the City in the GIS format.

Input Data Sources

Asset Data Sources

Asset Theme	Dataset/Description	Source
Commercial Properties	Miami-Dade County parcels	Miami-Dade County GIS Hub
	Esri Business locations	Esri Business Analyst program
Critical Facilities and Government-owned Properties	Miami-Dade County Parcels	Miami-Dade County GIS Hub
	Critical Facilities	City of North Miami
	State HAZUS Essential Facilities Inventory	Florida Dept. of Emergency Management
	Residential Health Facilities	Shimberg Center for Housing Studies, University of Florida
Cultural Properties, Parks and Community Facilities	Miami-Dade County Parcels	Miami-Dade County GIS Hub
	Parks and Community Centers	City of North Miami
Residential Properties	Miami-Dade County Parcels	Miami-Dade County GIS Hub
	Assisted Housing Inventory	Shimberg Center for Housing Studies, University of Florida
	Residential Health Facilities	Shimberg Center for

		Housing Studies, University of Florida
Roads and Connectivity	OpenStreetMap road centerlines	OpenStreetMap
	Fire Station locations	

Threat Data Sources

Threat	Dataset/Description	Source
Floodplain Inundation	FEMA floodway, wave action, 1% annual chance (100-yr) and 2% annual chance (500-yr) floodplains	FEMA National Flood Hazard Layer, effective Nov. 2020
Storm Surge Inundation	Sea Lake and Overland Surge from Hurricanes (SLOSH) Maximum of the Maximum Enveloped of Water (MOM) layer for hurricane categories 1-5	NOAA National Weather Service's National Hurricane Center
Current and Future Tidal Flooding	Flood extents of 2, 3, and 4ft of water above mean higher high water (MHHW) mapped using a "modified bathtub" approach	NOAA Office for Coastal Management
Extreme Heat	Impervious surfaces of low to high development intensity	MRLC National Land Cover Database 2016
	Percent tree canopy cover	USFS Tree Canopy Cover 2016

Assessment Output Layers

The following sections explain the information contained in the assessment output GIS layers.

Census Block Group Aggregation Data

This aggregation data summarizes the assessment within census block group boundaries. The output dataset (Census Block Group Aggregation Data) provides the assessment summaries in a format that is best suited to be viewed using definition or attribute queries. The following table lists the attributes of the dataset along with some description and example data values:

GEOID	Census block group ID	ID string
MODULE	The unique asset-threat pair associated with the metric	string
ASSET	Assessment asset category	city_owned commercial
THREAT	Assessment threat	floodplain storm_surge_cat_2 tidal_flood_2ft
VARIABLE	Variable type / theme	asset exposed vulnerability combined_vulnerability_risk
VAR_UNIT	Variable subtype / specific unit	count improvement_value
VAL	Count of total for "asset" and "exposed" variables; count of medium or high for "combined_vulnerability_risk" and "vulnerability"	[number]
HML_H	Count of high	[number]
HML_M	Count of medium	[number]
HML_L	Count of low	[number]

Values from multiple columns in the dataset may need to be selected in or order to select individual map variables or asset-threat pairs. For example, to view the residential property/flooding high or medium combined vulnerability and risk map as seen in the default view in AccelAdapt, the following selection or definition query would need to be made:

MODULE = residential_flood

VARIABLE = combined_vulnerability_risk

Then, the resulting selection or definition query could be symbolized using the VAL column (which is a total of HML_H + HML_M for “combined_vulnerability_risk”, as described above).

Parcels

The parcel-level dataset contains attributes that identify the parcel asset categories and specify parcel-level values of vulnerability and risk components. The output dataset (Parcels) has the following attributes:

PARCEL	Unique parcel ID	number
TAGS	Comma separated list of asset categories parcel belongs to	string
VAL	Total parcel value in dollars	number
VAL_LAND	Parcel land value in dollars	number
VAL_IMPRV	Parcel improvement value in dollars	number
YR_BLD	Year built of structure on parcel (min year if multiple structures)	number
CBG_GEOID	ID of the census block group parcel is within	string

Parcel-level assessment variables

The following column attributes include the components of the vulnerability and risk assessment. These column names can be deciphered using the following replacement pattern of THREAT_VARIABLE. For example, FLD_VR is the parcel-level variable for flooding combined vulnerability and risk. Below is a list of the THREAT and VARIABLE abbreviations:

THREAT	VARIABLES		
FLD = floodplain inundation ST2 = Storm Surge (Cat 1-2) ST5 = Storm Surge (Cat 3-5) TF2 = Tidal Flooding +2ft MHHW TF3 = Tidal Flooding +3ft MHHW TF4 = Tidal Flooding +4ft MHHW	EX	Exposure	[0=None, 1=Yes]
	EX_BLD	Building exposure	[0=None, 1 =Yes]
	P	Parcel threat probability	threat-specific/relative likelihood
	P_BLD	Building threat probability	threat-specific/relative likelihood
	PI	Potential impact	[0 = None, 1=Low, 2=Med, 3=High]
	AC	Adaptive capacity	[0 = None, 1=High, 2=Med, 3=Low]
	AC_C	Adaptive capacity desc.	commentary
	V	Vulnerability	[0 = None, 1=Low, 2=Med, 3=High]
	RP	Risk probability	[0 = None, 1=Low, 2=Med, 3=High]
	RC	Rist consequence	[0 = None, 1=Low, 2=Med, 3=High]
	R	Risk	[0 = None, 1=Low, 2=Med, 3=High]

	VR	Combined vulnerability & risk	[0 = None, 1=Low, 2=Med, 3=High]
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